

## **APPENDIX A**

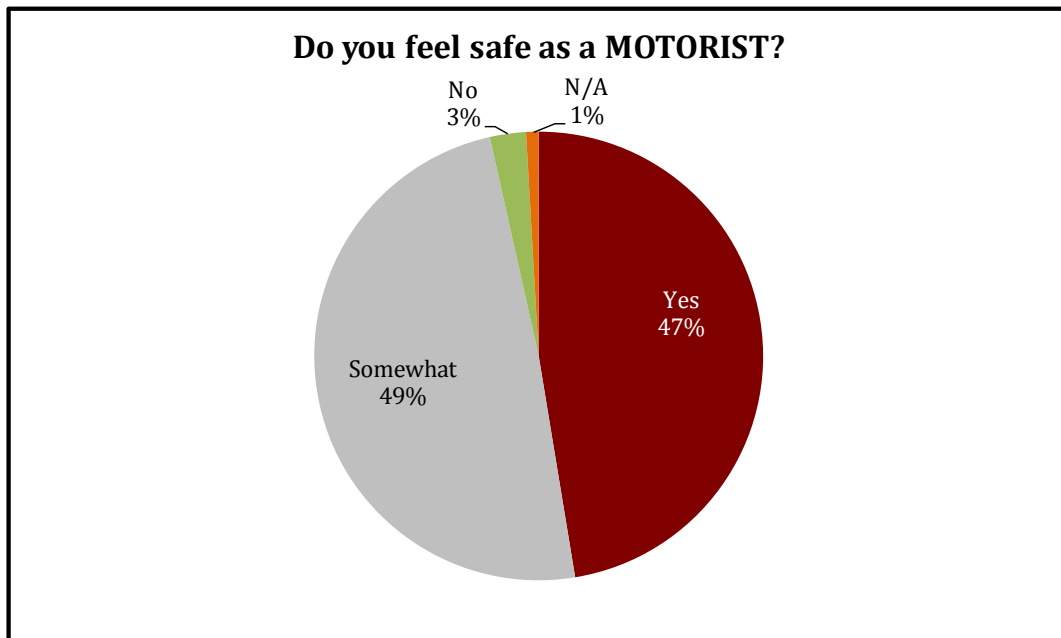
# **2010 WAMPO SAFETY SURVEY RESULTS**

# Safety Survey Summary

A safety survey was posted to the WAMPO website for three weeks from March 2, 2010 through March 9, 2010 and again from March 25, 2010 through April 9, 2010. The survey included 13 transportation-related questions and 6 demographic questions. Demographic information is not reported in this appendix and is available by contacting WAMPO. The survey received 114 responses. The survey collected public opinion on safety as a motorist, bicyclist, pedestrian, and transit user. The respondents provided thoughts on specific locations and areas where safety was a concern.

## Question 1

<b>Do you feel safe as a MOTORIST?</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Yes	47.4%	54
Somewhat	49.1%	56
No	2.6%	3
N/A - I don't drive	0.9%	1
<i>answered question</i>		<b>114</b>
<i>skipped question</i>		<b>0</b>



## Question 2

<b>Which of the following are safety concerns for you as a MOTORIST? (Check all that apply.)</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Travel speed	18.0%	20
Condition of lighting	13.5%	15
Bad weather	36.9%	41
Lane widths	18.9%	21
Pavement condition	38.7%	43
Rail crossings	14.4%	16
Design of intersections	25.2%	28
Spacing of on/off ramps	20.7%	23
Levels of congestion	25.2%	28
Aggressive driving	55.9%	62
Inattentive driving	73.9%	82
Construction/Work zones	29.7%	33
On/off ramps are too short	39.6%	44
Visibility and location of traffic signs and signals	18.9%	21
School zones and crosswalks	3.6%	4
Movement of oversized loads including farm implements	13.5%	15
Bicyclist/pedestrians on roadways not designed for them	33.3%	37
Other (please specify)		22
	<b>answered question</b>	<b>111</b>
	<b>skipped question</b>	<b>3</b>

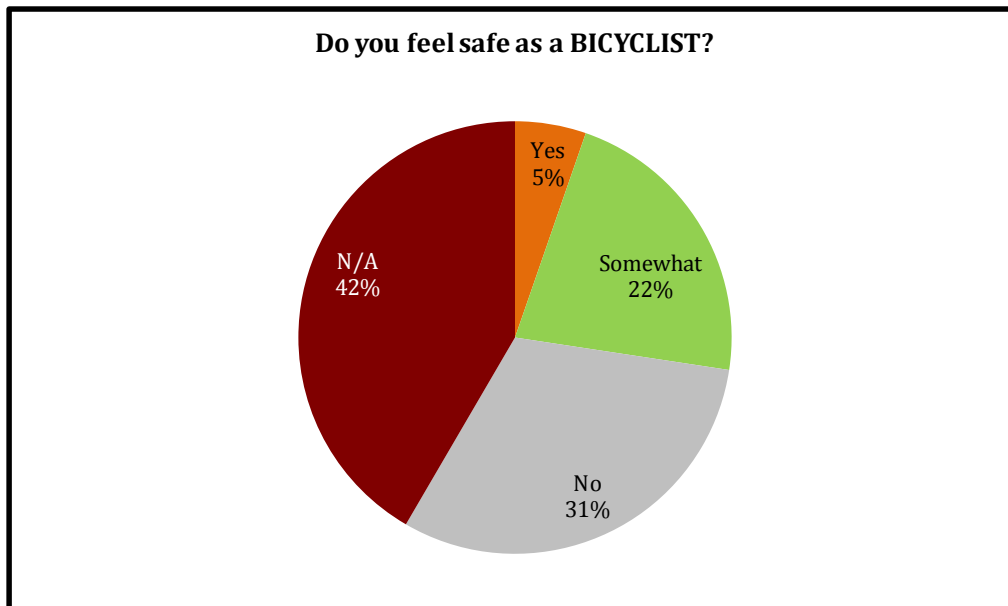
<b>Other (please specify)</b>
BLOCKED VISIBILITY DUE TO PARKED CARS,CROPS, PILED SNOW, SIGNAGE ON RIGHT OF WAY
Need reflective lane markers
Impaired drivers.
use of cell phones by drivers
Very comfortable driving, Wichita is completely catered to vehicle transporation
The lack of skill demonstrated by Kansas Drivers.
People going the wrong way.
drive=by shootings
cell phone use/ texting while driving
Bad driving etiquette
People running red lights.
Bad weather
Vehicles with a BU sticker on thier tag...Butler County
Conditions not adequate for an aging population
Lack of speed enforcement in residential neighborhoods
Too much cell phone use & texting while driving
to many pot holes that are damaging my vechiles
Cell phone texing!!!!!!!!!!!!
Talking on cell phones and texting.
Drivers ignoring Kansas Driving Laws, should be more traffic enforcement.
Insufficient policing for traffic violations
other drivers on cell phones

### Question 3

Are there specific locations in the region you avoid as a motorist due to safety concerns?	
<b>Answers</b>	
235 & Kellogg, north ramp; west ramp.	
Kellogg	
Kellogg/135 , K96/254/I135	
Rock Rock anywhere north of Kellogg.	
I135/235/254/96	
Right now it's West Street construction.	
I-235 and Kellogg interchange.	
Rock Road	
Kellogg anywhere along the construction route	
Rock Road and Central West Street during construction	
Kellogg & 235 - Given. Any intersection or road that does not contain turn lanes or center lanes. Rock & K-96 and other very high traffic intersections that are poorly designed. Kellogg & CBD because of the single lane on & off ramps as well as the shortness of the space between CBD & Seneca and CBD & Washington.	
I-235 and Kellogg 21st and Rock Road Rock Road from Lincoln to K-96	
I-135 and I-235	
Central between Oliver and Hillside - very narrow road. And, roads within a high crime area.	
235 and Kellogg 103rd South and Rock Road (light signal on east side doesn't see you on the west.	
The west side of Wichita, Kellogg street and surround area.	
wichita=east side	
235 & Kellogg. 135N&235 N (although less avoidable).	
Kellogg and 235, 235 and Zoo, all of Kellogg	
54/235 Intersection in west Wichita 37th to 45 North Woodlawn 45th North Woodlawn intersection	
The entire interchange at I-235 and US-54 is dangerous in need of IMMEDIATE upgrade.	
From Washington eastbound ramp to Kellogg at 5:00 PM rush.	
Kellogg & I-35	
us400 and I235	
235 & Kellogg (54/400)	
North and NE Wichita	
Inter State Highways	
West Street	
Greenwich construction right now down to one lane, but motorists sometimes driving wrong way. Occasionally construction will have no notice and go down to one lane unsafely.	
west kellogg	
Highway/interstate construction	
Kellogg/235 interchange; Kellogg 3:30 pm - 4:30 pm especially east and west near aircraft plants; K-96/I-135 at morning and evening rush hours	
Kellogg and webb turnpike area, Kellogg and I 235 area	
These are annoyances to me and safety concerns for older drivers. Wondered about driving/parking around arena and afterwards but turned out ok.	
235 and kellogg	
I-235 and Kellogg	
anything that is under heavy construction	
Kellogg at 235 west	
Kellogg and canal route	
Kellogg & I-235 whenever traffic is heavy	
central and I-235	
Construction zone in Derby on Buckner	
around the high schools 30 minutes before school starts, during lunch, and until 15 minutes after they r out of school.	
I-135 north bound at exit for K-96 is dangerous at rush hour. You can come over a hill and find traffic ahead of you stopped. The same is true at times on Kellogg. You can come over a hill and find traffic ahead of you stopped with no advance warning.	
Kellogg Canel Route	
All parts of Kellogg	
Gang areas.	
tyler road north of 21st st. the road narrows and the conjestion is a mess most of the time.	
Kellogg	
Any major N/S road through Wichita, any major E/W road through Wichita	
Kellogg/235 on and off ramps	
I-135 and K-15/ Pawnee and West Street	
Zoo BLVD, 13th and I-235. It's a mess!	
kellogg and Rock area, mainly all of Kellogg	
downtown wichita, construction sites, arena	
<i>answered question</i>	63
<i>skipped question</i>	51

