Opening a Tool Box: Road Safety Audit



November 10, 2011

INTRODUCTIONS

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What is a Road Safety Audit? (Road Safety Assessment)

A road safety audit (assessment) is a formal safety performance examination of an existing or future road or intersection by an independent audit team.

What is a Road Safety Audit?

• *formal:*	procedures and documentation
• *safety performance:*	focus on safety
• *independent:*	no previous experience with audited road
• *audit team:*	general experience and specialists (3 minimum)

RSA Procedure

1. start-up meeting
2. site visit
3. analysis
4. presentation of findings
5. response by owner of road

Traditional Road Safety Review *versus* Road Safety Audit

Traditional Road Safety Review

- reactive
- in-house team
- no field review
- standards compliance

Road Safety Audit

- proactive
- independent team
- field reviews
- comprehensive, with human factors

When do we conduct RSAs?

- pre-construction:
  - planning / feasibility
  - preliminary (draft) design
  - detailed design



- construction:
  - work zones
  - pre-opening



- post-construction/operational:
  - existing roads



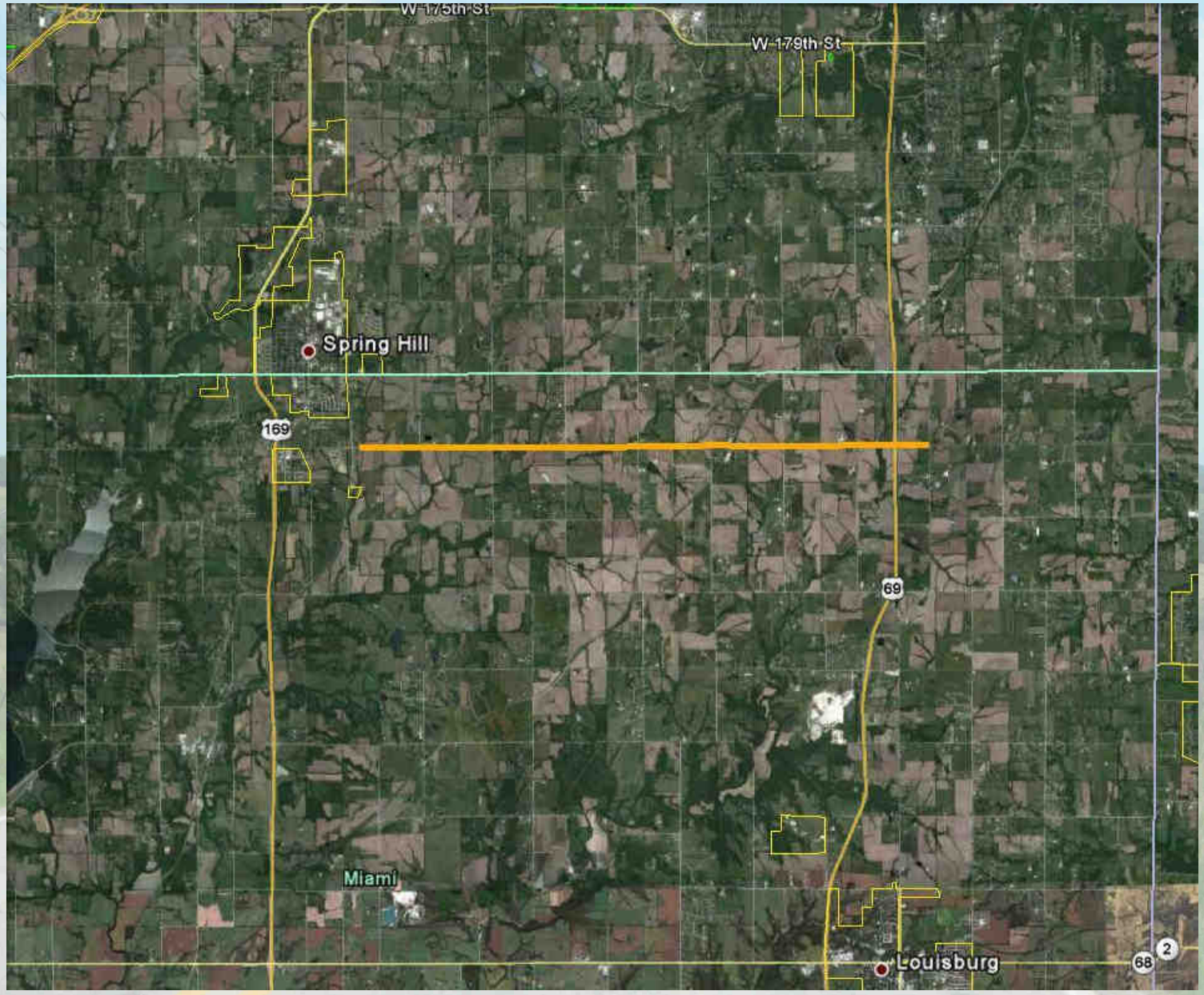
Good Candidate Projects for Post-Construction RSAs

