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MOVITE

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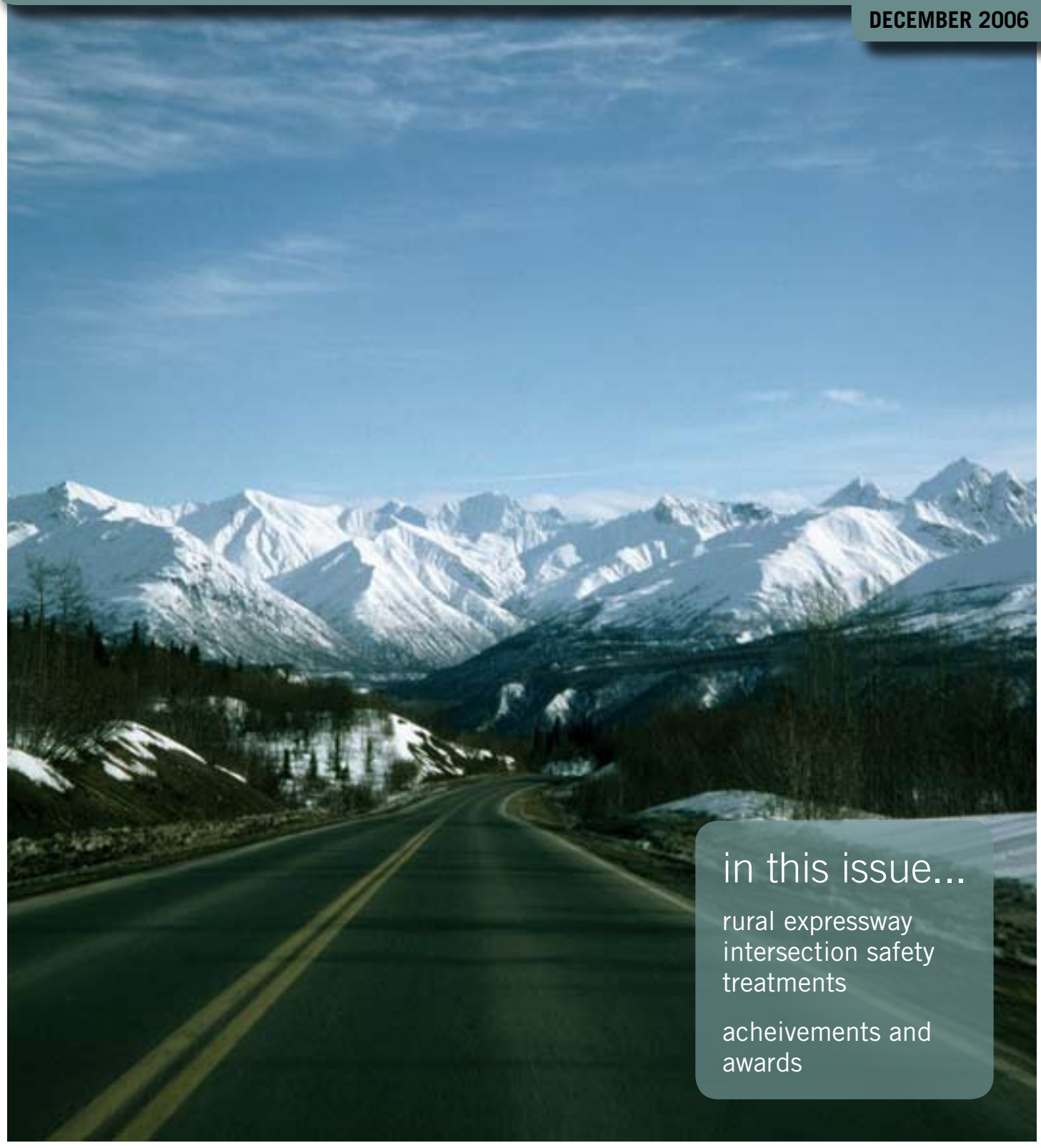

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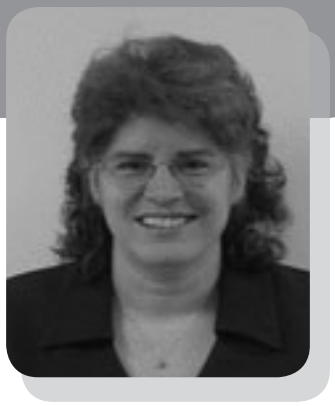
MOVITE

president's message

WOW
it is hard
to believe the year
is almost over!



Linda Voss, President

I think that it has been a successful year and there are so many people I would like to thank. First the board—they have done an awesome job. I do not think a lot of people realize all they are responsible for. I also would like to thank our section administrator, our journal editor, and our web administrator. We could not function without all their help. And lastly, thank you. Without the support of the membership, MOVITE would simply not exist.

Also thank you to the planning committee at the Lincoln meeting and the Topeka meeting. I was very impressed with the technical and the social agendas. And it was great to see everyone!

Thank you for allowing me to serve as President this year—it has been a huge honor.

So what has been accomplished this year? As noted above, we had two great meetings. We also had two board meetings, a board retreat, and two board strategic management sessions. In the last, the board looked at, and will continue to look at; where is MOVITE and where do we see the organization in the future. Our past president committee has been a great help with this task. Also a number of section meetings. We have four sections in the MOVITE area and two that are in the process—that is tremendous.

Don't be shy. If you feel there is a way to improve the meetings or the organizations—let us know. You can contract me, or any board member.

