# Minutes of Meeting

**GEOMETRIC DESIGN STANDING COMMITTEE**  
Spring 2013 Technical Meeting

**Date:** April 12 and 13, 2013  
**Place/Time:** Ottawa Convention Center, Room 205, Level 2  
**Next Meeting:** September 22, 2013, Winnipeg  
**Attendees:** Attached  
**Distribution:** Committee Members

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<tr>
<th>Item</th>
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<td><strong>1. Review and Approval of Agenda</strong></td>
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<td>- Aziz Merali reviewed the proposed agenda and solicited comments. No additions or deletions were noted.</td>
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<td>- <strong>It was agreed by motion</strong> (Homann/Biller) to adopt the agenda as presented.</td>
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<td><strong>2. New Members and Resignations</strong></td>
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| - The following new member were welcomed to the GDSC: | - Jason Meliefste, City of Edmonton  
  - Adam Laughlin, City of Edmonton  
  - Sylvain Felton, Ville de Montreal | |
| - The following members have resigned or retired from the GDSC: | - Paul Szczepanski, City of Edmonton  
  - Max Shmyr, City of Edmonton  
  - Jean Phillippe, Ville de Montreal  
  - Richard Voyer, BC Ministry of Transportation | |
| **3. Updates to GDSC Membership** | |
| - Self-introduction of members in attendance was completed. | |
| - Aziz reminded everyone to update the GDSC roster, which was circulated to the committee members in attendance. | |
| - The following guests attended the meeting: | - Kamran Ata, Government of Northwest Territories  
  - Binay Yadav, Government of Northwest Territories  
  - Ian Pestano, ISL Engineering & Land Services Ltd.  
  - Jeff Spares, Halifax Regional Municipality  
  - Phil Weber, Ourston Roundabout Engineering | |

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Item                                                                 Action
4. **Review and approval of the previous Minutes of Meeting**
   - Gregg Cooke provided an overview of the minutes from the Fall 2012 meeting held in Fredericton New Brunswick. No revisions were noted.
   - **It was agreed by motion** (Sloan/Christiansen) to adopt the minutes as presented.
   - Gregg Cooke will submit the meeting minutes to the TAC Secretariat to be posted on the TAC website.

5. **Committee Mandate, Roles and Responsibilities**
   - Aziz Merali reviewed the mandate of the GDSC and noted that additional information is available on the TAC website.
   - The current term for the GDSC Executive expires in the fall of 2013.
   - The GDSC will elect a new Secretary at the 2013 Fall Meeting. The next Secretary should be a GDSC member from the public sector (the current Secretary is from the private sector).
   - The committee was encouraged to forward nominations to Larry Purcka in advance of the 2013 Fall Meeting.

6. **Chief Engineers Council Update**
   - Aziz Merali and Keith Boddy attended the Chief Engineers’ Council Meeting on October 15, 2012, on behalf of the GDSC.
   - Aziz provided an overview of the meeting and the GDSC presentation. The following notes were extracted from the TAC CEC Minutes, dated October 15, 2012:
     - Aziz Merali (Focus Corporation) provided a presentation on behalf of the Geometric Design Standing Committee (GDSC).
     - As part of his presentation, Mr. Merali emphasized the importance of securing the necessary funds and launching the project to develop a new edition of the *Geometric Design Guide for Canadian Roads*.
     - Mr. Merali also drew attention to the project to produce a *Canadian Roundabout Design Guide*. He emphasized the importance of proceeding with the project and explained that the Geometric Design Guide would only include geometric design aspects of roundabouts.
     - On behalf of the GDSC, Mr. Merali expressed concerns about the approval process for the *Canadian Guide for Greener Roads*. He noted that the committee had not had sufficient time to review the practices contained within the guide.
### Item 7. 2013 Fall Conference Preparations