- high-collision sites
- high-profile (political or public interest)
- sites at which traffic characteristics have changed



Good Candidate Projects for Pre-Construction RSAs

- safety-oriented
- high-profile (political or public interest)
- complex design


W 175th St
W 179th St
Spring Hill
169
69
Miami
Louisburg
68
2

KDOT Perspective



KDOT Perspective

- History
- High Risk Rural Roads (HRRR)
- MARC Destination: Safe Initiative

KDOT Perspective- History

- Started in mid 90's by Jim Tobaben
- National interest was growing
- Wanted a proactive rather than reactive approach
- Adapted procedures to fit Kansas
- Thorough review of state system county by county

KDOT Perspective- HRRR

- Counties were going to be identified on the 5% report
- Wanted to offer help in some way
- RSAs could be provided as Preliminary Engineering through HRRR
- Deficiencies found through the RSA could then be corrected with additional HRRR funds

KDOT Perspective- HRRR (cont.)

- Discussion with FHWA toward different approach
- Use KDOT personnel and a few volunteers from the County
  - Reduces time to write and approve agreements
  - Reduces time to acquire consultants
  - Reduces time to receive report
    - Write an informal report without in-depth investigation noting deficiencies and solutions

KDOT Perspective- MARC Initiative

- Destination: Safe Coalition
  - Started in 2005
  - Brought together groups with safety interests
    - KDOT & MoDOT
    - Law Enforcement
    - Medical Services
    - Numerous educational groups
    - Would like more engineering interest

KDOT Perspective- MARC Initiative

- RSAs
- One per year alternating states
  - US-50 & Milton-Thompson Intersection
  - Eisenhower Road Corridor Lansing/Leavenworth

Performing an RSA



Selecting the RSA Team

- independent
- experienced
- Interdisciplinary
- 3-6 members



Interdisciplinary RSA Team: Skills

<u>Core skill set (every assessment):</u>

- traffic operations
- geometric design
- road safety

Interdisciplinary RSA Team: Skills

<u>Supplementary skills (some assessments):</u>

- positive guidance/human factors
- specialist skills (such as bridges or signing)
- enforcement
- maintenance

RSA Procedure

1. start-up meeting
2. site visit
3. analysis
4. presentation of findings
5. response by owner of road

(1) Start-up Meeting



- introductions
- exchange of information
- RSA process
- schedule

(1) Start-up Meeting: Exchange of Information

- collision history
- traffic volumes
- aerial photographs
- design drawings
- background reports
- design criteria



(1) Start-up Meeting

- assessment sites, including constraints, challenges, or known issues — *road agency*
- RSA process — *Assessment team*
- schedule — *all*

Pre- and post-construction assessments: Will an RSA drive up costs?

The assessment team provides suggestions only. The road agency or designer remains responsible for design decisions.