## Question 4

<b>Do you feel safe as a BICYCLIST?</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Yes	5.3%	6
Somewhat	22.1%	25
No	31.0%	35
N/A - I don't use a bicycle for transportation	41.6%	47
<i>answered question</i>		<b>113</b>
<i>skipped question</i>		<b>1</b>



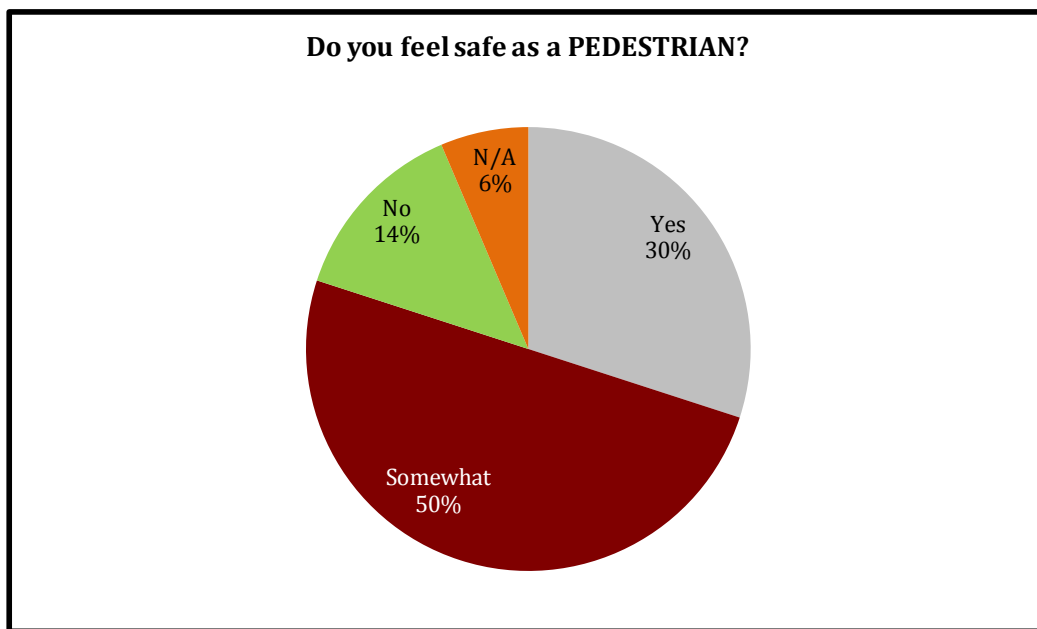
## Question 5

<b>Which of the following are safety concerns for you as a BICYCLIST? (Check all that apply.)</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Travel speed of motorists	43.7%	31
No shoulders or dedicated bike lanes	93.0%	66
Construction/Work zones	11.3%	8
Lane widths	43.7%	31
Visibility and location of traffic signs and signals	8.5%	6
School zones and crosswalks	4.2%	3
Movement of oversized loads including farm implements	5.6%	4
Rail crossings	14.1%	10
Design of intersections	22.5%	16
Levels of congestion	28.2%	20
Driving habits	60.6%	43
Light conditions	14.1%	10
Pavement condition	39.4%	28
Lack of pathway connections	63.4%	45
Lack of signage	33.8%	24
Other (please specify)		15
	<i>answered question</i>	<b>71</b>
	<i>skipped question</i>	<b>43</b>

<b>Other (please specify)</b>
Inattentive Driving and overall poor motorist education/training.
<b>Lack of respect from motorists</b>
Motorists hogging the roads--not giving a cyclist 3-4 ft of room. And cracks in bicycle paths that jar your whole body!!!
<b>Inattentive or aggressive drivers</b>
Drivers realizing bikes can be on roads.
I know a number of people who have been struck by an automobile while riding their bikes
Lack of education of motorists of bike laws and safety
Some drivers intentionally pass very close to me.
road rage
connections of bike paths from outlying satellite regions. Derby, Andover, Rose Hill...
Bad / inattentive drivers
Inattentive drivers
We have nice new wide sidewalks in mulvane but I wish they had Bike lanes like in Colorado

## Question 6

<b>Do you feel safe as a PEDESTRIAN?</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Yes	30.0%	33
Somewhat	50.0%	55
No	13.6%	15
N/A	6.4%	7
<i>answered question</i>		<b>110</b>
<i>skipped question</i>		<b>4</b>



## Question 7

<b>Which of the following are safety concerns for you as a PEDESTRIAN? (Check all that apply.)</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Travel speed of motorists	46.2%	43
Construction/Work zones	12.9%	12
Visibility and location of traffic signs and signals	16.1%	15
Condition of lighting	25.8%	24
Rail crossings	4.3%	4
Design of intersections	19.4%	18
Levels of congestion	21.5%	20
Driving habits	53.8%	50
Crime	35.5%	33
Lack of pedestrian facilities/sidewalks/crossings	61.3%	57
Pavement condition	18.3%	17
Other (please specify)		18
	<i>answered question</i>	<b>93</b>
	<i>skipped question</i>	<b>21</b>

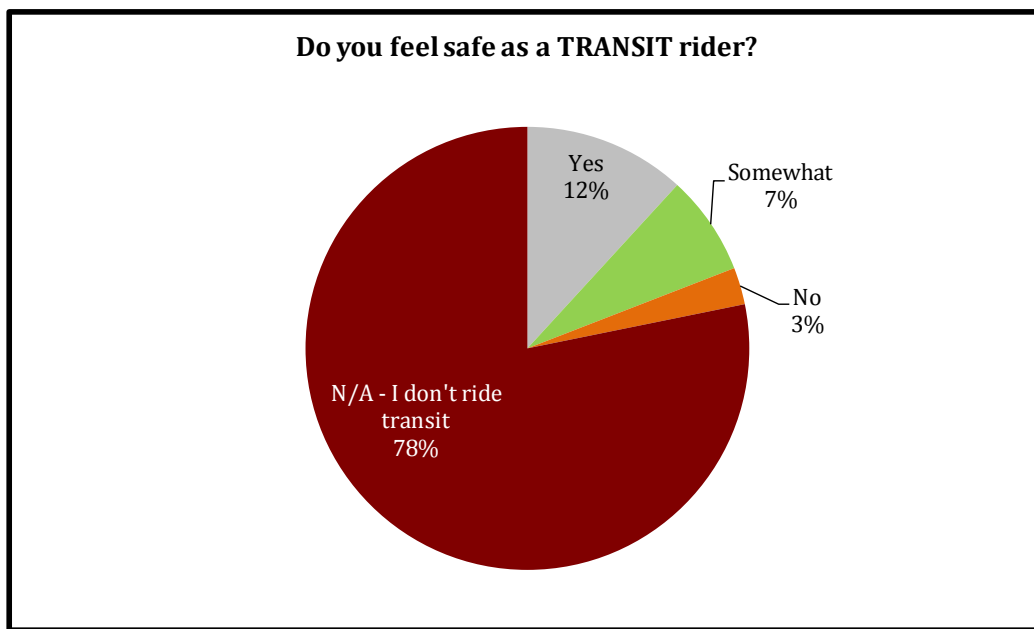
<b>Other (please specify)</b>
Vehicle speed too high in Old Town 1st & 2nd
<b>vehicle speed too high in Old Town</b>
Inattentive Driving and overall poor motorist education/training.
<b>Weather conditions</b>
cars exceed 30 MPH on neighborhood gravel roads
<b>Lighting along Douglas corridor could be added</b>
Inattentive drivers turning left (on green) through crosswalk
<b>I feel especially vulnerable on sidewalks that are curbside (without a space between the sidewalk and the curb).</b>
Lack of pedestrian right of way in crosswalks.
<b>Distracted drivers</b>
pedestrian crossings are not observed by drivers and the City does not have an ordinance requiring motorists to stop for pedestrians by law
<b>my son catches the city bus and the traffic is really bad and he has almost been hit several times and he has the right of way.</b>
cars going across pedestrian cross walks before theys\ stop at stop signs or lights.
<b>Drivers ignoring pedestrians and crosswalks.</b>
so few sidewalks
<b>Wish we had more sidewalks around Mulvane</b>

