

Stressing Our Roads

An adequate and safe rural road system is critical to the timely and efficient transportation of grain and farm machinery at harvest time. However, changes in agricultural operations over the past 30 years are having a dramatic impact on Kansas's road system, and are affecting our ability to maintain that system.



The average size of an Kansas farm has increased from 574 acres in 1970 to more than 702 acres today. Modern agricultural practices have also produced higher yields per acre, which mean more grain to haul to market.

Because stress to pavements and bridges is related to a vehicle's axle weight, Kansas laws regulate the axle weights of heavy vehicles using the roadways. The legal weight limits are 20,000 lbs for a single axle and 34,000 lbs for a tandem axle, with vehicles exceeding those limits needing a special permit. Criminal penalties for violation of weight and load laws do not apply to implements of husbandry temporarily moved upon a highway, but the farmer may be liable for damage to a road or bridge due to the overload.












Tractors and most farm implements do not exceed the legal axle weight limits. However, a liquid manure tank, grain cart, or grain wagon may have an axle load of 60,000 lbs, which is three times the legal axle load. The front axle of a large combine can exceed the 20,000 axle weight limit if a corn head is attached or if there is grain in the hopper.

Axle weights greatly exceeding legal limits were not anticipated when pavements, culverts and bridges were constructed. These overloads can break up pavement in a few passes, and cause catastrophic collapse of bridges and culverts.

Bridges and culverts are a special concern because of safety to the driver and the high cost of structural repairs. Bridges and culverts have been designed for truck loads and typical truck axle spacing. A concentrated load from a grain cart or liquid manure tank can cause rapid collapse as shown in the picture on the cover of this brochure. High flotation tires do not offset the higher axle weight.

Effect of different vehicles on roadway pavement

The following chart compares the stress on pavement created by a variety of heavy vehicles. The number of passes to failure indicates that some vehicle types shorten the life of pavement with significantly fewer passes.

Type	Axles	# Passes to failure 6" PCC*	# Passes to failure 7" PCC*
 5-Axle Tractor-Semitrailer 80,000 lbs.	1 Single/2 Tandems	12,000	135,000
 7-Axle Tractor-Semitrailer 96,000 lbs.	1 Single/2 Tridems	78,000	175,000
 Grain Cart - 900 bu. 58,000 lbs. (20% on tow vehicle)	Tandem	200	6,000
 Grain Cart - 875 bu. 57,000 lbs. (20% on tow vehicle)	Single	<10	<30
 Grain Cart - 650 bu. 42,000 lbs. (20% on tow vehicle)	Single	<30	270
 Grain Wagon - 775 bu. 49,000 lbs.	2 Singles	1,000	60,000
 2 Grain Wagons - 450 bu. 31,000 lbs. each	4 Singles	106,000	239,000
 Combine - Empty	2 Singles (1 tire on pavement)		
27,500 lbs. w/o corn head	18,000 front/9,500 rear	3,790,000	8,468,000
32,000 lbs. w/corn head	26,000 front/6,000 rear	887,000	1,980,000
 Combine - w/240 bu.	2 Singles (1 tire on pavement)		
41,000 lbs. w/o corn head	27,500 front/13,500 rear	712,000	1,591,000
46,000 lbs. w/corn head	36,000 front/10,000 rear	100,000	456,000
 Large Row Crop Tractor 18,000 lbs.	2 Singles 11,000 front/7,000 rear	1,525,000	3,410,000
 Liquid Manure Tanks 10,000 gallon - 96,000 lbs	2 Tandems 26,000 front/70,000 rear	<10	<30
7,500 gallon - 71,000 lbs	1 Tandem	<10	<30

* PCC - Portland Cement Concrete. Source: Iowa DOT. Note: Structurally equivalent asphalt pavements may experience similar impacts. See Fall 2008 KUTC Newsletter, page 6, for an article on damage to asphalt roads. <http://www.kutc.ku.edu/pdf/FILES/KUTC2008-Fall.pdf>

Trucks are also stressing the roads. Farmers today have higher crop yields which results in more grain being trucked from the fields to market. Just the increase in the number of truck trips results in more road wear, and pavements will deteriorate faster than expected. Legally loaded trucks spread the weight out over many legally loaded axles and should not damage modern bridges and culverts, but do affect the life of pavements. Small overloads cause considerable road damage, for instance an overload of just 20 percent will double the damage to pavements.

What should farmers do?

- Minimize hauling on roads with loaded grain carts and liquid manure wagons, especially during wet weather.
- Do not cross bridges and culverts with loaded equipment that exceed standard axle weight limits.
- Do not overload trucks. The increased hauling efficiency is offset by damage to the roads.

What should road agencies do?

Because varying conditions, it is difficult to make specific recommendations for road repairs. However, here are some options to consider:

- On rock or sand roads increase the amount of base and maintain a good crown.
- Maintain good drainage. Wet spots in ditches may affect subbase strength.
- In soft areas consider using geosynthetics.
- Timely maintenance of asphalt roads is critical. Consider increasing frequency of crack filling, chip seals, and overlays. On asphalt roads with heavy traffic consider structural overlays or increasing base thickness. Sometimes businesses that generate the heavy traffic will contribute part or all of the cost for upgrading key stretches of road.
- A higher budget may be needed for significant road improvements to carry heavy loads.
- Where there are known overload issues, discuss the problem with local law enforcement and ask for better enforcement.
- Set Spring weight limits where you have significant freeze/thaw problems.
- Consider axle weight limits for timber structures.

Sources:

1. *Stressing Our Future* brochure, Iowa DOT, 1997.
2. U.S. Department of Agriculture. Kansas Farm Facts 2012. http://www.nass.usda.gov/Statistics_by_State/Kansas/Publications/Annual_Statistical_Bulletin/ff2012.pdf
3. Interview. Norm Bowers, Kansas Association of Counties, January 2014.



The numbers on rural roads and bridges in Kansas

Miles of paved county & township roads 14,269

Miles of gravel and earth county & township roads 99,851

Number of bridges on local system..... 19,836

Number of structurally deficient or obsolete local bridges 3,702

Road data: KS DOT Planning and Development Division, 2012.
 Bridge data: KS DOT Bureau of Local Projects, March 2014.

For more information, contact

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Related video available from the Kansas LTAP Lending Library:

“How Heavy is Too Heavy for the Roads of Kansas?”
 DVD format. Order online at <http://www.ksltap.org>

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The changing picture of road damage in rural Kansas