

2013 REPORT CARD FOR MISSOURI'S INFRASTRUCTURE

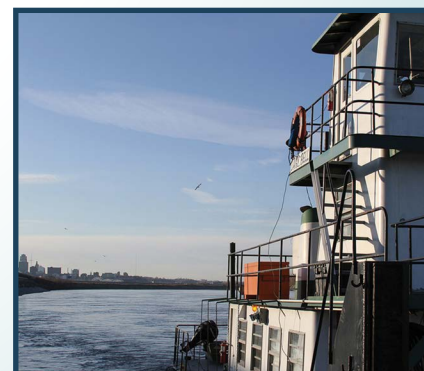
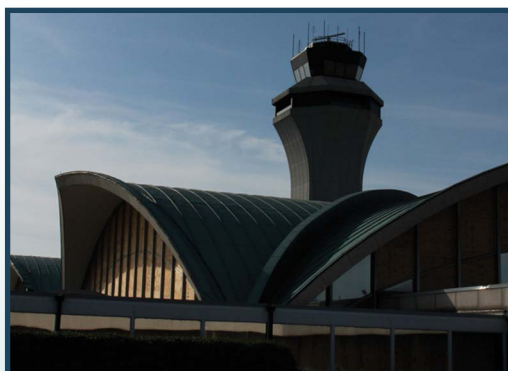
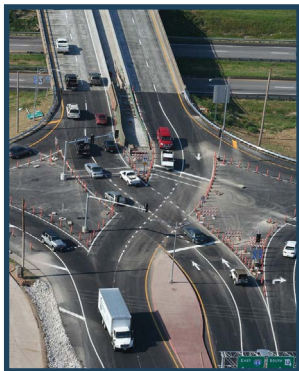
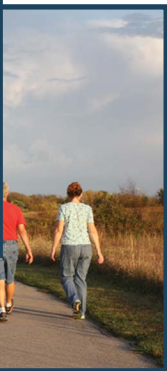


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EXECUTIVE SUMMARY

BACKGROUND AND METHODOLOGY:

Infrastructure is the backbone of the state's economic and social activity. On any given day we engage in the use of infrastructure in all of our daily activities. From the water we drink, to the roads we drive on, to the energy that heats and cools our homes and powers our computers, to the schools in which our children are educated; we are completely dependent on the infrastructure that provides these necessities. Although they often go unnoticed, elements such as reliable power, efficient transportation, and safe schools provide quality of life and drive our economic engines as they attract business and allow it to prosper. The central location of the state of Missouri gives our infrastructure a unique importance as the crossroads of several interstate highways, rail systems and two major inland waterways intersect in our state.

With this in mind, engineers from the Kansas City and St. Louis Sections of the American Society of Civil Engineers (ASCE) came together to grade the infrastructure for the entire state of Missouri and raise awareness of the need for continued funding and maintenance of these essential facilities. This report provides a state perspective of the 2013 Report Card for America's Infrastructure that reviews the nation's infrastructure. Find out more at <http://www.infrastructurereportcard.org/missouri/missouri-overview/>

Technical committees reviewed existing reports and inventories of the nation's infrastructure and discussed the current condition and funding levels with public officials. All available information was used to summarize the current state of the infrastructure and a composite grade was awarded based on individual grades for the following criteria:

- **Capacity:** The measure of the infrastructure's capacity to meet current and future demands
- **Condition:** The existing physical condition of the infrastructure
- **Funding:** The current level of funding of each infrastructure type compared to the estimated funding need
- **Future Need:** The cost to improve infrastructure to an acceptable level
- **Operation and Maintenance:** The measure of the owner's ability to operate and maintain the infrastructure properly and within government regulations
- **Public Safety:** The extent to which the public's safety is jeopardized by the condition of the infrastructure and the consequence of failure
- **Resilience:** The infrastructure's capability to prevent or protect against significant multi-hazard threats and incidents

The report card utilizes a 10-point grading scale, similar to a traditional school report card. Each of the seven grading components was assigned a grade as follows:

- 90-100 = A
- 80-89 = B
- 70-79 = C
- 51-69 = D
- 50 or Below = F

RESULTS:

Eleven different categories of infrastructure for the state of Missouri were evaluated and graded. They are summarized in the following table:

Infrastructure Category	Grade
Aviation	C
Bridges	C-
Dams	D-
Drinking Water	C-
Energy	D+
Inland Waterways	D
Levees	C-
Railroads	C
Roads	C
Schools	C
Wastewater	C-
Overall	C-

Overall the infrastructure for the state of Missouri receives a C- grade. It is the hope of ASCE that this evaluation can be used by citizens, and public officials to:

- Raise awareness about the significance of infrastructure to our daily lives;
- Highlight the importance of efficient operation and maintenance of the state's critical infrastructure; and
- Provide a starting point for discussion about the importance of continued funding to maintain and improve the condition of the state's infrastructure.

ACKNOWLEDGEMENTS:

Many ASCE Members have devoted a considerable amount of time to this effort. We would like to acknowledge following the groups of individuals:

The Report Card Oversight Committee for their work in organizing this effort and reviewing the write-ups. Members included:

- Tom Jacobs, P.E., CFM – Co-chair
- Chad Schrand, P.E. – Co-chair
- Alex Darby, P.E. – Co-chair
- Steve Lackey, P.E. – Subgroup Leader
- John Dowell, P.E. – Subgroup leader

The Authors for their efforts in researching, writing and grading the infrastructure categories. Individual authors are recognized in each write-up. The authors are recognized at the end of this document.

Shockey Consulting Services for their expertise in graphic design and editing.

The Kansas City, and St. Louis Sections of ASCE and ASCE Society for their support in promoting and funding this effort.

C

AVIATION

RECOMMENDATIONS:

- Ensure the viability of the State Aviation Trust Fund by extending the authorization of the Trust Fund through 2023 to pay for improvements at the state's non-NPIAS system airports.
- Extend reauthorization of the aviation jet fuel tax through 2023 to ensure an uninterrupted revenue stream to fund improvements at Missouri's public-use/public-owned airports. This includes maintaining the funds full reserve at \$10 million.
- Prevent State Aviation Trust Funds from being diverted to other state funds to make up for statewide budget shortfalls.
- Increase the cap on FAA Passenger Facility Charges (PFC) to fund improvements at Missouri's Primary Commercial Airports, Columbia Regional (COU) and Springfield-Branson National Airport (SGF).

(continued)

EXECUTIVE SUMMARY:

The 114 airports in Missouri provide \$9.5 billion in total economic activity each year and experience 1.54 million takeoffs and landings each year. Only 41 percent of Missouri airports have runways that meet Federal Aviation Administration (FAA) minimum length objectives and only 40 percent have adequate taxiways. Currently the state's airports typically run at less than 60 percent of annual service volume; however three of the state's airports are expected to meet or exceed this value in the future. It is anticipated that nearly \$175 million will be necessary to meet aviation needs over the next five years, currently only about \$93 million is expected to complete this work. The state should increase funding to this important economic force in the state to help improve to current "C" grade.

BACKGROUND:

The scope of this report card is to evaluate the current infrastructure of the 114 airports that are included within the Missouri State Airport System Plan (MOSASP) and administered by the Missouri Department of Transportation, Aviation Section (MoDOT). These airports serve a wide array of activity including scheduled passenger air service, business-related and recreational flying. Of the airports included in MOSASP, 76 are considered significant to the national transportation system, and therefore, are included within the National Plan of Integrated Airport Systems (NPIAS). The remaining 38 public-use airports are non-NPIAS facilities.

Key characteristics of the state's system includes:

- Missouri's commercial service and general aviation airports, including the Kansas City International Airport (MCI) and Lambert-St. Louis International Airport (STL), contribute 149,500 jobs, nearly \$3.7 billion in annual payroll and \$9.5 billion in total economic activity.
- Missouri's airports host 3,900 based aircraft and experience 1.54 million takeoffs and landings (operations) per year.
- There are 15,900 pilots living in Missouri that are certificated by the FAA.

- 160,000 tons of cargo are transported by air each year to and from Missouri's airports.

MOSASP identifies four different roles served by airports in the state. The roles for the airports and corresponding service objectives are shown as follows:

Commercial Airports

Commercial airports accommodate the highest level of general aviation activity and serve major population centers throughout the state. Airports with scheduled commercial airline service, general aviation airports which are designated as FAA Reliever Airports, and airports maintained in accordance with Federal Aviation Regulation (FAR) Part 139 are included in this classification.

MOSASP did not include Kansas City or Lambert-St. Louis international airports within the state's airport system due to unique financial, operational and market attributes of each facility. Both airports enplane approximately 5.1 and 6.3 million annual passengers, respectively.

Regional Airports

Regional Airports serve primarily general aviation activity with a focus on serving business activity including small business jets and single- and multi-engine turbo-props. These airports support the system of commercial airports and provide significant access to the state's population. There are currently 31 facilities within the MOSASP which are designated Regional Airports.

Business Airport

Business Airports focus on providing aviation access for small local businesses as well as recreational flying activities throughout the state. There are 35 facilities within MOSASP which are designated Business

Airports.

Community Airport

Community Airports are considered to have local community importance serving primarily recreational and personal flying activities in which they are located. There are 34 facilities within the MOSASP which are designated Community Airports.

CONDITION:

The current state of Missouri's aviation infrastructure is measured by its capacity to accommodate aircraft and passenger demand. The fundamental airport components used to assess the system's condition include an evaluation of the following items:

- Airfield Facilities
- Navigational Aids, Lighting and Weather Reporting Capabilities
- Terminal Area Facilities
- Pavement Condition
- Accessibility to the Airport System

Airfield Facilities

Table 1 indicates the minimum runway length and width requirements for Missouri's airports based on FAA design standards for determining recommended runway dimensions. Considering the system as a whole:

RECOMMENDATIONS:

(continued)

- Expand the MoDOT airport pavement condition pilot program to all system airports to monitor pavement conditions throughout the state as a tool to efficiently use available funds.
- Lobby the U.S. Congress to support multi-year reauthorizations of the FAA's Airport Improvement Program to maximize funding availability for Missouri's NPIAS airports. This includes reauthorizing the AIP at its minimum funding reserve of \$3.2 billion.
- MoDOT and airport owners need to consider the findings of the Report Card in an effort to improve the condition and/or availability of those facilities that are deficient including runway and taxiway needs, NAVAIDs and terminal area facilities.
- Develop future aviation Report Cards to monitor the condition of the infrastructure and make improvements as necessary to meet the needs of current and future users.

- 41 percent of the airports meet the minimum runway length objectives;
- 60 percent of the system's airports meet the minimum runway width objectives; and
- 50 percent of the airports meet their taxiway needs for their respective role.

Roughly half of the airports in the state fall short of providing adequate runway dimensions and taxiway facilities to serve users. Airport owners are encouraged to track user activity to determine the need to expand airfield facilities to serve demand. Federal and state aviation agencies are recommended to continue to provide guidance and financial support to improve the state's runway and taxiway facilities.

Table 1:
Minimum System Requirements for Runways and Taxiways

Airport Role	Runway Length	Runway Width	Taxiway Type
Commercial Service	5,500 ft.	100 ft.	Full Parallel
Regional	5,000 ft.	75 ft.	Full Parallel
Business	4,000 ft.	75 ft.	Turnarounds at Each End Minimum; Full Parallel Desired
Community	Maintain Existing	NPIAS-60; Non-NPIAS: Maintain Existing	Turnarounds at Each End Minimum

Table 2: Source: MOSASP
Airfield Facility Grading Summary

Objective	Percent (%)	Grade
Runway Length	41	F
Runway Width	60	D
Taxiway Type	50	F
FAA Design Standards	76	C
System Demand/Capacity	99	A
All-Weather Capabilities	91	A
Composite Score	70	C

Source: MOSASP

Figure 1:
FAA Design Standards

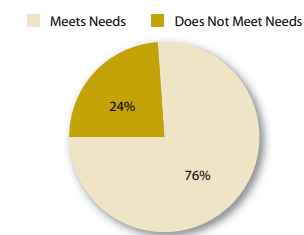


Figure 2:
System Operational/
Capacity

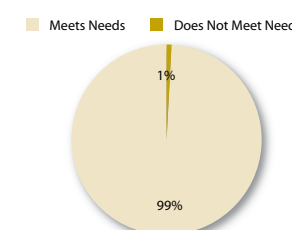


Figure 3:
All-Weather Capabilities

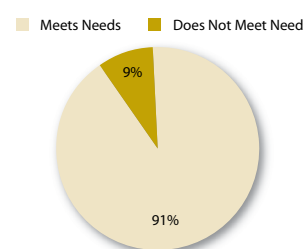
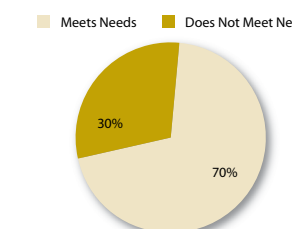


Figure 4:
Airports Meeting Airfield
Facility Needs



An airport's Airport Reference Code (ARC) is established by the FAA to relate airport design standards to the operational and physical characteristics of aircraft that operate at a particular airport. The FAA also establishes Runway Safety Area (RSA) criteria that need to meet applicable design recommendations. Currently, 65 percent of airports in Missouri comply with the FAA's and MOSASP's ARC objectives. Eighty-six percent of the system's runways meet RSA standards. **Figure 1** summarizes the system's ability to meet overall compliance with FAA design standards.

Airport owners are encouraged to maintain airports according to established FAA planning and engineering recommendations in order to maintain and further improve the safety and operational efficiency of the state's aviation system.

Annual service volume (ASV) is a measure of an airport's annual operational capacity. The FAA recommends airports operate at less than 60 percent of its ASV in order to reduce delay and increase capacity. Three airports of 114 are expected to exceed their target ASV in the future. **Figure 2** summarizes the system's ability to meet MOSASP and FAA's operational capacity objectives.

Nearly all of the airports in Missouri experience minimal delays and are capable of maximizing the usage of existing facilities to accommodate a wide range of users which include a diverse fleet of small and large aircraft.

Published instrument approach procedures increase an airport's utility, safety and efficiency during low visibility and/or inclement weather conditions. Instrument approaches allow aircraft to approach to and land on a specific runway. **Figure 3** summarizes the percentage of airports with the ability to meet all-weather capabilities with published instrument approach procedures.

Airport owners need to be constantly aware of tall structures that are located in the vicinity of airports. Having the airport's airspace clear of hazards will ensure future success of the system's capability to serve aircraft during low visibility conditions. The composite grading summary of Missouri's airfield facilities' capability to achieve service objectives is presented in **Table 2**. Seventy percent of the system's airports achieve airfield facility needs for their respective role as indicated in **Figure 4**.

C

AVIATION

Improving the state's runway and taxiways will be crucial in determining the system's capability to serve the users of Missouri's airports. This includes maintaining the system in a condition to accommodate aircraft in a safe manner during all-weather conditions throughout the year.

Navigational Aids, Lighting and Weather Reporting Capabilities

Table 3 indicates the minimum navigational aid (NAVAID), lighting and weather reporting requirements for Missouri's airports.

Table 3: Minimum NAVAID Reporting Requirements

Airport Role	NAVAID	Lighting	Weather Reporting System
Commercial Service	Rotating Beacon, Wind Cone/Segmented Circle, REILs and VGSIs	MIRL/MITL; HIRL/HITL; ALS Desired	AWOS
Regional	Rotating Beacon, Wind Cone/Segmented Circle, REILs and VGSIs	MIRL/MITL	ASOS or AWOS
Business	Rotating Beacon, Wind Cone/Segmented Circle, REILs and VGSIs Desired	MIRL	ASOS or AWOS Desired
Community	Wind Cone/Segmented Circle Minimum, Rotating Beacon Desired	LIRL Desired	None

REIL - Runway End Identifier Lights
 VGSIs - Vertical Guidance Slope Indicator
 MIRL/MITL - Medium Intensity Runway Lighting/Medium Intensity Taxiway Lighting
 HIRL/HITL - High Intensity Runway Lighting/High Intensity Taxiway Lighting

ALS - Approach Lighting System
 ASOS - Automated Surface Observation System
 AWOS - Automated Weather Observation System
 LIRL - Low Intensity Runway Lighting

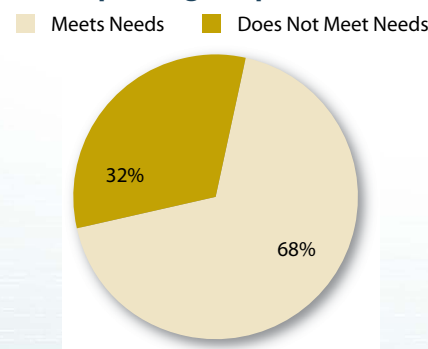
Source: MOSASP

Table 4: NAVAID, Lighting and Weather Reporting Grading Summary

Objective	Percent (%)	Grade
NAVAIDs	48	F
Lighting	86	B
Weather Reporting System	71	C
Composite Score	68	D

Source: MOSASP

Figure 5: NAVAID, Lighting and Weather Reporting Capabilities



Terminal Area Facilities

Table 5 highlights the minimum terminal area needs for the Missouri's airport system indicating each airport role's standards for accommodating aircraft and passenger demand. Figure 6 summarizes the system's ability to meet the needs to provide adequate terminal facilities to users while Table 6 indicates the grading summary of the system's capability to meet service objectives based on the findings of MOSASP.