- Can focus on low cost safety improvements
- Can be prescreened with agency
- Needs to be consistent with design stage

(2) Field Review

- **Observe road user characteristics.**
- **Observe surrounding land uses.**
- **Observe link points to the adjacent transportation network.**



(2) Field Review

- Review crash data (if available).
- Put the team in one vehicle.
- Designate a driver and secretary.

(2) Field Review

- drawing and/or aerial photographs of site
- camera (still and video)
- measuring wheel and stopwatch (optional)
- high-visibility vests (recommended)



(2) Field Review

Checklists and prompt lists:

- may provide structure to the site visit
- remind the team what to look for, and help ensure that nothing is missed

(3) RSA Analysis

- workshop setting
- review information
- systematically review information
- identify, prioritize, and mitigate safety issues



(4) Presentation of Findings: Preliminary Findings Meeting

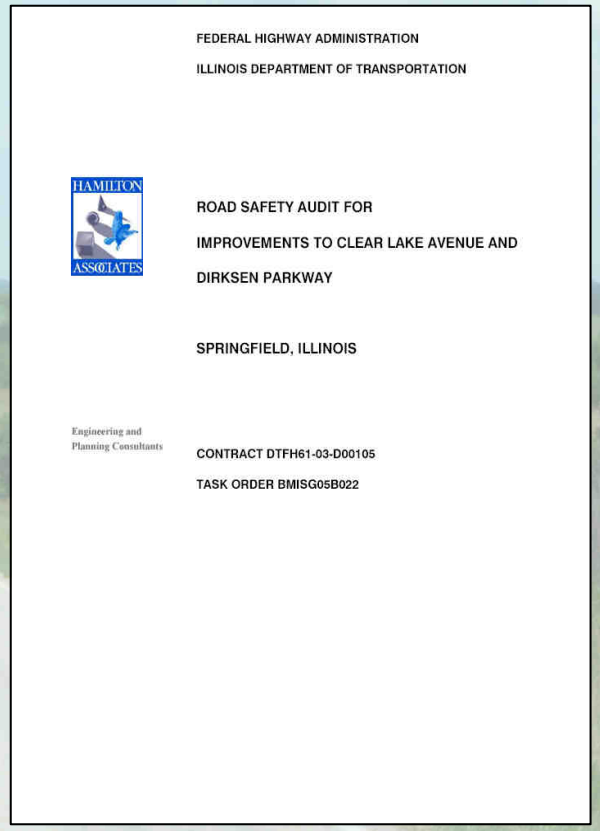
- RSA team, local road agency
- discuss preliminary findings and possible solutions
- use results to write RSA report



Photo: Craig Allred (FHWA)

(4) Presentation of Findings: RSA Report

- documents the results of the RSA
- identifies and prioritizes safety issues
- may include suggestions for improvements



FEDERAL HIGHWAY ADMINISTRATION

ILLINOIS DEPARTMENT OF TRANSPORTATION

HAMILTON ASSOCIATES

ROAD SAFETY AUDIT FOR

IMPROVEMENTS TO CLEAR LAKE AVENUE AND

DIRKSEN PARKWAY

SPRINGFIELD, ILLINOIS

Engineering and Planning Consultants

CONTRACT DTFH61-03-D00105

TASK ORDER BMISG05B022

(4) Presentation of Findings: RSA Report

RSA report includes:

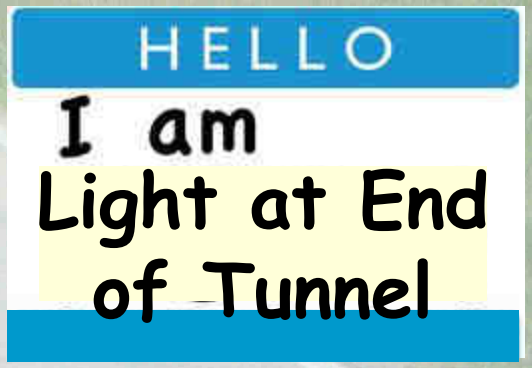
- background
- Team members, materials, and process
- site observations
- RSA findings