- The 2013 TAC Annual Conference will be held in Winnipeg Manitoba, September 22\textsuperscript{nd} to 25\textsuperscript{th}, 2013.
- The theme of the 2013 TAC Annual Conference is **Transportation: Better – Faster – Safer.**
- It was noted (again) that there has been a poor response to the call for papers for GDSC hosted sessions. Only six papers were received through the Call for Papers process. The TOMSC received several papers and provided two papers for the GDSC sessions.
- Keith Boddy provided an overview of the two GDSC hosted sessions.
- **Emerging Issues Session**
  - Better and Safer Intersections Through Emerging Design Principles
  - Bison Drive, Winnipeg
  - Roundabout Versus Traffic Signals – A Case Study in Alberta
  - Striping Roundabouts – A Case Study
- **Lessons Learned**
  - Design of the Highway 406 Termination Roundabout
  - Accommodating Cyclists, Buses and Pedestrians at Transit Stops
  - Accuracy Limits of Geometric Analysis Based on Data Collection Vehicles
  - Slotted Left-Turn Lanes on the Manitoba Highway Network
- Keith suggested that we should consider “presentation” sessions in addition to the traditional paper sessions, workshops and poster sessions.
- All GDSC members were encouraged to solicit staff to prepare papers for the 2014 Annual Conference.
- Zane Sloan suggested that the book “A Road for Canada”, which provides the history of the Trans-Canada Highway, would make an interesting presentation.
8. Geometric Design Guide Project Update

- A Project Steering Committee (PSC) has been created. It was noted that a minimum of $10 K funding is required to participate on the PSC.
- The PSC held its first meeting on April 11, 2013.
- The CEC will appoint one provincial Chair and one Municipal Chair.
- Funding of approximately $1.2 Million is committed to the project, including TAC administration fees of $270 K. There is the possibility that additional funding will be obtained once the project is underway.
- The RFP is based on the previous Geometric Design Guide Scoping Study, and identifies five main areas of interest:
  - Design Exceptions
  - Roadside design:
  - Human Factors:
  - Intersections and Modern Roundabouts:
  - Active Transportation:
- There is a strong desire to look at other areas, in addition to the major chapter revisions. However, this may require some “work-in-kind” from the successful consultant.
- It was noted that there has been some discussion about allocating some of the GDG budget to the Canadian Roundabout Design Guide project budget.
- The schedule includes selecting a consultant in fall 2013, draft submission in 2016, and publication in 2017.

9. TAC Centennial Activities

- Gérald Cadet provided an overview of the TAC Centennial activities that are planned for 2014.
- In 2014, the Transportation Association of Canada (TAC) will mark 100 years as an association. In doing so, we will celebrate the past, present and future of transportation in Canada by inviting our members, other transportation stakeholders, and students to participate in a special year-long campaign, Transportation 2014.
- The celebrations will culminate during the 2014 TAC Conference and Exhibition in Montreal, September 28 to October 1. In addition to the conference, numerous other activities and events celebrating transportation will be launched in 2013 and 2014.
- A copy of the presentation is attached to the meeting minutes.
- Please visit www.transportation2014.ca for more information.
### Item 10. Technical Information Services and Library Update

- Glenn Cole provided an overview of the Technical Information Services and Library, including a virtual tour of the library.
- Bill Kenny indicated that AT has a copy of the 1963 GDG. Bill will send to Glenn to be added to the TAC Library.
- Please visit [www.tac-atc.ca/english/resourcecentre/library](http://www.tac-atc.ca/english/resourcecentre/library) for more information.

### Item 11. Member Presentation #1

- Blake Wellner provided a presentation about the I-94 East-West Corridor Study in Milwaukee County.
- A copy of the presentation is attached to the meeting minutes.

### Item 12. Member Presentation #2

- Michael Chiu provided a presentation about the conversion of HOV lanes to HOT lanes in the GTA.

