



usRAP

UNITED STATES ROAD ASSESSMENT PROGRAM

***Safety Benefits of Highway
Infrastructure Investments***

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usRAP Sponsors

- 2004-2014
 - AAA Foundation for Traffic Safety
- 2016 - present
 - Federal Highway Administration
 - has highlighted usRAP protocols as data-driven safety tools in Every Day Counts 3
 - Roadway Safety Foundation
 - working with FHWA to encourage use of usRAP's protocols and provide technical support to users

AAA Foundation for Traffic Safety

- Sponsoring research using usRAP results to assess:

Safety Benefits of

Highway Infrastructure Investments

Key Issues

- Are policy makers and decision makers aware of the potential crash reduction benefits highway investments?
- Is the U.S spending enough on highway infrastructure investments to improve safety?
- If the U.S. is not spending enough on highway infrastructure investments:
 - how much should we be spending?
 - what improvement types should we be investing in?
 - what benefits would result?

Ongoing Research

- AAA Foundation has funded a one-year research effort to address the Key Issues
- Results expected by January 2017
- Research team:
 - MRIGlobal – Kansas City, MO
 - Iowa State University – Ames, IA
 - University of Kentucky – Lexington, KY

Estimation of Improvement Needs

- usRAP has developed Safer Roads Investment Plans for 12,700 mi of roads in 9 states:
 - Alabama
 - Illinois
 - Iowa
 - Kansas
 - Kentucky
 - Michigan
 - Utah
 - Washington
 - Wisconsin

What is a usRAP Safer Roads Investment Plan?

- **Safer Road Investment Plan:** A plan that suggests specific safety improvements at specific locations on a selected roadway network
- **Input Data:** Approximately 50 roadway and traffic characteristics for each 327-ft (100-m) segment of the roadway network
- **Processing Software:** developed with web-based ViDA software
- **Output:** a safety improvement plan for your road network

What Does a usRAP Safer Roads Investment Plan Include?

- **Safer roads investment plan** for a road network includes:
 - specific countermeasures to be implemented
 - specific implementation locations
 - quantitative cost estimates
 - quantitative safety benefits (in crashes reduced and dollars)
 - cost-effectiveness measures
 - benefit-cost ratios
 - all countermeasures meet a minimum benefit-cost ratio specified by the user
 - output in the form of tables, maps, and Excel spreadsheets

Sample of Roads Included in Past usRAP Studies

- Rural roads (arterials and collectors):
 - 8,500 mi of conventional roads
 - 900 mi of freeways
- Urban roads (arterials only):
 - 3,000 mi of conventional streets
 - 300 mi of freeways
- This sample appears to be sufficiently diverse to estimate national conditions

Sample of Roads Included in Past usRAP Studies

- Data for sample roads includes:
 - roadway and roadside characteristics
 - traffic volumes
 - estimated annual fatalities and serious injuries
 - recommended improvements
 - crash reduction benefits and dollar benefits of recommended improvements

Improvement Types Identified in Past usRAP Studies

- Add lanes
- Add lanes and median
- Add median treatment
- Add median barrier
- Add rumble strips
- Add bicycle facilities
- Add pedestrian facilities
- Improve delineation
- Improve intersection
- Improve/remove parking
- Improve roadside
- Widen lanes
- Widen shoulders

Scaling Up from usRAP Sample to Nationwide Road System

- Approximately 1.2 million miles of comparable roads nationwide (data from HPMS):
 - 670,000 mi of rural roads – paved arterials and collectors (no unpaved or local roads)
 - 570,000 mi of urban roads – paved arterials (no unpaved, collector, or local roads)
- Scaling will be done in individual cells by area type, road type, and AADT level
- Test of scaling to national level:
 - how well do scaled up data reproduce FARS fatality estimates?

Area Type, Road Type, and AADT Categories

Area Type	Road Type	AADT (veh/day)
<ul style="list-style-type: none"> • Rural • Urban 	<ul style="list-style-type: none"> • Two-lane undivided • Four-lane undivided • Six-lane undivided* • Four-lane divided • Six-lane divided* • One-way street* • Four-lane freeway • Six-lane freeway • Eight-lane freeway* 	<ul style="list-style-type: none"> • 0 – 400 • 400 – 1,000 • 1,000 – 2,000 • 2,000 – 5,000 • 5,000 – 10,000 • 10,000 – 25,000 • 25,000 – 50,000 • 50,000 – 100,000 • 100,000-200,000 • over 200,000

*urban only

Final Report

- Summary of research on crash reduction effectiveness of infrastructure improvement (CMFs)
 - AASHTO *Highway Safety Manual*
 - CMF Clearinghouse
 - Other sources
- Case studies of infrastructure improvements
 - up to 7 case studies presenting actual projects and their crash reduction effectiveness

Final Report

- Estimates of national infrastructure improvement needs:
 - improvements needed by improvement type – number of miles or number of sites
 - cost of improvements
 - benefits of improvements in terms of fatal and serious injury crashes reduced and dollars
- Assessment of additional resources needed

Star Ratings

- Star ratings have been used since the inception of RAP programs
- Star ratings are assigned based on presence or absence of road design and traffic control features related to safety
- Over 50 safety-related design and traffic control features are considered
- Star ratings are in 1 to 5 scale:
 - five-star road (full range of known safety-related design and traffic control features)
 - one-star road (limited safety-related design and traffic control features)

Star Ratings

- Separate star ratings by user type:
 - vehicle occupants
 - motorcyclists
 - pedestrians
 - bicyclists

Role of Minimum Star Ratings

- International funding agencies have been using star ratings as basis for design of projects:
 - goal: minimum three-star rating for improved road to justify a project
 - most such design projects are on main roads
- International coalition has been encouraging adoption of minimum three-star ratings for individual design projects

Role of Minimum Star Ratings

- Not every road can or should be a minimum three-star road.
- What is the appropriate role of minimum star rating criteria in the U.S.?
- Key issue in the U.S. is not individual design projects, but management of an entire road network
 - range of road types
 - range of AADT levels

Role of Minimum Star Ratings

- Data from past usRAP studies will be used to explore potential role of minimum star ratings in the U.S.
- Is there a minimum AADT level to which minimum star ratings should apply?
- Should minimum star rating levels vary by roadway type?

Questions?

Key Safety-Related Roadway Characteristics

- No. of lanes
- One-way/two-way
- Roadway width/lane width
- Shoulder width
- Horizontal alignment (esp. curve radius)
- Vertical alignment (esp. grades)
- Delineation
- Road surface condition
- Sidewalks

Key Safety-Related Roadway Characteristics

- Roadside severity
- Shoulder rumble strips
- Access point density
- Median type
- Intersection type
- Pedestrian facilities
- Bike facilities
- Area type (rural/semi-urban/urban)
- Land use (commercial/residential)

Key Safety-Related Roadway Characteristics

- Quality of curve
- Quality of intersection
- Quality of pedestrian crossing

Key Operational and Traffic Control Characteristics

- Traffic volume
- Motorcycle percentage
- Pedestrian flow
- Bicycle flow
- Intersecting road volume
- Speed limit
- 85th percentile traffic speed