Linda Voss
President

Earl E. Newman, P.E., PTOE (F)

Earl E. Newman, P.E., PTOE (F)
ITE President-elect

My year as ITE Vice-President has flown by. It has been a year of learning, travel and personal growth. I was sworn in as President-Elect at the recent meeting of the International Board in Washington, D.C. Immediately, my work as President has started as I have begun to make appointments to councils and committees and write my first President's Message for the January 2007 issue of the ITE Journal.

I will have spent 70 days traveling in 2006. My trips include visits to 5 districts, 7 sections, 4 chapters and 4 student chapters along with attending the ITE major meetings. Riding on a Harley-Davidson motorcycle into the opening session of the Milwaukee ITE Meeting was definitely a highlight of the year as well getting to visit the Baseball Hall of Fame in Cooperstown, N.Y.

The International Board has approved the following priorities for 2007:

- A succession plan for key staff will be prepared.
- Develop action plan for membership recruitment, retention and reactivation.
- Continue working on enhancements to the journal, webpage and e-newsletter.
- Begin working on ITE position for the next reauthorization bill.
- Implement an enhanced customer service plan.
- Complete the Leadership Task Force action plan.
- Integrate international aspects into all MEGA issues and technical services.
- Support the needs of the members with respect to public relations and image.
- Integrate MEGA issues into Council activities and core services of the Institute.
- Provide training for new certification programs.

Sections and Chapters will be challenged to increase and enhance services as well as undertake and expand their recruitment and retention activities. I know I can count on MOVITE to determine some innovative ways to promote ITE membership.

Discussion will be continuing on International Aspects of ITE and on Public Relations and the Image of the Profession. Look for additional ITE resources to be expended in these areas.

I am proud to be representing MOVITE and the Midwestern District this year. I especially look forward to attending the joint MOVITE Midwestern District meeting in St. Louis in June. The St. Louis LAC is working hard to insure a great meeting. I hope you are considering submitting a paper in response to their Call for Papers.

My campaign theme for 2005 was "Bringing ITE to You". I hope that you are receiving the membership benefits that you want and I would be glad to hear from you about improvements we can make. Thanks to each of you for your support. I am committed to "Bringing ITE to You" in 2007.

volume 47 number 3

from the journal editor

Reggie Chandra, Editor

It is with great pride that we present you with the fall issue of the MOVITE Journal. Incidently, this is also the very last paper issue. The future issues of the journal will be in an electronic web format. I am really looking forward to the transition. The web journal will permit us to publish more content without seeing an escalation in printing costs. Also, it will simplify my job as the editor as well.

Please keep on sending articles for the journal. We are looking for material to fill our "Project Spotlight" feature. If you have been involved in any interesting projects lately that you think would be interesting to our membership, please share.

Happy holidays!

Reggie Chandra
Journal Editor

The MOVITE Journal is looking for technical articles. Do you have one worthy of publication? Please e-mail articles to: rchandra@marc.org for consideration.

We are also interested to increase the quality of our technical articles by setting up a peer-review board. Would you like to be a member of our article-review board? Please e-mail the editor at: rchandra@marc.org

www.movite.org

The Web site is continually being updated with the most recent information. Your comments and suggestions for changes and improvements to the site are most appreciated—keep them coming!

potential rural expressway intersection safety treatments

INTRODUCTION

A rural expressway is a high-speed, multi-lane, divided highway with partial access control. It is typically divided by a wide, depressed, turf median and may have intersections that are at-grade or grade separated. The typical rural expressway at-grade intersection, as shown in Figure 1, is two-way stop-controlled (TWSC) with the stop control on the minor, usually two-lane roadway. Converting rural two-lane highways to expressways is a popular highway safety improvement used by many State Departments of Transportation (DOTs) because the high design speed and multi-lane cross-section enable expressways to operate, between intersections, with a capacity approaching that of an interstate or freeway, while being constructed at a lower cost. Expressways are less expensive to build because they don't require the construction of as many interchanges or the acquisition of as much right-of-way (1). By providing an extra lane of travel in each direction and a physical separation between opposing traffic flow, expressways make passing easier and drastically reduce the likelihood of dangerous head-on and opposite-direction sideswipe collisions experienced on rural two-lane highways (2). As such, expressways have become the fastest growing component in the nation's highway system (3). Between 1996 and 2002, rural expressway mileage in the U.S. increased by more than 2600 miles (1). This expansion is expected to continue as 26 out of 28 DOTs recently surveyed stated that they plan to expand their state expressway systems over the next ten years (1).

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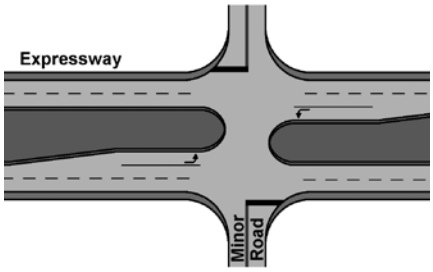


FIGURE 1
Typical Rural Expressway Intersection

CRASH TYPE	CRASH RATES (crashes/million vehicle miles)		PERCENT DIFF.
	324 MI OF RURAL 2-LANE HWYS PLANNED FOR EXPRWYS EXPRWY CONVERSION	111 MI OF RURAL 4-LANE DIVIDED (ADT < 8000 vpd)	
All Crashes	0.942	0.991	+ 5.2
Fatal	0.022	0.015	-31.8
Injury	0.324	0.309	-4.6
Property Damage Only	0.596	0.668	+ 12.1
Intersection-Related Crashes	0.231	0.236	+ 2.2
Single Vehicle Crashes	0.556	0.661	+ 18.9
Run-Off-Road	0.213	0.247	+ 16.0
Animal	0.309	0.381	+ 23.3
Multiple Vehicle Crashes	0.386	0.330	-14.5
Sideswipe (Opposite)	0.067	0.005	-92.5
Head-On	0.012	0.004	-66.7
Rear-End	0.131	0.093	-29.0
Sideswipe (Same)	0.064	0.051	-20.3
Left-Turn	0.026	0.025	-3.8
Right-Angle	0.087	0.149	+ 71.3

