LTAP
KANSAS LOCAL TECHNICAL ASSISTANCE PROGRAM

SPRING 2022

# KANSAS LTAP NEWSLETTER

A Service of The University of Kansas Transportation Center for Road, Street, & Bridge Agencies

## INSIDE THE ISSUE

# DIRECTOR'S UPDATE

By Emily Wilder, KS LTAP

As I write this, it is my last day with the University of Kansas Transportation Center and as Kansas LTAP Director. As sad as I am to be leaving the center, I am looking forward to traveling the country with my wife in our Airstream. To make that possible, I have accepted a fully remote position as an education program manager for the Merchant Risk Council.

Until my position can be filled, I am happy to announce that Erin Walkenshaw, our current business coordinator, will serve as interim Kansas LTAP Director. Erin is an excellent communicator and project manager. I believe you will find her to be prompt, personable, and reliable. She is supported by a wonderful team that is available to help discuss any questions, comments, or technical assistance you may need.

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For the past three and a half years it has been my pleasure to serve and work alongside the LTAP community. I am incredibly thankful for the people I have met and the work that we have accomplished together. As always, I value your feedback, so I'm asking for help one last time. If you have a favorite travel destination (or places to avoid), please feel free to share with me at wilderemilya@gmail.com. Thank you for an incredible journey so far, and I hope to see you down the road!

# WHAT CAN KANSAS LTAP'S LOCAL FIELD LIAISON DO FOR YOU?

By Nelda Buckley, KS LTAP

A "Local Field..." What? "Liaison" – a go-between! The Local Field Liaison is a go-between to encourage communication and to connect cities and counties with services offered by the Local Technical Assistance Program (LTAP) and the Kansas Department of Transportation (KDOT). And it is me – Nelda Buckley. Our first Local Field Liaisons, Clark Rusco and Mike Perkins, are retired, and I am now on the job, full-time. I started in January and have already visited quite a few cities and counties throughout Kansas. My initial focus has been on counties without a Local Road Safety Plan to help them understand the benefits and application deadline. Beyond that, I have been

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introducing myself and LTAP resources; it is surprising how many cities are unfamiliar with LTAP. My background in traffic engineering, signing, traffic control, access management, and local road projects and safety makes me well suited to this position.

## NOW, WHAT DO YOU NEED HELP WITH?

### UNDERSTAND HOW TO IMPLEMENT LRSP RECOMMENDATIONS

Hopefully, most Counties have or will soon have a Local Road Safety Plan (LRSP). The plans are very thorough and cover everything from how the plan was developed to the risk factors for each segment, intersection, and curve to recommendations for the highest risk locations. But where should you start? Do you need to implement every recommendation? What if you do not have enough funds to even match (generally 10%) federal funds for a safety project? I can help look at your options and determine what might be best for your situation.

### LEAD A PRACTICAL ROAD SAFETY ASSESSMENT

Whether you are a County (with or without an LRSP) or a City, you may have a location that you or a citizen are concerned about, but you don't have any good ideas. I can help put together a small team of both locals and "outsiders" to take a closer look, propose some options, and develop some written recommendations. This Practical Road Safety Assessment (PRSA) is intended to be just that – practical advice, like asking a neighbor questions such as "Have you ever seen something like this? What did you do?"

### MAKE MINOR SAFETY OR TRAFFIC ENGINEERING RECOMMENDATIONS

If you are not interested in the variety of options that a PRSA might offer and just have a spot with safety or traffic engineering concerns, I am more than willing to discuss the conditions and your concerns. I can help assess the situation and make engineering recommendations or just be someone to bounce ideas off of. I can be contacted by phone or email and can schedule a site visit if appropriate.


### ASSIST WITH KDOT FUNDING APPLICATIONS

Sometimes you just need to know which form or application to use for your situation. One notable example is the Traffic Engineering Assistance Program (TEAP) application. Although the program is available year-round to both cities and counties, you forgot where to find the application (the Bureau of Local Projects' web page at www.ksdot.org) or what information would be most helpful to include in the application, I can help. Or just knowing when the next High-Risk Rural Road (HRRR) or Transportation Alternatives (TA) call for projects might be. Just ask - I can help find the answers.