### Item 13. Roundtable Discussion

- Aziz Merali initiated a discussion about current issues and challenges associated with the transportation design industry. The following discussion points were noted:
  - Integrating both transportation and land-use requirements in the road design process; “character roads”; “complete streets”, accommodating trucks, cars, buses, pedestrians, bicycles, etc.; supporting adjacent land uses (Toronto, Edmonton, Montreal)
  - The need for an updated GDSC (keep the project moving)
  - Accommodating LRT within existing urban areas; accommodating LRT at roundabouts; maintaining acceptable LOS for cars; roundabouts; no negative safety impacts (Mississauga)
  - Guidelines for long distance, low volume roads (NWT)
  - Guidelines for adapting current highway design principles to accommodate climate change; minimizing road disasters and wash-outs (British Columbia)
  - Access management policies to accommodate development (Newfoundland)
  - Permafrost challenges and upgrade requirements for the Shakwak Highway Project (Yukon)
  - The GDSC update project should include guidelines for resource and mine access roads (Yukon)
  - Accommodating ATVs and snowmobiles within road right-of-ways (New Brunswick)
  - Accommodating long combination vehicles at interchange ramp terminal intersections (New Brunswick)
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<tr>
<td>Roundabout Design: North American approach versus UK approach?</td>
<td>(New Brunswick)</td>
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<td>Doing more for less (New Brunswick)</td>
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<td>The need for a systems approach to Highway Safety, such as Vision Zero (Sweden), which aims to achieve a highway system with no fatalities or serious injuries in road traffic (Alberta)</td>
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<td>Reduced transportation budgets in Alberta</td>
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<td>Corridor LOS (including transit, pedestrians) versus traditional LOS (Edmonton)</td>
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<td>Safety issues associated with geometric design requirements (Edmonton)</td>
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<td>New Brunswick DOT fiscal restraints now that the Route 1 Gateway project is complete</td>
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<td>Geometric design versus providing adequate spacing for guide signs (Vancouver)</td>
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<td>British Columbia DOT downturn; layoffs for roadway designers</td>
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<td>The GDG needs a definition of terms (i.e. capitalize words that are defined in a glossary of terms)</td>
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<td>How intersection performance is affected by the construction of roundabouts at adjacent intersections (New Brunswick)</td>
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<td>Guidelines for selecting traffic signals versus roundabout at intersections (Ontario)</td>
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<td>Decision sight distance requirements in tunnels (Ontario)</td>
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<td>Sharing the road; accommodating “other” users (Ontario)</td>
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<td>Accommodating long combination vehicles on “400” series highways (Ontario)</td>
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<td>Manitoba Infrastructure and Transportation budget pressures; elimination of 600 public sector employees; minimizing design standards to reduce construction costs; reclassify highways to match available funding?</td>
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<td>Incorporating project phasing and implementation into the design process to match available funding (Alberta)</td>
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<td>Guidelines for design exceptions (Alberta)</td>
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<td>Incorporating Human Factors into the highway design process (Quebec)</td>
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<td>Constrained right-of-ways; accommodating pipelines; accommodating SWN facilities in urban areas (Calgary)</td>
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<td>The need for “systems interchanges” to accommodate development in Saskatchewan</td>
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<td>A systems approach to incorporating passing lanes for long highway corridors (Saskatchewan)</td>
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<td>The need for a “hands on” geometric design course (Saskatchewan)</td>
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<td>The GDG should include additional background technical</td>
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April 12 and 13, 2013
GEOMETRIC DESIGN STANDING COMMITTEE
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<td></td>
<td>o Addressing aging infrastructure requirements (Montreal)</td>
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<td>o Guidelines for roadway design in difficult soil conditions (permafrost, Canadian Shield); difficult to achieve minimum K values due to extreme terrain (NWT)</td>
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<td>o The following future papers were suggested during the roundtable discussion:</td>
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<tr>
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<td>o Transportation Master Plan Implementation (Koziel)</td>
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<td>o LRT/BRT Experience in Mississauga (Harvey)</td>
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<td>o Highway 1 between Kamloops and Alberta (Sloan)</td>
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<td>o Newfoundland’s First Interchange (Morrissey)</td>
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<td>o The History of the Alaska Highway Project (Bidniak)</td>
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<td>o Comparing the NA approach versus the UK approaches to Roundabout Design (Hallden)</td>
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<td>o An In-service Review of Various Roadside Barriers (Kenny)</td>
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<td>o The Evolution of the Highway Design Process (Bidulka)</td>
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<td>o Geometric Design Standards for Driverless Vehicles (Meliefste)</td>
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<td>o In-service Performance Review of Existing Roundabouts (Murphy)</td>
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<td>o The Typical Career of a Senior Highway Design Practitioner (Wellner)</td>
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<td>o Accommodating Active Transportation at Interchanges (Busik)</td>
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<td>o The Evolution of the TAC Geometric Design Guide (Christianson)</td>
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14. Joint Roundabout Sub-committee Report