## Question 8

Are there specific locations in the region you avoid as a bicyclist and/or pedestrian due to safety concerns?	
Answers	
downtown	
<b>any area without a sidewalk</b>	
Kellogg	
<b>ped: major roadways lacking sidewalks (e.g., E. Douglas) ☒bike: Douglas, McClean to Washington</b>	
I keep walking, but dodging cars in the street.	
<b>Too many to list, but some are Rock Rd btwn Derby and Wichita, 47th around south of McConnell, the 79th St S/Hillside "Curve of Death" (Just West of Derby)</b>	
Most major thoroughfares	
<b>None per se, construction area between City Building and the Courthouse presents a challenge</b>	
my neighborhood	
<b>any street that isnt a designated bike path. even those, crossing streets is always dangerous.</b>	
As a cyclist I avoid Rock Road completely and Central, West of Rock Road.	
<b>Oliver between Spirit and 63rd st South ☒Rock Road between Chet Smith and 103rd South</b>	
crossing K-15	
<b>Any high traffic area.</b>	
wichita	
<b>Yes. Downtown, midtown 13th-21st areas</b>	
21st street, any intersection that crosses Kellogg,	
<b>Undesirables in Chisolm Park in northeast Wichita</b>	
There is no pedestrian crossing at US-54 & 167th, 183rd, & 199th Streets West. US-54 bisects Goddard and there is no way for a pedestrian or bicyclist to cross.	
<b>Kellogg and Armour; Rock Road anywhere, trying to cross Central anywhere between I-135 and Broadway, Armour and Douglas</b>	
Most arterial streets	
<b>Wichita</b>	
I don't walk outside of my general neighborhood.	
<b>City Traffic</b>	
yes	
<b>No - concerns are to me more of a situational nature rather than structural. Design concerns</b>	
Maple Street	
<b>Mt. Vernon between Crestway and bluff there is no sidewalk to access the park.</b>	
not alone, but with my son...most busy intersections...drivers do not pay attention and the safety to cross streets in questionable...sometimes there are big concerns with broken sidewalks	
<b>zoo blvd</b>	
entire city	
<b>Most major thoroughfares, due to absence of shoulder space.</b>	
unlit areas, mt vernon and washington	
<b>As a bicyclist I avoid busy streets at rush hours.</b>	
Gang areas.	
<b>Downtown within 5 blocks each direction of Douglas/Main.</b>	
Every heavily-travelled street without a sidewalk. That means many bridges too--over streams, Kellogg, railroad tracks.	
<b>K-15 in Mulvane</b>	
downtown wichita, arena	
	<i>answered question</i> 42
	<i>skipped question</i> 72

## Question 9

<b>Do you feel safe as a TRANSIT rider?</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Yes	11.8%	13
Somewhat	7.3%	8
No	2.7%	3
N/A - I don't ride transit	78.2%	86
<i>answered question</i>		<b>110</b>
<i>skipped question</i>		<b>4</b>



## Question 10

<b>Which of the following are safety concerns for you as a TRANSIT rider? (Check all that apply.)</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
Driving habits	20.0%	4
Crime	40.0%	8
Lack of pedestrian facilities/sidewalks/crossings to access stops	60.0%	12
Condition of buses	35.0%	7
Other (please specify)		9
<i>answered question</i>		<b>20</b>
<i>skipped question</i>		<b>94</b>

<b>Other (please specify)</b>
I would ride it much more often if we had a grid type system
<b>Spider web system instead of grids</b>
Transit service needs to improve before it is reasonable to use
<b>condition of bus stops--limited seating; no arrival time info</b>
No curb cuts at some shelters for persons in wheelchairs; not enough shelters; bus stops not marked or time of arrival like Ks City
<b>Waiting areas for public transit are often not covered or secure</b>
cleanliness, other people

## Question 11

<b>Who / what groups do you believe can have the most positive impact on making transportation safer in the region? (check all that apply)</b>		
<b>Answer Options</b>	<b>Response Percent</b>	<b>Response Count</b>
engineers	52.3%	56
law enforcement	60.7%	65
educators	18.7%	20
citizens	47.7%	51
planners	70.1%	75
public officials	54.2%	58
Other (please specify)		6
<i>answered question</i>		<b>107</b>
<i>skipped question</i>		<b>7</b>

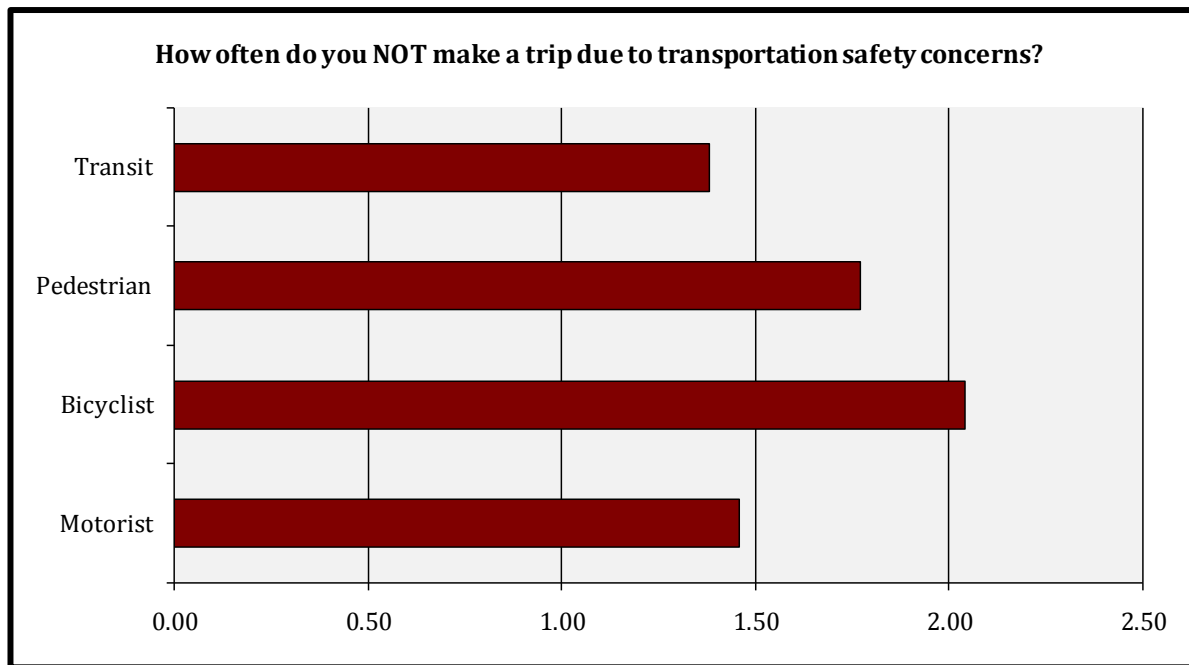
<b>Other (please specify)</b>
Everyone needs to work together.
<b>Emergency Management for Weather Information</b>
The Media
<b>Everyone can have a positive impact if they know what is needed and couch the subject in the correct light.</b>
pay as you go and do not have construction everywhere