Source: Reference (4)

TABLE 1
Nebraska Crash Experience
(2-Lane Highways vs. 4-Lane Expressways)

This paper was written
as part of NCHRP 15-30,
"Median Intersection Design for Rural High-Speed
Divided Highways"

PROBLEM STATEMENT

An unpublished study (4) conducted in 2000 by the Nebraska Department of Roads (NDOR) revealed that right-angle intersection collisions on rural, four-lane divided sections of Nebraska's existing expressways system seem to be reducing the safety

benefits that should be derived from converting rural two-lane highways to expressways. The results of this study are presented in Table 1. While other intersection-related, multi-vehicle crash types (i.e., rear-end/left-turn) have lower crash rates on expressways, the overall intersection-related crash rate is slightly higher on expressways due to the elevated (71% higher) right-angle crash experience. Right-angle collisions are potentially more severe on expressways than on two-lane highways due to the higher speed of expressway traffic and are consequently cause for concern; especially as many DOTs intend to construct more intersections of this type in the near future.

The right-angle crash problem at rural expressway intersections is not specific to Nebraska. Minnesota data showed that 42 percent of all rural divided highway crashes were intersection-related and 57 percent of those collisions were right-angle or turning crashes (5). An examination of Utah data in the same study revealed similar percentages. A more recent study showed that 52 percent of rural expressway intersection collisions in Iowa are of the right-angle variety (1). These crash statistics illustrate that minimizing right-angle collisions is very important in the management of rural expressway intersection safety.

...the underlying cause seems to be the poor gap selection choices of left-turning and crossing minor road drivers.

In an effort to understand the causes of crashes at rural TWSC intersections, Preston et al. (6) reviewed three years of rural intersection crash data for the Minnesota DOT. This study concurred with the NDOR findings that rural expressway intersections have a greater proportion of right-angle collisions than intersections on two-lane highways. In addition, a detailed review of the crash reports at three high-crash frequency, four-legged, TWSC rural expressway intersections showed that 1) 87 percent of the right-angle crashes were due to the inability of minor road drivers to recognize oncoming expressway traffic and/or select safe gaps in the expressway traffic stream, 2) 78 percent of the right-angle crashes were “far-side” collisions (i.e., right-angle crashes involving left-turning or crossing minor road vehicles that successfully cross the near set of expressway lanes, but collide with expressway traffic in the far-side set of lanes after traversing the median), and 3) intersection recognition by drivers on the minor, stop-controlled approaches was not a contributing factor in the right-angle crashes at these locations.

From these observations, it appears that the primary intersection safety problem at TWSC rural expressway intersections is far-side, right-angle collisions and their underlying cause seems to be the poor gap selection choices of left-turning and crossing minor road drivers. A recent survey of elderly drivers in West Virginia (7) indicated that nearly half of the respondents have had problems turning or crossing from the minor road at TWSC expressway intersections.

PROJECT OBJECTIVES

State DOTs have tried several intersection safety treatments at problematic rural expressway intersections to improve their safety performance while avoiding costly

Intersection Geometric Design Elements	Positive Correlation	Negative Correlation	No Significant Effect
Number of Intersection Legs	Harwood et al., 1995 (5)		
Intersection Skew/Angle	Van Maren, 1980 (9)		
Intersection Median Opening Length	Harwood et al., 1995 (5)		Van Maren, 1980 (9)
Total Distance Across Expressway	Van Maren, 1980 (9)		
Approach Geometric Design Elements	**Positive Correlation**	**Negative Correlation**	**No Significant Effect**
Median Width (Expressway)		Priest, 1964 (10) Harwood et al., 1995 (5) [4-legged intersections] Maze et al., 2004 (1)	Cribbins et al., 1967 (11) Van Maren, 1980 (9) Harwood et al., 1995 (5) [3-legged intersections]
Presence of Median Barrier (Expressway)			Van Maren, 1980 (9)
Degree of Horizontal Curvature (Expressway)	Van Maren, 1980 (9)		
Percent Grade (Expressway)			Van Maren, 1980 (9)
Number of Lanes (Expressway)	Harwood et al., 1995 (5) [4-legged intersections]	Harwood et al., 1995 (5) [3-legged intersections]	
Lane Width (Expressway)	Harwood et al., 1995 (5) [4-legged intersections]		Harwood et al., 1995 (5) [3-legged intersections]
Shoulder Width (Expressway)			Van Maren, 1980 (9) Harwood et al., 1995 (5)
Left-Turn Deceleration Lane Presence (Expressway)	Van Maren, 1980 (9) Harwood et al., 1995 (5) [3-legged intersections]	Harwood et al., 1995 (5) [4-legged intersections]	Maze et al., 2004 (1)
Left-Turn Acceleration Lane Presence) (Expressway		Van Maren, 1980 (9) Hanson, 2002 (12)	
Offset Left-Turn Lane Presence (Expressway)	Schurr et al., 2003 (13) [due to speed differential]	Schurr et al., 2003 (13) [due to sight distance]	
Right-Turn Deceleration Lane Presence (Expressway)	Van Maren, 1980 (9)		Maze et al., 2004 (1)
Right-Turn Acceleration Lane Presence (Expressway)	Van Maren, 1980 (9)		
Intersection Traffic Control and Operational Elements	**Positive Correlation**	**Negative Correlation**	**No Significant Effect**
Signalization	Cribbins et al., 1967 (11) Cribbins & Walton, 1970 (14) Van Maren, 1980 (9)	Solomon, 1959 (15)	
Bouncing Ball Beacon (BBB)		Solomon, 1959 (15)	
Median Traffic Control Type			Harwood et al., 1995 (5)
Presence of Intersection Lighting	Harwood et al., 1995 (5)		
Presence of Rolling/Mountainous Terrain		Harwood et al., 1995 (5)	
Total Entering Volume (ADT)	Priest, 1964 (10)		McDonald, 1953 (16)
Approach Traffic Control and Operational Elements	**Positive Correlation**	**Negative Correlation**	**No Significant Effect**
Expressway Volume (ADT)	McDonald, 1953 (16) Priest, 1964 (10) Cribbins et al., 1967 (11) Harwood et al., 1995 (5) Maze et al., 2004 (1)		
Minor Road Volume (ADT)	McDonald, 1953 (16) Priest, 1964 (10) Harwood et al., 1995 (5) Maze et al., 2004 (1)		
Speed Limit (Expressway)	Cribbins et al., 1967 (11)		
Design Speed (Expressway)			Harwood et al., 1995 (5)
Advance Warning Signage (Expressway)			Van Maren, 1980 (9) Pant & Huang, 1992 (17)
Advance Warning Signage (Minor Road)		Van Maren, 1980 (9)	
Stop Sign Size (Minor Road)		Van Maren, 1980 (9)	
Presence of Painted Stop-Bars (Expressway & Minor Road)		Van Maren, 1980 (9)	
Access Control (Expressway)	Harwood et al., 1995 (5) [3-legged intersections]		Harwood et al., 1995 (5) [4-legged intersections]
Functional Classification (Divided Highway)		Harwood et al., 1995 (5) [4-legged intersections]	Harwood et al., 1995 (5) [3-legged intersections]