Table 5: Minimum System Requirements for Terminal Area Facilities

Airport Role	Apron/Tie-Downs*	Hangar Storage	Terminal Building**	Auto Parking	Fuel	Aircraft Maintenance***
Commercial Service	30% for Based Aircraft; 75% for Transient Aircraft	70% of Based Aircraft	2,500 sq. ft.	1 space/ Based Aircraft; 50% for Employees/ Visitors	100LL and Jet A	Full Service
Regional	30% for Based Aircraft; 75% for Transient Aircraft	70% of Based Aircraft	2,500 sq. ft.	1 space/ Based Aircraft; 50% for Employees/ Visitors	100LL and Jet A	Full Service
Business	40% for Based Aircraft; 25% for Transient Aircraft	60% of Based Aircraft	1,500 sq. ft.	1 space/ Based Aircraft; 25% for Employees/ Visitors	100LL; Jet A as Required	Full Service
Community	Maintain Existing	Maintain Existing	Maintain Existing	Maintain Existing	100LL	As Required

(*) Includes maneuvering area and tie-down spaces.
 (**) Includes public use space, restrooms, conference rooms and pilots' lounge.
 (***) Includes airframe and powerplant service capabilities.

100LL - Is an aviation fuel used to power piston-engine aircraft.
 Jet A - Is a type of fuel designed for use in aircraft powered by gas-turbine engines (e.g., turbo-prop and jet aircraft).

Source: MOSASP

Figure 6: Terminal Area Facilities

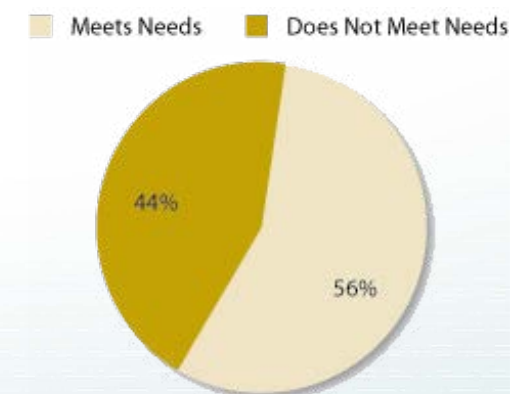


Table 6: Terminal Area Facility Grading Summary

Objective	Percent (%)	Grade
Apron/Tie-Downs	56	F
Hangar Storage	86	B
Terminal Building	44	F
Auto Parking	36	F
Fuel	74	C
Aircraft Maintenance	37	F
Composite Score	56	F

Source: MOSASP

Pavement Condition

Pavement maintenance is important in preserving the integrity of the system's runway, taxiways and parking aprons, thereby reducing future rehabilitation costs and extending the life-cycle of existing facilities. As indicated in **Table 7**, the Pavement Condition Index (PCI) is a numerical scale between 0 and 100 used to indicate the condition of paved surfaces. The MOSASP has identified a conservative pavement condition of 'Fair' as the service objective for all paved facilities in the system. Ninety percent of system airports currently meet this criteria. However, a PCI index of 70 or greater is desirable and is considered to meet the needs. As indicated in **Figure 7**, 78 percent of the 66 system airports that were included in the MoDOT airport pavement conditions pilot program have a PCI of 70 or greater.

Accessibility to the Airport System

The FAA, in formulating the NPIAS, established a guideline in which access to the national air transportation system would be provided within 30-minutes of populated areas. MOSASP established this guideline as a service objective for the airport system. It is estimated that 99 percent of Missouri's population is within a 30-minute drive from any public airport in the state..

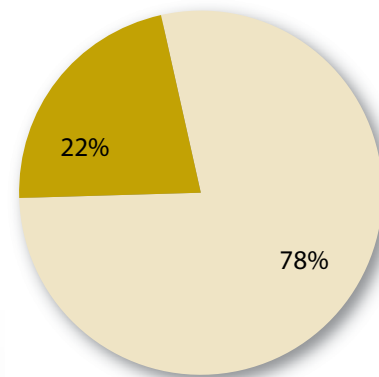
**Table 7:
Pavement Condition Index Scale**

PCI Value	Rating
86-100	Excellent
71-85	Very Good
55-70	Good
41-54	Fair
26-40	Poor
11-25	Very Poor
0-10	Failed

Source: ASTM D5340-11

**Figure 7:
Pavement Condition**

■ Meets Needs ■ Does Not Meet Needs



Condition Summary

Due to operational and facility constraints discussed in this section in addition to funding shortfalls, the current infrastructure's performance is fair to marginal. Overall, the state's public-use airport system, as reported by MOSASP, received a grade of C. The grading summary of Missouri's airport system's condition, according to MOSASP, is presented in **Table 8**.

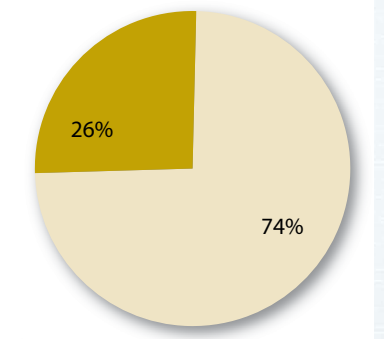
**Table 8:
Aviation System Condition Grade Summary**

Airport Component	Percent (%)	Grade
Airfield Facilities	70	C
NAVAIDs, Lighting and Weather Reporting System	68	D
Terminal Area Facilities	56	F
Pavement Condition	78	C
Accessibility to the Airport System	99	A
Composite Score	74	C
Composite Score	70%	C

Source: MOSASP

**Figure 8:
Missouri Aviation System Condition Summary**

■ Meets Needs ■ Does Not Meet Needs



ECONOMICS

Funding Availability

Airport improvement projects in Missouri are funded with federal, state and local sources. Because Missouri participates in the FAA's State Block Grant Program, MoDOT assumes the responsibility of administering federal Airport Improvement Program (AIP) grants, or Non Primary Entitlement (NPE) funds, for the state's NPIAS airports. AIP grants provide 90 percent of improvement costs with the airport owners contributing the remaining 10 percent.

MoDOT also administers the State Aviation Trust Fund (Trust Fund) to fund improvements at non-NPIAS airports that are included in the State Transportation Improvement Program (STIP). The Trust Fund derives its revenue from a portion of the state sales tax on jet fuel and a \$0.09 per gallon tax on aviation gasoline. The Trust Fund covers 90 percent of project costs with the remaining 10 percent being contributed by the airport owner. Lastly, Apportionment funds pay for MoDOT's Aviation Section's annual operational budget. These funds are also eligible to be used to fund projects at any public-use/public-owned airport. Forecasted federal and state funding levels are summarized in **Table 9**.

Short-Term (0-5 Year) Needs

According to the Missouri Statewide Aviation Transportation Program (FY2012-FY2016), which does not include MCI and STL, airport capital improvements projects over the next five years, including environmental, planning, engineering design, construction and land acquisition, are expected to cost nearly \$174,326,000. **Table 10** summarizes the state aviation system's short-term funding needs. Funding for these projects will be paid for by federal, state and local funding sources including city, county and third-party investments.

Table 9:
Estimated 5-Year Missouri Aviation Funding Availability

Funding Source	Annual Fund Allocation	Forecasted Level (0-5 Year)
Non Primary Entitlement	\$10,000,000	\$50,000,000
State Aviation Trust Fund	\$4,000,000	\$20,000,000
State Apportionment	\$4,600,000	\$23,000,000

Source: MoDOT

Table 10:
Missouri Statewide Aviation Transportation Program FY2012-FY2016

State Fiscal Year (July 1 thru June 30)	Projected CIP*
July 2012-June 2013	\$38,743,000
July 2013-June 2014	\$37,055,000
July 2014-June 2015	\$32,140,000
July 2015-June 2016	\$30,734,000
July 2016-June 2017**	\$35,654,000
Total***	\$174,326,000

(*) Current dollar amounts are rounded to the nearest thousand.
 (**) FY16 CIP was estimated based on the previous four years of proposed improvement projects.
 (***) Does not include capital improvement projects for MCI and STL.

Source: MoDOT

Funding Summary

Considering the available funding sources highlighted in **Table 9**, coupled with the project funding needs over the next five years, a shortfall of slightly more than \$81 million is anticipated during the short-term development period. The funding gap will have to be filled with monies from system stakeholders including airport businesses, or Fixed Base Operators, airport users and tenants, third-party developers as well as airport owners.

RESOURCES:

- American Society for Testing and Materials (ASTM) D5340-11: Standard Test Method for Airport Pavement Condition Index Surveys.
- CDM Smith, Inc., Missouri State Airport System Plan, 2005.
- CDM Smith, Inc., The Economic Benefit of Missouri's Airport System, 2005.
- Federal Aviation Administration.
- Kansas City Aviation Department Traffic Statistics (2012). Retrieved June 2012 from <http://www.flykci.com/Newsroom/TrafficStats/Index.htm>.
- Lambert-St. Louis International Airport Passenger Statistics (2012). Retrieved June 2012 from <http://flystl.com/Newsroom/PassengerStats.aspx>.
- Missouri Airport Managers Association.
- Missouri Department of Transportation, Aviation Section.
- Missouri Department of Transportation, Multimodal Operations Division.

Figure 9:
Short-Term Aviation Funding Summary



RECOMMENDATIONS:

- Make repair or replacement of the 6,893 deficient Missouri bridges a priority in future state budgets
- Work with legislators to explore new funding and expand existing funding streams to match the MoDOT long term planning needs
- Continue to use alternative delivery procedures, i.e. design build, to efficiently repair the most deficient bridges
- Continue to investigate practices used in other states, i.e. alternate technical concepts.

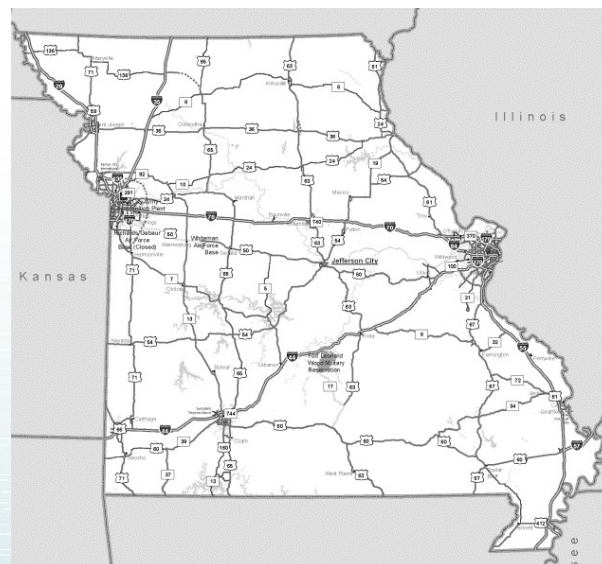
EXECUTIVE SUMMARY:

Even considering recent strides to improve the condition of Missouri's bridges, more than one in four of the state's bridges is considered deficient and one in seven is considered structurally deficient. The recently completed Safe Sound Bridge Improvement Program has made great progress in dealing with those in the worst condition, but considering the large number of bridges in the state inventory, similar programs must be implemented to prevent losing those gains. The state's roads and bridges are the lifelines for our state and national economy and reducing the number of deficient bridges is key to keeping that economy strong.

BACKGROUND:

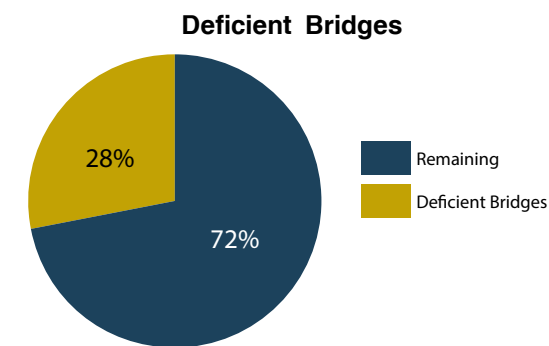
The Federal Highway Administration's (FHWA's) National Bridge Inventory (NBI) lists Missouri as having 24,334 bridges, ranking Missouri 7th in the nation in total number of bridges. 2,791 of these bridges are part of National Highway System (NHS) (illustrated in Figure 1) which includes bridges considered important to the nation's economy, defense, and mobility. This ranks Missouri 12th on the number of NHS bridges. The remaining 21,543 bridges rank Missouri 6th nationally in bridges not included in the NHS.

Figure 1 - National Highway System in Missouri



CONDITION:

Approximately one in seven of Missouri's 24,334 bridges are considered structurally deficient meaning load carrying members have been found in poor condition or the adequacy of the waterway opening is considered extremely insufficient. This ranks Missouri 41st in the percentage for this category and at 3,528 bridges ranks 47th in overall number. In addition, a similar percentage are considered functionally obsolete which indicates their design is outdated considering current standards. These categories combine to approximately 28% or 6,893 of the overall bridges are defined as deficient (structurally deficient or functionally obsolete).



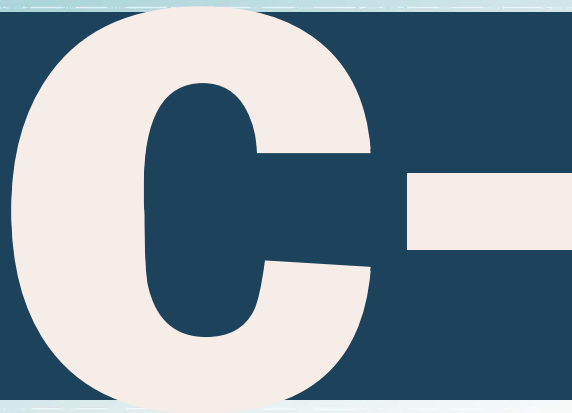
At 4 percent, Missouri is below the national average of 4.5 percent of structurally deficient NHS listed bridges, and is ranked 26th in this category, however, only 15 other states have more than Missouri's 111 structurally deficient NHS bridges. Missouri has 393 NHS listed bridges that are considered functionally obsolete, which is 14 percent of Missouri's NHS inventory. Compared to of the national average of 16 percent, Missouri ranks with the 22nd lowest percentage in the country.

At 16 percent, Missouri ends up at 40th in the nation in the percentage of structurally deficient non-NHS bridges. An even dire statistic is the total number of

both structurally deficient non-NHS bridges and total structurally deficient bridges. Only the states of Pennsylvania, Oklahoma and Iowa exceed Missouri's 3,417 structurally deficient non-NHS bridges and 3,528 total structurally deficient bridges. The above statistics only tell part of the story. The Missouri Department of Transportation (MoDOT) has focused on improving the condition of their highway bridges over the last 10 years. In 2001 Missouri had 449 functionally obsolete NHS bridges, 29 percent of non-NHS bridges were structurally deficient, and 26 percent of the total number of bridges were structurally deficient. The improvement of these numbers can be attributed to several factors such as the funding infusion from the federal American Recovery and Reinvestment Act, where Missouri was home of the first bridge project under construction, and innovative project delivery as demonstrated by the Safe & Sound Bridge Improvement Program. In 2008, the Safe and Sound Bridge Improvement Program was launched by MoDOT to improve the state's 802 worst condition bridges. Improvements include rehabilitation of 248 bridges and 554 complete bridge replacements.

ECONOMICS:

To estimated cost to simply repair or replace the deficient bridges noted in the 2011 bridge report is \$1.6 billion. While steps have been taken to improve the condition of Missouri's highway bridges over the last 10 years, MoDOT's latest Long Range Transportation Plan indicates there is a transportation funding gap of \$1 billion per year for the next 20 years. Adjusted



BRIDGES

for inflation assuming 3 percent over the first half and 4.5 percent for the remainder, that gap grows to \$2 billion - putting MoDOT's record of improvement in jeopardy. While MoDOT is looking at new ways to fund infrastructure improvement projects, the department will require future public and legislative support to bolster their funding streams. Currently, Missouri has the 6th lowest gas tax and the 5th lowest diesel tax in the country despite having the 7th most number of bridges.

RESILIENCE AND REDUNDANCY:

Due to the vast number of roads and bridges in Missouri, a certain amount of inherent redundancy is built into the bridge network. This should serve the state well in the short term should a portion of the network be taken out of service due to unexpected events such as a natural disaster or need for emergency repairs.

RESOURCES:

Glossary:

MoDOT: Missouri Department of Transportation

FHWA: Federal Highway Administration

NBI: National Bridge Inventory

NBIS: National Bridge Inspection Standards

National Highway System (NHS): The National Highway System (NHS) includes the Interstate Highway System as well as other roads important to the nation's economy, defense, and mobility. Source: FHWA.

Structurally Deficient (SD): Bridges are considered structurally deficient if significant load-carrying elements are found to be in poor condition due to deterioration or the adequacy of the waterway opening

provided by the bridge is determined to be extremely insufficient to the point of causing intolerable traffic interruptions. Source: MoDOT

Functionally Obsolete (FO): A functionally obsolete bridge is one that was built to standards that are not used today. These bridges are not automatically rated as structurally deficient, nor are they inherently unsafe. Functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demand, or those that may be occasionally flooded. Source: MoDOT

Deficient: Sum total of structurally deficient (SD) and functionally obsolete (FO).

REFERENCES:

1. United States. Federal Highway Administration. National Bridge Inventory 2012.
2. United States. Federal Highway Administration. National Bridge Inventory 2001.
3. State of Missouri. Department of Transportation. Long Range Transportation Plan, 5 Oct. 2001.
4. State of Missouri. Department of Transportation. Safe and Sound Bridge Improvement Program, 1 May 2012 <<http://contribute.modot.mo.gov/safeandsound/index.htm>>.
5. State of Missouri. Department of Transportation. I-70 Public-Private Partnership. 3 Aug. 2012 <<http://www.modot.org/i-70p3/>>.
6. United States. Federal Highway Administration. National Highway System. 10 Jul. 2012 <http://www.fhwa.dot.gov/planning/national_highway_system/>.
7. American Petroleum Institute. Motor Fuel Taxes. State Gasoline Tax Reports. 13 Jul. 2012.
8. <<http://www.api.org/oil-and-natural-gas-overview/industry-economics/fuel-taxes.aspx>>.