Response Letter

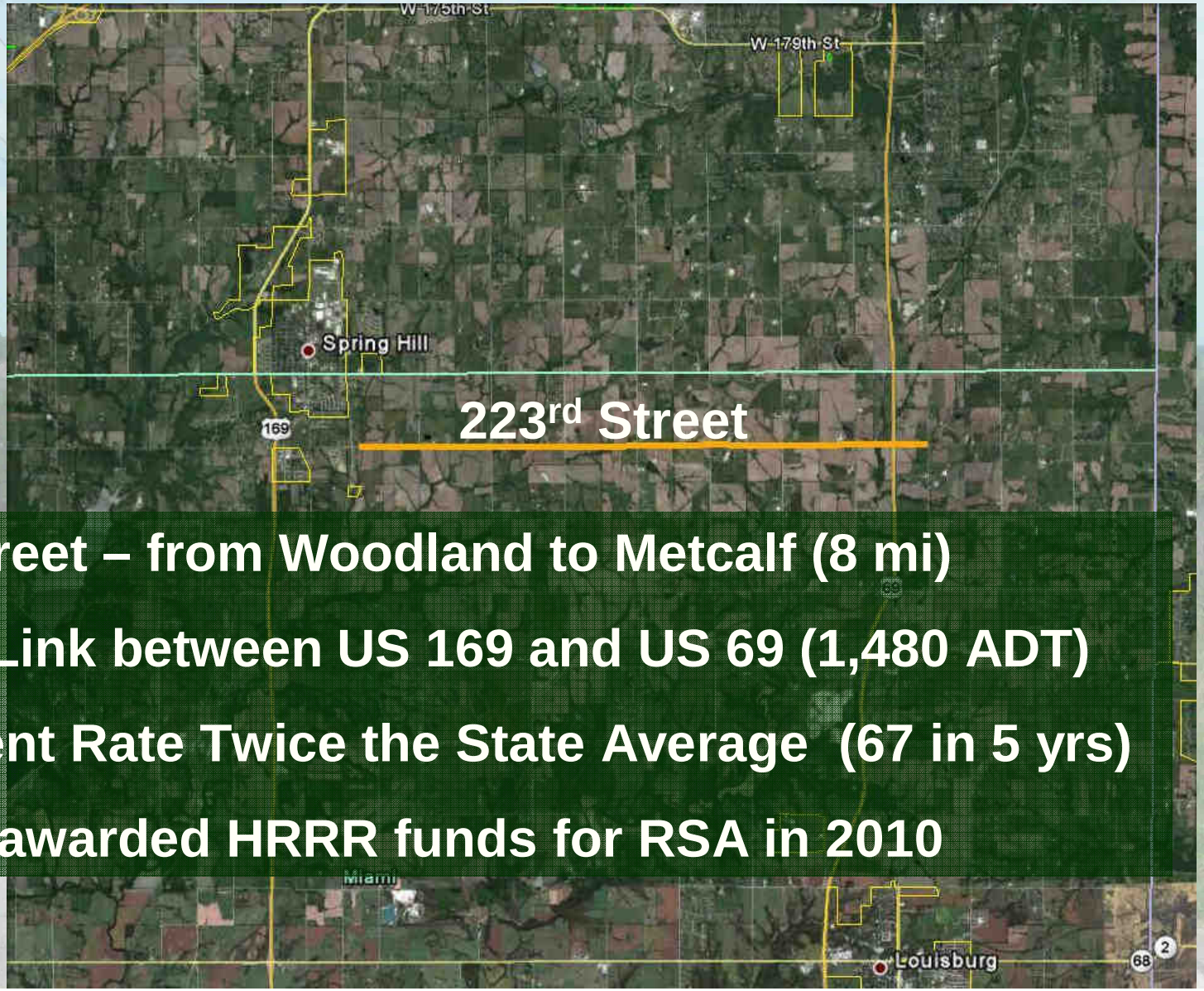
- prepared by the local road agency (with possible input from designer)
- for each assessment issue, identifies what action will (or will not) be taken with a brief explanation
- part of the project record

