



## Focus on the Infrastructure: Indiana's Local Bridges

### Introduction

Bridges are critical links in our transportation system and play an important role for mobility in Indiana, and particularly in rural areas, where most trips are made using the road network. Bridges have served as an essential component of the transportation system for thousands of years, providing passage over rivers and other obstacles.

In Indiana, there are 19,089 public bridges over 20 feet long; 68 percent of these bridges are local bridges, which are generally operated and maintained by county officials. (Only bridges that are 20 feet or longer are included in these totals, based on regulations specified by the Federal Highway Administration (FHWA). Structures less than 20 feet are typically referred to as small structures or culverts rather than bridges, since these small structures do not need to be included in the bridge inventory, which is required by FHWA.) The combined length of Indiana's county bridges is over 180 miles. Bridges on interstates and state roads are maintained by the Indiana Department of Transportation, or in some cases, the toll road authority that is responsible for them.

Bridges play an important role in facilitating commerce and supporting economic development in all areas, including rural areas. Although bridges are a critical infrastructure element, they are aging, as illustrated in Figure 1. Over 3,000 of the county bridges currently in the inventory were built before 1960 and nearly 8,000 of our county bridges have been in service for more than 30 years. However, just because a bridge is old, does not mean that it is not functional or safe.

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### The Rural Indiana Issues Series

**Audience:** Local and state leaders who work with rural communities.

**Purpose:** To find data about issues of concern in rural communities and to interpret that data in meaningful ways to aid in decision-making.

**Method:** Bridge data from the Indiana state Bridge Inspection Application System (BIAS) analyzed across county groupings – rural, rural/mixed and urban.

**Potential Topics:** Demographic changes, business development, health, health care, local government, taxes, education, agriculture, natural resources, leadership development, infrastructure, etc.

**Outcome:** Better, more informed decisions by rural decision-makers.

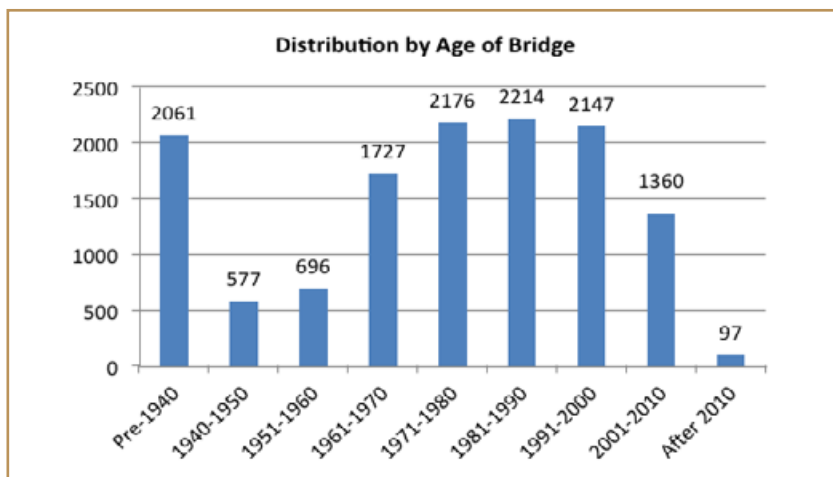


Figure 1. Indiana's County Bridges

All bridges in Indiana are inspected on a regular basis, typically every two years, and more frequently when necessary due to bridge condition or other risk factors. Local bridge inspections are conducted under the supervision of a professional engineer, typically a consultant who is hired by the county and reports to either the county engineer or highway superintendent. Bridge inspections include an evaluation of the bridge deck, the bridge superstructure, and the bridge substructure. The bridge deck is the roadway surface of the bridge, which is often reinforced concrete, but may be open grid steel or even timber. In some cases, the bridge deck has been overlaid with asphalt. The bridge superstructure consists of the bridge deck and structural members, as well as the handrails, lighting, and drainage features. The bridge substructure consists of all the components that support the superstructure, primarily the abutments, piers, footings, and pilings (Ohio Department of Transportation, 2013). All bridge inspection information is provided to the county and is also uploaded to the Indiana State Bridge Inspection Application System, a database that includes information about every bridge in the state.