### DIRECT YOU TO LTAP RESOURCES (TRAINING, EQUIPMENT LOANS, AND MORE)

LTAP has so many resources it is not easy to keep track of them all. Most counties and some cities are aware of at least some of the training offered by LTAP (both in-person and online), but there is also a variety of fact sheets, guidebooks, and newsletter articles to address your needs as well. And finally, there is the equipment loan program; what better than free equipment to use when you need it?

We recognize that public works/road and bridge staff have many responsibilities. It is sometimes difficult to remember all the resources available to you. The Local Field Liaison can be that point of contact to direct you to the right resource for your situation. I can be contacted at Nelda.Buckley@ku.edu or (785) 864-0489.

# CULVERT MANAGEMENT

By Keith Browning, P.E., KAC Local Road Engineer

Culverts represent a sizable asset for local governments. While each individual culvert represents a much smaller investment than for a bridge, the sheer number of culverts combine to represent a large asset value for local governments. It is not unusual for a county to have ten times the number of culverts compared to the number of bridges. Taken together, county investment in culverts may be similar to their investment in bridge assets. Like other valuable public assets, culverts need to be managed.

## WHAT IS A CULVERT?

Kansas Statutes (K.S.A. 68-1101) define a bridge as "a structure having a clear span of more than twenty (20) feet, measured along the center line of the road between the inside faces of end supports, and multiple-span structures where the sum of the individual clear spans plus the aggregate width of the intermediate support or supports is in excess of twenty (20) feet". The same statute defines a culvert as any waterway structure not defined as a bridge. So, a culvert is any waterway structure that has a span of 20 feet or less.

While many people think of concrete or metal pipes when they hear the word "culvert", actually culverts can be constructed of various materials and come in various shapes. A structure that meets the above definition of culvert can be a clear span structure (span = 20 feet or less) constructed of timber, concrete, or steel. A culvert may have a deck on grade, similar to a bridge, or be buried under fill. A culvert can be constructed of stone masonry in an arch shape, or it can be a reinforced concrete box culvert.

Culverts come in a variety of materials, sizes and shapes

## WHAT SHOULD I KNOW ABOUT MY CULVERT ASSETS?

First, you need to know what culverts are in your inventory. If you are starting from scratch with no culvert inventory records, this may mean driving every mile of road and gathering field information for each culvert. Construction plans can also be used to

gather culvert data. For each culvert in your inventory, you should compile a file (paper, digital, or both) with as much of the following information as possible:

- Exact location
- Structure type
- Culvert size (span length, height, diameter, culvert length)
- Physical condition, and date it was last inspected
- Photos of each culvert, the roadway approaches, and any related signs
- Roadway width
- Construction date
- Construction plans
- Design information (structural, hydrology & hydraulics)
- Maintenance history
- Weight limit resolutions
- Pertinent correspondence, e.g., safety concerns, roadway overtopping, etc.

Gathering this information is a sizable task. However, it is important to have this culvert information on file, especially for cross-road culverts. Entrance culverts are typically small, pipe culverts, and it is less important to maintain a file on those. However, for larger entrance culverts, having a record and a file would be beneficial.

Location information for larger culverts might be obtainable from aerial photographs. In the field, latitude and longitude coordinates can be determined by Global Positioning System (GPS), which would allow the location to be captured in a Geographic Information System (GIS). The location should also be recorded according to your agency's location conventions (e.g., north & east coordinates, street address, etc.), as this will be more usable for workers in the field.

## WHY INSPECT CULVERTS?

Age, environmental exposure, scour from large stormwater runoff events, heavy traffic loads, physical damage all lead to culvert deterioration. Culvert failure can lead to roadway collapse, flooding, or embankment washout. At minimum, structural failure can result in road closures and traffic delays, and at worse can be life-threatening to the traveling public. Inspection of culverts is needed to maintain safe roadways.