An Example of an RSA

Miami County 223rd Street



223rd Street RSA



223rd Street – from Woodland to Metcalf (8 mi)

- **Major Link between US 169 and US 69 (1,480 ADT)**
- **Accident Rate Twice the State Average (67 in 5 yrs)**
- **KDOT awarded HRRR funds for RSA in 2010**

223rd Street RSA Kick-Off

Kick-Off Meeting Involved

- **County Engineering staff**
- **County Highway staff**
- **Sheriff's Office**
- **KDOT**
- **Consultant staff**

Topics Discussed

Geometric Deficiencies

Range of Uses

Types of Traffic

Crash History

Maintenance Issues

Enforcement Challenges

223rd Street RSA Field Review

Performed March 3rd, 2011

Field Review Team

- **County Highway foreman**
- **Sheriff's deputy**
- **Consultant staff (4)**
- *Canine escort*



223rd Street RSA Field Review









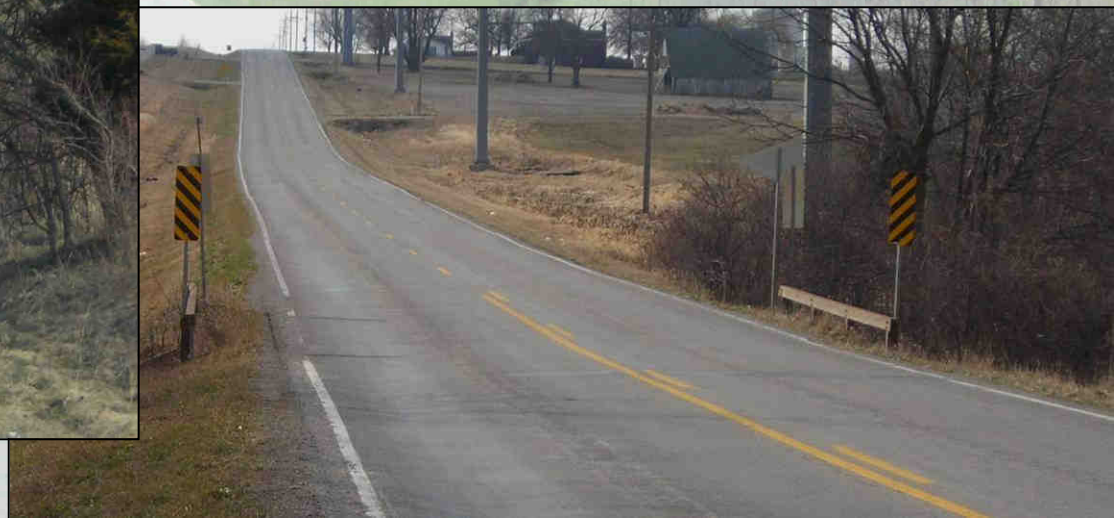


223rd Street RSA Field Review









223rd Street RSA Field Review








LACKMAN ROAD
223RD STREET
CRASH LEGEND
ANIMAL
FIXED OBJECT
OFF-ROAD
COLLISION
OTHER
INJURY / FATALITY

223rd Street RSA Deliverables

Summary of Observations

Table 5 – Intersection Sight Distance Evaluation

Intersection	North Approach		South Approach		Comments
	Looking East	Looking West	Looking East	Looking West	
Woodland Rd	(ADQ)	(ADQ)	(ADQ)	(ADQ)	
Ridgeview Rd	430 ft	(ADQ)	gated approach (private)		Cross road ahead (W2-1) signage already exists for WB direction
Renner Rd	(ADQ)	(ADQ)	(ADQ)	(EX)	
Lackman Rd	(EX)	(ADQ)	(EX)	(ADQ)	Rock quarry to the south, probabl large vehicles entering road
Pflumm Rd	80 ft	80 ft	300 ft	480 ft	Nearby farm structures. See signi suggestions
Quivira Rd	(EX)	(EX)	(EX)	(EX)	
5th Ave. in Bucyrus	-	-	(ADQ)	(EX)	
4th Ave. in Bucyrus	(ADQ)	(EX)	75 ft	(ADQ)	Limited sight distance to east fror south leg due to nearby railroad crossing
3rd Ave. in Bucyrus	-	-	(EX)	(ADQ)	
2nd Ave. in Bucyrus	-	-	(EX)	(ADQ)	
Switzer Rd	(ADQ)	(ADQ)	(ADQ)	(ADQ)	
Antioch Rd	(EX)	455 ft	(EX)	(ADQ)	
US-69 SB off-ramp	(ADQ)	(ADQ)	-	-	

RSA – GENERAL ISSUES (1 of 4)	Yes	No	N/A	COMMENTS
INTERSECTIONS				
Are intersections free of sight restrictions which could result in safety problems?		X		Some intersection sight distances that are restricted may need advance warning signs.
Are intersections free of abrupt changes in elevation or surface condition?	X			
Are advance warning signs installed when intersection traffic control cannot be seen a safe distance ahead of the intersection?		X		Sight distances observed to be marginal during field review have been measured by County.
SIGNING & DELINEATION				
Signing				
Is the road free of locations where signing is needed to improve safety?		X		Consider installing Stop signs (R1-1) at Bucyrus intersections 2nd, 3rd, 4th & 5th Streets.
Are the regulatory, warning, and directory signs in place conspicuous?	X			
Is the road free of locations with improper signing which may cause safety problems?	X			