## Question 12

Do you have specific ideas for improving transportation safety in the region?	
<b>Answers</b>	
Addition of signs encouraging people to MERGE LATER and not stop at the beginning of long acceleration lanes and merging lanes	
<b>slow down traffic in Old Town &amp; Downtown</b>	
More sidewalks especially around schools, more working from home, less housing sprawl.	
<b>1. Better education for new and "veteran" drivers.</b>	
<b>2. Better enforcement of existing laws.</b>	
Addition of bike lanes on roadways. REcognition of bicycling as a transportation mode, rather than strictly for recreation	
<b>improve road conditions and systems for better traffic flow</b>	
Better schedule areas of adjacent/geographically related construction projects	
<b>YES, clean up the actual route system and it will be more appealing to a larger demographic of people. Right now the only people in their right mind who would use the bus system only do, because they have no other means of transportation. So, people view it as unsafe because the majority of riders are lower class to homeless. Or, (potential but don't for safety reasons anymore) cyclists like myself, who are looked at like purposeful traffic inhibitors. I have had bottles thrown at me, been cursed at, i hear allot of "get off the road!". Where the hell else am I supposed to be lol :)? Also, there are a minimal amount of ACTUAL stops for the busses with benches that say "they wait here for the bus". Let alone covered locations... allot of places have a worn area in the grass to stand.</b>	
1) implement center islands & turn lanes in every major mile street, examples can be found in stretches such as maple between Maize & 135th sts West. Eliminate all Left hand turns within 100' of an intersection. Implement "fast turns" at every intersection.	
3) design ALL roads and highways with traffic projections in mind. Example, kellogg was widened in the 80's at west street with no space to expand in the future. today we should begin to expand Kellogg from CBD to I-235 another lane for a total of 4 through lanes WITH turn lanes. West street was not designed to handle an extra lane. Every new project should be designed to handle at least one extra lane. Another example, K-96 & Rock. The underpass at rock should have been designed for a total of 8 lanes under it. 3 through each way & 2 turn. of course it was not and now it is a bottle neck.	
4) redesign mass transit in this town for a hub and spoke type design and a park and ride emphasis. i.e. run shuttles from Dillons and Wal-Mart parking lots to the bus station downtown. Let people catch connecting shuttles from there OR go to their destination downtown. Downtown should have a loop shuttle that circles douglas from oldtown to delano. then north/south shuttles for the business and government district, arena district, delano district and old town areas, all intersecting with the douglass connector.	
<b>Public Awareness needs to be a high priority.</b>	
Make a path for those coming from Spirit to the South.	
<b>metropolitan transportation system such as a rail system going from the airport to the Kellogg and Webb Road area and from Mulvane to Newton. High expectations I know but with long range planning, implementation in</b>	
Bike lanes marked along city streets. More patrols for speeding!	
<b>Improve surface of bike paths and connect bike paths together so you can go somewhere! Also, better signage.</b>	
Please consider a bypass four lane around the Southeast Wichita area region.	
<b>Slow the traffic down on Kellogg. Improve intersection at Kellogg and 235, Need a full service bridge over 235 at 13th.</b>	
Woodlawn North of 37th North to K254 @ 54/235 intersection in west Wichita	
<b>Taking care and/or improving existing transportation systems before creating new roadways and/or transportation system.</b>	
Traffic cameras should be installed at hazardous intersections to MAKE people obey lights, etc. Some drivers take their chances on when a police officer will be around, but cameras are there 100%. If they have to do the <b>Improved communication and enforcement regarding laws concerning use of lights when wipers are needed and driving in the right lane.</b>	
More notice on small construction sites, more enforcement at large construction sites (not just speed traps on Kellogg!)	
<b>Incrested education for law enforcement and design engineers</b>	
make roads and highways more age appropriate and safe for an aging population	
<b>Offer more connecting bike paths or clearly marked shoulders to access them</b>	
Bicycle lanes	
<b>Add more public transportation and have the transportaion pick up at more locations than they do now</b>	
better enforcement city wide not just specific areas	
<b>Crack down on speeding cars/drivers</b>	
Improve the exit from I-135 onto southbound K-15 highway - merging with K-15 traffic is hazardous.	
<b>1) connect existing bike paths @2) make 17th st rail path a bike path - it would be a safe one</b>	
Please observe for road rage at bicyclists. While most drivers are very polite, a few are truly dangerous to us.	
<b>Plan for more bike routes.</b>	
Increased driver training	
<b>Dedicate more police to traffic enforcement. Not just speeding, but enforcement of the driving laws.</b>	
Better law enforcement; better driver education to promote driver courtesy	
<b>More facilities for non-car transportation.</b>	
get people off of their cell phones and time the lights to enhance traffic flow	
<i>answered question</i>	42
<i>skipped question</i>	72

## Question 13

How often do you NOT make a trip due to transportation safety concerns?						
Answer Options	Never	Sometimes	Frequently	N/A	Rating Average	Response Count
Motorist	61	41	4	0	1.46	106
Bicyclist	17	30	20	30	2.04	97
Pedestrian	35	38	15	11	1.77	99
Transit	19	4	3	70	1.38	96
<i>answered question</i>						<b>110</b>
<i>skipped question</i>						<b>4</b>