TABLE 2
Expressway/Divided Highway Intersection Safety Literature Review Summary

A positive correlation means that as the element of interest increases or is present, crashes and/or crash surrogates increase according to the specified reference, indicating a deterioration of intersection safety (vice versa for a negative correlation).

In general, selection of the most appropriate crash countermeasure should be based on the type of crashes occurring at each location.

grade separation. In general, selection of the most appropriate crash countermeasure should be based on the type of crashes occurring at each location. TWSC expressway intersections seem to present challenges to crossing and left-turning minor road drivers attempting to select gaps in the far expressway traffic stream. These maneuvers involve complex speed and distance judgments as well as assessing the movements of other traffic using the median. They can be more difficult for older drivers due to naturally declining visual, motor, and cognitive abilities (8). To assist DOTs in mitigating these issues, two treatments are presented which address the underlying problem and therefore, have great potential to improve rural expressway intersection safety.

LITERATURE REVIEW

An extensive literature review was conducted pertaining to at-grade intersection safety on rural expressways. Of particular interest were studies analyzing rural expressway intersection crash frequency, rate, or severity as a function of traffic demand, traffic control, or geometric design variables. Table 2 summarizes the findings of this review.

RURAL EXPRESSWAY INTERSECTION SAFETY TREATMENTS

Rural expressway intersection safety treatments can be divided into three categories: conflict point management, gap selection aids, and intersection recognition devices. Treatments were compiled from the literature review, including two previous surveys of DOTs (1, 18) and are summarized in Table 3. Based on the underlying cause of crashes at rural expressway intersections described previously, the conflict point management techniques and the gap selection aids would seem to have the most potential to improve safety at these locations.

Conflict Point (Access) Management

Intersection conflict points represent locations where vehicle paths cross as they move from one intersection leg to another. Intersection conflict point analysis is a common method of comparing the relative safety of alternative intersection designs (19). The basic premise suggests that the more conflict points an intersection has, the more dangerous it will be. This approach is useful, but flawed because it assumes crash risk is equal at each conflict point, when in fact, crash risk at each point varies depending on the volumes and complexity of the conflicting movements. Nevertheless, conflict point management techniques have the most potential to improve rural expressway intersection safety because they remove, reduce, or control the number and type of vehicular conflicts that can occur at an intersection. Two intersection design concepts that utilize conflict point management while avoiding costly grade separation are described in this report. The liberal implementation of these cost-effective design solutions could significantly improve rural expressway intersection safety.

Conversion of Four-Legged Intersections to Three

Crash models developed by Harwood et al. (5) revealed that crash frequency and rates at rural, three-legged, unsignalized, divided highway intersections are substantially lower than at their four-legged counterparts. It has long been acknowledged that three-legged intersections operate more safely because they have fewer conflict points (19). A typical four-legged, four-lane rural expressway intersection has a total of 42 conflict points assuming

that opposite left-turn paths do not overlap. A similar three-legged, T-intersection has almost 75 percent fewer conflict points with only eleven. The Alabama DOT has experienced positive safety benefits by minimizing the number of four-legged expressway intersections (1).

When replacing four-legged intersections with T-intersections, there are three different designs that could be used: a typical T, a channelized T, or a continuous green T. These types of T-intersections are illustrated in Figure 2. Further research is necessary to determine which of these designs performs best in terms of safety and operations; however, the continuous green T-intersection was developed specifically for locations where a minor collector roadway ends at a major highway (20).

With the conversion of a four-legged intersection into a three-legged intersection, adequate through access for minor road traffic can still be maintained by creating an "offset T-intersection" design, as shown in Figure 3A. Converting a four-legged expressway intersection into two T-intersections still reduces the number of conflict points from 42 to 22. This design should work well if the through volumes emanating from the minor road are low (21). However, if minor road through volumes are higher, a "one-quadrant interchange" design, as shown in Figure 3B, may be justified.

