Roundabouts & Traffic Engineering

Presents:

High Speed Approaches At Roundabouts Update

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Purpose

- Roundabouts Were Proposed on High Speed Rdwys
- Question Continually Asked: "Are Roundabouts Appropriate on High Speed Roadways?" (USA)
  - Most Other Countries Worldwide Prefer Roundabouts on High Speed Roadways, But What About North America?
- In 2004, RTE Was Asked to Produce In-Country Results For Roundabouts on High Speed Roadways
- 2005 TRB: RTE Presented Brief Highlights of the *High Speed Approaches At Roundabouts* Publication
- 2008 TRB: 1) Review; 2)Changes in the Past 3 Years?

2005 H.S.A.R. Objectives

- **Objective 1:** Evaluate *Perceived* Concern of High Speed Approaches at Roundabouts
- **Objective 2:** Present Safety Statistics & Data of Roundabouts Worldwide with H.S.A.
- **Objective 3:** Conduct Case Studies of Existing Roundabouts in N.America w/ H.S.A.
- **Objective 4:** Demonstrate Geometric Design Treatments Currently Used for High Speed
- **Objective 5:** Recommend Additional Design Treatments for H.S.A.

Similar Safety Statistics

- 40% Reduction in All Crash Types Combined / PDO
- 80% Reduction in Injury Accidents
- 90% Reduction in Fatalities
- 30% Reduction for Pedestrian and Bicycles
- Up to a 75% Reduction in Delay
- ***Results Consistent With International Studies***

Maryland State Hwy Admin.

- E. Myers' *Accident Reduction with Roundabouts* Reported 5 High Speed Intersections
- Data: 3Yrs Before/ 3Yrs After Roundabout Constr.
- Summary Results:
  - 59% Overall Accident Reduction
  - Avg of 5.56 Accidents Before
  - Avg of 2.3 Accidents After
  - Injury Accidents Reduced by 80%
  - All Intersections: Reduced Frequency & Severity

TRL LR 1120

Table 3: Roundabout Crash Types & Rates

Accidents Statistics By Roundabout Type & Speed

Roundabout Category	Operating Speeds (MPH)	Total # of Accidents	Avg Accident Rate	Percentage By Accident Type: Entering / Circulating	Approach	Single Vehicle	Other	Ped
Small	30 - 40	497	37.1	72.2%	6.6%	7.5%	9.7%	4.0%
	50 – 70	150	28.7	67.3%	8.0%	10.7%	12.0%	2.0%
Conventional (No Flare)	30 - 40	146	21.2	16.4%	18.6%	37.6%	19.2%	8.2%
	50 – 70	193	28.7	24.9%	26.9%	29.0%	17.1%	2.1%
Two-Lane	30 - 40	244	22.5	21.7%	24.2%	24.2%	18.4%	11.5%
	50 – 70	197	22.4	16.8%	29.9%	32.5%	17.8%	3.0%

Source: TRL, LR 1120 — RTE High Speed Approach Tables.xls

TRL LR 1120

TABLE 4: Roundabout Accident Severity

Crash Statistics By Roundabout Type & Speed

Roundabout Category	Operating Speeds (MPH)	Number of: Sites	Number of: Junction Years	Accidents: Fatal	Accidents: Serious	Accidents: Slight	Accidents: Total	Accident Frequency/ Junction/Yr	Severity %
Small	30 - 40	25	113.4	2	86	409	497	4.38	18
	50 – 70	11	53	1	20	129	150	2.83	14
Conventional (No Flare)	30 - 40	11	61.9	3	37	106	146	2.36	27
	50 – 70	11	62.2	0	30	163	193	3.1	16
Two-Lane	30 - 40	14	72.5	1	30	213	244	3.37	13
	50 – 70	12	68.3	0	22	175	197	2.88	11

Source: TRL, LR 1120 — RTE High Speed Approach Tables.xls

Case Study: Novelty Hill

- SR 203/124th St Stop Control, Rural High Speed, High Accidents
- *Perceived:* "Roundabouts are unsafe on high speed roads." → Study Required
- Local Signal Comparison Freq/Severity at 9 HS/LS Intersections Prev. Stop
- Acc Results → Increase in Rates & Severity After Signal
- Rbts Resulted in 50-80% Reduction in Inj. & Fatalities

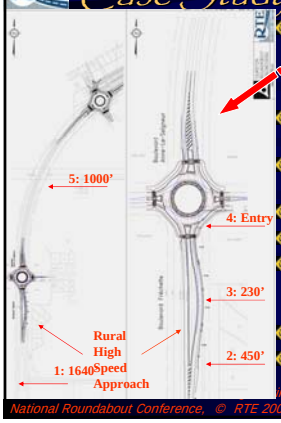
Washington DOT

- Final Decision: Build SR 203/ 124th Roundabout
- Completed October 2004
- Still No Collision Problems!