Regular, routine inspections allow minor problems to be spotted and corrected before they become serious problems. Regular inspections reduce failure risk, and allow for short-term and long-term planning and budgeting.

**Roadway collapse due to structural failure (Source: AASHTO Culvert and Storm Drain System Inspection Guide)**

## CULVERT INSPECTIONS

A culvert inspection should evaluate three things about the culvert, (1) structural integrity, (2) hydraulic performance, and (3) approach roadway and roadside compatibility.

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Inspecting and assessing structural condition will be different for different culvert types and materials. For span culverts, the inspections will be similar to bridge inspections. Timber members should be checked for inherent deficiencies (checks, splits, knots), fungi decay, insect damage, loose connections, and damage from overloads (crushing, cracking), fire, impact, wear and weathering. Concrete slabs should be checked for cracking (flexure and shear), delamination, spalling, efflorescence, honeycombs, wear and abrasions. Steel stringers need to checked for corrosion, overloads, coating failures. Flexible culverts like metal and plastic pipe derive much of their structural integrity from the surrounding soil. The shape of metal and plastic pipe should be closely checked to determine if the soil/structure interface is functioning properly. Corrosion is a common cause of failure in metal pipe culverts.

The hydraulic performance of the culvert should be assessed during the inspection. The inspector should look for signs of overtopping, high water marks, and erosion and scour at culvert inlets and outlets. Undermining of foundations on a span culvert is a major cause of culvert failure. The inspector should probe around foundations to detect signs of undermining. The channel should also be assessed. Channel instability (incision, head cutting, alignment changes) can seriously affect the functionality and life of culverts.

**Structural failure due to undermining of the foundation.**

The roadway approaches should be assessed for traffic safety. Narrow roadways over culverts, severe road alignment, steep roadside slopes, and rigid objects near the traveled way detrimentally affect the safety of the traveling public. Traffic control signs should be checked for appropriateness. Missing or needed signs should be noted.

## INSPECTION FREQUENCY

The FHWA requires bridges to be inspected every two years. Given the large number of culverts most local governments have in their inventory, it is impractical to inspect every culvert every two years. Prioritizing which culverts to inspect in a given year could be based on known conditions from previous inspections, culvert type/size/age, culverts on roads slated for upcoming pavement work, culverts on high traffic volume roads, culverts on roads with heavy truck traffic, culverts in recently flooded areas, etc. Each agency will have different culvert inspection priorities depending on their culvert inventory, traffic patterns, planned road projects, and recent high-water events.

Different culvert types warrant different inspection schedules. Timber span culverts should be inspected more frequently since timber can fail suddenly and catastrophically. Span culverts with spread footings should be checked relatively frequently for undermining of the foundations. Reinforced concrete box culverts and smaller pipes in fair or better condition may warrant less frequent inspections.

Culverts under roads with upcoming pavement work should be inspected well in advance of the planned work. Any needed culvert maintenance or replacement should occur prior to the pavement work.

## CULVERT CONDITION RATING SYSTEMS

The culvert's condition should be rated somehow to allow comparisons among many culverts. This is needed for planning and scheduling work, whether it be maintenance work or total replacement. The rating system should provide information to decision

makers to help determine and prioritize needed culvert maintenance or replacement projects.