The offset T-intersection design shown in Figure 3A is known as a "right-left" configuration because a through vehicle on the minor road must first turn right onto the expressway and then turn left off of it (1). The right-left configuration is preferred over a left-right configuration because it would reduce the required number of high risk, left-turning maneuvers from the minor road. The two T-intersections should be spaced far enough apart so that they will each operate independently, allowing a through vehicle on the minor road adequate space to merge across the expressway lanes and safely enter the opposite minor roadway without causing undue interference to through expressway traffic. The minimum spacing between median openings currently used by DOTs in rural areas ranges from 500 feet to a half mile (19).

TABLE 3 Potential Rural Expressway Intersection Safety Treatments

Treatment Category	Subcategory	Rural Expressway Intersection Safety Treatments
Conflict Point (Access) Management	Removal Through Access Control	1) Conversion of Entire Expressway Corridor to Freeway
		2) Isolated Conversion to Grade Separation or Interchange
		3) Use of Frontage Roads (i.e., close low volume intersections)
	Reduction	1) Convert Four-legged Intersections to T-Intersections • Three Types (Typical, Channelized, and Continuous Green) –Use a "One-Quadrant Interchange" Design –Use Offset T-Intersections
		2) Replace High-Risk Conflict Points with Lower Risk Maneuvers • J-Turn Intersections (indirect minor road left-turn/crossing) • Other Indirect Left-Turn Treatments (loops & jug-handles)
		3) Provide Left and/or Right-Turn Lanes (Use Longer Lanes)
		4) Provide Free Right-Turn Ramps
	Control	1) Reduce Median Opening Length
		2) Signalization (Use Protected Left-Turn Phasing on Expressway)
Gap Selection Aids	Gap Assistance Devices	1) ITS Intersection Decision Support System (IDS)
		2) Roadside Markers/Poles (Passive Markings at a Fixed Distance)
	Median Control & Delineation	1) Add Centerline, Yield/Stop Bars, and Signage in the Median
		2) Extend Left Edge Lines of Expressway Across Median Opening
	Geometrics	1) Widen Median to Provide for Adequate Vehicle Storage
		2) Provide Left and/or Right-Turn Acceleration Lanes
	Signage	1) Expressway Speed Limit Reduction
	Maximize Intersection Sight Distance	1) Provide Clear Sight Triangles
		2) Provide Offset Left and/or Offset Right-Turn Lanes
		3) Move Minor Road Stop Bar as Close to Expressway as Possible
		4) Realign Skewed Intersections
		5) Straighten/Flatten Horizontal/Vertical Curves on Expressway
		6) Don't Use "Pork Chop" Right-Turn Lanes on Minor Road Approaches without Providing Right-Turn Acceleration Lanes.
Inter-section Recognition Devices	Intersection Treatments	1) Provide an Overhead Bouncing Ball Beacon (BBB)
		2) Provide Intersection Lighting
	All Approaches	1) Improved (Overhead/Larger) "Intersection Ahead" Signage
	Expressway Approaches	1) Provide Diagrammatic Freeway-Style Intersection Guide Signs
		2) Interactive "Watch For Entering Traffic When Flashing" Signs
		3) Use of a Variable Median Width (Wider in Intersection Vicinity)
		4) Use of Raised/Paved Median in Vicinity of Intersection
	Minor Road Approaches	1) Use Larger Stop Signs w/Flashing Beacons and Wider Stop Bars
		2) Provide "Stop-Ahead" Signs and In-Lane Pavement Markings
		3) Use In-Lane Rumble Strips
		4) Provide Splitter Island at Mouth of Intersection
		5) Provide Signage for Prevention of Wrong-Way Entry