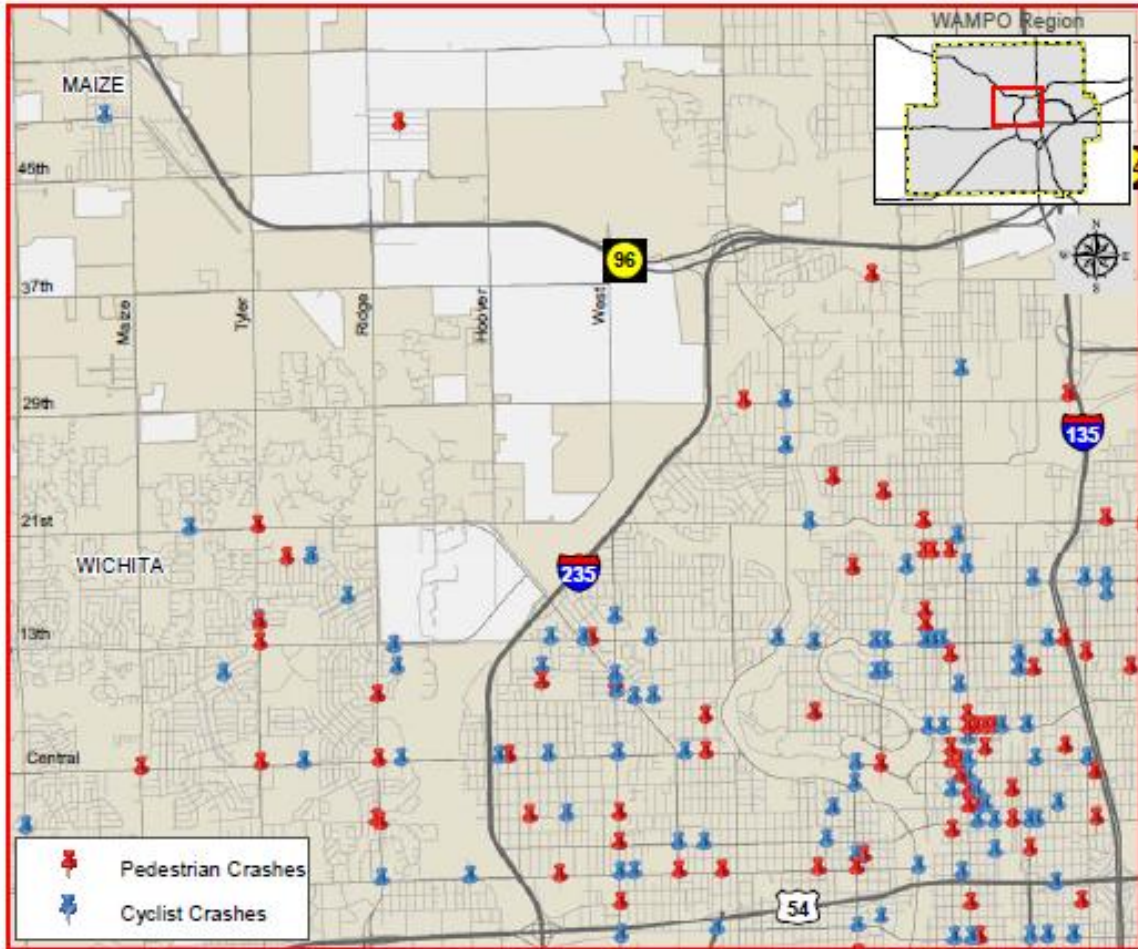


## **APPENDIX B**

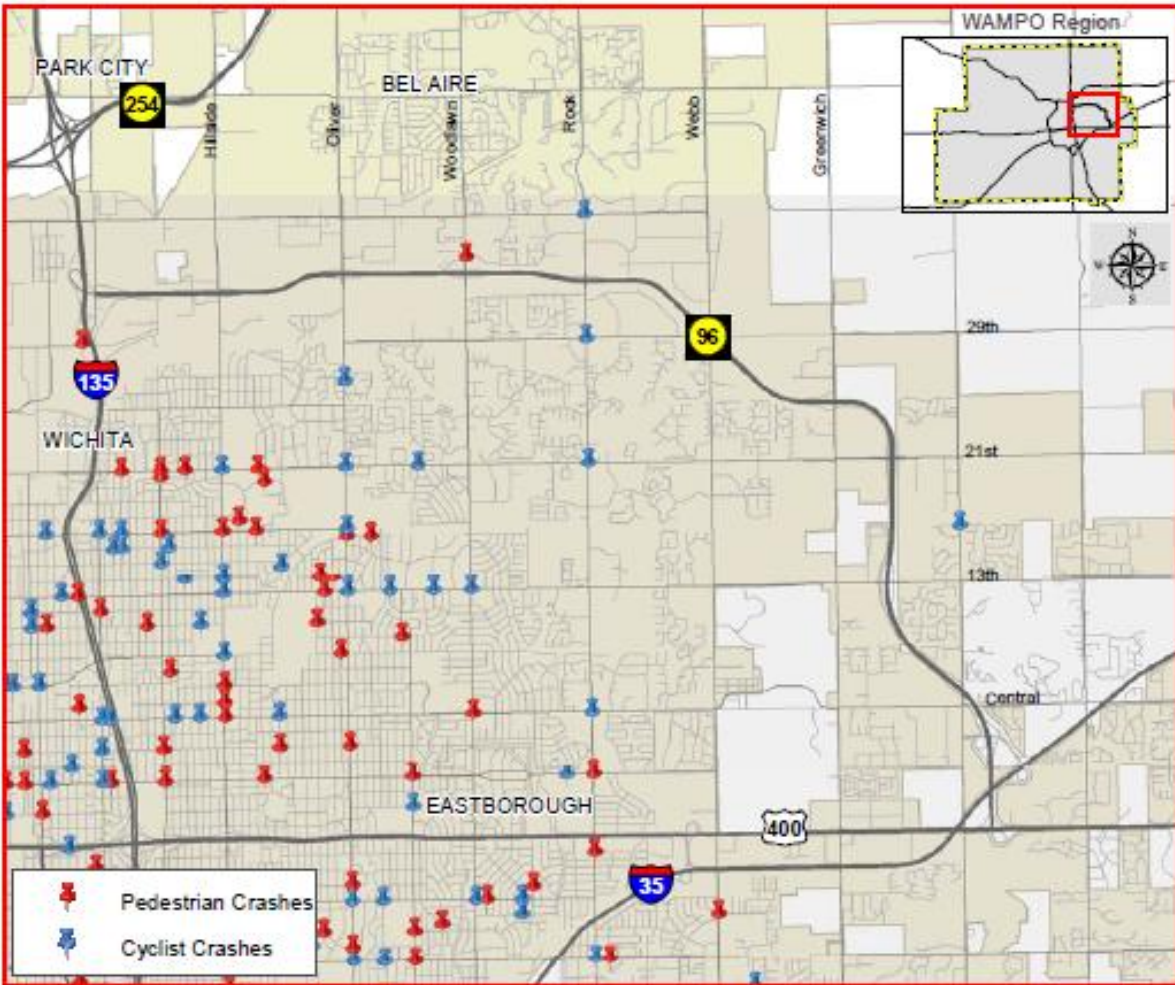
### **2004 to 2008 Bicycle and Pedestrian Crash Location Maps**