The AASHTO document "Culvert and Storm Drain System Inspection Guide" suggests rating culvert components on a scale from 1 (Good) to 4 (Severe). Culvert components identified in the guide include the culvert barrel, approach roadway, embankment over the culvert, channel alignment and protection, end treatments, and joints. This rating system assumes component-level ratings are more practical to convey the nature of distresses.

| | 1<br>GOOD | 2<br>FAIR | 3<br>POOR | 4<br>SEVERE |
|---|---|---|---|---|
| CONDITION | Like new, with little or no deterioration, structurally sound and functionally adequate. | Some deterioration, but structurally sound and functionally adequate. | Significant deterioration, functional inadequacy, or both, requiring maintenance or repair. | Very poor conditions that indicate possible imminent failure or failure which could threaten public safety. |
| ACTION INDICATED | No action is recommended. Note in inspection report only. | No immediate action is recommended, but more frequent inspection may be warranted. Maintenance personnel should be informed. | Team Leader (Inspector) evaluates need for corrective action and makes recommendation in inspection report. | Corrective action is required and urgent. Engineering evaluation is required to specify appropriate repair. |

**AASHTO culvert rating system rates culvert components on a scale of 1 to 4. Each component is rated on this numerical scale with different condition descriptors for each component. Source: AASHTO Culvert and Storm Drain System Inspection Guide**

The AASHTO guide is intended primarily for buried culverts. For span culverts with a deck at or near grade, a rating scale similar to FHWA's Bridge Inspector's Reference Manual, or BIRM, may be more applicable.

The BIRM describes rating bridge components (deck, superstructure, substructure, channel) on a scale of 9 (Excellent) to 0 (Failed). In this system, ratings of 7-9 indicate Good condition, ratings of 5 & 6 indicate Fair condition, and ratings of 4 or less indicate Poor condition. This same rating scale could be used to rate culverts. There are a couple of advantages of this rating scale over the AASHTO scale, (1) it is familiar to users since it is used for bridges, and (2) it provides for different degrees of Good, Fair, or Poor condition ratings.

| Code | Description |
|---|---|
| N | NOT APPLICABLE |
| 9 | EXCELLENT CONDITION |
| 8 | VERY GOOD CONDITION - no problems noted. |
| 7 | GOOD CONDITION - some minor problems. |
| 6 | SATISFACTORY CONDITION - structural elements show some minor deterioration. |
| 5 | FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling, or scour. |
| 4 | POOR CONDITION - advanced section loss, deterioration, spalling, or scour. |
| 3 | SERIOUS CONDITION - loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present. |
| 2 | CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken. |
| 1 | "IMMINENT" FAILURE CONDITION - major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put bridge back in light service. |
| 0 | FAILED CONDITION - out of service; beyond corrective action. |

**Rating scale from FHWA "Bridge Inspector's Reference Manual"**

The specific rating system used to assess culvert conditions is not critical. Agencies may want to develop their own rating system. The important thing is that a rating system of some kind is used. Even rating culvert conditions simply as Good, Fair, or Poor is better than no rating system. However, the purpose of a rating system is to convey meaningful information to decision makers. Detailed rating information allowing for comparisons of many culverts is beneficial.

A report on each culvert should be produced and placed in the culvert file following the inspection. In addition to a condition rating, the report should include culvert information (location, culvert type and size, etc.) and a narrative describing the culvert's condition and explaining the given rating. This can be a simple, one-page report recorded on a form. Photographs (especially of deteriorated conditions or other problems) should accompany the report. The report should also describe any maintenance needed for the culvert.

## MANAGING CULVERT DATA

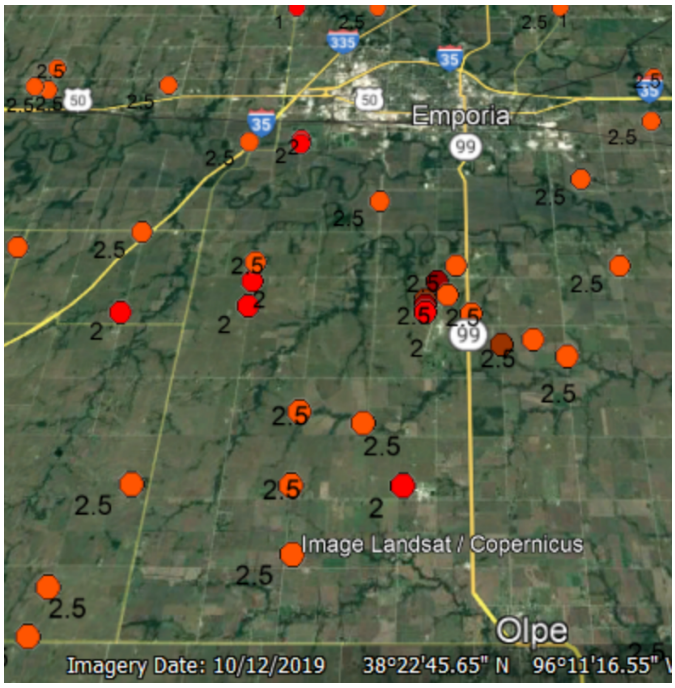
It is important that inventory and condition data for culverts be readily available and usable for decision