Case Study: Ancaster Kbt

- Design Works With Rural High Speed Approach
- Elongated Splitter Island
- Adequate Deflection
- 6 Point Speed Corridor Study Conducted

Case Study: Chambly Rbt



- Speed Studies Conducted to Compare Predicted Design Speeds & Post Construction Speeds at Rural High Speed Site
- Long Splitter Island, Curvilinear Approach in Design
- Post Roundabout Speed Study at 5 Points along HS Roadway
- 1: 55mph, 85th=63mph, Avg=58
- 2: 85th=45mph, Avg=39mph
- 3 & 4: Speeds are Lower Than Predicted Fast Path Design Speed w/ Highest Actual Speed =20mph
- 5: 85th=41, Avg=39
- Results are positive!

2005 Report Concluded

- Report Provides Case Studies and Statistics at Hundreds of Roundabouts Studied by Roundabout Specialists, Jurisdictions & Organizations Throughout the Globe
- Common Results → Self Regulating Modern Roundabout is Proven to be The Safest At Grade Intersection Type
- Statistics Show Rbts as the Most Appropriate Control for Intersections with High Speed Approaches
- Case Studies Acknowledge Roundabouts on High Speed Roadways Are Acceptable, Function Well, & Preferred
- Yet, Evidence is Still Needed to Form Geometric / Safety Performance Relationships on High Speed Approaches
- U.K. Relationships Should Not Be to the Contrary in N.A.
- Additional Design Treatments Are Still Recommended

Back to Original Objectives

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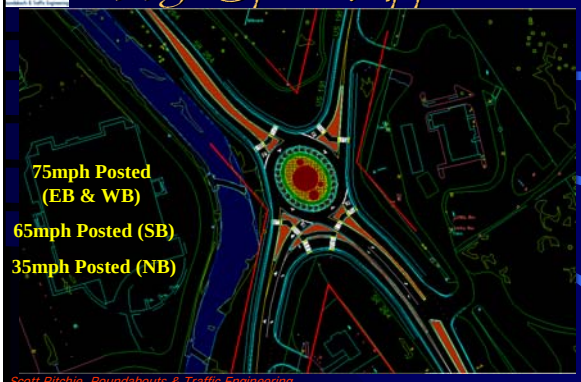
Perception Now Changed?

- Has the Perception Changed in Past Three (+) Years?
- *YES!* Many Have Adopted RTE's 2005 Publication:
  - Proof Rbts **Work** At High Speed Locations
  - Rbts **ARE** Appropriate on High Speed Rdwys
  - Measures for High Speed Rbt Approaches **NOW USED**
- Most Extg Rbts on High Speed Rdwys Operating Well With Continual Safety (More Data Needed)
- **More** Roundabouts Are Being Proposed & Designed on High Speed Roadways (Can Analyze in Future)
- In 2008, Seems To Be the Preferred Alternative!
  - Same as Other Countries Worldwide! (Shocking?)

High & Low Speed Rbt

High Speed Approaches



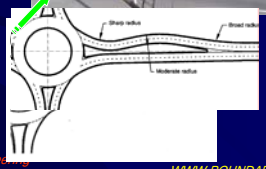
High Speed Approaches

Geometric Design Treatments

- Sufficient Deflection at Entry is Key!
- Proper Entry Design Correlating to the Fastest Path Design Speeds that Are **Balanced**
- Entry Design Correlates to Circulating Speeds with Appropriate Speed Differential
  - Less than 12 mph
- Entries are Visible To Driver With Properly Extended Curb & Gutter

Geometric Design Treatments

- Extend Splitter Islands to SSD Differential
- Curvilinear Approaches
- Appropriate Vertical Design of Roadways, Circulating Roadway, & Truck Apron
- Consider Two-lane Entry with Short Flare Length
- Conduct Rbt Review & Use Expert Designers



Non-Geo Design Treatments

- Avoid Excessive Signing
- Increased Chevron Signs On Central Island
- Long Hatched Areas (Striping), as an Alternative to Long Splitter Islands
- Repeat Lane Assignment Arrows
- Thermoplastics Not Paint
- Transverse Yellow Bar Markings
- Internally Illuminated Bollards
- Internally Illuminated Exit Signs (i.e. Vail, CO)

Non-Geo Design Treatments

Conclusions

- Make Rbt & Need to Slow Down Clear to Driver with Long Splitter Islands, Extended Curbing, & Striping
- Make Rbt Visible with Foliage, Chevrons, and Striping
- Avoid Excessive Signing: Hinders Driver's Ability to See the Roundabout, Peds, & YIELD
- Make Roundabout Visible During Night with Illuminated Signs, Extended Chevrons, & Lighting
- Add Side Friction with Planters, Curbing, Trees, Splitter Islands, Good Deflection PRIOR to Entry
- Ensure Proper Geometric Design: Deflection, Speeds, Fast Paths, Entry Radii, & Exit Radii (No Small Radii)