FIGURE 2: Types of T-Intersections

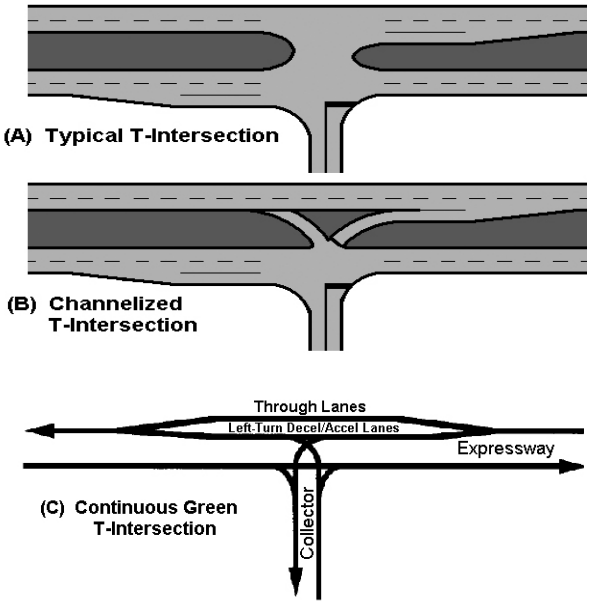


FIGURE 3: 4-Leg To 3-Leg Designs To Accommodate Minor Road Through Traffic

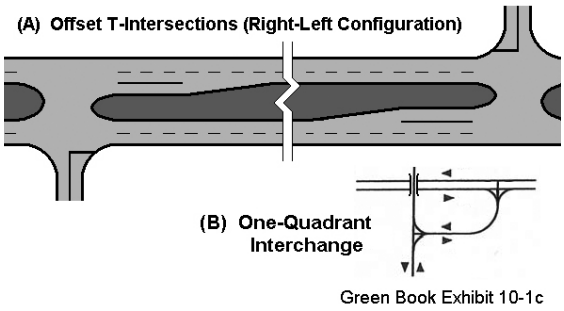
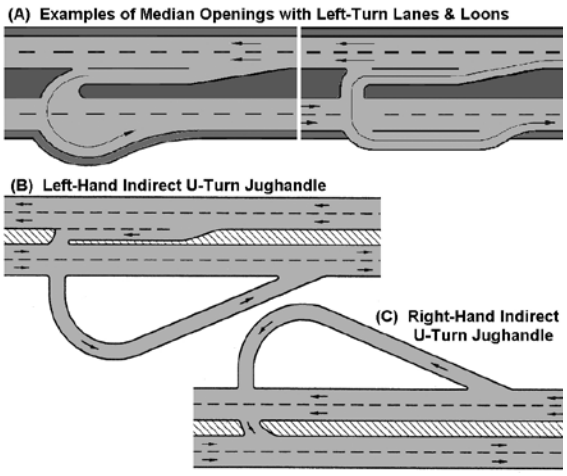


FIGURE 4: J-Turn Intersection



J-Turn Intersection Design

The ability to accommodate high volumes of traffic safely and efficiently through intersections largely depends on the arrangements provided for handling intersecting traffic (2). All movements through a typical four-legged, TWSC rural expressway intersection do not have the same crash risk. The greatest crash risk movements (i.e., those accounting for the greatest share of crashes) are typically the minor road left-turn and crossing maneuvers (6). Therefore, elimination or minimization of these conflicts can be a very effective means of improving safety at rural expressway intersections. An intersection design which accomplishes this is a directional median opening combined with two median U-turns, otherwise known as a "J-Turn" intersection. The Maryland DOT implemented this treatment at the junction of US-301 and Maryland State Highway 313 in 2000 and their experience has shown that J-turn intersections can offer superior safety performance as compared to a typical four-legged rural expressway intersection.

The J-turn intersection, as shown in Figure 4, accommodates vehicles making left-turns off of the expressway, but forces left-turning and crossing minor road traffic to turn right, weave to the left, make a downstream U-turn, and then return to the intersection. This design treatment thereby replaces the high crash risk minor road maneuvers with lower risk movements. There is no indication that U-turns at unsignalized median openings constitute a safety concern (19). In addition, this design reduces the total number of conflict points, as compared with a typical four-legged intersection, from 42 to 24, assuming vehicles making U-turns are able to turn directly into the interior expressway lane without encroaching on the outside lane.

Similar to the offset T-intersection design, the U-turns should be adequately spaced from the main intersection. The AASHTO "Green Book" (2) recommends that the U-turn crossover be located 400 to 600 feet from a signalized intersection. No guidance is provided for an unsignalized intersection of this kind; however, the Maryland DOT constructed the median turnarounds approximately 1500 feet from the intersection at US-301 and MD-313 and the design seems to operate quite well.

One of the disadvantages of the J-turn intersection is that it may require the acquisition of more right-of-way because a wide median is necessary to enable the U-turn movement. Figure 4 can be misleading in this regard. Ideally, the median width should be sufficient to permit the design vehicle to U-turn from an auxiliary deceleration lane in the median to an auxiliary acceleration lane in the median in the opposite direction. The Maryland J-turn was designed such that it allowed passenger cars to U-turn in this fashion. However, while monitoring intersection operations, the Maryland DOT observed that passenger cars tend not to use the acceleration lanes

and opt to U-turn directly into the inside (passing) expressway lane instead. As a result, the Maryland DOT has decided not to use U-turn acceleration lanes in the future.

Minimum median widths to accommodate U-turns by different design vehicles turning from the passing lane on a four-lane divided facility are given in Exhibit 9-92 of the Green Book (2); however, the Green Book states, "Where U-turn openings are designed specifically for the purpose of eliminating the left-turn movement at a major intersection, they should be designed with a median left-turn lane for storage." Therefore, Table 4 was developed to show the minimum median widths required by different design vehicles to execute a U-turn from a twelve foot wide left-turn deceleration lane.

Minimum Median Width (ft): U-Turn From Left-Turn Deceleration Lane				
Design Vehicle	**To Left-Turn Acceleration Lane**	**To Expressway Inner Lane**	**To Expressway Outer Lane**	**To Expressway Shoulder**
19 ft. P	54	42	30	20
40 ft. BUS	87	75	63	53
55 ft. WB-50 65 ft. WB-60	95	83	71	61

For all calculations, 12 foot wide lanes were assumed.

TABLE 4
Minimum Median Widths for J-Turn U-Turns

According to the Green Book, the appropriate design vehicle for determining the median width should be chosen based on the actual or anticipated vehicle mix of crossroad and U-turn traffic. A school bus is often the largest vehicle to use the median roadway frequently in rural areas (2). Where a school bus is used as the design vehicle and a median width of at least 63 feet cannot be provided, consideration should be given to providing a loon or a left-hand indirect U-turn jug-handle as shown in Figure 5. The purpose of these designs is to provide additional space to facilitate the larger U-turning paths of commercial vehicles. The Maryland J-turn design provided a wider expressway shoulder to accommodate the U-turning path of a WB-50 vehicle. However, forcing large trucks to make part of their U-turn in the high-speed expressway lanes may hinder operations. If so, a left-hand indirect U-turn jug-handle for trucks may be warranted. The right-hand indirect U-turn jug-handle design shown in Figure 5C should not be used in conjunction with a J-turn intersection because, by requiring a left-turn into the far expressway lanes, it would defeat the purpose of providing a J-turn intersection.