makers. The data provides information on the overall condition of your culvert assets, and helps road department leaders determine what maintenance actions are needed and when those actions may be needed. It aids decision makers in scheduling culvert replacements and determining needed budget amounts for culvert work.

Compiling culvert data can be done in several different forms. Of course, simple paper records are an option. A better option is compiling data in spreadsheet format or in a database. These electronic formats allow for querying and sorting that makes the data more readily usable. In addition to these electronic formats, tying the data to a GIS application allows showing culvert data in map form. Using GIS, maps can be produced showing culverts that are rated in poor condition, all culverts of a certain type, load-posted culverts, undermined culverts, all culverts on a certain road section, etc. This can be very helpful for decision makers, including governing boards, department heads, and superintendents.

Jim Brull, Assistant Engineer, Lyon County, has developed an inexpensive and relatively simple method of managing culvert data using Google Earth Pro. Lyon County records its culvert data in spreadsheet format, including latitude and longitude coordinates for each culvert in the spreadsheet. To import the data into Google Earth Pro, they save the spreadsheet in CSV format. This CSV file is imported into Google Earth Pro. Culvert locations and selected information for each culvert are then shown in Google Earth Pro. The application allows the creation of relatively small KMZ files so the various created maps can be saved in a usable format that can be opened and shared easily. Various KMZ files created by Lyon County show culvert span lengths, culverts that need to be monitored, all culverts below a certain rating, etc.

Commercial GIS software can be used to show geographically referenced culvert data. Various information can be tied to the GIS. For example, clicking on a culvert's location on the map could open up culvert photos, inspection records and construction plans. The GIS allows analyzing a multitude of




**Partial image of Google Earth Pro application showing locations of culverts with ratings of 2.5 and below in Lyon County (Courtesy of Jim Brull, Lyon County Road & Bridge)**

scenarios. For example, all timber culverts could be shown, or all culverts rated in poor condition for a designated road section. The possibilities are virtually limitless.

Commercial culvert and bridge management system software packages are also available. These software packages are complete and ready to use, so time is saved over developing your own management system.

## PRIORITIZING CULVERT REPLACEMENTS

Each local agency will have different priorities for culvert replacement projects. Obviously, culverts in poor condition should be a high priority for replacement. Traffic volume and truck volume should factor in to the prioritization process. Narrow culverts on high trafficked roadways may be prioritized over culverts in similar or worse condition on low volume roads. Culverts with approach roadway safety concerns may be a high priority. Undersized culverts that experience roadway flooding should be a high priority, especially on roads with higher traffic

volumes. There are a multitude of ways to prioritize culvert replacements. Of course, the agency's budget is a major factor on which culverts get replaced.

## FINAL THOUGHTS

Culverts are an important public asset that deserve proper management. It is important that every local agency know the culverts in their inventory and their condition. Managing culverts allows for more informed decisions, shows governing boards and the public you know what you are doing, and helps support budget requests. Most importantly, developing and following a culvert management program means safer roadways for the traveling public.