## Bridge Evaluations Based on Bridge Inspections

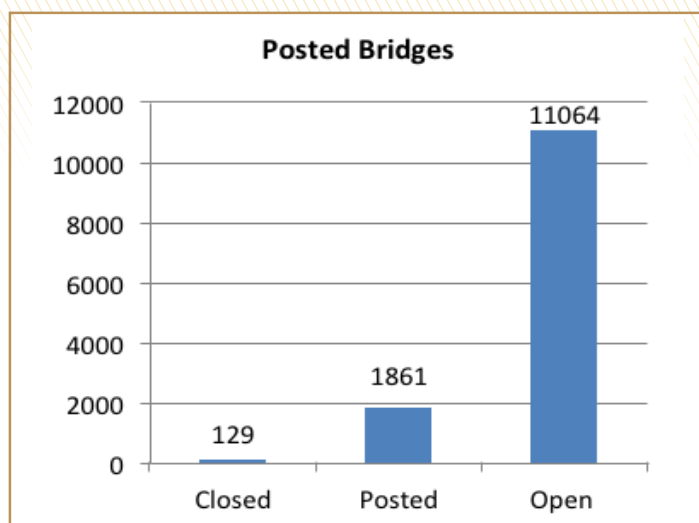
### Deficiency Classifications

Each Indiana Bridge is inspected systematically following standards established by the FHWA (Office of Engineering, 1995). Information collected during the bridge inspection allows deficient bridges to be identified. There are two deficiency classifications, *structurally deficient* and *functionally obsolete*.

- A *structurally deficient* bridge has deteriorated structural components. As a result of this deterioration, the bridge may be closed, posted, or require immediate rehabilitation. A posted bridge is not capable of carrying modern design loading based on an engineering analysis. As a result, there must be a sign posting this restriction next to the bridge, as shown in Figure 2. Posted bridges are safe for use as long as the load restriction and speed limit are followed. Currently there are 1,990 local bridges that are closed or posted, as shown in Figure 3. This represents



**Figure 2. Bridges with Load Restrictions Must Have a Sign Posting the Allowable Load Limit**



**Figure 3. Fifteen Percent of Local Bridges in Indiana are Closed or Posted**

approximately 15 percent of all local bridges. Bridges that are not structurally deficient are assessed to determine if they are functionally obsolete, and structurally deficient bridges are assumed to be functionally obsolete.

- A *functionally obsolete* bridge does not meet current design standards. For example, a functionally obsolete bridge may not have enough lanes for the current traffic volume, the lanes may be narrower than current standards, it may not have adequate shoulders, it may not have adequate clearance, or it may not have the load carrying capacity appropriate for current standards (Dunker & Rabbat, 1995).

The percent of bridges in Indiana that are deficient, either structurally deficient or functionally obsolete, is shown in Table 1. The average percent of deficient bridges for each county has decreased

**Table 1. Deficient Local Bridges in Indiana**

Year	2002	2004	2006	2008	2010	2012
Structurally Deficient or Functionally Obsolete	27%	26%	25%	24%	19%	22%

from 27 percent (37 out of 137) to 22 percent (32 out of 142) in the past decade. This improvement can be attributed to increased maintenance, repair, rehabilitation, and reconstruction by county officials. There is an increasing emphasis on not just building new bridges or reconstructing bridges, but also maintaining bridges so they last longer. This can be accomplished using a bridge management program, a process that inventories bridges and their condition and prioritizes improvements to assure the highest benefit for the funds invested. Table 2 provides a comparison of Indiana's bridges with those of other Midwestern states. In most states, the percent of deficient bridges on interstates and state roads is lower than the percent on local roads; this reflects the importance of state bridges, the higher traffic volumes and the increased loads that these bridges must carry.