- Keith Boddy provided an overview of the current activities of the Joint Roundabout Sub-committee.
- The following topics of interest were discussed at the recent meeting:
  o Education
  o Accessibility
  o Rules of the Road
  o Aging Population
- It was noted that CITE will be publishing a report entitled *A Review of Canadian Roundabout Experiences* in the fall of 2013.
- It was also noted that TRB is sponsoring the 4th International Conference on Roundabouts on April 16-18, 2014, in Seattle, Washington.
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<tr>
<td><strong>15. Canadian Roundabout Design Guide Project Update</strong></td>
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<tr>
<td>• Keith Boddy provided an overview of the Canadian Roundabout Design Guide (CRDG) project.</td>
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<td>• Keith has been appointed Chair of the Project Steering Committee.</td>
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<td>• Approximately $95 K of sponsorship funds have been committed to date; the project has been launched without the target budget of $130 K in place.</td>
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<td>• The consultant will be required to provide “work-in-kind”; and the PSC may be able to provide additional resources (data collection).</td>
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<td>• It was noted that the GDSC owns the project, with support from the TOMS and the RSSC.</td>
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<td>• Coordination with the GDG Update project will be required.</td>
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<td>• A technical Review Committee will be established, with representation from the GDSC, the TOMS, and the RSSC.</td>
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<td>• The schedule includes selecting a consultant in July 2013, and publication in 2016.</td>
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<td><strong>16. Traffic Operations and Management Standing Committee Report</strong></td>
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<td>• Ron Stewart provided an overview of the current activities of the Traffic Operations and Management Standing Committee.</td>
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<td>• The following TOMSC projects are in progress:</td>
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<td>o Guidelines for Planning and Implementing Transit Priority Measures in Urban Areas</td>
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<td>o Roadway Lighting Efficiency and Power Reduction Guide</td>
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<td>o Manual of Uniform Traffic Control Devices for Canada Update Scoping Study</td>
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<td>o Signs and Markings for Multilane Roundabouts</td>
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<td>o Pedestrian Signal Warrants</td>
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<td>• The TOMSC is planning a workshop for the fall conference related to intersection design considerations to accommodate vulnerable road users at intersections (signalized intersections and roundabouts).</td>
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Item 17. Road Safety Standing Committee Report
  - Bill Kenny provided an overview of the current activities of the Road Safety Standing Committee (RSSC).
  - It was noted that Geni Bahar is the current Chair of the Committee.
  - It was also noted that the RSSC is an "open" committee.
  - The following topics of interest were discussed at the recent meeting:
    o Nominations for Executive
    o Sub-committee Reports
    o Project Updates
    o Funding Updates
    o Agencies

Item 18. Revisions & Additions Sub-committee Report
  - Geoff Millen provided an overview of the current activities of the Revisions & Additions Sub-committee (RASC). A copy of the presentation is attached to the meeting minutes.
  - The RASC held a meeting on Thursday, April 11, 2013.
  - One new member (Sylvain Felton) was welcomed to the RASC.
  - Geoff presented the RASC recommendations for revisions to Figure 2.4.8.7 and Figure 2.3.7.3 (Direct Taper Two-Lane On-Ramps).
    - It was agreed by motion (Boddy/Kroman) to accept the revisions to Figure 2.4.8.7 and Figure 2.3.7.3 as presented.
  - Geoff presented the RASC recommendations for revisions to Table 2.2.10.2 (Horizontal Clearances at Bridge on Rural Roads).
    - It was agreed by motion (Purcka/Marquis) to accept the revisions to Table 2.2.10.2 as presented.
  - There was discussion regarding the need for revisions to Section 2.8.1(Critical Grade Lengths for Truck Climbing Lanes) based on improved truck performance. It was agreed that the RASC would distribute the suggested revision to the GDSC members in advance of the fall meeting for acceptance at the fall meeting.
  - There was discussion regarding the need for revisions to Table 2.1.2.5, Table 2.1.2.6, and Table 2.1.2.7, all related to spiral curve length. It was agreed to move this issue to Parking Lot 1, for further review during the GDG Update project.
  - Bruno Marquis will provide a copy of a paper related to ATVs on structures to the RASC.
19. Member Presentation #3
- Bill Kenny provided a presentation about the use of Barrier End Treatments (EAGRTs) in Alberta.
- A copy of the presentation is attached to the meeting minutes.