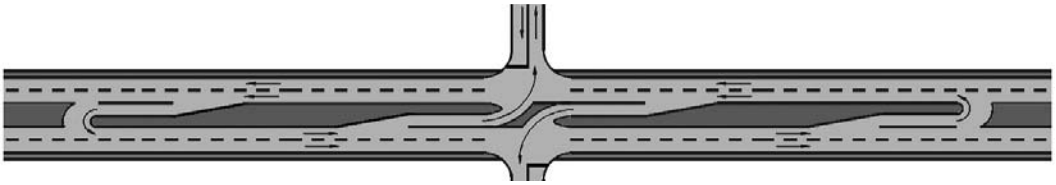


FIGURE 5
U-Turn Treatments with Narrow Medians

CONCLUSIONS

Far-side right-angle collisions at TWSC rural expressway intersections are reducing the safety benefits that should be achieved when converting rural two-lane highways to expressways. The intersection safety treatments described in this paper reduce or eliminate the possibility of these crash types and therefore, seem to have the greatest potential to cost-effectively improve rural expressway intersection safety. The use of these strategies should be considered at existing expressway intersections with safety concerns as well as during expressway corridor planning in an effort to avoid costly grade separation.

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recent movite awards and acheivements

OUTSTANDING STUDENT CHAPTER

This year's outstanding student chapter award goes to **Iowa State University.**

Joshua Hochstein accepting the award for Outstanding Student Chapter.

TRANSPORTATION ACHIEVEMENT AWARD

This is an annual award that is presented to an organization for outstanding transportation achievement. I am proud to announce that this year's award goes to the **KC Scout.**

Overtime, the KC area has extended its metropolitan reach to become the third largest metropolitan area in the nation based on land area. That growth has brought with it all the challenges of a sustainable transportation system. Designs such as adding pavement to the existing highway system are not feasible in many parts of the metro area. Further, a struggling economy continues to drain typical sources of funding for transportation improvements.

The solution—KC Scout.

KC Scout includes 100 high-resolution video camera and 3 dozen electronic signs and 1000 roadway sensors supported by new technology specifically designed for this program. Scout monitors traffic conditions, sends help to clear congestion, and provides traffic updates to travelers more quickly.

Ray Webb, KC Scout, accepting the Transportation Achievement Award.

JOHN B. PINKLEY INDUSTRY MEMBER AWARD

This award is named after John Pinkley. John began his traffic industry career in 1964 as a regional manager for Prismo Corporation and immediately became active as a member of MOVITE. He enjoyed the industry so much that in 1977 John formed his own company in Oklahoma City. John touched the lives of industry members from coast to coast. However, the majority of his time he working in the states of Oklahoma, Arkansas, Texas and Louisiana. He dedicated himself to his customers and to the industry. He was active in the business up until the time of his death in 2002. While I did not personally know John—I am told he did a lot for the traffic industry such as solving traffic problems with the latest equipment and innovations. I was also told that John was a fun loving person that was a joy to be around.

The Industry Member Award is an annual award that is presented to an individual who has made outstanding contributions to the advancement of the traffic industry through service to MOVITE. I am pleased to announce that this year's award goes to: **Graham Montgomery**

It is hard to believe that I have known Graham for over 25 years. When I first started out at KDOT—Graham was the one we always called with our questions—some were really dumb questions—but he was always very patient with us and always explained the best way to do this or that.

Graham was born and raised in Canada and attended DeVry Technical in Toronto and began his career in Traffic Control products working for Eagle Signal. When Eagle closed their plant in Canada, Graham transferred to the Eagle home office in Davenport, IA. In 1972, Graham was hired by Dave Wigglesworth, new owner of Gades Sales in Wichita, KS, when Fred Gades, Jr. retired.

Except for a 2 ½ year period when he returned to Canada to work for another signal manufacturer/distributor, Graham has worked for Gades Sales Company. When Dave Wigglesworth retired in 1988, Graham purchased the company and returned to Wichita. This was not only a great opportunity to own a great business but provided an opportunity for him and his family to return to Wichita and to the Midwestern way of doing business, and the folks at KDOT were glad to have him back! Graham says that in the Midwest, there has been, and still is, a level of trust where people's word is good and many deals are made with verbal commitments or handshakes. I would certainly echo his same comment about Graham; he is definitely a man of his word and great to work with.

Graham Montgomery, Gades Sales, with the John B. Pinkely Industry Member Award.

The first MOVITE meeting that Graham attended after joining Gades was held in Topeka, KS in the spring 1973. Dave Wigglesworth was one of the founding members of KAUTC in 1973 and Graham joined KAUTC soon after the organization was formed. Graham served in all of the KAUTC offices and was President in 1993-94.

In the fall of 1985, Dave Wigglesworth and Graham were elected to be the first Affiliate Directors for MOVITE. Ironically, Graham only served one week before changing jobs and moving back to Canada.

Graham and his wife Joy have been married for 38 years and they have two daughters (Juli and Jennifer), and three granddaughters. Graham says he is having too much fun to consider retirement.

One of our KDOT friends summaries Graham quite well when he said "over the years Graham has been a great resource for us to tap into as he is always willing to answer a technical question, look into something for us or contact a community about a problem they may be having. He is very trustworthy and that can be hard to find in the sales industry."

Anyone who knows Graham has meet or at least talked on the phone with his co-worker Sharon who has worked with Graham for over 22 years. Sharon told me how intelligent Graham was and how he always was on top of the newest technology. However, Sharon also told me how great of a boss he was as she is raising three kids in addition to her full time job. She told me he is very understand and caring of life's emergencies and life's everyday situation. My favorite quote is " I even remember the year he helped me wrap Christmas presents in my office at the last minute—I don't think Santa would have made it without him!"