D-

DAMS

RECOMMENDATIONS:

- Permitting and regulatory authority to include more high hazard dams and large significant hazard dams.
- Funding be increased to facilitate inspections and repairs to aging dams of all hazard classifications.

EXECUTIVE SUMMARY:

Although they provide essential benefits and protection to residents, the vast majority of Missouri's dams are unregulated and aging. Additionally, only three percent of the dams whose failure could cause significant loss of life or property have an Emergency Action Plan to mitigate the risk. Funding for increased inspection and regulation of our high hazard dams will be necessary to address the safety issues and raise the current grade of D-.

BACKGROUND:

Missouri dams meet a variety of needs, including agricultural, recreational, stormwater management, water supply, and commercial, while providing vital resources to residents. Unlike most components of U.S. infrastructure, the majority of dams in the state are privately owned and maintained for personal or private use.

Since 1979, the Missouri Department of Natural Resources Dam and Reservoir Safety Council has regulated the design, construction, and maintenance of dams over 35 feet in height. A staff of five people work for the Dam and Reservoir Safety Program in administering the state's Dam Safety Program.

Dams are categorized into one of three classes or levels to indicate the relative risk that could be posed if the dam were to fail and release large amounts of water downstream. There are a total of 1,588 dams classified as high hazard dams, which means there is the potential for significant loss of life and property if one of these dams were to fail. There are also 3,511 dams rated as significant or low hazard potential for loss of life in the event of a dam failure. Of these dams, the state regulates 462 high hazard dams and 218 significant and low hazard dams.

In Missouri, three types of dams are not regulated by the State Dam and Reservoir Safety Council: 1) dams under 35 feet in height, 2) dams with a specific exemption for agricultural uses regardless of height, and 3) dams regulated by other state or federal agencies.

Missouri has 680 dams that fall under Dam and Reservoir Safety Coun-

cil regulatory authority, 66 federal dams and 132 state dams run by other agencies, and approximately 4,200 dams that do not fall under state regulatory authority nor have federal or state oversight.

The Dam and Reservoir Safety Program has limited authority to increase safety of all dams due to the limited regulatory authority for dams under 35 feet in height and the agricultural exemption for any size dam. As dams increase in size, the amount of water stored behind them that would be released in the event of a failure also significantly increases. Several years ago, there was a proposal to improve the regulatory requirements and increase the number of dams under state jurisdiction. The proposal would have more than doubled the number of regulated dams to approximately 1,500 in the state, but the proposal was not passed into law.

CONDITION:

Regular maintenance of all dams in Missouri is the responsibility of the individual dam owners. State Dam and Reservoir Safety staff currently provide regular inspection of all 680 regulated dams, but the inspection of non-regulated dams is not specified by state regulations and is completed by individual dam owners. State Dam and Reservoir Safety staff will offer assistance to owners of non-regulatory dams in the form of on-site evaluations and general engineering recommendations, but the engineering and construction for any needed improvements are the responsibility of the dam owner.

Typically, unregulated dams are not as well maintained since the dam owners are not necessarily trained in dam safety and inspection. For example, owners typically do not trim back trees that grow on dam embankments, nor do they monitor the condition of the principal spillway pipe, or pipe that carries the

normal flows. These items can often hide erosion or other problems until they fail catastrophically during an intense, prolonged rainfall event.

In the period from January 2010 to May 2012, there were a total of 39 construction permits issued for new dams, enlargement of existing dams, and other improvements. Of these permits, 25 were for repair of defects or required improvements due to changes in the downstream hazard classification of the dam (e.g. increased development downstream increased the hazard potential from low hazard to high hazard). This indicates approximately 10 dams per year are identified as requiring upgrades due to ongoing inspection or approximately 1.5 percent of regulated dams.

An Emergency Action Plan (EAP) is often required to establish emergency contact information and operations to maximize safety of downstream residents in the event of dam failure or dam emergency. There are 53 high hazard dams that have an EAP, or approximately three percent of the total high hazard dams in Missouri. By contrast, the national average for EAPs for high hazard dams is 66 percent, with a recommendation for 100 percent. A well-prepared EAP with easy to follow actionable steps can greatly reduce the potential for loss of life in the event of a dam emergency or dam failure.

Many dams were built with corrugated metal pipe or concrete principal spillways, which handle the major-

D -

DAMS

ity of flows through the dam. The anticipated life of corrugated metal pipe utilized in construction is approximately 25 to 30 years, after which the pipes begin to rust through and develop holes. Water can escape through the rusted pipe and erode the dam from the inside, potentially causing a sudden failure during a rainfall event. The anticipated life of concrete is often 50 to 75 years, or potentially longer if properly constructed and regularly maintained. The state of Missouri includes 759 dams that are over 50 years old, and another 1,040 dams that are 40 to 50 years old. It can be anticipated that more of these dams, which includes both unregulated and regulated dams, will continue to require improvements and upgrades to ensure continued proper operation and protection for residents and property downstream.

ECONOMICS:

Due to the large number of unregulated dams in the state of Missouri, there is not a definitive measure of the condition or potential for repairs on all dams in the state. Recent dam construction permits indicate that approximately 1-2 percent of regulated dams require improvements or upgrades each year, or approximately 10 per year. The necessity of repairs on unregulated dams, which does not require a permit or notification to state dam safety authorities, is likely much higher due to more lax inspection and maintenance. Dams built 50 years ago were engineered and constructed by the best standards available; however, many of these dams are not expected to safely withstand current predictions regarding large floods. These dams likely require improvements and maintenance to maintain safe operating conditions. In addition, all high hazard dams should be required to have an EAP to reduce the risk of loss of life in the unlikely event that a catastrophic failure would occur.

Based on the previous figures, it is estimated that the 680 regulated dams require approximately \$4 million per year in design and construction for upgrades, in addition to regular maintenance costs. This assumes 10 dams requiring improvements each year and \$400,000 per dam. Of the 1,126 unregulated high hazard dams in the state, it is likely that the number of dams requiring improvements is 1 to 5 times that for regulated dams. The unregulated significant and low hazard dams typically require upgrades at the same frequency, but costs for these improvements are typically lower. It is estimated that the total cost to upgrade dams to national standards of repair and operation, including development of an EAP for all high hazard dams, over the next ten years is \$225 million, or \$22.5 million per year.

RESOURCES:

1. ASCE – 2013 Report Card for America's Infrastructure (2013).
2. Association of State Dam Safety Officials – Performance Report for the State of Missouri (2012).
3. Personal Correspondence – Robert A. Clay, P.E., Chief Engineer, Missouri Department of Natural Resources, Water Resources Center, Dam and Reservoir Safety Program, May 2012.
4. National Inventory of Dams Web site: <http://geo.usace.army.mil/pgis/f?p=397:1:0::NO>, accessed June 2012.
5. Missouri Department of Natural Resources Water Resources Center website: <http://dnr.mo.gov/env/wrc/damsft/bkgrd.htm>, accessed August 2012.

C-

DRINKING WATER

RECOMMENDATIONS:

- Create federal and state programs to provide commodity purchase pool for public water utilities to purchase water main pipelines and supporting equipment and supplies for transmission and distribution systems.
- Increase Missouri's state budget allocation for water infrastructure investment to provide 50 percent matching grants to public water utilities funding for capital infrastructure investment.
- Provide priority on Community Development Block Grants (CDBG) for water infrastructure investment to other programs.
- Establish water operator certification grants as part of its state employment training programs.
- Require public water systems to develop an asset management program prior to future participation in Missouri funding and SRF programs.

(continued)

EXECUTIVE SUMMARY:

Missouri is fortunate to have abundant water to supply its domestic, industrial, and agricultural demand. Approximately 73 percent of the water provided to its population is provided by surface water. The remaining 27 percent is provided by groundwater sources such as underground aquifers.

Even though Missouri has an abundance of water for serving its communities, its aging water treatment and distribution systems are struggling to keep up with current demand for operations and maintenance. Improved planning and increased funding are vital to Missouri to not only maintain its current water supply but also to assure it is safe for future Missouri generations.

OVERVIEW:

More than five million Missouri citizens are provided drinking water by approximately 2,780 public water systems. The largest source of drinking water for Missouri is the Missouri River which serves 54 percent of its population. Even though the Mississippi River forms the eastern border of the state, less than one percent of Missouri's population is provided drinking water by the river.

The state public water system was graded for capacity, condition, funding, and public safety. The 2007 Needs Survey by the Environmental Protection Agency (EPA) and the 2009-2010 State Revolving Fund Biennial Report by the Missouri Department of Natural Resources (MDNR) provided information to grade funding and future needs. The 2011 Annual Compliance Report by the MDNR provided information necessary to grade the capacity, condition and public safety.

CAPACITY:

In 1996, the MDNR prepared a report titled "Water Use in Missouri." At that time, the total water use in the state was 8.65 trillion gallons which was enough to fill the Lake of the Ozarks 13 times. According to the 1996 report, a significant portion of the water use in Missouri is utilized to generate electricity in the state which required 8.2 trillion gallons which includes 1.9 trillion for electrical generation facilities and 6.3 trillion for hydroelectric plants. The majority of water used in the state for electrical generation is not consumed and actual "consumption" is 15 billion gallons.

The state of Missouri consumes approximately 450 billion gallons water annually of which 233.3 billion gallons or 52 percent of this consumption is by municipal water users. Of this 233.3 billion gallons, domestic use by households reported only 15.6 billion gallons (6.7 percent) of municipal water. In comparison, industrial users reported nearly 23.5 billion gallons (10.1 percent) of water used in the creation of products and 148 billion gallons (63.4 percent). In the state, the Kansas City and St. Louis metropolitan areas account for more than two-thirds of the total domestic use.

In Missouri, water provides additional uses for its citizens such as water-based recreation. Annually, Missourians spend approximately 134 million activity-days in outdoor water-based recreation such as boating and fishing. Water is also important to the state to support and sustain fish and wildlife including habitat preservation.

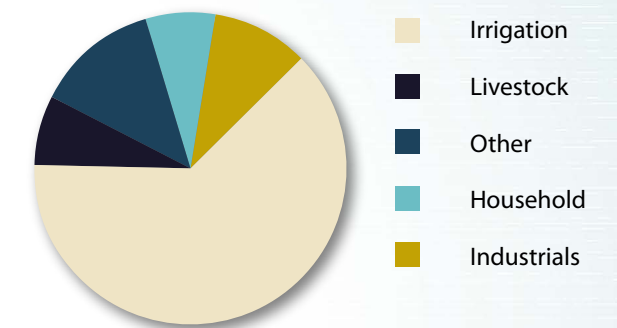
In 2011 the MDNR reported surface water provided 73 percent of the water provided to the population served while only 27 percent was provided by groundwater from underground aquifers. The majority of surface water is supplied from the Missouri River or its alluvial wells at 54 percent of the population and its importance to the Missouri as a natural resource cannot be overstated.

According to the 2011 Annual Compliance Report of Missouri Public Drinking Water by the MDNR, there are approximately 2,780 public water systems in Missouri of which 1,470 (52.9 percent) were community systems such as cities, water districts, and subdivisions. These water public water systems serve more than five million citizens.

The ability of Missouri's public water systems appears to be losing ground in its capacity to provide for the need of water infrastructure. According to the EPA, from 1995 to 2007 the 20-year need reported by water utilities in 2007 dollars had increased from

\$2.72 billion to 7.09 billion. Over this 12 year period, the average yearly increase in need was \$364 million translating to over a 10 percent annual increase.

Water Quantity By Use Category



CONDITION:

Missouri's public drinking water systems will require significant investment to maintain current service levels to its citizens in the future. According to the 2007 Needs Survey, which sampled about 14 percent of Missouri's community systems, over \$7.1 billion of financial need for maintaining the same level of service was reported by its public drinking water systems. The majority of the need was for transmission and distribution at approximately 68 percent (\$4.8 billion) while only 18 percent (\$1.3 billion) was for treatment facilities.

The problem is evident in Missouri's two largest cities, as seen in the growing number of water main breaks in recent years. At over 1,500 water main breaks in 2011, Kansas City broke its previous record of 1,430 in 2000. Similarly, St. Louis is seeing significant issues with its water distribution system with the average age of 55

C-

DRINKING WATER

RECOMMENDATIONS:

(continued)

- Require public water systems to operate at public corporations similar to electric utilities, with user rate structures that account for the full cost of services including the loss of value of systems (depreciation) over time.
- Pass legislation for public water systems to establish adequate reserves for one year of debt service.
- Impose stricter state penalties for community water systems with acute violations of contaminants.
- Place public water systems that fail to comply with federal and state reporting requirements on one-year probation for state grants and other funding mechanisms.

to 65 years old for its distribution mains. This aging has created a \$680 million funding gap for water systems in St. Louis based on a private report by CDM Smith. The required replacement, in addition to an annual one percent water main replacement in St. Louis, is 34 miles.

ECONOMICS:

Much of the capital infrastructure funding for public drinking water in Missouri is the responsibility of local municipalities. A valuable resource for public drinking water utilities is Missouri's Drinking Water State Revolving Fund (SRF) which is a part of the EPA Drinking Water SRF Program. As of June 2010, Missouri SRF had received a total of \$195 million in grants from the EPA through the American Recovery and Reinvestment Act (ARRA) of 2009.

The Missouri SRF existed prior to the ARRA funding and according to federal Safe Drinking Water requirements, states are required to provide a minimum match of 20 percent of the total grant. Beginning in 2004, Missouri's match was provided through the proceeds of the sale of Environmental Improvement and Energy Resources Bonds. While a significant amount of funding was appropriated through ARRA funding, Missouri's cumulative Drinking Water SRF binding agreements total is \$300 million resulting in 118 commitments, 73 leveraged loans, 26 direct loans, and 19 grants.

Even though \$225 million was appropriated in the Missouri 2012 state budget for environmental quality, water resources, soil and water conservation, and environment financial support, most of these funds were not allocated for drinking water investment. In 2012, a total of \$134 million was appropriated by the state of Missouri for Environmental Financial Support which, in addition to water capital investment, included other uses such wastewater facilities, air pollution, clean up abandoned and uncontrolled hazardous waste sites, reduce and reuse solid waste, and reclaim abandoned mine lands.

An evident gap exists between the required \$7.1 billion capital investment for improving Missouri's water systems and the funding provided by federal and state SRF programs. Simply put, capital infrastructure investment is inadequate to fund both current and future public drinking water systems needs.

PUBLIC SAFETY:

Although the majority of the Missouri population receives safe drinking water, a significant number of citizens are negatively affected

by water quality standard violations, as established by the EPA. 2011, MDNR reported violations for community water systems serving approximately 6.23 percent of its population. While this appears as a low percentage, this equates to approximately 311,500 people.

Public drinking water systems measure public safety and well being by the level of contaminants in the water supply. Examples of contaminants in the water supply include organic, inorganic, radiological, and microbial (MCL) contaminants. In 2011, the number of organic and inorganic violations in Missouri was relatively low with less than 1 percent reporting violations.

A more significant portion of the public water systems reported contaminant violations for MCL, with 421 reporting non-acute violations. While only 14 public water systems (0.5 percent) had acute violations for coliform or E. coli., these violations resulted in 32 boil orders issued for public water systems in the state of Missouri in 2011.

While the number of violations was larger than desired, the number of future violations is expected to decrease. In 2011, the Missouri Clean Water Commission was provided the authority to prevent new pollutants flowing into its lakes and rivers that were distressed. As a result, the Commission and MDNR will have authority to limit permits, inspect, and bring enforcement actions against a broader range of facilities when the water is under severe distress.

RESOURCES:

1. Our Aging Water Infrastructure: The Attributes and Needs of the Water and Wastewater Infrastructure in the bi-state St. Louis Region (CDM). http://www adaywithoutwater.net/mm/files/mWIP-Our_Aging_Water_Infrastructure.pdf.
2. EPA 816-R-09-001: 2007 Drinking Water Infrastructure Needs Survey and Assessment.

- http://water.epa.gov/infrastructure/drinkingwater/dwns/upload/2009_03_26_needsurvey_2007_report_needsurvey_2007.pdf.
3. General Accounting Office, 2002 Water Utility Financing and Planning Report (GAO-02-764). <http://www.gao.gov/new.items/d02764.pdf>.
4. Missouri Budget and Legislative Priorities, Fiscal Year 2011. <http://oa.mo.gov/documents/bp/bib2011/priorities.pdf>.
5. Missouri Department of Natural Resources: 2011 Annual Compliance Report of Missouri Public Drinking Water. <http://www.dnr.mo.gov/pubs/pub2449.pdf>.
6. Missouri Department of Natural Resources: Missouri Drinking Water State Revolving Fund Biennial Report Fiscal Years 2009-2010. <http://www.dnr.mo.gov/env/wpp/srf/final-dwsrf-fy09-10-biennial-report-030111.pdf>.
7. Office of Administration, Department of Natural Resources Financial Summary, <http://oa.mo.gov/bp/budg2013/NaturalResources.pdf>.
8. State Allotment Percentages for the Drinking Water State Revolving Fund Program, Federal Register /Vol. 74, No. 101 /Thursday, May 28, 2009 /Notices, <http://www.gpo.gov/fdsys/pkg/FR-2009-05-28/pdf/E9-12470.pdf>.
9. Weather Triggers Record Water Main Breaks in Kansas City. Steve Vockrodt, Kansas City Business Journal, 11/15/2011. <http://www.bizjournals.com/kansascity/news/2011/11/15/weather-triggers-record-water-main.html>.