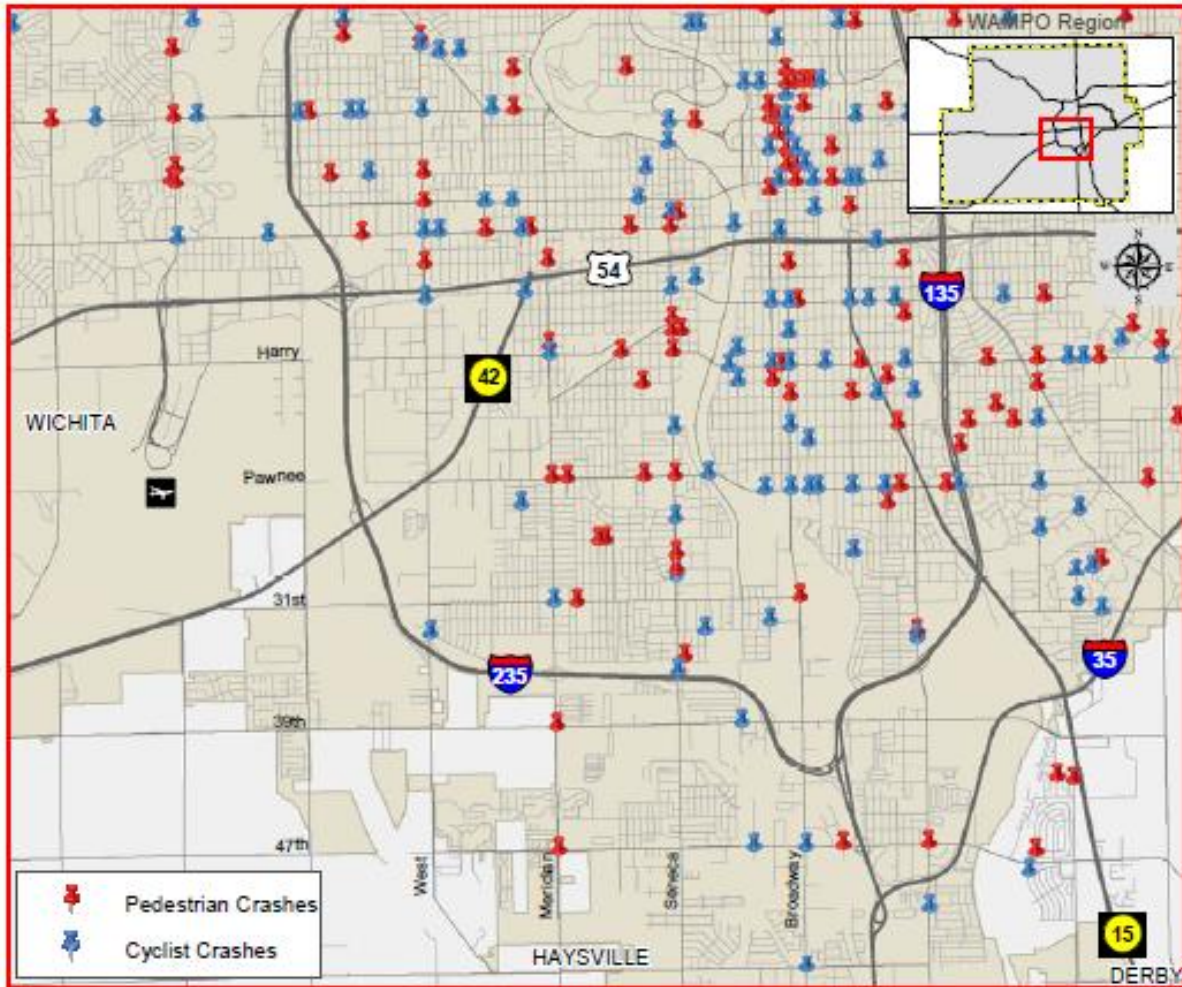
# Northwest Wichita



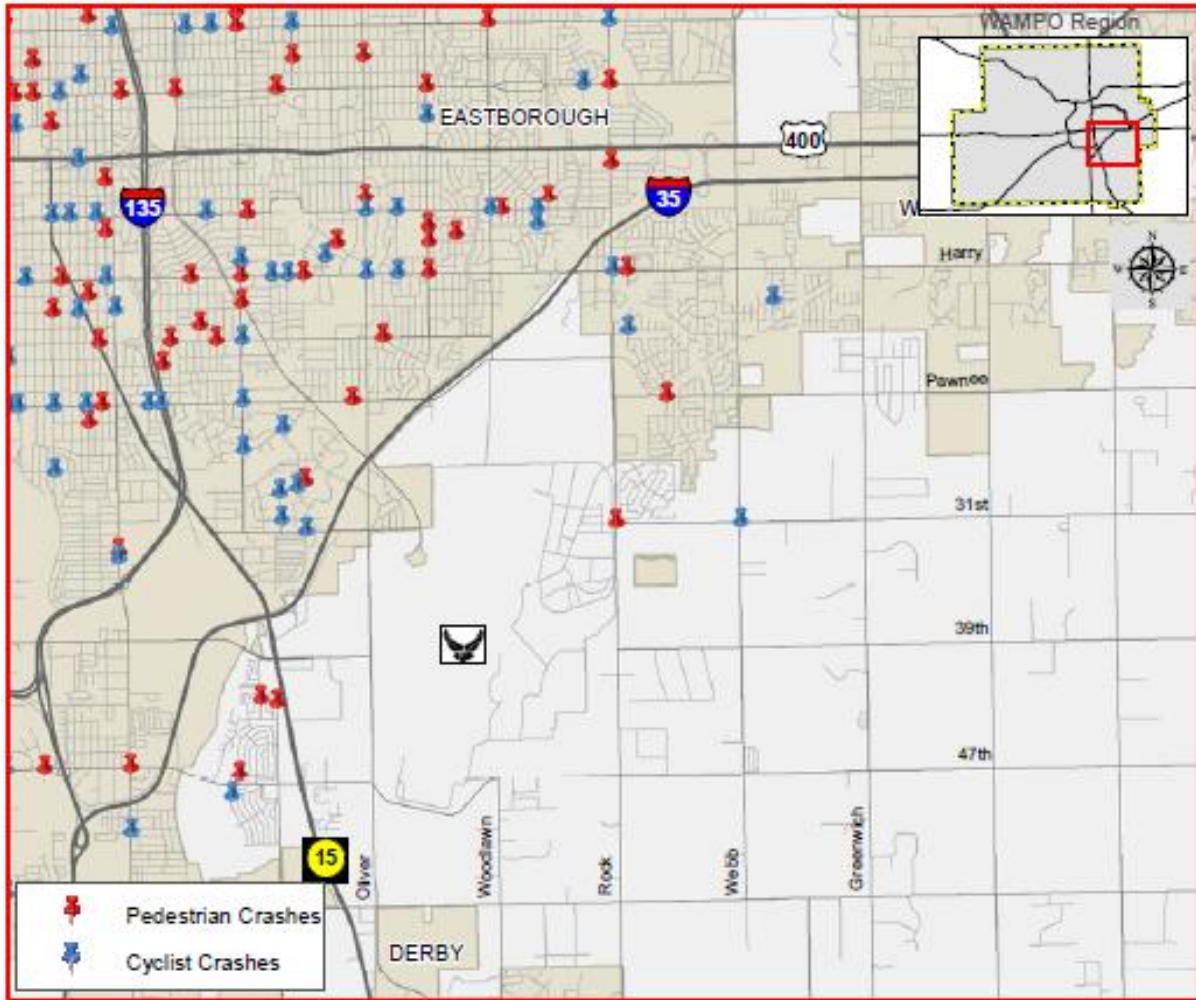
# Northeast Wichita



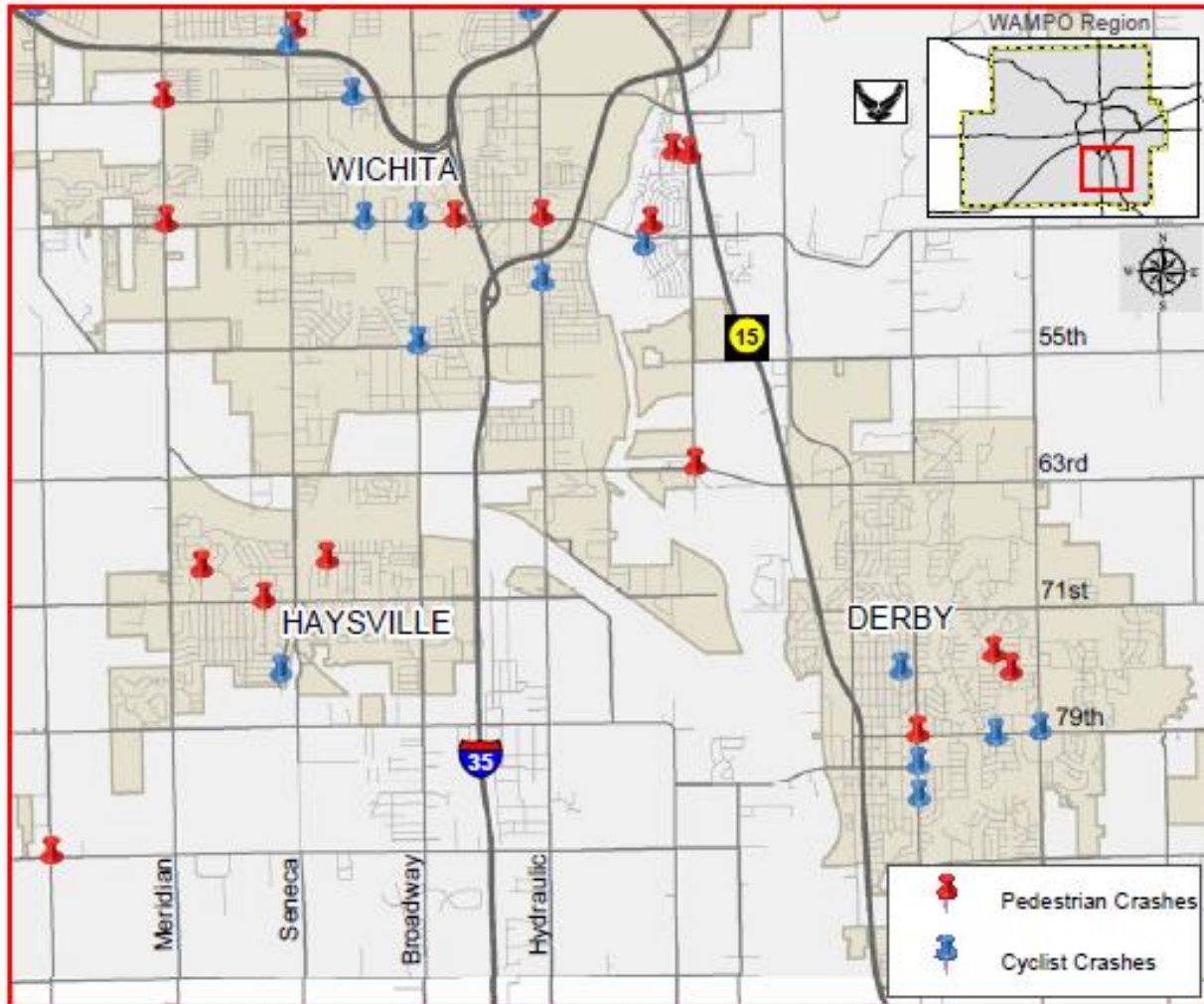
# Southwest Wichita



# Southeast Wichita



# Haysville and Derby



**APPENDIX C**

**SAFETY TOOLBOX**

## Crash Type, Probable Cause, and Countermeasures for Intersections

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Right-Angle/ Angle	Restricted Sight Distance	a) Inadequate corner clearance b) Road obstacles close to the travel lanes c) Parking too close to intersection	1) Remove sight obstruction 2) Restrict parking near corners 3) Install warning signs per Manual on Uniform Traffic Control Devices (MUTCD) 4) Channelize intersection 5) Install/improve street lights at intersection 6) Reduce speed limit (Spot speed study to be conducted)  <u>Unsignalized Improvements</u> 7) Install yield signs (per MUTCD) 8) Install stop signs (per MUTCD) 9) Install traffic signals (per MUTCD)
	Large Total Intersection Volume	a) Signal absent when needed	1) Install traffic signals (per MUTCD) 2) Coordination of signal system
	Excessive Speed on Approaches	a) Speed limits b) High speed causing erratic or unusual maneuver of vehicles	1) Set appropriate speed limit (Spot speed study to be conducted) 2) Install rumble strips 3) Install overhead flashing beacon (per MUTCD)
	Inadequate Roadway Lighting	a) Roadway lights inadequate	1) Install/improve street lighting
	Inadequate Traffic Control Devices	a) Inadequate signage b) Signal absent when one is needed c) Inadequate pavement markings	1) Install warning signs (per MUTCD) 2) Install standard signs (per MUTCD) 3) Install/improve delineation/pavement markings 4) Install flashing beacons  <u>Unsignalized Improvements</u> 5) Install yield signs (per MUTCD) 6) Install stop signs (per MUTCD) 7) Install traffic signals (per MUTCD)  <u>Signalized Intersection Improvements</u> 8) Install larger signal heads 9) Install back plates on signal heads