**Table 2. Deficient Bridges<sup>1</sup> in Midwestern States in 2012<sup>1</sup>**

State	Interstate and State Bridges	Local Bridges	All Bridges
<b>Indiana</b>	<b>15%</b>	<b>22%</b>	<b>21%</b>
Illinois	19%	15%	16%
Kentucky	27%	35%	30%
Michigan	21%	25%	24%
Wisconsin	11%	15%	14%
Iowa	9%	29%	26%
Minnesota	9%	15%	14%
Missouri	21%	29%	26%
Average	17%	23%	21%

<sup>1</sup> Structurally deficient or functionally obsolete, based on 2012 Bridge Inventory (Better Roads Magazine, 2012)

## Sufficiency Rating

In addition to the two deficiency classifications, bridges are evaluated using a sufficiency rating, which indicates sufficiency to remain in service. A sufficiency rating of 100 percent indicates a completely sufficient bridge, whereas a sufficiency rating of 0 percent indicates a completely deficient bridge. The sufficiency rating provides a systematic evaluation considering four weighted factors:

- Structural adequacy and safety (includes ratings for the superstructure and substructure),
- Serviceability and functional obsolescence (includes ratings for deck condition, number of lanes),
- Essentiality for public use (includes ratings for detour length and the average traffic on the bridge), and
- Special reduction (includes ratings for traffic safety and structure type).

The bridge sufficiency rating provides a single value that is calculated in the same way for all bridges across the country. While

the sufficiency rating makes it easy to compare bridges in different places, it does not provide an indication of how long the bridge will remain sufficient (Indiana LTAP, 2012).

Table 3 shows the percentage of local bridges that are deficient and the average sufficiency rating for urban, rural/mixed and rural areas in Indiana. This table reflects only local bridges, which are maintained by cities and counties. It does not reflect bridges on interstates or state highways, which are maintained by the Indiana Department of Transportation. There are 17 urban counties, 42 rural counties, and 33 rural/mixed counties. These categories were established based on total population, population density, and the population of the largest city in the county (Ayres, Waldorf, & McKendree, 2012).

Rural areas tend to have fewer bridges, although a higher percentage is deficient, and the average sufficiency rating is lower. Maintaining bridges in rural areas is challenging, because the primary source of funding for bridges is typically the Cumulative Bridge fund, which is a property tax-based fund with a statutory maximum rate of \$0.10 per \$100.00 assessed valuation. One of the problems with the Cumulative Bridge fund is that it is not

**Table 3. Bridge Information for Local Bridges in Indiana**

	Number of bridges in county	Percent of deficient bridges	Funding per Bridge	Bridge sufficiency rating (100 is best)
<b>Urban</b>				
Average	212	18.86	\$ 7,707.97	79.95
Max	527	36.24	\$ 21,087.40	88.36
Min	119	8.97	\$ 2,247.09	70.70
<b>Rural/Mixed</b>				
Average	137	18.45	\$ 3,844.82	82.35
Max	235	46.08	\$ 8,462.20	92.67
Min	49	2.04	\$ 872.22	71.68
<b>Rural</b>				
Average	118	25.07	\$ 3,252.46	76.46
Max	252	59.49	\$ 12,193.68	91.59
Min	31	3.51	\$ 821.29	47.24



very effective in raising revenue in large rural counties. Cumulative Bridge fund revenues are greater in smaller, more developed counties because revenues are generated in proportion to the net assessed value of the property in the county.

## Funding for Local Bridges

Funds to maintain and reconstruct local bridges include local, state, and federal revenues. Large bridge projects, such as new construction and reconstruction, may be funded using federal aid (supported by the 18.4¢ federal gas tax). Typically, federal aid projects are funded using 80 percent federal funds and 20 percent local funds, which are referred to as the "local match." Local funds are also used for smaller projects and bridge maintenance. Local sources of funds for bridges and roads include the Cumulative Bridge fund, the Motor Vehicle Highway fund, and the Local Road and Street fund. The Cumulative Bridge fund can be used for bridge maintenance, repair, and construction, and is supported by property taxes that are under the control of local governments. A few counties have a Major Bridge fund, which is also a property-based tax. Both the Motor Vehicle Highway and the Local Road and Street funds are supported by the 18¢ Indiana gas tax and by one percent of total sales tax revenue; these funds are state formula funds controlled by the state. Depending on the county, bridges and roads may also be supported by local funds from a wheel tax and excise surtax, a local option income tax, gaming funds, and general revenues.

## Future Challenges

Maintaining local bridges and the local road network is critical to rural Indiana's quality of life and economic development. Local decision makers must make sure that adequate funding is available to support the transportation infrastructure so that it can provide the connections needed to maintain the independence and economic opportunities necessary for residents and communities.

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