Graham is one those extraordinary people MOVITE has been lucky to have and is very deserving of the Industry Member Award.

Bruce Wacker accepting the Melvin B. Meyer Transportation Professional of the Year.

The Melvin B. Meyer TRANSPORTATION PROFESSIONAL OF THE YEAR AWARD

Melvin Meyer served as MOVITE's 25th President in 1976. Mr. Meyer went on to become the President of ITE in 1984. This award was named in his honor due to his service to the ITE and MOVITE organizations.

This award is offered annually by MOVITE to an individual who has made outstanding contributions to the advancement of traffic engineering, through service to MOVITE and ITE. I am happy to announce that this year's award goes to: **Bruce Wacker.**

Here is a quote from Bruce's co-workers: "We have been extremely impressed by his professionalism, his dedication to his job and his interest in doing the right thing. He daily displays his concern for his employees and his dedication to serving both internal and external customers."

Bruce served on the MOVITE Board for six years. He was originally elected in 1996 and in 2000 became MOVITE's 49th President. The following year he also served on the District Board.

During this time Bruce was an active participant in each of the positions that he held and worked to improve the operation and efficiency of those positions. Today he is still active as he is heading the Past President's Committee.

Bruce grew up in a small town in Nebraska and graduated from the University of Nebraska. He began his career with Larkin Associates, in 1998 he moved to the city of Overland Park.

During his time with the city, Bruce completed a wide variety of projects including the 110th and Lamar roundabout, back-up power for traffic signals, dynamic messages signs, and traffic calming.

Again to quote a co-worker—One of the key areas that Bruce oversees is the development of each of his employees. He takes on a true servant leadership role to make sure that each of his employees' needs are meet.

Bruce and Christy have been married for 19 years and have one daughter Sarah, who is 12 and a 7th grad of home school. Christy is a full time homemaker and schoolteacher who plays the harp.

Bruce—thank you for all your service to MOVITE and the City of Overland Park. Please accept the Transportation Profession of the Year Award.

MOVITE DISTINGUISHED MEMBER AWARD

The Distinguished Member Award is an annual award which is an honorary designation presented to a member of the Section who has provided outstanding and significant contributions to MOVITE over a period of many years. Distinguished Members are elected by the Executive Board.

I am very proud to announce that this years Distinguished MOVITE Member Award is being presented to: **Garry Metcalf.**

Thru the help of email—I had several people help me find out more about Garry….

Garry who was born in Indiana received his engineering degree from Purdue in 1964; he served in the Navy and worked for Wilbur Smith and Associates prior to 27 years of service with the city of Overland Park where he retired 1997. Now he enjoys his winters in Florida and his summers at Royals Stadium.

Garry is a huge Buddy Holly fan—he claims to have a pair of Buddy's glasses.

When he started in the city of Overland Park there was apparently an article in the newspaper that said, "Metcalf hired to solve Metcalf Avenue Traffic Problems." However, I am not really sure that is true, as many sources have told me that Garry had Metcalf Avenue named after him after he started with the city of Overland Park?

Garry is one of those people that make a huge impression on you, practically when you are a young professional. He is always so positive and he is always concerned about you and how you are doing. He is very encouraging and instills the right values—gathers the facts, follows the standards—in short he does the right thing.

One member told me "my first encounter with Garry was an a senior at KU in search of a project for my traffic engineering class. I was commuting from Johnson County that semester so my professor encouraged me to contact Garry. Of course he was very helpful in identifying a study location and getting me started. He was also kind enough to implement my recommendations, quite a thrill for a young punk ready to take on the world."

There are a lot of stories about how fun-loving Garry is. Apparently the one about him carrying a tire in an elevator is legendary? Someone else is going to have to tell us the details on that one.

Garry was always held in high regard for his direct answers and professional approach. His staff was always highly motivated and introduced the best in traffic engineering applications, common sense solutions, and using the latest in technological tools and materials. As a result, elected officials, fellow staff professionals, and more importantly the citizens of Overland Park appreciated his dedication and commitment to the traffic engineering field and its applications to serve the public.

A couple of situations that might seem appropriate to support the above statement include the signals on Metcalf Ave. and the building of the Sprint Corporate Headquarters and Campus at 119th St. and Nall Ave. in O.P.

Regarding Metcalf Avenue, Garry mentioned this to one of us many years ago. The City had recently installed their 1st generation of a computerized signal systems and Garry was running his street—Metcalf Ave.—to see how well it worked. He had traveled approximately 80% of the system hitting the progression sequence perfectly when he notice the car next to him was being driven by the Mayor. They proceeded to travel the corridor together and did not hit one red light. Garry of course was excited, the systems' timing appeared good, progression was excellent, and the traffic pattern very stable. That evening at a Council Meeting, Garry approached the Mayor and asked what he thought of the new timing and progression pattern on Metcalf Ave. The Mayor's comment was "he did not notice since he had green lights all the way".

In 1981 he served as our 30th president. After that Garry served as the District 4 Director for two years. In addition to his many contributions to MOVITE—Garry was a founding member of KAUTC and served as the president in 1974. He is also active in APWA and involvement in TRB and MUTCD committees.

Most importantly Garry was always an active mentors for his employees and always stressed the importance of professionalism. Garry is one those special people MOVITE has been lucky to have and is very deserving of the Distinguished Member Award.

Garry Metcalf receiving the MOVITE Distinguished Member Award.

Bonseok Kuh from University of Missouri—Columbia was not present to accept the Jan Kibbe Student Scholarship Award.