20. Topics for Fall 2013 Meeting
- Discuss Call for Papers Process
  - Geometric Design – Emerging Issues?
  - Geometric Design – Lessons Learned?
  - Presentation Sessions?
- It was suggested that additional GDSC meetings could be held by teleconference or web conference.

21. Closing Remarks/Adjourn
- Aziz Merali thanked everyone for their attendance and participation.
- It was agreed by motion (Christianson/Homann) to adjourn the meeting at 12:00 PM.
Transportation Information Service

- Collection of Numbers for fiscal 2012-13
  - 313 records added to library catalogue
  - 56 items published in TIB
  - 32 Canadian Entries added to TRID

Ongoing Programs

- Surface Transportation Research Survey
  - There are no “too small” projects.
- Library Catalogue
  - Still searchable from web site
- Current Practices and Innovations Database
  - Includes maintenance, construction, safety, and environmental/climate change citations
- Transportation Intelligence Bulletin
- TAC Wiki
Questions for You 1

- Do you use any of these media?
  - LinkedIn
  - Twitter
  - RSS feeds
  - Email alerts/newsletters (eg TIB, TRB newsletter, alerts from journals or publishers)

Questions for You 2

- Would a subject-specific link on your committee page to recent article abstracts be useful?
- What is one thing you need from TAC?
Virtual Library Tour

Questions? Comments?

Glenn Cole
Manager, Technical Information Programs
Tel: 613-736-1350 ext 244
Gcole@tac-atc.ca
Library@tac-atc.ca
Tis@tac-atc.ca
@TAC_Library (Twitter)
TAC Spring Meetings
11-15 April 2003
A time for Celebration

• In 2014, TAC turns 100
• What better time to celebrate transportation!
  ➢ What is Transportation 2014?
  ➢ Past, Present, Future
• Reaching out to stakeholders (4)

Marking it in three ways

• Celebrating transportation
  ➢ Communication campaign
  ➢ Partnered activities
• TAC Centennial
  ➢ Spotlight on TAC and you, our members
• 2014 Conference & Exhibition
Five partnered activities

- Video vignettes – GMCT
- Showcase – An exhibit of our past and present
- Student Fair – Unlocking the minds of tomorrow
- Ebook – Transportation beyond TAC
- Lectures series – A cross Canada activity

TAC centered activities

- 2014 Conference & Exhibition
- Homecoming
  - Highlighting members contribution to TAC
- Signature event
  - Marking 100 years of existence
Councils and TFs’ participation

- Participation in partnered activities
  - Three activities open for CTFs
- TAC centered activities
- Developing own events and/or activities

Partnership opportunities

- Five partnership levels
- Great visibility across activities and communication materials
- Your support is critical
For more information:

www.transportation2014.ca or
www.transport2014.ca

Gérald Cadet, Project manager
613-736-1350 x222
gcadet@tac-atc.ca
I-94 East-West Corridor Study
(70th St – 25th St)
Milwaukee County

Value Engineering Study and Road Safety Audit
Project Briefing

Existing Project Area

- 2.85 miles long
- 6 interchanges
- 11 left hand entrances or exits
- Access to Miller Park
- Bisects Several Cemeteries
- Railroad and River Crosses Corridor
Miller Park

Left Hand Entrances and Exits
Replace in Kind - December 2012

Spot Improvements - December 2012
Cemetery area

Cemetery Area
Stadium Interchange
This is where the modified turbine.pdf goes.