RECOMMENDATIONS:

- Provide a clear statewide energy policy including potential sources of energy generation, goals for make-up of the future generation sources and the transmission (delivery) systems required.
- Provide for maintenance and retrofit to existing facilities, specifically the aging generation and transmission infrastructure.
- Invest in the research of alternative energy and advanced nuclear energy sources to diversify the energy generation sources within the state.
- Remove any unnecessary permitting hurdles that delay needed projects.
- Create proper incentives to catalyze the generation and transmission investments.

EXECUTIVE SUMMARY:

Missouri is unique in that it is a member of three power distribution networks. Approximately 81 percent of the energy in Missouri is produced through coal power plants with another 12 percent being provided through nuclear energy; the remainder of Missouri's energy needs are met through natural gas, hydroelectric and wind generation. Aging infrastructure and government regulation continue to be major drivers for large expenditures at both the power plants and in the distribution system. Energy prices in Missouri are currently very affordable; however due to a projected \$107 billion dollar national shortfall in funding, additional costs will likely be passed along to the customers and drive up energy costs. A clear plan for energy development should be developed for the state to help improve the current grade of "D+."

BACKGROUND:

Energy and transmission infrastructure in North America is divided into several networks. These networks separate the infrastructure into geographical regions which are then managed by Independent System Operators (ISO). The ISO's are responsible for supplying the country with efficient and reliable energy. Missouri is part of three ISO networks: Southwest Power Pool (SPP), Midwest Independent Transmission Systems Operator (MISO), and Southeastern Electric Reliability Council (SERC).

The nation's energy is primarily generated from four different types of fuel: coal, gas/oil, nuclear, and renewables. Gas and oil are the predominant fuels in the SPP system, while coal is the predominant fuel in the MISO and SERC Systems. Missouri relies principally on generation from coal. Missouri relies on many miles of transmission lines that are in aged condition and were originally arranged to support local needs instead of regional needs. Due to these dynamics, **Missouri power producers are facing uncertainties related to fuel cost variability, environmental regulations, land acquisition restrictions and growing load demand. Increased investment in generation facilities and transmission distribution networks is needed to maintain a reliable power system.**

ENERGY MAKEUP:

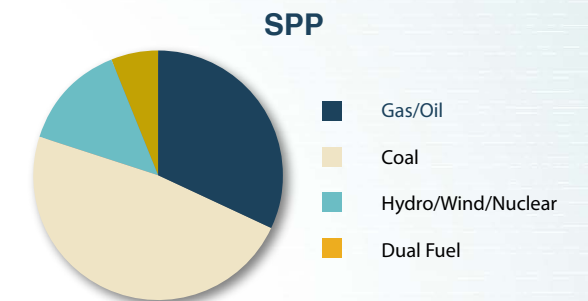
Missouri has large coal fleet. These coal plants are aged and will continue to need maintenance and upgrades. Missouri does not have a viable coal, petroleum or natural gas reserve in the state. Although a large amount of coal is located in the state, it is not considered viable due to its high sulfur content. Missouri receives a substantial portion of its coal from Wyoming via rail car. Most of the coal, gas, and petroleum consumed in the state are imported from other states. Coal accounts for nearly 81 percent of Missouri's generation. Major pipelines cross the state, providing the means of transport for these resources into the state. Nuclear energy generation accounts for nearly 12 percent of Missouri's power generation today. This nuclear energy is provided by a lone source, Callaway nuclear plant. Natural gas, hydroelectric and wind generation account for less than seven percent. Most of this renewable generation can be attributed to hydroelectric generation.

Missouri does not participate in capping greenhouse emissions. Missouri does not have any regional memberships to organizations evaluating or working on capping measures. Missouri has adopted a renewable portfolio standard that requires investor-owned utilities to deliver renewable generation of five percent, 10 percent and 15 percent total output by 2014, 2018 and 2021 respectively. This renewable standard will require investment in renewable infrastructure or means to purchase reliable renewable energy from other states, creating a need for upgraded and new transmission.

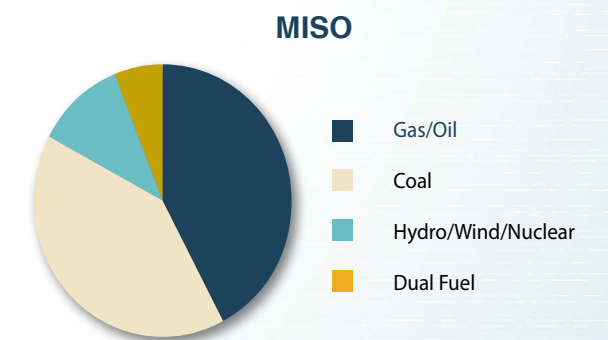
INVESTMENT PLANNING:

Missouri has a unique power network, containing three regional entities, the SPP, MISO and southeast pool. The SPP, MISO and southeast pool are respon-

sible for maintaining their respective infrastructure and charting unique paths forward, dependent on their regional needs.



In the SPP region, the anticipated growth in the upcoming years is forecasted to be roughly 1.16 percent annually. As of 2010, the SPP generation portfolio consisted of the following breakdown: gas/oil (42 percent), coal (40 percent), hydro/wind/nuclear (11 percent), dual fuel (6 percent).



Midwest ISO growth is forecasted to be 0.75 percent (per year). As of June 2012, the MISO generation portfolio had a capacity of 131,581 MW and consisted of the following breakdown: gas/oil (32 percent), coal (48 percent), Renewables (wind and hydro) (14 percent), nuclear (6 percent).

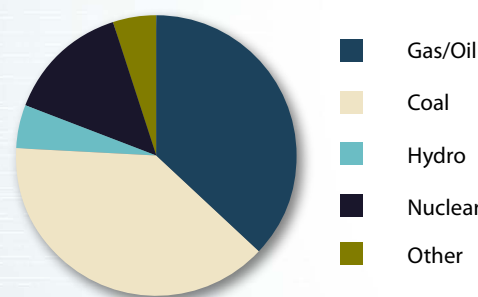
One of the challenges for MISO is the aging

D+

ENERGY

generation plants, where the average age of coal plants more than 40 years old. If current trends continue, these aged plants will require upgrades and environmental retrofits, requiring substantial investment. This issue is compounded by the potential effects on the generation capacity due to carbon legislation and the number of states implementing renewable portfolio standards within the MISO footprint.

SERC Generation Portfolio



As of June 2011, the SERC regional capacity was 247,943 MW and consisted of the following breakdown: coal (39 percent), gas/oil (37 percent), nuclear (14 percent), hydro (5 percent), and others (5 percent). Peak energy demand is expected to grow by 1.43 percent annually through 2020. **Future load generation growth is projected to be primarily in the nuclear market, with some additional capacity provided by gas/oil as well as decommissioning approximately 1,000 MW of coal generation.** A primary area of focus for the SERC utilities is adding new transmission lines and existing system upgrades over the next five years. **Current transmission projects through 2013 are projected to have \$11.8 billion in expenditures. Over the next 10 years, “planned transmission expansion at 100kV and above in SERC represents approximately 14.6 percent of all transmission expansion in the U.S.”**

ECONOMICS:

Missouri power customers are provided some of the least expensive energy in the country. This is principally linked to Missouri’s use of coal generation. **Tightening rules regarding sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) emissions will create the need for large capital improvements at plants leading to higher prices for users, needed to pay for these projects.** This is occurring around the nation today. In the future, potential carbon regulations will impact prices but this is less eminent than SO₂ and NO₂ regulations, which are already moving forward. The reasons for these standards have been provided by the EPA and are linked to prevention of premature deaths, preventable sick days and \$280 billion of healthcare benefits.

The condition of the existing power transmission systems is important to monitor and sources indicate that a national shortfall of \$37.3 billion in investment is expected between now and 2020.

Without the needed improvements, the probability of failure associated with wind storms and ice events increases for transmission infrastructure.

Utilities can create a more reliable business model through more efficient transmission systems. Creating an efficient system appears to be an opportunity being vetted currently. Transmission infrastructure is critical to creating a reliable energy distribution network for a day-ahead marketplace. With the establishment of a day-ahead marketplace, it appears that utilities and their clients could potentially benefit from these efficiency’s as well as improve reliable energy delivery. **Financial incentives and improvements to permitting speed and land access would help accelerate these projects.**

Renewable energy in Missouri is moving forward and a Renewable Energy Standard has already been

established. The development of these sources appears to be closely tied to the economic benefits of credits and other incentives associated with renewable energy sources. **Without these incentives, many speculate that this market becomes less viable for prospective investors and power producers.**

Natural gas is abundant in neighboring Kansas and is beginning to establish a marketplace that has proved reliable in the near term. This marketplace is tied to innovative methods of drilling and a strong demand. **Infrastructure projects associated with gas delivery have proven to be difficult to permit due to environmental challengers, delaying the potential economic benefits of gas exports and the associated jobs.** Gas is being used around the country for new power generation and also to replace decommissioned coal plants, due to its decreased emissions.

Given current trends, a national investment shortfall of \$107 billion is expected by 2020. Eleven percent of this shortfall is new generation and 89 percent is transmission and distribution. The SPP and SERC are expected to have an investment shortfall of \$2.4 billion and \$29.7 billion, respectively, by the year 2020. This lack of investment is expected to reduce GDP by \$70 billion and cost 529,000 jobs by the year 2020.

CONCLUSION:

Power customers in Missouri are currently benefiting from reliable and cheap energy. The state relies on power from multiple sources but largely coal. This infrastructure will need to expand and upgrade due to new demand, current age, and environmental standards. Wind energy has the potential to grow but could stall due to expiring incentives. The state delivers energy through a transmission network that is aging and needs to grow to meet the new renewable and gas sources. The power generation and delivery

market is facing investment needs driven by new demand, environmental regulations, deteriorating infrastructure, expiring incentives, land acquisition restrictions and a lack of proper enticement to investment. Finding permitting and regulatory balance, coupled with investment solutions will require action by government, power providers and power users.

RESOURCES:

1. http://www.spp.org/publications/2010_SPP_Strategic_Plan.pdf.
2. http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=KS07R.
3. <http://www.instituteforenergyresearch.org/state-regs/pdf/Missouri.pdf>.
4. <http://consumerenergyalliance.org/state-energy-profiles/missouri/>.
5. <https://www.midwestiso.org/AboutUs/Pages/AboutUs.aspx>.
6. <https://www.midwestiso.org/AboutUs/Pages/AboutUs.aspx>.
7. [http://www.serc1.org/Documents/SERC/SERC%20Publications/Information%20Summary/2011%20Information%20Summary%20Brochure%20\(July%202011\).pdf](http://www.serc1.org/Documents/SERC/SERC%20Publications/Information%20Summary/2011%20Information%20Summary%20Brochure%20(July%202011).pdf).
8. <http://205.254.135.7/state/state-energy-profiles.cfm?sid=MO>.
9. http://205.254.135.7/forecasts/archive/aeo11/source_nuclear.cfm.
10. http://www.asce.org/uploadedFiles/Infrastructure/Failure_to_Act/energy_report_FINAL2.pdf.
11. Energy Information Administration, State Energy Data System (www.eia.gov).

D

INLAND WATERWAYS

RECOMMENDATIONS:

Various aspects need to be considered, to improve the inland waterways in Missouri.

- Provide a predictable and reliable source of maintenance funding with a dedicated source of revenue. Investing in the regular maintenance of existing infrastructure is crucial. Deference will result in higher costs later.
- Improve the program to maintain and improve the locks and dams on the Mississippi River.
- Limit degradation of the Missouri River by finalizing the study and implementing recommended solutions.
- To optimize the navigation of freight, it is necessary to also respect the needs related to: hydroelectric power, flood control, municipal water, irrigation, fish and wildlife habitat, and recreation.
- Continue to collaborate between the agencies and the stakeholders, to encourage development and barge traffic on the Missouri River.
- Maintain the depth of channels to accommodate the current and future fleet.

EXECUTIVE SUMMARY:

With 965 miles of barge navigable waterways and additional waterways utilized for water sources, hydroelectric power, navigation, and recreation, the rivers in Missouri provide a valuable resource for its residents. This resource is significantly underutilized due to an aging system of locks and the lack of consistent support for barge traffic on the Missouri River. Additional funding to improve the locks on the Mississippi River and maintain the channel and facilities on the Missouri River will lead to savings in transportation costs, remove traffic from our crowded roads, and raise the current grade of “D” for the system.

BACKGROUND:

Missouri’s rivers are used for hydroelectric power, flood control, navigation, municipal water, irrigation, fish and wildlife habitat, and recreation. This report focuses on the use of the river for navigable barge commerce with some consideration for the other purposes.

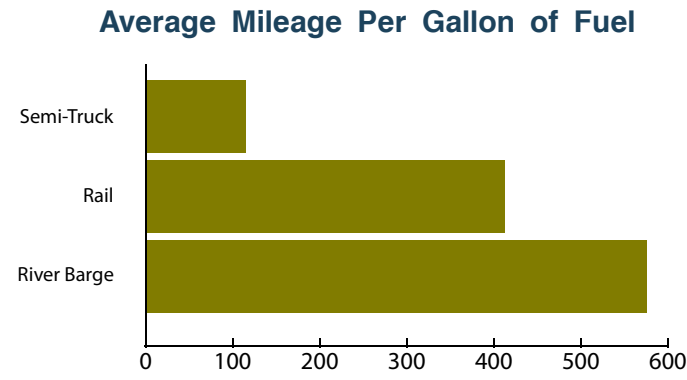
Each year the Missouri River carries 8 million tons of cargo, throughout its navigable length. The Mississippi River carries 58 million tons to the mouth of the Missouri River, and 189 million tons to Baton Rouge, Louisiana. This cargo primarily includes coal, salt, petroleum, chemicals, construction materials, and agricultural products.

There are 965 miles of barge navigable waterways in Missouri (553 on the Missouri River and 412 miles on the Mississippi River). The Mississippi River and the Missouri River carry Missouri’s barge traffic. The Mississippi River along the eastern edge of the state of Missouri, shares its banks with Illinois, Kentucky and Tennessee.

The three primary modes for commerce transport are by barge, train and semi-truck, with the barge being the most fuel efficient and safe.

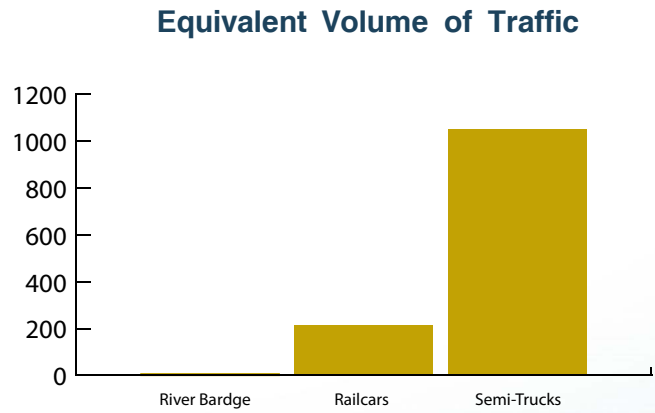
Barges Are More Fuel Efficient

On one gallon of fuel, a barge can move one ton of cargo 576 miles, while a train can move one ton of cargo 413 miles and a semi-truck can move one ton of cargo 155 miles.



Barges Safer:

Barges also reduce rail and highway congestion by moving the equivalent cargo that would require 216 rail cars or 1,050 semi-trucks. A Texas Transportation Institute study determined that if navigation was halted due to an infrastructure failure on the Mississippi River in the vicinity of St. Louis, there would be significant safety concerns. This would cause truck traffic to double, resulting in traffic delays and increasing the interstate injury and fatality rate by 36 to 45 percent.



Barges Have Lower Transportation/Consumer Costs

Barges on these rivers currently transport 64 million tons of cargo each year, worth about \$4.1 billion; **barge shipping currently saves consumers \$11 per ton as compared to other modes.** This translates into a savings of \$649 million in transport costs each year, with a potential savings of \$721 million per year if improvements are made.

Barges More Environmentally CO2 Friendly:

According to the Texas Transportation Institute, **compared to barge transport, rail transport generates 39 percent more CO2 and trucking generates 371 percent more CO2.**

CONDITION:

Portions of the Missouri River bottom have been dropping as a result of sediment load, channel straightening, and many other reasons; therefore, this is being investigated by the United States Army Corps of Engineers (USACE). The USACE is charged with maintaining the navigable rivers in Missouri while the United States Coast Guard conducts law enforcement, search and rescue, and the maintenance of aids to navigation on the River. Most of the navigable Missouri River is within the USACE Kansas City

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INLAND WATERWAYS

district, and the Mississippi River is within USACE's Rock Island, St. Louis and Memphis districts.

Historic alterations to the river for the use of navigation has created a continual maintenance challenge for USACE. The barge commerce on the Missouri River has decreased, and this is the result of issues related to low river stages and market confidence in its use. An authorized 9-ft depth is to be maintained on the river to accommodate navigation; however, this requirement is difficult to balance with the hydroelectric power, flood control, municipal water, irrigation, fish and wildlife habitat, and recreation needs. **The river bottom dropping also causes erosive cascades to progress upstream on smaller rivers and streams that release into the Missouri River.**

A study by Hanson Professional Services, Inc. completed for the Missouri Department of Transportation (MoDOT) in 2011 stated that the Missouri River has 79 facilities with port infrastructure, which includes 29 active facilities, 30 inactive facilities, and 20 unknown facilities. More than half of the active facilities move sand and the remainder move a specific commodity. Most ports could be revitalized with minimal investment to handle dry bulk, such as grain and fertilizers. Ports suited to handle liquids infrastructure would require significant investment, unless they are in locations of multimodal transportation facilities. Heavy cargo port infrastructure for handling steel, containers, palletized, or loose cargo is relatively weak, due to the lack of stable crane platforms and staging areas, with the exception of ports in Jefferson City, Kansas City, and St. Joseph.