Is the road free of unnecessary signing which may cause safety problems?	X			
Are signs effective for likely conditions?	X			
Can signs be read at a safe distance?	X			OM-3's eastbound at Metcalf obstruct Stop sign.
Is the road free of signing that impairs safe sight distances?	X			
Delineation				Add OM3 signs to locate/identify un-marked drainage structures along 223rd Street.
Is the road free of locations with improper or unreliable delineation (post delineators, chevrons, object markers)?	X	X		

223rd Street RSA Deliverables

223rd Street Road Safety Audit - Suggestions

Issue 1: Cross Section

223rd has numerous cross sectional issues that have developed over 60 years of road maintenance activities. . These issues include 22 ft. pavement width, no shoulders, steep foreslopes, and deep ditches. Crash data indicated twenty five (25) off-road crashes occurred along 223rd Street during a five year period, which accounts for 37 % of the total crashes. Ten (10) of those crashes resulted in serious injuries. While no specific cross sectional issue can be linked with any specific crash, the cumulative affects result in a relatively unforgiving roadside environment when driver error allows the vehicle tires to leave the pavement. Each of the above issues will be addressed separately.



Photos show typical cross section for 223rd Street within the project corridor.

The right-of-way width averages about 60 feet, and there are numerous power poles, fences and other structures near the right-of-way line. While it would theoretically be desirable to provide a wider clear zone, these right-of-way line obstacles are relatively insignificant when compared to the issues listed above, and will not be addressed by this study. These right-of-way line issues will be addressed when the road is upgraded to current design standards.

223rd Street Road Safety Audit – Suggestions

Issue 1B: Steep Fore-Slopes and Ditches

Along 223rd Street, the adjacent ditch slopes generally have slopes steeper than 3:1 which does not provide for a recoverable slope when vehicles leave the roadway. In addition, erosion has compounded the situation by creating a narrow and deep "V" shaped ditch profile throughout much of the corridor.

Suggestions:

Short-term: In areas where ditch erosion is evident, re-shape ditch and use erosion blanket or other ditch lining material to protect the ditches from runoff eroding and deepening the ditch bottoms.

Intermediate: Efforts to re-configure the ditch sections along 223rd where the slopes are 3:1 or steeper should be considered. Smoothing out slopes, eliminating abrupt transitions at intersections or driveways, and extending the run-out areas are generally a safety improvement for off-road crash events. Traversable grates could also be considered for all exposed culvert openings. These measures can be coordinated with efforts to address the lack of shoulders discussed elsewhere in this document.