### REFERENCES


AASHTO; "Culvert and Storm Drain System Inspection Guide"; 2020; First Edition

FHWA; "Bridge Inspector's Reference Manual"; BIRM Volume 1; December 2012

Jim Brull; Lyon County; Emailed information; October 2021

Norm Bowers; "Culvert Management 2019" PowerPoint for Kansas LTAP


# RESOURCES FOR ADDRESSING NON-MOTORIZED SAFETY CONCERNS IN LOCAL COMMUNITIES

By Nikhila Gunda, KS LTAP

About 90 percent of all public roads in Kansas are rural roadways that represent over two-thirds of fatal crashes statewide, even though they carry less than 50 percent of all vehicle miles traveled ("KANSAS Strategic Highway Safety Plan 2020-2024", 2020). Along with cars and trucks, non-motorized users can be expected along rural roads. Examples include biking, walking, horse/animal-drawn vehicles, skaters, and golf carts. These users are more vulnerable to crashes when sharing the roadway with motorized vehicles due to the roadway characteristics and conditions of rural roadways.

The purpose of this article is to identify safety concerns of these non-motorized transportation users on local and rural roadways and some resources that can guide local authorities and communities in improving their safety.

## IDENTIFY CIRCUMSTANCES AFFECTING ROAD USER SAFETY

To reduce and/or prevent crashes or incidents involving non-motorized users, it is necessary to understand different factors associated with these crashes. In addition to the identification of contributing circumstances, information obtained through field assessments and stakeholders is an essential aspect for improving safety. According to a study "Factors Contributing to Pedestrian and Bicycle Crashes on Rural Highways," rural pedestrian crashes are twice as likely and rural bicycle crashes are three times as likely to result in a fatality compared to urban crashes (Carter & Council, 2006). About three percent of rural fatal crashes involved non-motorized and unconventional transportation users on devices like personal conveyances, which includes horse-drawn vehicles, skaters, scooters, Segways, golf carts and others ("Fatality Analysis Reporting System (FARS) | NHTSA", 2009). Though these crashes are relatively low overall, they are region specific, and the safety of these unconventional and non-motorized users should not be overlooked.

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**A study "Pedestrian and Bicycle Crash Types of the Early 1990's" had found that while crashes involving pedestrians and bicyclists that result in fatality are typically reported, less serious crashes are more frequent and underreported (Hunter et al., 1996).**

A study conducted by Hunter et al (Hunter et al., 1996) analyzed rural non-motorized crashes and found that crashes involving a motorized vehicle and a pedestrian (or a cyclist) involve the following common factors:

- Two-lane roadways
- Nighttime conditions
- Non-intersection related
- Relatively high vehicle speeds
- Absence of shoulders along the roadway and other space constraints

Typically, a combination of two or more above-mentioned factors affect the safety of non-motorized users on rural and local roadways. Other factors, such as behavioral factors like users' expectations of encountering non-motorized users, improper driving and road usage habits, unpaved shoulders, and various roadway contexts impact the safety of roadway users, both motorized and non-motorized.

The challenge in addressing non-motorized crashes in rural areas is that these crashes tend to be widely dispersed in time and location. This may make it difficult to target specific locations for assessment and improvement. Choosing and implementing safety and countermeasures depending on crash factors, analysis and regional priorities is helpful for improving non-motorized roadway safety.

## USE THE AVAILABLE RESOURCES

Each local area is unique and there is no "one-size-fits-all" approach to addressing and improving non-motorized roadway safety. Some of important resources that can help guide local authorities to improve roadway safety are as follows:

### NON-MOTORIZED USER SAFETY: A MANUAL FOR LOCAL RURAL ROAD OWNERS

This federal guide provides information, tools, and resources that can assist the local road practitioners in addressing the safety of non-motorized users. This guide includes the information that helps in understanding common conditions and behaviors and their assessment in addition to listing various countermeasures with their implementation and evaluation methods. Also, this document presents a general process, known as four-step process, that can be used to identify potential issues and problematic areas and develop targeted strategies to reduce and resolve them.
Link - https://safety.fhwa.dot.gov/local_rural/training/fhwasa010413/#ref6