Most of the Mississippi River's locks and dams were constructed in the 1930s and are in need of repair or replacement. The lock and dams numbered 20 through 27 are along the Mississippi River along the

banks of the state of Missouri. Locks 20 through 25 are only 600-ft long, requiring barge tows to be split in two for passage, which is time consuming and can cause safety concerns. Regular maintenance has not been adequately funded to tend to unexpected issues, so those sometimes take months to repair.

ECONOMICS:

The USACE has partnered with the Mid-America Regional Council (MARC) in order to study the degradation of the Missouri River bed. They are studying the causes of this degradation and how it will affect the infrastructure and economy of the Midwest. The reconnaissance study was completed in August 2009. Congress authorized and appropriated funding for the USACE/MARC feasibility study. In addition, affected public entities and private organizations (listed in Appendix B of the "Missouri River Bed Degradation Reconnaissance Study") are partnering to sponsor the ongoing and upcoming phases of study. This project is currently in the study phase and any construction that will occur pursuant to the study recommendations are not yet funded.

To increase Missouri River port and barge usage, it will be necessary to maintain the navigable channel and to encourage private businesses to share in the infrastructure development and maintenance.

The connection of ports along the Missouri River is supported by the Missouri Department of Transportation. Seventy percent of Missouri's economy is within a 30-minute drive of the Missouri River.

State funding is limited, but stakeholders have suggested consideration to mimic the U.S. Department of Transportation (DOT) federally subsidized "Essential Air Service" program to an "Essential Water Service" program, where there would be a potential for establishing a guaranteed minimum amount of

freight on the river. The federal support from the Coast Guard and USACE is dependent on meeting or exceeding minimum activity level.

In regards to the Mississippi River, for the past three decades, the rehabilitation and maintenance of the locks and dams throughout the country have been funded by the Inland Waterways Trust Fund (IWTF) and congressional appropriations. The IWTF was established in 1978 to help pay for new lock construction and major rehabilitation costs. As the infrastructure ages, the maintenance costs are regularly exceeding the available funding, and new construction or replacement has become less common.

According to a 2009 USACE report "Upper Mississippi River – Illinois Waterway System" funding for the lock and dam system has been "largely flat or declining for decades." As the system continues to age the maintenance needs continue to rise. Long-established programs for preventative maintenance of major lock components have essentially given way to a fix-as-fail strategy.

The Water Resources Development Act of 2007 authorized the dual-purpose navigation and ecosystem restoration plan for the Upper Mississippi River. This Act provided permission to pursue the reconstruction of Locks 20, 21, and 22. Under this plan, these locks would be extended to 1,200 feet which would increase the efficiency of the locks by accommodating the much longer barges used today. It is important to note that this Act merely allowed for the reconstruction, however it did not fund it. This Act required annual appropriations to be made in order to fund construction. Title IV of the American Recovery and Reinvestment Act of 2009 did provide funds to the USACE to allow them to perform maintenance on the Locks and Dams and the reconstruction of Lock and Dam #27.

Estimated Maintenance Costs for Missouri Locks and Dams

Locks and Dams	Location	Current Total Estimated Cost of Maintenance (millions)
20	Canton, Missouri	\$41,600
21	Quincy, Illinois	\$31,530
22	Saverton, Missouri	\$35,110
24	Clarksville, Missouri	\$13,807
25	Winfield, Missouri	\$18,258
26	Alton, Illinois	\$9,464
27	Granite City, Illinois	\$12,121
Total		\$161,890,000



INLAND WATERWAYS

RESOURCES:

1. Texas Transportation Institute, Center for Ports and Waterways, "A Modal Comparison of Freight Transportation Effects on the General Public", March 2009.
2. American Society of Civil Engineers, Illinois Report Card for America's Infrastructure, 2009 Navigable Waterways <http://www.infrastructurereportcard.org/node/178>.
3. U.S. Army Corps of Engineers - Navigation Data Center "The U.S. Waterway System — Transportation Facts", December 2005.
4. Cambridge Systematics, Inc., "Kansas Statewide Freight Study, Existing Freight System" 2009.
5. United States Government Accountability Office, "Missouri River Navigation: Data on Commodity Shipments for Four States Served by the Missouri River and Two States Served by Both the Missouri and Mississippi Rivers" 2009.
6. Reservoir Control Center U. S. Army Corps of Engineers Northwestern Division - Missouri River Basin Omaha, Nebraska "Missouri River Mainstem Reservoir System Master Water Control Manual Missouri River Basin" Revised March 2006.
7. Hanson Professional Services Inc. for Missouri Department of Transportation, "Missouri River Freight Corridor Assessment and Development Plan", October 2011.
8. Missouri Department of Transportation, "Infrastructure & Development Opportunities", post-October 2011.
9. Mid-America Regional Council "Missouri River Bed Degradation Study - About the Project.", 2013. Web. 10 Jan 2013. <http://mobeddeg.org/about.asp>.
10. United States of America. US Army Corps of Engineers "Missouri River Bed Degradation Reconnaissance Study", August 2012.
11. United States of America. US Army Corps of Engineers. Upper Mississippi River- Illinois Waterway System Locks and Dams. 2009.
12. United States Congress, The American Recovery and Reinvestment Act of 2009. 111th Cong., 1st sess. Washington: GPO, 2009. PDF.
13. "Missouri Port Authority." Missouri Port Authority. N.p., n.d. Web. 16 Nov. 2012. <<http://www.missouriports.org/>>.
14. McMichael, Matthew B. Update of Missouri Port Authority Assessment. Rep. no. Or08.007. N.p.: n.p., n.d. Update of Missouri Port Authority Assessment. Missouri Department of Transportation, Nov. 2007. Web. 16 Nov. 2012. <<http://library.modot.mo.gov/RDT/reports/Ri07027/or08007.pdf>>.

C-

LEVEES

RECOMMENDATIONS:

- Establish a program to ensure proper identification, inspection, and maintenance of levees not in the Corps of Engineers programs.
- Establish a program to ensure adequate funding of ongoing maintenance and repairs for levees not in U.S. Army Corps of Engineers or FEMA programs where failure could significantly impact lives or property.
- Develop statewide standards for levees in accordance with national levee design practices.

EXECUTIVE SUMMARY:

It is estimated that over 10,000 miles of levees exist in the state of Missouri. Only 2,068 miles of this total distance are under the jurisdiction of the U.S. Army Corps of Engineers (USACE) and have any documented ongoing inspection or maintenance program. The levees that have an inspection program are generally considered acceptable. If the total number of levee miles is considered, the overall condition of the state's levee system would decrease dramatically. A yearly expenditure between \$45 and \$112 million would be needed to fund the necessary maintenance to bring all levees to an acceptable level. To help do this and increase the current grade from a "C-" a set of standardized regulatory rules should be developed and put into place for all levees not just those under the U.S. Army Corps of Engineer's jurisdiction along with funding sources to assist in completing the necessary inspections and improvements.

BACKGROUND:

Levees in Missouri provide flood protection for lands in urban, suburban, and rural/agricultural settings that would otherwise be subject to frequent inundation. Although levees have long been utilized for flood protection in Missouri, there are no consistent standards or regulations governing the design, construction, maintenance, and ongoing inspection of levees in the state.

Although a comprehensive tabulation of all levees in the state is not available, the National Levee Database (NLD), which is a compilation of levees participating in U.S. Army Corps of Engineers programs, lists Missouri as having a total of 192 levees with a total length of 2,068 levee miles. It is estimated that up to 85 percent of levees are not part of the NLD, although Missouri likely has a lesser percentage of undocumented levees due to the extensive levees along the Mississippi and Missouri Rivers. It is estimated that Missouri could have an additional 4,000-8000 miles of unlisted levees. What is most important to Missourians however is the fact that **it is impossible to tell the actual number of levees and levee miles, raising questions of how we maintain vital infrastructure we cannot see.**

Levees in Missouri are owned and maintained by a variety of

organizations, including the federal government, local drainage and levee districts, local governments and government entities, and private interests. In the NLD, there are 33 levee units (17 percent) in the state representing 116 levee miles (6 percent) for which the sponsor/owner is unknown or does not exist.

CONDITION:

Regular maintenance and inspection of all levees in Missouri is the responsibility of the individual levee owners or sponsors. The NLD indicates that approximately 1,300 levee miles (63 percent) have been inspected within the last three years. Based on the results of these inspections, approximately 21 levee miles (1 percent) were considered unacceptable, and 1,097 levee miles (53 percent) were considered minimally acceptable.

The St. Louis Section of ASCE in 2003 published responses from 36 levee and drainage boards in the St. Louis region (not all in Missouri) regarding levee inspection, maintenance, and condition. The respondents indicated that levees were typically inspected every year or every other year, and maintenance was regularly completed on nearly all levees.

The levees in the NLD have an average age over 50 years. Although the information gathered on documented levees indicates good inspection and maintenance frequency, this information likely represents less than half of the actual levee miles currently constructed. In addition, as levees age, they require more intensive maintenance and vigilance to ensure they will perform properly in a large flood event.

The improvements and development behind levees, in levee protected areas, continue to have residual

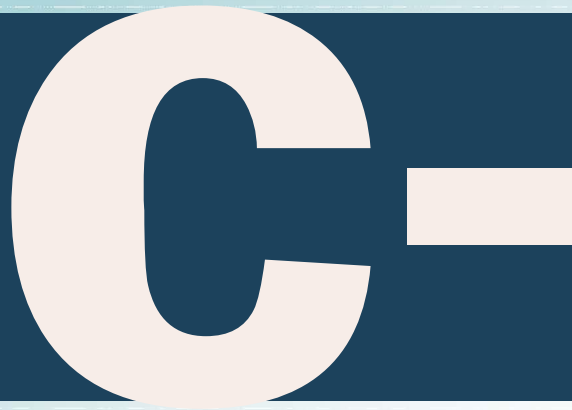
risk from the potential failure or breaching of the levee. Often, the residents and businesses behind a levee do not recognize the protection of the levee, nor do they understand the requirements to ensure a properly functioning levee. With no universal standards and regulations for inspection, maintenance, and documentation of levees, the actual condition of levees and risk to properties protected by levees is often misunderstood by those protected.

For example, in some areas, levees that once protected agricultural fields from frequent flooding along small streams were often designed with only a 10-year or 25-year protection level, since overtopping or failure of the levee only threatened agriculture. However, these same levees may now protect newer homes and businesses which depend on the levee's protection, leaving citizens unaware of the level of protection and overall importance of the levee to prevent flood damage. If a moderate flood event occurs that exceeds the capacity of the levee, the homes and businesses could be subject to significant flood damage.

The condition of levees in Missouri is generally acceptable based on evaluation of known levee locations. Problems arise however due to the fact that there is not a comprehensive list of levees in the state, their design protection level, or conditions.

ECONOMICS:

There is not a definitive measure of the condition or potential for repairs on levees in the state. The NLD pays between 80 percent and 100 percent for repairs on levees in various Corps programs where the levee system is eligible and funding is available. However,



LEVEES

the USACE funding has been flat and is subject to yearly appropriations. Which means it may not be able to cover all repairs that are identified and eligible due to limited funding.

In the 2003 ASCE St. Louis Section survey, only four out of 36 districts (11 percent) indicated they had a fully funded long-term maintenance plan. This indicates that yearly mowing of grass lined levees may be feasible, but replacement of aging pipe penetrations through levees, settlement or erosion damage, repair/ replacement of concrete structures, or other larger capital improvements to maintain the integrity of an aging system are not adequately funded. Repair of levees can range from \$20,000-\$50,000 per levee mile for minor repairs or vegetation establishment to several millions of dollars per mile for upgrades to provide adequate protection or repairs necessitated by a levee failure. **It is likely that only 5 to 10 percent of levees in the state have adequate funding for the long-term repairs** that will be required as the levees age.

Based on the above figures, it is estimated that there are approximately 10,000 miles of levee in Missouri, and approximately 9,000 miles will require maintenance in the next 20 years. Assuming an average improvement cost of \$100,000-\$250,000 per levee mile that is currently not funded, **the resulting funding deficit is \$900 million to \$2.25 billion over the next 20 years**, or approximately \$45 million to \$112 million per year.

RESOURCES:

1. ASCE – 2013 Report Card for America's Infrastructure (2013).
2. National Committee on Levee Safety – Recommendations for a National Levee Safety Program (Draft) (January 15, 2009).
3. National Committee on Levee Safety Web site: <http://www.leveesafety.org/index.cfm>, accessed November 2012.
4. National Levee Database Web site: <http://nld.usace.army.mil/egis/f?p=471:1:0::NO>, accessed November 2012.
5. Interagency Levee Policy Review Committee – The National Levee Challenge, Levees and the FEMA Flood Map Modernization Initiative (September 2006).

C

RAILROADS

RECOMMENDATIONS:

1. Continue to act on the Missouri Revised Statutes 680.200, which was enacted into law on August 28, 2011. <http://www.moga.mo.gov/STATUTES/C600-699/6800000200.HTM>

A) Promote development and implementation of improvements to intercity passenger rail service in the Midwest;

B) Coordinate interaction among Midwestern state elected officials and their designees on passenger rail issues;

C) Promote development and implementation of long-range plans for high speed rail passenger service in the Midwest and among other regions of the United States;

D) Work with the public and private sectors at the federal, state and local levels to ensure coordination among the various entities having an interest in passenger rail service and to promote Midwestern interests regarding passenger rail; and

(continued)

EXECUTIVE SUMMARY:

Given Missouri's location at the center of the country, it is an important crossroads for railroad infrastructure. Because there are major economic benefits derived from a quality rail system, the state has drafted a State Rail Plan covering the next 20 years. While much of the freight system is privately funded and maintained, the passenger system must rely on public funds. Missouri should aggressively pursue all avenues available to implement proposed rail improvements identified in the State Rail Plan.

BACKGROUND:

In Missouri, there are approximately 4,400 miles of mainline track, 2,500 miles of yard track and 3,800 public grade crossings being operated by 5 Class 1 railroads and 13 short line railroads. A list of these railroads and their classes are shown on the Figure 1.

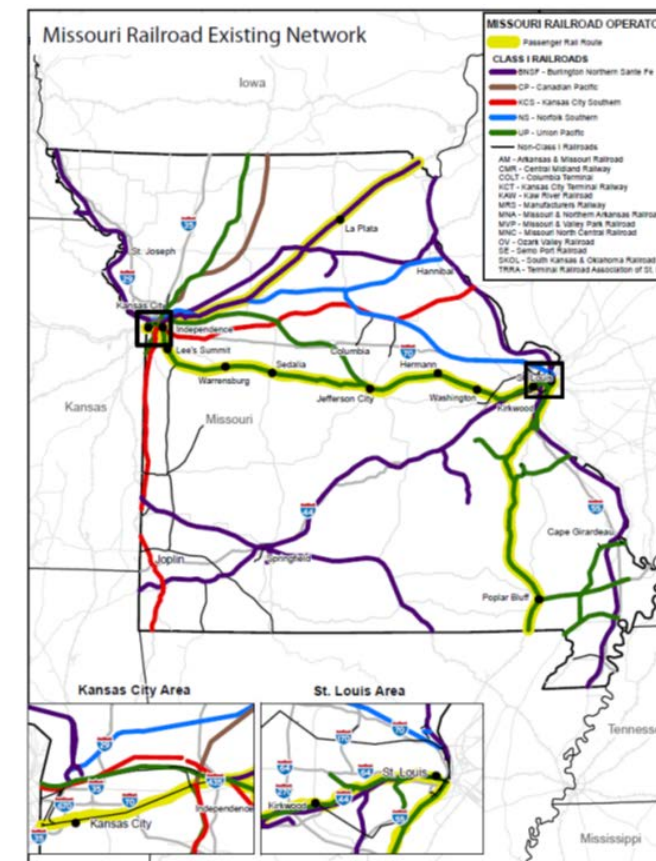
Missouri has drafted a State Rail Plan for the next 20 years to set a strategic framework for recommended policies and prioritizes investments to enhance the movement of people and goods and expand all connections between all modes of transportation. In addition, the plan meets the requirements established by the federal Passenger Rail Investment and Improvement Act of 2008 and will help ensure that Missouri is positioned to obtain future federal funding for rail projects.

Missouri's rail vision is to provide safe, environmentally-friendly transportation options supporting efficient movement of freight and passengers, while strengthening communities and advancing global competitiveness through intermodal connectivity.

The vision is supported by the following plan goals:

- Promote the efficient movement of passengers
- Promote the efficient movement of freight
- Encourage intermodal connectivity
- Enhance state and local economic development
- Promote environmentally and socially responsible rail transportation development

Missouri's State Railroad System



The Missouri Department of Transportation (MoDOT) Multimodal Operations division administers the state's railroad program which includes freight rail regulation, passenger rail, light rail safety regulation, highway/rail crossing safety, rail/highway construction, and railroad safety inspection and outreach. MoDOT Railroad Intermodal division is responsible for public highway-railroad crossings and inspection of railroad infrastructure as it relates to track, grade crossing signals, and operating practices of each railroad.

Missouri railroads moved 302 million tons of freight in 2011, which greatly benefited the Missouri economy and reduced congestion on highways. This movement

of freight is expected to increase by 1.7 percent annually with freight shipped out of state to increase by 1.9 percent annually. If there were no freight rail service in Missouri, 20 million trucks would be added to the state's roadway systems annually.