Long-term: With the acquisition of additional right-of-way, re-grading of the ditches and slopes can be accomplished in coordination with other efforts to address lack of shoulders and pavement drop-offs in an integrated approach. The provision of recoverable slopes would help reduce the severity of off-roadway crashes along the corridor.





Photos: Steep slopes and erosion of ditches within the corridor.

Improvement Suggestions

223rd Street RSA Deliverables

Prioritized Costs

SUMMARY OF CONCEPTUAL IMPLEMENTATION COSTS
RURAL ROAD SAFETY AUDIT
223rd Street (Woodland to Metcalf)

SUGGESTION IMPLEMENTATION PRIORITY RECOMMENDATION

Short-Term

Suggestion	Issue Addressed	Estimated Construction Cost	Estimated Unit Cost
Install 36"x36" Stop sign on left side of 223rd Street at Metcalf	Metcalf Intersection	$500	$500/sign
Relocate stop bar closer to Metcalf	Metcalf Intersection	$300	$25/lf
Adjust edge line on intersection radii	Metcalf Intersection	$175	$2.50/lf
Replace existing stop ahead sign with new symbolic sign (W3-1) & relocate guide sign >250ft before stop ahead sign	Metcalf Intersection	$1,100	$275/sign
Install rumble strips on eastbound and westbound lanes	Metcalf Intersection	$3,200	$1,600/ approach
Extend 45 MPH speed limit on Metcalf from nearby school zone thru intersection area	Metcalf Intersection	$1,100	$275/sign
Perform study and implement all-way stop signs at intersection	Metcalf Intersection	$5,000	$5,000 ea
Install Stop signs at Bucyrus intersections along 223rd Street	Traffic Signage & Pavement Marking	$1,400	$350/sign
Install OM-2, OM-3, or other markers at all roadside obstructions	Roadside Protection for Structures	$2,750	$250/sign
Install W2-1 signs at intersections with limited sight distance	Traffic Signage & Pavement Marking	$1,100	$275/sign

Intermediate-Term

Suggestion	Issue Addressed	Estimated Construction Cost	Estimated Unit Cost
Construct 2-ft gravel shoulders & re-shape ditch fore-slopes	Lack of Shoulders	$3,200,000	$40/lf
Re-shape slopes to 3:1 or flatter	Ditches	$3,000,000	$60/lf
Mill & overlay 2" of asphalt pavement to provide uniform cross slope	Uneven Surface	$1,040,000	$26/lf
Install up-to-date guard fence/rail with end terminals at all existing structures	Roadside Protection for Structures	$93,000	$150/lf
Install 30-degree safety edge during next overlay	Pavement Edge Drop-Off	negligible if recd during overlay	N/A

Long-Term

Suggestion	Issue Addressed	Estimated Construction Cost	Estimated Unit Cost
Reconstruct & lower roadway & reshape overall roadway cross-section	Lack of Shoulders, Steep Fore-Slopes and Ditches, Roadway	$10,000,000	$1.25M/mile
Extend all existing drainage structures to meet current minimum width	Roadside Protection for Structures	$480,000	$30,000 ea

Note: All conceptual prices based on 2011 values. The costs shown on this estimate represent a conceptual estimate of probable costs prepared in good faith and with reasonable care. BHC Rhodes has no control over the costs of construction labor, materials, or equipment, nor over competitive bidding or negotiating methods and does not make any commitment or assume any duty to assure that bids or negotiated prices will not vary from this estimate. This estimate does not include costs for design services, utility relocation, or engineering administration.

223rd Street RSA – Follow Up

- **Final Report Submitted to County - June 2011**
- **HRRR Application for Phased Improvements - Sept 2011**
- **KDOT Awarded HRRR funds for first 0.75 mi - Oct 2011**

Questions ???????