### SAFE TRANSPORTATION FOR EVERY PEDESTRIAN (STEP)

This program aims to reduce the pedestrian fatalities and serious injuries that have risen sharply nationally in recent years. STEP is a "state-based model that identifies and rapidly deploys proven, yet underutilized innovations that make transportation system adaptable, sustainable, equitable and safer for all. Proven innovations promoted through EDC facilitate greater efficiency at the State, Local and Tribal levels, saving time, money and resources to ensure our infrastructure is built better, faster, and smarter" ("About Every Day Counts (EDC)", 2021). This program promotes many proven countermeasures, like road diets, pedestrian hybrid beacons (PHBs), raised crosswalks, rectangular rapid flashing beacons (RRFB), leading pedestrian intervals (LPIs) and other measures that targets specific areas of improvement with proper utilization of investment that can improve safety and enhance quality of life.
Link - https://safety.fhwa.dot.gov/ped_bike/step/

### PROVEN SAFETY COUNTERMEASURES (PSCI)

FHWA's initiative Proven Safety Countermeasures (PSCi) is a "collection of countermeasures and

strategies effective in reducing roadway fatalities and serious injuries on our Nation's highways" ("Proven Safety Countermeasures | Federal Highway Administration - Safety | Federal Highway Administration", 2022). These proven countermeasures and strategies can help local authorities target specific problem areas and/or issues that can be resolved with the implementation of these measures and strategies. In addition to the pedestrian and bicyclist strategies, PSCi includes countermeasures and strategies based on the contributing factors such as pavement conditions, speeding, roadway departures and intersections.
Link - https://safety.fhwa.dot.gov/provencountermeasures/

### KANSAS ACTIVE TRANSPORTATION PLAN (ATP)

Currently, the Kansas Department of Transportation (KDOT) is developing the state's first Active Transportation Plan (ATP) in 25 years ("Kansas Active Transportation Plan", 2022). This plan will analyze the needs of non-motorized users and will focus on strategies and policies that can help in planning, design, and partnerships with other state agencies and local communities to improve the safety of these users as a priority. More information can be found at the link below.
Link - https://www.ksdot.org/KansasATP.asp

## CONCLUSION

According to the Kansas Strategic Highway Safety Plan (SHSP) 2020-2024, non-motorized user fatalities and serious injuries are expected in increase to an annual average of 133 by the year 2024, based on available data, trend line, and without any intervention ("KANSAS Strategic Highway Safety Plan 2020-2024", 2020). Addressing non-motorized road user safety can be challenging. Resources and programs such as those listed above provide tools and information addressing user safety along with implementation and evaluation methods that have been proven to be effective and efficient to improve the non-motorized user safety and enhance the quality of life.


## ACKNOWLEDGEMENTS

Special thanks to Nelda Buckley for providing her expertise, advice, and valuable input for this factsheet from her experience of more than 30 years in roadway safety.


Special thanks to Nelda Buckley for providing her expertise, advice, and valuable input for this factsheet from her experience of more than 30 years in roadway safety.

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# FULL DEPTH REPAIR FOR JOINTED CONCRETE PAVEMENTS

By Mark Shelton, MO/KS ACPA

Concrete pavements, when designed and constructed properly, provide the most durable, resilient, and based on life cycle costs, the least expensive pavements. Even so, like any pavement, there are times when maintenance is required to extend the useful service life of the pavement. This article will discuss full depth pavement repair (FDR) for jointed concrete pavements.

FDR can be a good option for maintenance when the total repair area is less than five to ten percent of the total pavement area. FDR can address distresses such as transverse cracking, corner breaks, pavement blow ups, punch outs and joint distresses. It should be noted that if the joint distresses are being caused by D-cracking or alkali-silica reaction, the repairs will only provide a temporary solution.