Freight railroads operate and maintain their own infrastructure with revenues that are generated by shipping. Most commonly, capacity improvements along freight routes are funded with private investments from the railroad as needs arise. Public funding may be sought from railroads if these improvements benefit operations, such as improvements made along shared freight/passenger corridors that benefit all parties, such as recent projects to remove bottlenecks on these shared corridors.

Missouri's intercity passenger rail ridership has experienced increases of 46 percent over the last five years. Missouri provides about \$8 million annually to support operations for the Missouri River Runner service. These services are provided on two regional routes, which are the Missouri River Runner and the Lincoln Service and two long distance routes, the Southwest Chief and the Texas Eagle, operated by Amtrak.

C

RAILROADS

RECOMMENDATIONS:

(continued)

- E) Support efforts of transportation agencies involved in developing and implementing passenger rail service in the Midwest.
- 2. Aggressively pursue all avenues available to implement proposed rail improvements for both immediate and long term benefit and to bring high speed rail service between Kansas City and St. Louis.
- 3. Pursue all avenues available to prosecute proposed fixed guideway improvements for commuter services in Kansas City, Jefferson City, Springfield and St. Louis to improve connectivity and reduce congestion for alternate transit services in those and other communities in Missouri including street car and light rail systems to connect to the high speed rail network.

The State Rail Plan identifies rail funding challenges and opportunities. Missouri has maintained and improved existing passenger rail service with modest state funding and federal grants and the state funding for grade crossing improvements for safety as speeds increase. Missouri has successfully procured \$179 million in passenger rail service grants along the River Runner Route; the Missouri General Assembly continues to support passenger service along this route. Challenges that exist are a lack of dedicated funding for passenger rail service, limited state funding for freight rail development and no dedicated funding to provide matching funds for federal passenger rail grants and limited federal funds dedicated for rail system improvements.

A Service Development Plan was drafted in 2009 and is currently published on MoDOT's website at: <http://www.modot.mo.gov/other/transportation/rail/index.htm>. A partnership was established between Illinois, Wisconsin, Michigan, Indiana, Ohio, Minnesota, Iowa, Nebraska, and Missouri in partnership with the Federal Railroad Administration and Amtrak, to evaluate the potential role of high-speed rail in the Midwest. This initiative, also known as the Midwest Regional Rail Initiative (MWRRI), resulted in a coordinated business plan to implement 110 mph service with the main hub out of Chicago. The Missouri corridor would be from St. Louis to Kansas City.

MoDOT has been making improvements along the Amtrak route between Kansas City and St. Louis, which is shared on Union Pacific tracks. Funding for current improvements include \$63 million for capacity improvements, and \$6 million for preliminary engineering and environmental clearance on six future projects and procurement of new equipment to improve both ride and capacity. Improvements implemented along the River Runner Route are exemplary; however, much more needs to be done to assist the staff at MoDOT multimodal division to realize true high-speed rail service from Kansas City to St. Louis.

Missouri Passenger Rail Service



Other more local rail initiatives in the Kansas City, Missouri area include the ongoing Alternatives Analysis of the I-70 corridor on Kansas City Southern tracks, the Rock Island Line on abandoned tracks currently owned by UPRR and an additional corridor along the recently re-designated I-49 corridor through Grandview is currently under way. These alternatives are being developed in partnership with the Mid America Regional Council, Jackson County, Kansas City, Missouri and the Kansas City Area Transportation Authority with Jackson County being the lead agency. The outcome of this study will be a locally preferred alternative for fixed guideway commuter service along one of these two routes to present to the Federal Transit Administration and move forward to implement commuter passenger rail service into the River Market to connect to the Street Car (see next paragraph), and to Union Station which is a major connection point in Kansas City.

There is also a street car fixed guideway system currently being developed by Kansas City, Missouri from Union Station down Main Street (central

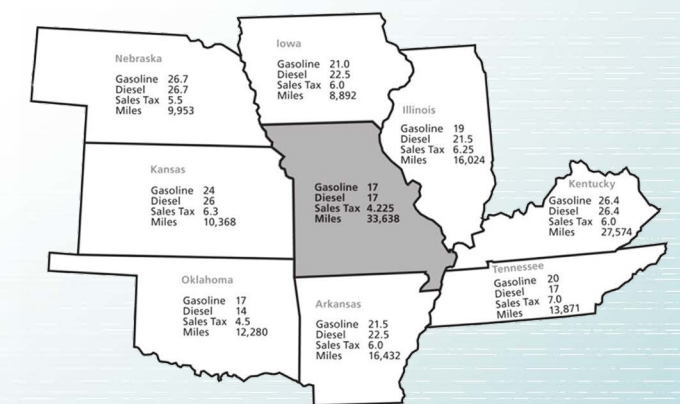
business district) with a north loop in the River Market area. Kansas City recently passed a Transportation Benefit District to help fund the project. Final design is about completed and construction for the system has been established to start in the spring of 2013. Current costs at this time are approximately \$101M including the rolling stock. These costs are being refined as the preliminary engineering progresses.

ECONOMICS

Improvements included in MWRRI to meet future travel demands and improve accessibility and economic development across the state from Kansas City to St. Louis is mandatory. State funding for these improvements remains the key issue to this system being implemented. Several key issues remain at the center of transit in the state and are discussed below.

Funding from the state on Missouri for transit services is one of the lowest in the United States and the lowest in the eight state midwest region as shown on the following map.

State Transit Funding In Millions Of Dollars



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RAILROADS

Missouri Constitution Article IV Section 30(b) states: “[T]he state road fund shall be used and expended...for the following state highway system uses and purposes and no other”. Missouri is one of 8 states with such a restriction. Missouri has the largest highway system of the eight states: 33,681 miles and the second lowest fuel tax in eight states: 17 cents.

Revision to the State Constitution will be necessary to better fund all modes of transportation including freight and passenger rail to allow flexibility for highways, rail and transit for the citizens of Missouri.

There are major economic, transportation and environmental benefits with freight and passenger rail. These modes of transportation of people and goods also benefit safety, longevity and efficiency on Missouri’s state highway systems. Dedicated funding sources in addition to federal funding streams will be necessary to meet the existing and future demands that are projected.

CONDITION:

It should be noted that the MWRRRI includes as a plan for higher speed rail at 110 mph service on a shared freight rail corridor with UP. As noted earlier, UP may not tolerate disparate operating speeds and currently plans to separate passenger and freight corridors across Missouri do not exist.

Maximum freight rail operating speeds on the best maintained corridors are 79 mph and cannot be mixed with true high speed passenger service. In order to meet this goal, a dedicated rail corridor from Kansas City to St. Louis with no grade crossings and possibly electrification will need to be constructed. This type of rail service may not be immediately implementable because of a lack of funding as noted above, considering the costs to purchase dedicated right-of-

way and required infrastructure improvements for the track, bridges and power.

A practical plan for the present time may be a phased approach where Amtrak can increase speed to 90 mph operating speeds along the shared UP corridor. Because of the restrictions to 79 mph on freight corridors, additional improvements will need to be undertaken to meet these increased speeds. With current and future improvements, passenger rail may compete with private automobile travel. Increased demand for efficient transit services because of aging population, fuel and automobile maintenance costs and safety concerns continue to increase.

FUTURE NEED:

The Midwest High Speed Rail Association (MWHsRA) has been in the process of studying Core Express Service from Chicago to St. Louis, which is noted as 125 mph+ with 25 daily departures, which would cost an estimated \$84 billion and generate approximately \$2 billion in annual revenue and serve approximately 44 million annual riders. Trips from Kansas City to St. Louis and Chicago would take approximately 2 hours to each city respectively. This would serve the traveling public, offer better connectivity and increase safety by reducing congestion for users of all modes of transportation including automobiles, and air travelers.

Projects in Missouri have included adding a second bridge over the Osage River, grade crossing safety improvements and siding improvements along the UP shared corridor. Preliminary Engineering has taken place on six additional projects. Currently these improvements would complete the trip from Kansas City to St. Louis in over five hours, which is slower than driving. In order to meet future travel demands and connect Kansas City with St. Louis and Chicago, which may serve as part of a mega-region in the

midwest, greater funding and much greater support from the state will be necessary.

In March of 2011, Missouri applied for federal funds for immediate improvements along existing UPRR lines between Kansas City and St. Louis (\$373 million) and \$600 million additional to complete necessary planning and purchase needed right-of-way for a dedicated high speed rail line between Kansas City and St. Louis.

RESOURCES:

1. Missouri Department of Transportation, Service Development Plan and other information:
<http://www.modot.mo.gov/othertransportation/rail/index.htm>
<http://www.modot.mo.gov/othertransportation/rail/freight.htm>
<http://www.modot.mo.gov/newsandinfo/District0News.shtml?action=displaySSI&newsId=47822>.
2. Midwest High Speed Rail Association
<http://www.midwesthsr.org/projects-missouri>.
3. KCRTA, Change the Conversation, December 2012.
<http://www.cnn.com/2011/POLITICS/04/13/high.speed.rail.fact.check/index.html>
4. Missouri Revised Statutes 680.200, August 28, 2011.
<http://www.moga.mo.gov/STATUTES/C600-699/6800000200.HTM>
5. Office of the Missouri Governor, Press Release, March 29, 2011.
http://governor.mo.gov/newsroom/2011/Missouri_will_pursue_nearly_1_billion_in_reallocated_federal_funding_for_rail_projects.

C

ROADS

RECOMMENDATIONS:

- Properly maintain existing system. When possible, transfer ownership to cities and/or counties.
- Continue safety enhancements in high-accident zones.
- Create long-term funding solution for transportation system.
- Seek cooperation from local communities and private sector for funding improvements.

EXECUTIVE SUMMARY:

Missouri has the seventh largest highway system in the nation. In recent years the Missouri Department of Transportation (MoDOT) focused on improving the condition of its existing system; with good results. The department has also gone through a significant reorganization process in an effort to become more efficient. With one of the lowest gas taxes in the area, however, MoDOT anticipates significant funding shortfalls. The state must focus on creating a long-term funding solution for the transportation system.

BACKGROUND:

For much of the past decade, MoDOT has focused on putting every possible dollar into the state's large system of roads and bridges. Practical design, practical operations, alternate bidding, strategic placement of lettings, design-build, involvement of the contracting community in project delivery decisions, and other efforts have enabled the agency to stretch its available resources to deliver the greatest number of improvements to Missourians. Most recently, MoDOT has been through a two-year right-sizing exercise that has further enabled the department to save even more money. Called the Bolder Five-Year Direction, the plan has reduced staffing levels by 1,200 employees, closed 131 facilities and reduced the size of its fleet by 752 units. These changes will generate \$512 million in savings by 2015, and has enabled MoDOT to bolster its annual construction budget by \$100 million per year.

But, going forward, it will not be enough to solve Missouri's long-term transportation challenges. They cannot cut themselves to an improved transportation system.

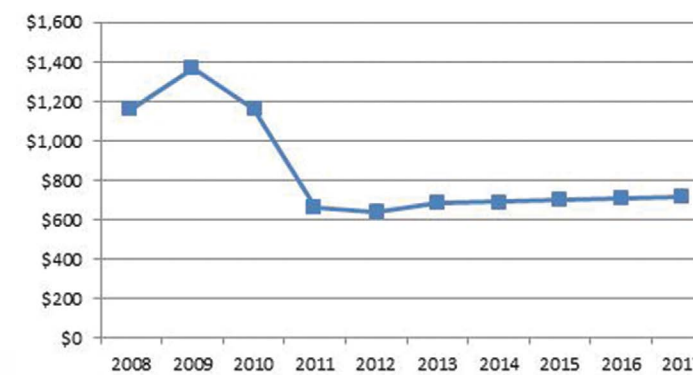
The last time the state of Missouri passed a piece of transportation funding related legislation was in 2004. The funding generated by the bill allowed for 2,200 miles of the state's busiest highways to be smoother and safer, sped up 55 critical highway projects and allowed \$1.6 billion in new construction.

With this additional funding and new construction, MoDOT saw significant results:

- Missouri has gone from having 47 percent of its major highways in good condition in 2004 to 85 percent good in 2009, and has maintained that condition level, ever since.
- Eighty-eight percent of the state's major roads are now in good condition.
- Missouri has the fourth lowest administrative costs per mile.
- Customer satisfaction with MoDOT is 85 percent.
- MoDOT received the 2007 Missouri Quality Award, which recognizes Missouri organizations dedicated to promoting quality.

Despite these accomplishments, the road ahead remains difficult. Simply put, funding levels are down and transportation needs remain high. The following graph illustrates the programmed funding for MoDOT's Highway and Bridge Construction Program, which funds transportation projects throughout the state. The decline is due to a lack of available funding for the program.

Highway and Bridge Construction Awards



MoDOT has started a conversation with its constituents about developing a plan of action to determine a transportation vision. An independent

Blue Ribbon Citizens Committee on Transportation Needs was created by the Speaker of the Missouri House of Representatives in March of 2012 for the purpose of examining Missouri's current and future transportation needs and exploring possible solutions. The Committee traveled around the state and heard a presentation from each of MoDOT's Districts on its existing transportation system's conditions and needs. District Engineers also shared their region's list of priority projects. The Committee determined MoDOT should be spending \$600 million to \$1 billion more than it currently does each year.

The Committee submitted their final report to the House of Representatives in early January 2013. The report contained a summary of the presentations and synopsis of the funding situation. The Committee recommended the House and Senate each produce a champion of transportation and work towards correcting the funding shortage.

In January 2013, MoDOT kicked-off a new long-term transportation planning effort known as "On the Move," to set the 20-year vision for Missouri's transportation system. On the Move is a statewide engagement effort to get direction on transportation priorities across the state. Missouri is doing this to update its transportation plan, and will use it to help guide the state's planning efforts moving forward. On the Move will engage Missourians through listening sessions, mobile tours and virtual forums over the next several months.

On January 24, 2013, a funding proposal was unveiled by Missouri Highways and Transportation

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ROADS

Commission Chairman Rudy Farber at the 2013 Missouri Conference on Transportation, co-sponsored by the Missouri Chamber of Commerce and Industry and Farm Bureau. The proposal outlines a temporary 10-year, one-cent general sales/use tax dedicated specifically to transportation needs. The Commission's proposal could go a long way toward creating jobs, making roads safer, reducing commuter congestion and stimulating economic activity for a more competitive Missouri.

CONDITION:

The public has indicated the condition of Missouri's existing state roadway system should be one of the state's highest priorities. In recent years, MoDOT has placed a higher priority on improving the condition of state highways. When voters approved Amendment 3 in November 2004, MoDOT established the Smoother, Safer, Sooner Program. The first element of the program, the Smooth Roads Initiative, provided 2,200 miles of smoother pavement by the end of 2006. However, as with all infrastructure maintenance, the lifespan of these improvements are limited without sustainable funding.

Comparing 2009 highway statistics from the Federal Highway Administration, Missouri ranks 11th overall in comparing the number of all federal aid major road miles per state. Missouri ranks 10th overall in comparing the number of all federal aid minor road miles per state.

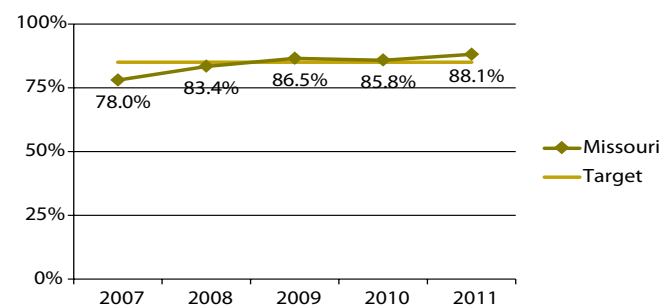
In Missouri, the major highway system provides for statewide and interstate movement of traffic. The major roads total approximately 5,500 centerline miles. The minor highway system mainly serves local transportation needs and totals almost 28,200 centerline miles

MoDOT tracks the condition of the state highways as a measure of success. Good condition is defined

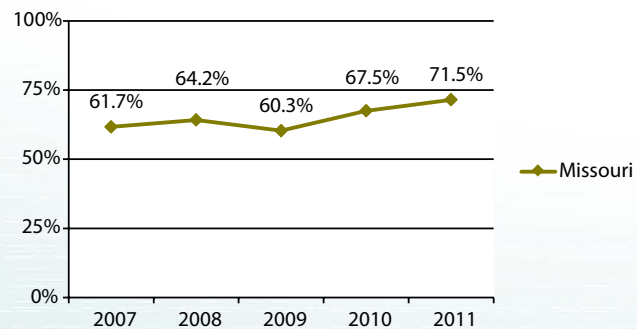
using a combination of criteria. Standardized criteria are not followed from state to state, so comparisons between states are difficult. In 2007 MoDOT set a goal that 85 percent of its major highways would be in good condition by 2011. The target was achieved in 2009. The graph below shows the positive trend.

Maintaining the minor road system in good condition is more of a challenge simply due to the increased inventory. However, as the graph below demonstrates, MoDOT has successfully shown improvement over the last four years. The measurable increase in 2011 was due to over \$140 million directed to improving minor roads. This was possible due to the operational savings realized from the Bolder Five-Year Direction. However, once these savings are expended, MoDOT's ability to adequately maintain good pavement conditions on minor highways in the long term is unlikely without sustainable funding mechanisms.