## Crash Type, Probable Cause, and Countermeasures for Intersections

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Rear End	Drivers Unaware of Intersection	a) Intersection visibility	1) Install warning signs (per MUTCD) 2) Reduce speed limit (Spot speed study to be conducted) 3) Install flashing beacons
	Slippery Surface	a) Slippery Pavement b) Poor Drainage	1) Overlay with skid resistant surface 2) Provide adequate drainage 3) Groove the pavement 4) Reduce speed limit (Spot speed study to be conducted) 5) Install “Slippery When Wet” signs
	Large Turning Volumes	a) Lack of Turn Lanes	1) Install left or right turn lanes 2) Increase turn bay length or taper length 3) Increase curb radii 4) Prohibit left/right turn traffic  <u>Unsignalized Intersection Improvements</u> 5) Install stop signs (per MUTCD) 6) Install traffic signals (per MUTCD)  <u>Signalized Intersection Improvements</u> 7) Provide protected turn movements/turn arrows
	Inadequate Roadway Lighting	a) Inadequate roadway lighting	1) Install/improve street lighting
	Excessive Speed on Approaches	a) Speed limits b) Speeding causing erratic driver behavior	1) Set appropriate speed limit (Spot speed study to be conducted) 2) Install rumble strips
	Lack of Adequate Gaps	a) Lack of turn lanes b) Large queue lengths	1) Install left or right turn lanes 2) Increase turn bay length or taper length 3) Improve roadway lighting  <u>Unsignalized Intersection Improvements</u> 4) Install stop signs (per MUTCD) 5) Install traffic signals (per MUTCD)  <u>Signalized Intersection Improvements</u> 6) Provide protected turn phases 7) Provide split phase operations

## Crash Type, Probable Cause, and Countermeasures for Intersections

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Rear End (Cont'd)	Absence of Turning Lanes	a) Lack of Turn Lanes b) Large queues in Through Lane	1) Install left or right turn lanes  <u>Unsignalized Intersection Improvements</u> 2) Install stop signs (per MUTCD) 3) Install traffic signals (per MUTCD)  <u>Signalized Intersection Improvements</u> 4) Provide split phasing operations
	Crossing Pedestrians	a) High Pedestrian Traffic b) Inadequate Pedestrian Markings and Signing	1) Install/improve pedestrian crossing signs and markings 2) Relocate crosswalk  <u>Unsignalized Intersection Improvements</u> 3) Install traffic signals (per MUTCD)  <u>Signalized Intersection Improvements</u> 4) Provide a pedestrian "Walk" phase to signal 5) Install Countdown Pedestrian signal if pedestrian volume is high
	Short Turn Radius	a) Inadequate Turning Radius	1) Increase curb radii 2) Prohibit left/right turn traffic  <u>Signalized Intersection Improvements</u> 3) Prohibit right turn on red 4) Add left or right turn arrow indicators to signal
	Improperly Located Driveways	a) Driveways located too close to intersection	1) Regulate minimum corner clearance 2) Regulate minimum driveway spacing 3) Move driveway to side street 4) Install curb to define driveway location 5) Consolidate adjacent driveways and provide cross access
	Large Volume of Driveway Traffic	a) Lack of Turn Lanes b) Lack of signs	1) Regulate minimum corner clearance 2) Regulate minimum driveway spacing 3) Move driveway to side street 4) Install service roads 5) Provide left or right turn lanes 6) Restrict parking near driveways 7) Increase curb radii 8) Add acceleration/deceleration lanes

## Crash Type, Probable Cause, and Countermeasures for Intersections

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Left Turn Head On	Large Volume of Left Turn Traffic	a) Lack of Turn Lanes b) Large queues in Through Lanes	1) Install left turn lane 2) Prohibit left turn traffic 3) Increase left turn bay or taper length  <u>Unsignalized Intersection Improvements</u> 4) Install stop signs (per MUTCD) 5) Install traffic signals (per MUTCD)  <u>Signalized Intersection Improvements</u> 6) Use protected left turn phasing 7) Add left turn arrow to signal
	Restricted Sight Distance	a) Inadequate Sight Distance b) Road Obstacles located near travel lanes c) Parking too close to intersection	1) Remove sight obstruction 2) Install/improve warning signs (per MUTCD) 3) Provide turn lane 4) Prohibit left turns 5) Restrict parking near corner of intersection 6) Install/improve street lighting 7) Reduce speed limit (Spot speed study to be conducted)  <u>Unsignalized Intersection Improvements</u> 8) Install stop signs (per MUTCD) 9) Install traffic signals (per MUTCD)
	Absence of Left Turn Lane	a) Lack of Turn Lanes b) Large queues in Through Lanes	1) Provide turn lane 2) Prohibit left turns  <u>Unsignalized Intersection Improvements</u> 3) Install stop signs (per MUTCD)  <u>Signalized Intersection Improvements</u> 4) Provide split phasing signal operations
Sideswipe	Inadequate Pavement Markings	a) Inadequate Pavement Markings	1) Install/restripe pavement markings with thermoplastic materials 2) Add signs to supplement pavement markings
	Improperly Located Driveways	a) Driveways located too close to intersection	1) Regulate minimum corner clearance 2) Regulate minimum driveway spacing 3) Consolidate adjacent driveways 4) Install curb to define driveway location

## Crash Type, Probable Cause, and Countermeasures for Intersections

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Sideswipe (Cont'd)	Inadequate Roadway Design	a) Narrow Lanes b) Poorly Aligned Lane	1) Increase lane width to 12 feet minimum 2) Provide properly aligned lanes
	Short Turn Radius	a) Inadequate Turning Radius	1) Increase curb radii 2) Prohibit left/right turn traffic  <u>Signalized Intersection Improvements</u> 3) Prohibit right turn on red 4) Add left or right turn arrow indicators to signal
	Parking too Close to Intersection	a) Parking too Close to Intersection	1) Restrict Parking near corners of intersections
	Inadequate Directional Signage	a) Directional Signs present	1) Install/improve advanced route or street signs
	Excessive Speed on Approaches	a) Speed limits b) Speeding causing erratic driver behavior	1) Reduce speed limits (spot speed study to be conducted) 2) Install rumble strips 3) Install traffic calming measures
	Slippery Surface	a) Slippery Pavement Surface b) Poor Drainage	1) Overlay with skid resistant surface 2) Provide adequate drainage 3) Groove the pavement 4) Reduce speed limit (Spot speed study to be conducted) 5) Install "Slippery When Wet" signs
	Poor Road Surface Conditions	a) Roadway Surface Failures	1) Repair road surface
Fixed Object	Fixed Objects close to travel lanes	a) Roadside Obstacles near travel way	1) Remove the roadside obstruction 2) Install guardrail for immovable objects 3) Improve visibility of object
Animal	Animals in the Roadway	a) Animals Standing or Crossing the Road	1) Install advance warning signs and reflectors 2) Install fencing 3) Install animal crossing warning signs
Run-Off Road	Narrow Lanes with Minimal Shoulder Width	a) Lanes less than 12 feet b) Sub standard Shoulder Design	1) Install guardrail 2) Widen travel lanes 3) Install/widen shoulder 4) Remove roadside drop off

## Crash Type, Probable Cause, and Countermeasures for Intersections

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Run-Off Road (Cont'd)	Inadequate Turning Radius	a) Inadequate turning radius – hard to turn left or right	1) Increase turning radii
Rollover, Overturn, Jackknife	Excessive Speed	a) Speed limits b) Speeding causing erratic driver behavior	1) Reduce speed limits (spot speed study to be conducted) 2) Install rumble strips
	Slippery Surface	a) Slippery Pavement Surface b) Poor Drainage	1) Overlay with skid resistant surface 2) Provide adequate drainage 3) Groove the pavement 4) Reduce speed limit (Spot speed study to be conducted) 5) Install “Slippery When Wet” signs
Bicycle/ Pedestrian	Inadequate or Improper Pavement Markings	a) Poor Pavement Markings	1) Install/restripe pavement markings with thermoplastic materials 2) Add signs to supplement pavement markings
	Improperly Roadway Lighting	a) Inadequate Roadway Lighting	1) Install/Improve street lighting
	Excessive Speed	a) Speed limits b) Speeding causing erratic driver behavior	1) Reduce speed limits (spot speed study to be conducted) 2) Install rumble strips  <u>Unsignalized Intersection Improvements</u> 3) Install a Pedestrian Signal
	Large Turning Volumes	a) Lack of Turn Lanes	1) Install left or right turn lanes 2) Increase turn bay length or taper length 3) Increase curb radii 4) Prohibit left/right turn traffic
	Sidewalks too Close to Travel Way	a) Under Designed Sidewalks	1) Installation of ADA compliant sidewalks