As the name implies, FDR, involves removing and replacing a section of pavement the full pavement depth. Repairs should be performed across the full width of the pavement to provide better stability for the patch. Some investigation may be needed to determine the extent of the distress because deterioration below the surface can extend wider than it appears on the surface. A minimum 6-foot-wide dowelled repair is recommended to reduce the risk of pumping and breakup of the new repair.

Saw cuts perpendicular to the lane lines resulting in rectangular sections should be made to remove the bad concrete section. Care should be taken when removing the concrete not to damage the pavement being left in place. The base material under the removed concrete should be evaluated to determine if there is a need to remove and replace some of the material or if a lateral edge drain should be installed to drain excessive accumulating moisture. It can be difficult to achieve proper compaction of material within the repair area. It may be best to replace disturbed base material with concrete. This will affect the ability of the repair to move laterally but may provide a more stable repair.

A minimum of 4 dowel bars per wheel path should be installed to provide for load transfer. Holes for the dowels should be drilled approximately 1/8th inch larger than the dowel diameter and secured in the existing pavement with epoxy. The exposed sections of the dowel bars should be lightly greased to prevent bonding and allow movement of the slab.
The concrete mix used for the repair should be designed related to the length of time the repaired area can be closed to traffic. Generally, a higher early strength mix design is necessary due to early opening requirements. Compressive strengths in the 2000 to 2500 PSI range can be used for lighter residential traffic and greater than 3000 PSI for heavier traffic.
Normal concrete finishing and curing techniques can be used. However, extra care should be given to the smoothness of the repair and the transition from the existing concrete and the repaired concrete. A well-constructed repair should not be noticed as the traveling public crosses over.
News releases informing the public a week to ten days ahead of actual repair work and a pre-meeting with all the workers discussing roles, responsibilities and safety are two additional recommended tools to facilitate a successful FDR operation.

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# KANSAS LTAP TRAINING UPDATE

By Megan Weinzirl, KS LTAP

Kansas LTAP is looking forward to offering in-person classes throughout the entirety of 2022. With the return of in-person classes, you will also see the return of lunch being provided during your training! The Kansas LTAP community can look forward to learning about Gravel Road Maintenance, Legal Permitting and Regulatory Processes, Snow and Ice Control, and so much more.

Instructors and course attendees will be required to adhere to federal, state, local, and venue COVID-19 mandates to foster a safe and comfortable learning environment for everyone.

As a reminder, Kansas LTAP has a new Learning Management System (LMS) that attendees will use to register for courses. The new LMS allows users to create accounts for themselves and others, view past and present enrollments, and register multiple people for multiple classes. We hosted a webinar about the new system that is now posted on our YouTube here. This webinar can be used as an introduction to the LMS or as a refresher.

As always, if you don't see a training you're interested in being offered this year -- or you and your colleagues are unable to make it to a training on the advertised date and/or location -- do not hesitate to reach out to us to see about hosting an on-demand course at your location. To contact us about hosting an on-demand course or for questions regarding the LMS, please email kutc_training@ku.edu or call Megan Weinzirl at 785-864-1344.

**SHARE!**

If you know individuals who would like to receive our newsletter, please have them go to: www.kutc.ku.edu/ltap and sign up for the Kansas LTAP email list. There is a box to check to request electronic notification of each new issue of the LTAP Newsletter. Back issues are available at our website in the newsletter archives section.


# KANSAS LTAP NEWSLETTER

The Kansas Local Technical Assistance Program (LTAP) is an educational, technology transfer and service program of the Kansas University Transportation Center (KUTC). Its purpose is to provide information to local government highway departments and their personnel and contractors by translating into understandable terms the latest technologies in the areas of roads, highways and bridges.

The Kansas LTAP Newsletter is published quarterly and is free to counties, cities, townships, tribal governments, road districts and others with transportation responsibilities. Editorial decisions are made by Kansas LTAP. Engineering practices and procedures set forth in this newsletter shall be implemented by or under the supervision of a licensed professional engineer in accordance with Kansas state statutes dealing with the technical professions.