Percent of Major Highways in Good Condition



Percent of Minor Highways in Good Condition



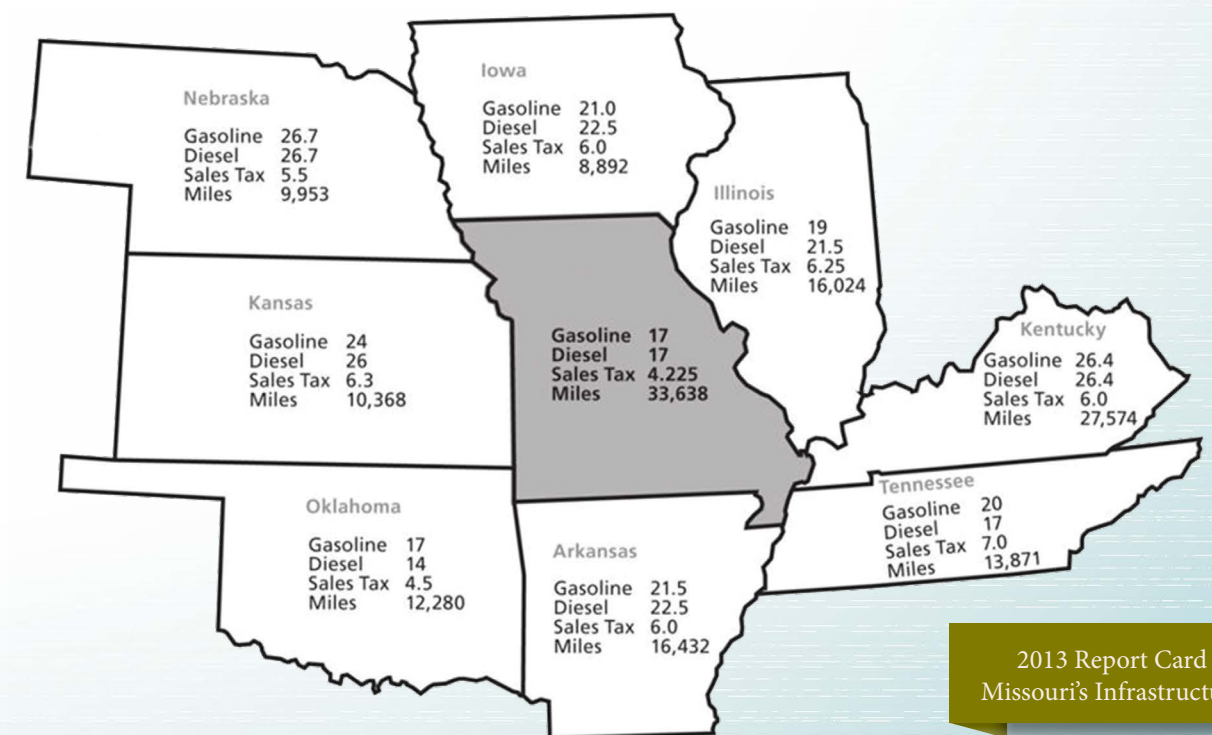
ECONOMICS:

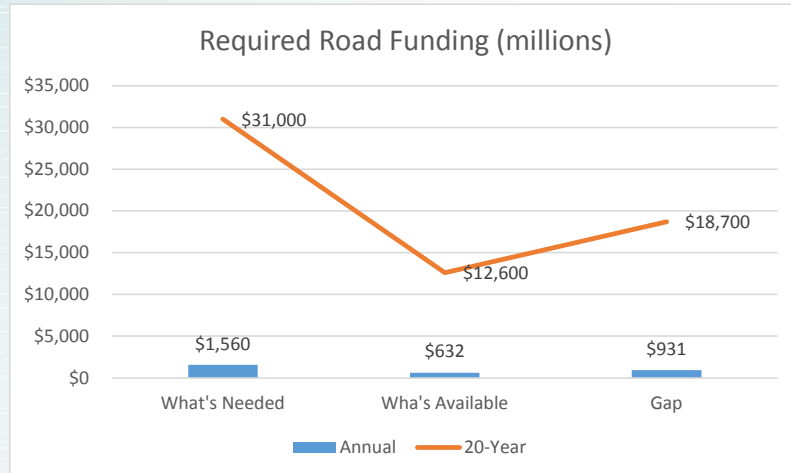
Like all other states, MoDOT receives funding from federal and state sources. The largest source of transportation revenue is from the federal government, which includes the federal fuel tax. The second largest source is from the state fuel tax. These two sources make up almost 70 percent of the state's transportation revenue.

Other sources include the following: vehicle and driver licensing, and multimodal fees; motor vehicle sales and use taxes; cost reimbursements, interest and miscellaneous revenue; and general revenue. A more recent source of funding used by Missouri Highways Transportation Commission (MHTC) has been through selling bonds. As of June 30, 2012, MHTC has \$3.1 billion of bonds outstanding. Current debt will require payments through 2033.

Fuel taxes are the primary source of both federal and state funding. The federal fuel tax has not been increased since 1993. Similarly, the last time the state tax was increased was in 1992. The figure below highlights that Missouri has one of the lowest motor fuel tax rates and, by contrast, the largest state maintained highway system miles of any of its surrounding states. As vehicles are made more fuel efficient and people drive fewer miles due to the increased cost of gasoline, fuel tax revenue will decline and the state will not be able to keep pace with the costs of Missouri's transportation needs in the future. Fuel tax revenues to MoDOT have declined for four straight years.

Fuel Tax Rates and Highway Miles by State





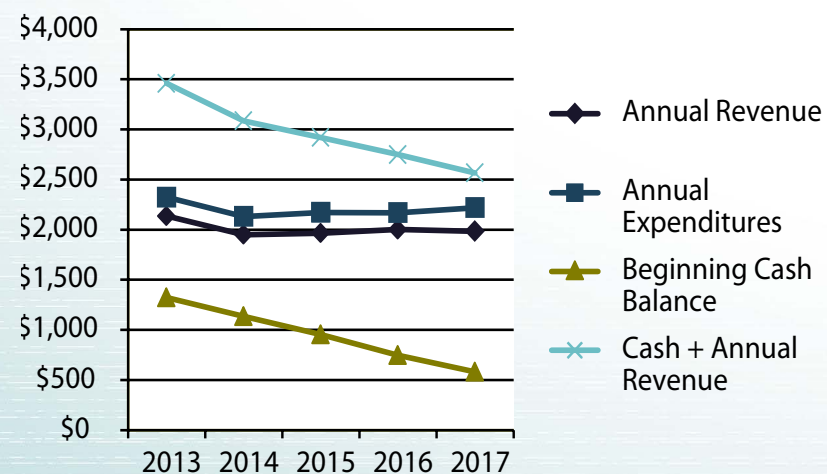
Current federal funding is authorized through Moving Ahead for Progress in the 21st Century Act (MAP-21), which was signed into law on July 26, 2012. This two-year bill did not address the need for increasing revenues for transportation purposes. It does, however, provide additional financing options. Apportionments in every state decreased due to the reduced budget for MAP-21. The direct impact on Missouri is about \$70 million a year less than the previous program.

Based on MAP-21 funding and projected state revenues, MoDOT's anticipated financial

outlook for the next five years is flat. Without the Bolder Five-Year Direction initiative, the forecast would have been more dismal. The plan identified a savings of \$512 million through reducing staff, closing facilities and selling equipment over five years. Additionally, the Bolder Five-Year Direction will also result in a sustained average savings of \$117 million per year to focus on statewide transportation needs. While this will not solve the long-term funding problems, it will position MoDOT to funnel any new funds straight to transportation improvements. As the graph below demonstrates, annual expenses are only balanced due to the current cash flow balance.

Based on the Top Five Priorities described previously, MoDOT has estimated the required funding to address these goals. Based on available projected funding, a significant gap exists and is presented below.

MoDOT's Anticipated Financial Outlook



RESOURCES:

1. Tracker, Missouri Department of Transportation, October 2012.
2. Phone call with Machel Watkins, Statewide Transportation Planning Director, Missouri Department of Transportation, November 2012.
3. Highway Statistics 2009, Federal Highway Administration, U.S. Department of Transportation.
4. I-70 Supplemental Environmental Impact Statement, Missouri Department of Transportation, May 2009.
5. Rough Roads Ahead, Fix Them Now or Pay for It Later, American Association of State Highway and Transportation Officials, 2009.
6. A Conversation for Moving Missouri Forward, Missouri Department of Transportation.
7. Financial Snapshot, Missouri Department of Transportation, October 2012.
8. Statewide Transportation Improvement Program (2013-2017), July 2012.
9. MAP-21 and its impact on MoDOT, Missouri Department of Transportation, August 2012.
10. MoDOT's Bolder Five-Year Direction, Missouri Department of Transportation, June 2010.
11. The Blue Ribbon Citizens Committee on Missouri's Transportation Needs - Final Report, December 2012.

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SCHOOLS

RECOMMENDATIONS:

- Require a comprehensive, quantitative evaluation for all public school systems at regular intervals. This will allow a baseline of all districts' needs to be established and allow for continual assessment of their needs.
- Establish a fund to meet the needs of school facilities throughout the state.
- Promote all districts to adopt and implement a comprehensive construction and maintenance program to allow for future needs and funding to meet those needs.
- Guide and encourage using sustainable design and solutions to provide efficiency in energy, waste disposal, and transportation options.
- Expand state tax credits and matching funds to support increased use of school construction bonds.
- Explore alternative financing, including lease financing, to facilitate school construction projects.

EXECUTIVE SUMMARY:

Infrastructure condition for Missouri's schools varies widely from district to district. There are 2,351 buildings in the Missouri system but the comprehensive assessment of the condition is not available. The state should work towards a quantitative evaluation of all public school system infrastructure and establish funding sources to meet the future needs. As such, Missouri schools receive a grade of "C".

BACKGROUND:

The Missouri State Department of Education annually produces a report card to provide information to the general public about state testing, attendance rate, crime, funding, age of buildings, and a wide range of other information. As this information is helpful, it does not paint the full picture as to the condition of the building in the system. Budget cuts in education are a heated topic year after year. School districts such as the Kansas City, MO, district are meeting budgets by closing the doors to older, less populated schools. As buildings get older the need to replace them or make costly repairs increases. There was a huge expansion in the 1950s where the amount of schools in Missouri more than doubled. These buildings are now 60 years old and many are in need of major repair or replacement.

CONDITION:

There are a total of 2,351 buildings in the state of Missouri school system. In 2010, 62 Missouri school districts used more than \$208.4 million in funds from the Qualified School Construction Bond program to rebuild and repair existing schools. Many new schools and facilities have been updated as a result of school integration programs and local bonds.

Although Missouri has resources for criteria to observe to keep school environments updated, reporting on the school conditions has generally been through voluntary surveys. Health risks such as mold, old heating and wiring systems, and older facilities conditions which may cause allergy and asthma are unknown. Data regarding school outlays on building repairs and maintenance is self-published by various districts. **Thus, a comprehensive view of the quality of Missouri schools is unavailable.**

A comprehensive federal study of the condition of schools across the nation was conducted in 1999 by the National Center for Education Statistics (NCES) and has not been updated since.

ECONOMICS:

The total assessed valuation of school facilities has increased by 13 percent from 2006 to 2010. However, 2011 data indicates a jump in assessed valuation of 25 percent in the last year due to the addition of schools. Including the cost of living increases over that same time span, the assessed valuation went up 38 percent between 2006 and 2011. The following table shows the total assessed valuation for all school districts (combined) and per pupil.

5-Year History of Assessed Valuation (State Totals)

	Total Assessed Valuation	Total Assessed Valuation Per Pupil
2006-2007	\$80,544,821,862	\$90,179
2007-2008	\$90,075,743,538	\$100,550
2008-2009	\$91,986,671,942	\$103,437
2009-2010	\$90,698,251,626	\$101,951
2010-2011	\$113,763,682,554	\$127,863

The reason the assessed value per pupil was able to stay about the same between 2006 and 2010 is due to enrollment levels declining about one percent in the last five years. Jumps in assessed value were mostly due to the addition of new charter schools and academies.

School facility funding can come from various sources. Local bonds and property taxes as well as casino revenue provide the bulk of funding. Funding may also come from grants and loan matches. Missouri put in place, with the 1993 Missouri Outstanding Schools Act (OSA) Foundation Funding Formula, a mechanism to level the revenue stream between districts and provide funding equity.

RESOURCES:

1. 21st Century School Fund. For Generations to Come, A Leadership Guide to Renewing Public

School Buildings, 2012.

2. Hunter, Richard. The Public School Infrastructure Problem: Deteriorating Buildings and Deferred Maintenance. School Business Affairs, V75 n2, P10, 12-14, February 2009.
3. Khan, Huma. Budget, Quality, population Issues Lead Cities to Close Schools: Is Yours Next?. Abcnews.go.com, March 1, 2010.
4. Kothari, Himanshu. Facilities Financing: Monetizing Education's Untapped Resource. AEI Future of American Education Project. Working Paper, 2011-04.
5. Missouri Department of Elementary and Secondary Education – Missouri Comprehensive Data System, <http://www.mcde.dese.mo.gov/Pages/default.aspx>.
6. Missouri Department of Elementary and Secondary Education – Division of Financial and Administrative Services. Memo: October Financial Information From: Ronald Lankford, Ed.D., Deputy Commissioner, October 22, 2012.
7. National Center for Education Statistics. Planning Guide for Maintaining School Facilities. <http://nces.ed.gov/pubs2003/maintenance/index.asp>.
8. Structural Engineers Association of Kansas and Missouri Report "Investigations and Recommendations based on the May 22, 2011 Joplin, Missouri Tornado", published May 2012.
9. U.S. Department of Education – NCES 2012-312. Documentation for the NCES Common Core of Data School District Finance Survey (F-33), School Year 2008-09 (Fiscal Year 2009), Version 1A.

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WASTEWATER

RECOMMENDATIONS:

Based on the history, condition, and economics of Missouri's wastewater infrastructure, the following recommendations are made in order to renovate, build, and sustain adequate wastewater collection and treatment infrastructure which is critical to health and the environment:

- All communities in the state need to determine how much their wastewater needs will cost, compare this cost to current tax payer and/or user charge revenues designated for wastewater, and adjust local funding as necessary.
- The current system of funding options from the federal and state government entities needs to be thoroughly reviewed and revamped.
- Action to upgrade wastewater infrastructure should initiate at the local level in a proactive manner.
- When increasingly stringent water quality regulations are being discussed at the federal and state levels, citizens need to be informed of the estimated costs to meet new regulations.

EXECUTIVE SUMMARY:

The ability to safely dispose of wastewater from homes, commercial facilities, and industrial facilities is a basic necessity for the health of the state of Missouri and its citizens. Right now, the condition of wastewater treatment facilities varies across the state. Many were built several years ago and are approaching the end of their design life. These facilities require constant operating and maintenance resources, along with regular replacement of machinery, pipes, tanks, and other critical components. The Clean Watersheds Needs Survey has documented Missouri needs totaling over \$5 billion. In the short term, the state needs a commitment to bring all wastewater infrastructure into a state of good repair and in the long term the state must modernize and build new facilities in a targeted and strategic manner. By employing strategies to use every dollar resourcefully and by deploying creative solutions to infrastructure development, the state can implement the right projects in an efficient and economical manner.

BACKGROUND:

The ability to safely dispose of wastewater (sewage) from homes, commercial facilities, and industrial facilities is a basic necessity for the health of our state, country, and the citizens. The state of Missouri has a network of established wastewater systems that have been functionally serving citizens for over 50 years in some locations.

Wastewater collection and treatment systems vary widely in size ranging from systems that serve individual homes, to systems that serve large metropolitan areas. A wastewater system is comprised of collection systems (e.g., sewers), municipal wastewater treatment plants, and onsite treatment systems (e.g., septic systems).

The numerous entities responsible for funding, operating, and maintaining these systems are independent of one another for the most part, but all are loosely banded through state and local regulatory structures and professional and trade associations.

This report is structured to provide a general evaluation of the state of Missouri as a whole and then specifically address the City of Kansas City, the Lake of the Ozarks, and the metropolitan St. Louis area's environmental infrastructure. The latter three were chosen for particular attention due to the very public challenges that have

occurred there in recent years.

State Overview

The enactment of the Clean Water Act (CWA) in 1972 resulted in dramatic improvements in the:

- Number of wastewater treatment plants.
- Percentage of the population served by wastewater treatment plants.
- Quality of effluent treatment from wastewater treatment facilities.

In 2008, 73 percent of Missouri residents received centralized wastewater treatment services at the secondary, advanced, or no discharge treatment level, compared to 17 percent in 1972.

Number of Centralized Treatment Facilities and Population Served

Treatment Level	Number of Facilities			Population Served				
	1972	2008	Projected ^a	Population	% Total	Population	% Total	Projected ^a
Less than Secondary	128	0	0	2,407,000	51	0	0	0
Secondary	73	635	575	645,000	14	3,796,209	64	4,123,603
Advanced	7	86	136	144,000	3	471,691	8	966,069
No Discharge	0	23	28	0	0	4,112	<1	7,550
Total	208	744	739	3,196,000	67	4,272,012	73	5,097,222

^a Number of facilities and population served if all needs documented in the CWNS 2008 are met.

In Missouri, small community wastewater facilities serve 17 percent of the population and comprise 6 percent of total wastewater treatment and collection needs.

Reported Needs for Facilities in Small

Population	Facilities		Facilities in Communities Less than 10,000 Population	
	2004	2008	2004	2008
0-999	127	185	\$139	\$122
1,000-3,499	48	64	\$117	\$115
3,500-10,000	28	25	\$109	\$76
Total	203	274	\$362	\$313

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WASTEWATER

RECOMMENDATIONS:

(continued)

then, costs versus tangible benefits should be discussed openly before new regulations are enacted.