## Crash Type, Probable Cause, and Countermeasures for Roadway Segments

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Right-Angle/ Angle	Restricted Sight Distance	<ul style="list-style-type: none"> <li>a) Inadequate sight clearance</li> <li>b) Roadway obstacles close to the travel lanes</li> <li>c) Parking on roadway</li> </ul>	<ul style="list-style-type: none"> <li>1) Remove sight obstruction</li> <li>2) Restrict parking along roadways</li> <li>3) Install warning signs (per MUTCD)</li> <li>4) Install/improve street lights at intersection</li> <li>5) Reduce speed limit (Spot speed study to be conducted)</li> </ul>
	Excessive Speed on Roadway	<ul style="list-style-type: none"> <li>a) Speed limits</li> <li>b) High speed causing erratic or unusual maneuver of vehicles</li> </ul>	<ul style="list-style-type: none"> <li>1) Set appropriate speed limit (Spot speed study to be conducted)</li> <li>2) Install rumble strips</li> </ul>
	Inadequate Roadway Lighting	<ul style="list-style-type: none"> <li>a) Roadway lights inadequate</li> </ul>	<ul style="list-style-type: none"> <li>1) Install/improve street lighting</li> </ul>
Rear End	Slippery Surface	<ul style="list-style-type: none"> <li>a) Slippery Pavement</li> <li>b) Poor Drainage</li> </ul>	<ul style="list-style-type: none"> <li>1) Overlay with skid resistant surface</li> <li>2) Provide adequate drainage</li> <li>3) Groove the pavement</li> <li>4) Reduce speed limit (Spot speed study to be conducted)</li> <li>5) Install "Slippery When Wet" signs</li> </ul>
	Large Turning Volumes	<ul style="list-style-type: none"> <li>a) Lack of Turn Lanes</li> </ul>	<ul style="list-style-type: none"> <li>1) Install left or right turn lanes</li> <li>2) Increase turn bay length or taper length</li> <li>3) Increase curb radii</li> <li>4) Prohibit left/right turn traffic</li> </ul>
	Inadequate Roadway Lighting	<ul style="list-style-type: none"> <li>a) Inadequate roadway lighting</li> </ul>	<ul style="list-style-type: none"> <li>1) Install/improve street lighting</li> </ul>
	Excessive Speed on Approaches	<ul style="list-style-type: none"> <li>a) Speed limits</li> <li>b) Speeding causing erratic driver behavior</li> </ul>	<ul style="list-style-type: none"> <li>1) Set appropriate speed limit (Spot speed study to be conducted)</li> <li>2) Install rumble strips</li> </ul>
	Lack of Adequate Gaps	<ul style="list-style-type: none"> <li>a) Lack of turn lanes</li> <li>b) Large queue lengths</li> </ul>	<ul style="list-style-type: none"> <li>1) Install left or right turn lanes</li> <li>2) Increase turn bay length or taper length</li> </ul>
	Absence of Turning Lanes	<ul style="list-style-type: none"> <li>a) Lack of Turn Lanes</li> <li>b) Large queues in Through Lane</li> </ul>	<ul style="list-style-type: none"> <li>1) Install left or right turn lanes</li> </ul>

## Crash Type, Probable Cause, and Countermeasures for Roadway Segments

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Rear End (Cont'd)	Crossing Pedestrians	a) High Pedestrian Traffic b) Inadequate Pedestrian Markings and Signing	1) Install/improve pedestrian crossing signs and markings 2) Relocate crosswalk
	Short Turn Radius	a) Inadequate Turning Radius	1) Increase curb radii 2) Prohibit left/right turn traffic
	Improperly Located Driveways	a) Driveways located too close to intersection	1) Regulate minimum corner clearance 2) Regulate minimum driveway spacing 3) Move driveway to side street 4) Install curb to define driveway location 5) Consolidate adjacent driveways and provide cross access
	Large Volume of Driveway Traffic	a) Lack of Turn Lanes b) Lack of signs	1) Regulate minimum corner clearance 2) Regulate minimum driveway spacing 3) Move driveway to side street 4) Install service drive/roads 5) Provide left or right turn lanes 6) Restrict parking near driveways 7) Increase curb radii 8) Add acceleration/deceleration lanes
Left Turn Head On	Large Volume of Left Turn Traffic	a) Lack of Turn Lanes b) Large queues in Through Lanes	1) Install left turn lane 2) Prohibit left turn traffic 3) Increase left turn bay or taper length
	Restricted Sight Distance	a) Inadequate Sight Distance b) Road Obstacles located near travel lanes c) Parking too close to intersection	1) Remove sight obstruction 2) Install/improve warning signs (per MUTCD) 3) Provide turn lane 4) Prohibit left turns 5) Restrict parking near corner of intersection 6) Install/improve street lighting 7) Reduce speed limit (Spot speed study to be conducted)
	Absence of Left Turn Lane	a) Lack of Turn Lanes b) Large queues in Through Lanes	1) Provide left turn lane 2) Prohibit left turns

## Crash Type, Probable Cause, and Countermeasures for Roadway Segements

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Sideswipe	Inadequate Pavement Markings	a) Inadequate Pavement Markings	1) Install/restripe pavement markings with thermoplastic materials 2) Add signs to supplement pavement markings
	Improperly Located Driveways	a) Driveways located too close to intersection	1) Regulate minimum corner clearance 2) Regulate minimum driveway spacing 3) Consolidate adjacent driveways 4) Install curb to define driveway location
	Inadequate Roadway Design	a) Narrow Lanes b) Poorly Aligned Lane	1) Increase lane width to 12 feet minimum 2) Provide properly aligned lanes
	Inadequate Directional Signage	a) Directional Signs present	1) Install/improve advanced route or street signs
	Excessive Speed on Approaches	a) Speed limits b) Speeding causing erratic driver behavior	1) Reduce speed limits (spot speed study to be conducted) 2) Install rumble strips 3) Install traffic calming measures
	Slippery Surface	a) Slippery Pavement Surface b) Poor Drainage	1) Overlay with skid resistant surface 2) Provide adequate drainage 3) Groove the pavement 4) Reduce speed limit (Spot speed study to be conducted) 5) Install "Slippery When Wet" signs
	Poor Road Surface Conditions	a) Roadway Surface Failures	1) Repair road surface
Fixed Object	Fixed Objects Close to Travel Lanes	a) Roadside obstacles near travel way	1) Remove the roadside obstruction 2) Install guardrail for immovable objects 3) Improve visibility of object
Animal	Animals in the Roadway	a) Animals standing or crossing the road	1) Install advance warning signs and reflectors 2) Install fencing 3) Install animal crossing warning signs

## Crash Type, Probable Cause, and Countermeasures for Roadway Segements

Crash Type	Common Situation/ Probable Cause	Engineering Features	Engineering Solutions (From NCHRP Series)
Run-Off Road	Narrow Lanes with Minimal Shoulder Width	a) Lanes less than 12 feet b) Sub standard Shoulder Design	1) Install guardrail 2) Widen travel lanes 3) Install/widen shoulder 4) Remove roadside drop off
	Inadequate Turning Radius	a) Inadequate turning radius – hard to turn left or right	1) Increase turning radii
Rollover, Overturn, Jackknife	Excessive Speed	a) Speed limits b) Speeding causing erratic driver behavior	1) Reduce speed limits (spot speed study to be conducted) 2) Install rumble strips
	Slippery Surface	a) Slippery Pavement Surface b) Poor Drainage	1) Overlay with skid resistant surface 2) Provide adequate drainage 3) Groove the pavement 4) Reduce speed limit (Spot speed study to be conducted) 5) Install “Slippery When Wet” signs
Bicycle/ Pedestrian	Inadequate or Improper Pavement Markings	a) Poor Pavement Markings	1) Install/restripe pavement markings with thermoplastic materials 2) Add signs to supplement pavement markings
	Inadequate Roadway Lighting	a) Inadequate Roadway Lighting	1) Install/Improve street lighting
	Excessive Speed	a) Speed limits b) Speeding causing erratic driver behavior	1) Reduce speed limits (spot speed study to be conducted) 2) Install rumble strips
	Large Turning Volumes	a) Lack of Turn Lanes	1) Install left or right turn lanes 2) Increase turn bay length or taper length 3) Increase curb radii 4) Prohibit left/right turn traffic
	Sidewalks too Close to Travel Way	a) Under Designed Sidewalks	1) Installation of ADA compliant sidewalks