- As wastewater collection and treatment facilities are operated, upgraded, expanded, and replaced, long term efficiency and environment compliance should be discussed for all aspects of wastewater systems to ensure they are delivering the most good for the least cost.
- Encourage public support for the efforts being made in Kansas City, the Lake of the Ozarks, and the Metropolitan St. Louis Area to address infrastructure improvement programs.

Kansas City

Kansas City, Missouri's wastewater system collects and receives domestic, commercial and industrial wastewater from a population of approximately 650,000 people in the city and 27 neighboring satellite communities, including a portion of Johnson County, Kansas. The system covers more than 420 square miles, and includes seven wastewater treatment plants, 38 pumping stations and more than 2,800 miles of sewer lines, making it one of the nations' largest.

Of the 420 square miles covered by the system, 58 square miles mostly within the city's urban core are presently served by combined sewers, which carry both stormwater and wastewater, and the remainder of the system is served by separated sewers.

Lake of the Ozarks

Wastewater treatment at the Lake of the Ozarks is provided by a combination of sewer districts and on-site systems around its perimeter. While the total number of on-site systems surrounding the Lake is unknown, one estimate puts the number between 15,000 and 20,000. Many of these systems were installed prior to the enactment of minimum construction standards for on-site systems in 1995 and often receive little to no maintenance.

The 2000 Census estimated the Lake area population at 79,924. If growth continues at the same rate as it has over the last ten years, the Lake area population could reach 180,000 by 2050. These population projections, when considered with the known, inadequate wastewater treatment infrastructure, require state and local leaders to plan for future wastewater treatment needs of the Lake region now. Yet, many large, developed areas are not located within reasonable proximity of any of the existing sewer districts.

St. Louis

As St. Louis grew and urbanized in the late 1800s and early 1900s, a patchwork of wastewater networks was created. Little regional planning occurred as wastewater systems were developed by subdivisions and various government entities. This resulted in a sprawling system built with different standards and operational processes in providing sewer services. In 1954, 79 systems originally owned by subdivisions

and local municipalities were consolidated within the Metropolitan St. Louis Sewer District (MSD) to provide regional systems to better serve the community. Over the years, MSD grew to be one of the largest pipeline systems in the country.

Wastewater service in the St. Louis Region is mainly provided by MSD which provides service to more than 415,000 wastewater customers in St. Louis City and about 80 percent of St. Louis County. MSD maintains:

- 7 treatment facilities processing over 330 million gallons of sewage daily
- 6,669 miles of wastewater sewers
- 3,144 miles of stormwater sewers
- 285 pump stations

In older communities, such as St. Louis City, some of the largest sewers are over 100 years old.

CONDITION:

The condition of wastewater treatment facilities varies across the state due to the large number of operating entities and the availability of ongoing funding. Wastewater treatment systems are not "build it once, and done" type facilities. Instead they require constant operating and maintenance resources, along with a regularly replacement of machinery, pipes, tanks, and other critical components as they reach the end of their functional lives. In addition, treatment facilities must keep up with ever changing environmental regulations, coupled with fluctuations in the amount of flow that must be received and treated.

A large portion of the wastewater collection and treatment facilities in the state of Missouri were built several decades ago and are approaching the end of their design life. Some have been expanded and upgraded over the years, while others have not. In either case, most municipal wastewater systems

are effectively collecting and transporting the vast majority of wastewater generated, and the facilities are consistently meeting the treatment requirements dictated by their state of Missouri operating permits. However, many facilities are at or near their capacity to accept more flow, are operating inefficiently from an energy consumption stand-point, and are under-funded to some extent.

State Overview

In order to legally discharge pollutants to waterways in Missouri, a party must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the Missouri Department of Natural Resources (MDNR). This permit sets limits on the amounts of certain pollutants that can be discharged. It may also set requirements for monitoring the effluent or the receiving stream.

One indicator of the condition of the wastewater treatment systems in the state is the number of streams listed as impaired by point source wastewater discharges. As of 2010, the number of miles of classified streams judged to be impaired is somewhat greater than the estimate from 1984, when statewide data on stream quality first became available. In 1984, 105 miles of classified stream were judged to be impaired by domestic or industrial wastewater. Domestic and industrial discharges include wastewater from cities, subdivisions, apartment complexes, mobile home parks, businesses and industries.

Stream miles impaired by point source discharges in more recent years were 104 miles in 2002, 101 miles in 2004, 83 miles in 2006, 70 miles in 2008, and 170



WASTEWATER

miles in 2010. The change in impaired mileage during the recent reporting cycles may be due in part to evolving data requirements and analytical methods, as prescribed by Missouri's 303(d) Listing Methodology. Also, the number of permitted point source discharges is likely higher than it was in 1984.

Additionally, concern over eutrophication of large, recreationally important reservoirs led to changes in the state regulations for discharges of wastewater. Eutrophication is the excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen. These regulations impose phosphorus concentration limits on most wastewater discharges in the Table Rock Lake and Lake Taneycomo watersheds. These limits may be further affected as numeric nutrient criteria for lakes are implemented.

Kansas City

According to the U.S. Environmental Protection Agency (EPA), since 2002, Kansas City has experienced approximately 1,294 sewer overflows, including at least 138 unpermitted combined sewer overflows, 390 sanitary sewer overflows, and 766 backups in buildings and private properties. The overflows are in violation of the federal Clean Water Act and the terms of the city's NPDES permits for operation of its sewer system. These overflows resulted in the annual discharge of an estimated seven billion gallons of raw sewage into local streams and rivers, including the Missouri River, Fishing River, Blue River, Wilkerson Creek, Rocky Branch Creek, Todd Creek, Brush Creek, Penn Valley Lake, and their tributaries.

Lake of the Ozarks

The greatest threat to long-term water quality at the Lake of the Ozarks is failing on-site sewage disposal systems around its perimeter. The proximity and

density of homes surrounding the Lake is unique in comparison to other recreational lakes in Missouri. The threat from on-site systems arises from the discharge of inadequately treated wastewater, or sewage, from aging or failing systems directly into the Lake, its tributaries, or groundwater. The complex karst geology and natural hydrology of the region exacerbate the problem. Soils around the Lake are not appropriate for most on-site systems.

There are also 419 permitted wastewater facilities that discharge directly into the Lake or that discharge into a major tributary of the Lake. Recently, the MDNR conducted inspections and reviewed the operational features of wastewater treatment plants to determine if the plants were functioning according to their designs.

The inspectors examined the physical components of the treatment works, such as basins and pipes, the power supply, motors and pumps. Inspectors also reviewed the level of maintenance at each facility, checked fencing, weed control and physical conditions, such as rust and corrosion. They surveyed the facility's treatment supplies, such as chlorine and other chemicals, to determine if they were available and being applied. In cases where treatment plants were discharging at the time of the inspection, the inspectors collected samples for analysis in the Department's laboratory to determine if the plant was providing adequate treatment.

Of the 419 facilities inspected, 63 percent were found to be in compliance with the conditions of their permits. Approximately 37 percent of the facilities had some violation that resulted in the issuance of a letter of warning (LOW) or notice of violation (NOV). A total of 208 separate violations were identified at 154 facilities during the sweep. These are shown in Table 3.

Violations were identified at 130 of the facilities at the time of the inspection, with 82 NOVs and 48 LOWs

issued. The department analyzed wastewater discharge samples and found that 44 facilities did not meet permitted limits, and these facilities were issued 20 NOVs and 24 LOWs. Twenty-two of these facilities had been cited for violations at the time of the inspection. The most common and serious violations were related to disinfection of wastewater. More than 40 percent of the facilities with violations had some problem related to disinfection.

Table 3
Violations Identified during Inspection Sweep

Violation	Description	Violations Cited
Effluent Quality	Effluent quality exceeded permitted limits	44
No/Nonfunctioning Disinfection	Chlorinator, dechlorinator or ultraviolet unit not operational	34
Unapproved Disinfection	Non-standard chlorinators or dechlorinators	32
Operation and Maintenance Issues	Various operation and maintenance issues	29
Permitting Issues	Construction or operation without a permit, failure to submit proper permit paperwork	19
Schedule of Compliance Issues	Failed to comply with permit schedule of compliance	16
Discharge Monitoring Report Issues	Missing reports or discharge monitoring report exceedances	12
Design Guide/Engineering Issues	Structural, sizing, component issues	12
Discharge Appearance Issues	Solids in discharge or stream, general poor effluent appearance	10

St. Louis

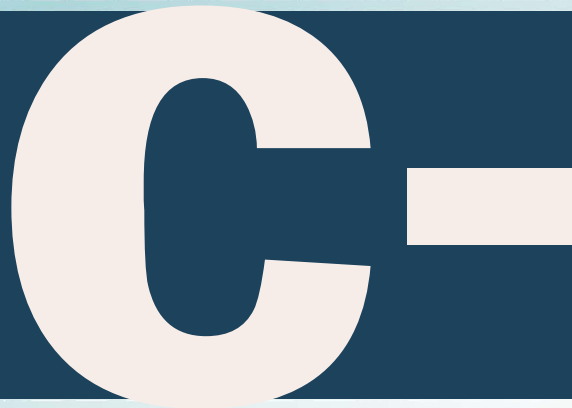
Sewers, sewage treatment plants, and other system components can age and deteriorate with some having short lives of as little as 15 years and other components lasting nearly 100 years. The following list outlines the life expectancy of various infrastructure components compared to the average age of infrastructure in the St. Louis region.

Table 4
Wastewater Components in Bi-State St. Louis

Wastewater Components in Bi-State* St. Louis	Expected Life	Average Age
Collections	80-100	60
Treatment Plants: Concrete Structures	50	40
Treatment Plants: Mechanical and Electrical	15-20	20
Force Mains	25	25
Pumping Stations: Concrete Structures	50	25
Pumping Stations: Mechanical and Electrical	25	15
Interceptors	90-100	40

*Includes Metro Illinois Counties

In comparing the age of St. Louis regional wastewater systems to the expected lifetime, it is clear that the average age of these system components is



WASTEWATER

quickly approaching the expected lifetime of those components. This means that nearly half of the St. Louis regional system has exceeded its expected life, and should be considered for replacement.

Furthermore, according to the EPA, **on at least 7,000 occasions between 2001 and 2005, deficiencies in the area's sewer system resulted in overflows of raw sewage into residential homes, yards, public parks, streets and playground areas.** These overflows are in violation of the federal Clean Water Act and the terms of the NPDES permits for operation of the sewer system.

ECONOMICS

A good portion of the wastewater collection and treatment facilities in the state were built in an era when federal, state, and local funding was available and targeted for such infrastructure investments. However, due to the maintenance intensive nature of wastewater systems and changing regulatory requirements, revenues have not kept pace with re-investment needs in most communities. Hence, current needs for upgrades, expansions, and replacements are vast and under-funded.

Few communities have the funds on hand to pay for much needed improvements, as local tax dollars have instead been allocated towards other community programs or not collected in adequate amounts in the first place. In recent history, federal and state tax dollars have not been targeted for wastewater grant programs in large amounts, therefore local communities cannot rely on grant programs either. This overall financial situation forces municipalities to borrow funds from both public and private financial sources. **Borrowing money to pay for needed wastewater improvements increases the overall cost of the infrastructure and commits future**

generations to debt payments for decades to come.

State Overview

The economic costs of wastewater treatment and nonpoint source management are extremely diffuse and difficult to calculate. The total operating costs of municipal, private, and industrial treatment plants are not readily available. Likewise, it is difficult to estimate total expenditures on nonpoint source management. The amounts that the state of Missouri spends on various aspects of water pollution control and prevention, however, may give some indication of the relative investments required.

MDNR annually spends about \$3.3 million on monitoring and analysis of ambient water and related media. Approximately \$3.6 million is spent on permit issuance annually and about \$7.6 million on other facets of water pollution control and administrative support.

Another significant expense is grants aimed at the improvement of water quality. The Section 319 grant program distributes about \$3.0 million annually of federal Section 319 funds specifically, as well as additional funding through other sources. The Special Area Land Treatment (SALT) program distributes about \$4.6 million annually for nonpoint source projects.

The economic benefits of improved water quality are even harder to quantify. Of all the money spent on water-based recreation and fishing in Missouri, it is nearly impossible to tell how much is dependent upon improved water quality. However great the economic benefits may be, the true benefits of clean water are high-quality recreation experiences, healthy and confident use of water resources, and a robust aquatic biological community.

The Clean Watersheds Needs Survey (CWNS) is a comprehensive assessment of needs to meet the water quality and water-related public health goals of the Clean Water Act (CWA). States and EPA conduct the CWNS every four years under CWA Section 516 (b). Missouri documented needs totaling approximately \$5.2 billion in 2008. This is a 10 percent decrease from approximately \$5.7 billion in needs documented in 2004.

**Table 5
Documented Needs in Missouri**

Type of Need	Needs (2008 Dollars, Millions)		
	2004	2008	Percent Change
Wastewater treatment	\$1,212	\$1,180	-3%
Pipe repair and new pipes	\$2,795	\$2,316	-17%
Recycled water distribution	nr	nr	0%
Combined sewer overflow correction	\$1,729	\$1,689	-2%
Total Wastewater Treatment Needs	\$5,736	\$5,185	-10%

Kansas City

Kansas City is making extensive improvements to its wastewater systems to eliminate unauthorized overflows of untreated raw sewage and to reduce pollution levels in urban stormwater, at a cost estimated to exceed \$2.5 billion over 25 years. When completed, the sanitary sewer system will have adequate infrastructure to capture and convey combined stormwater and sewage to the city's treatment plants. This will keep billions of gallons of

untreated sewage from reaching surface waters.

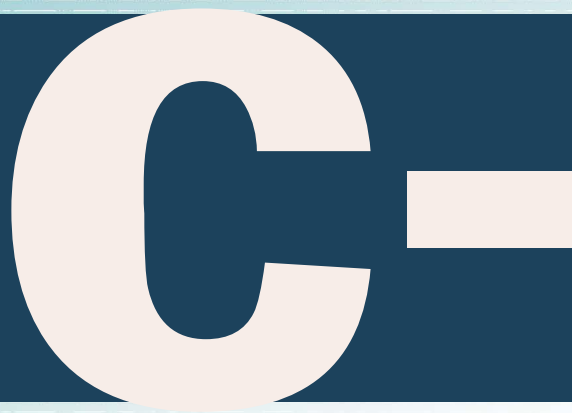
The plan is also structured to encourage the city to use natural or engineered "green infrastructure," such as green roofs, rain gardens and permeable pavement, to minimize stormwater burdens on the improved system.

In October 2012, the City's Water Services Department conducted a groundbreaking for the effluent disinfection improvements project at the Blue River Wastewater Treatment Plant, Kansas City's largest wastewater treatment facility. The \$48 million project is one component of a \$96 million overall investment by the city to improve the quality of the water returned to area waterways.

Project plans include the construction of three chemical terminal facilities. Combined, these facilities will store, distribute and move necessary supplies for wastewater treatment at Blue River and at two additional treatment plants in Kansas City. The project will meet heightened state requirements for wastewater disinfection, and is part of the city's 25-year Overflow Control Program.

Lake of the Ozarks

Since at least 1996, the concept of a regional sewer district to service a geographically defined area around the entire lake has risen to the forefront of public discussion. Supporters believe a regional sewer district at the Lake of the Ozarks would address the estimated **15,000 to 20,000 on-site systems that are**



WASTEWATER

aging and often poorly maintained. Rather than replacing or repairing those systems as they fail over the next 10 to 20 years, at an estimated cost of over \$150 million, resources could be spent on a wastewater infrastructure that would eliminate failing on-site systems and the threat they pose to water quality. A regional sewer district would also serve to eliminate the approximately **419 private wastewater treatment facilities that are currently discharging into the lake** pursuant to a permit issued by MDNR. This in turn would eliminate the necessity of administering and enforcing those permits.

There has been some discussion regarding the need for legislation to address the unique challenges facing a regional sewer district from the lake's topography, population distribution and seasonal demands. One such statutory change could be to give the district the authority to generate revenue from a sales tax. The greatest demand for sewer services occurs during the summer tourist season. It is reasonable to require those benefitting from the system to pay for the system through a sales tax.

Another consideration is granting reorganized and common sewer districts the authority to impose special assessments on real property benefitted by specific sewer projects and the authority to issue bonds payable from the special assessments. Special assessment financing would allow the district to address the specific challenges presented by various locations in the Lake region on a more local level.

St. Louis

MSD continues to make extensive improvements to its sewer systems and treatment plants and has in place a plan (at an estimated cost of \$4.7 billion over 23 years), to eliminate illegal overflows of untreated raw sewage, including basement backups, and to reduce

pollution levels in urban rivers and streams. MSD is also developing and implementing a schedule to eliminate more than 150 illegal discharge points within its sanitary sewer system as part of this plan.

MSD will significantly advance the use of large scale green infrastructure projects to control wet weather sewer overflows by investing at least \$100 million in an innovative green infrastructure program, focused in environmental justice communities in St. Louis. Environmental justice communities include low-income or minority communities who have suffered a disproportionate burden from air, water or land pollution. Green infrastructure involves the use of properties to store, infiltrate and evaporate stormwater to prevent it from getting into the combined sewer system.

Examples of potential green infrastructure projects include green roofs, bio-retention, green streets, rain barrels, rain gardens and permeable pavement.

Finally, MSD will engage in comprehensive and proactive cleaning, maintenance and emergency response programs to improve sewer system performance and to eliminate overflows from its sewer systems, including basement backups, releases into buildings and onto property.

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