This is where the new single-point.pdf goes.
West leg
East leg

TRAFFIC DIAGRAM

BRAIDED RAMPS OFF ALIGMENT
DRAFT DECEMBER 2012

Section A-A
Schedule

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Subject to funding availability and Legislative approvals

And in the end .....

- Questions ?????
Barrier End Treatments or EAGRTs
Presentation to TAC’s Geometric Design Standing Committee, April, 2013.
by Bill Kenny P. Eng., Director: Design, Project Management and Training, AT.

How can we eliminate this problem?
Current Practice – for Alberta Transportation.

- Clear Zone Policy
- Forgiving Roadside preferred.
- Prefer no barriers.
- If barriers are needed – minimize the hazard.
Barrier choices – Rigid, Semi-rigid, Flexible

Rigid – Concrete Median Barrier

Semi-Rigid – Strong Post W Beam
Outcome:
- Property Damage Only ($12,000)
- Passenger compartment was not violated
- Deceleration was relatively gentle
- No personal injuries or fatalities.
Need to ensure Good Engineering Practice is followed.

• Must “do no harm”.
• Preferred choice is “least damaging” system.
• Be aware of operational problems (snow etc).
• Allow “trial” installations based on crash tests.
• Implement In-Service Evaluations.

End Treatments – old and new
Yellowhead Highway – west of Edmonton
W-Beam Turn Down End Treatment.

Guardrail Turndown Performance Video
High Tension Cable Barrier End Terminals

Cable Release

Breakaway Cable Terminal
BCT.

Fixed Terminal


Breakaway Cable Terminal
BCT.

MELT.
New EAGRTs – in the last two decades.

Extruders

ET-Plus

SKT 350

New terminals

FLEAT-MT

FLEAT-350

Alberta
Crash Testing for ET-Plus – NCHRP 350, Manual for Assessing Safety Hardware AASHTO

- Part 1 – Testing during development
- Part 2 – In-Service Evaluation.

ET-Plus Crash Testing
In Service Evaluations of End Treatments

- published to date (last 25 years).

- 1988 Kentucky..... Breakaway Cable Terminals (BCT)
- 1992 Indiana DOT.... (VAT and CAT)
- 1996 TRB Paper.... ET-2000
- 2003 NCHRP Report 490 ....BCT, MELT, Bullnose. (M. Ray)
- 2004 U of Kentucky.... ET-2000 (Kenneth Agent)
- 2012 U of New Brunswick .... ET-Plus and SKT-350 (Ryan Esligar and Eric Hildebrand) presented at TAC Annual Conference.

- Proposed by AASHTO SCOR (Standing Committee on Research): "In-Service Evaluation of End Terminals"… Bryden, Ray and Durkos.

ET-2000 and ET-Plus – developed by TTI, marketed by Trinity Industries.

- ET-2000 accepted in 1991 (over 500,000 sold @ $2,800)
- ET-Plus accepted in 2000, modified in 2005 (lower cost and weight)
Evaluation of the ET2000 Guardrail End Treatment

2004 U of Kentucky…. ET-2000 (Kenneth Agent)

- 135 collisions in total, 80 crash reports located.
- 1 fatal, 12 serious injuries, 27 minor injuries, 40 pdo.
- Length of extrusion varied 0 – 35 feet.
- 88% proper performance, 12% improper.
- Improper: 7 overturns, 1 rotation & intrusion into car, 1 rebound, 1 no extrusion.
- Concern: angle of impact causing bent beam and jamming.

- Conclusion: Satisfactory but too costly for general use.


- 2 sections of Trans-Canada in New Brunswick from 2007 to 2010.
- Divided highway, design speed = 120 km/h, posted = 110 km/h?
- Shoulder Rumble Strips on right hand side only.
- 2 EAGRTs: ET-Plus and SKT-350
- 80% pdo, 19% injury, 1 fatality.
- 103 collisions, 18 studied in detail (reconstruction and analysis)
- Compared results to NCHRP 350 and MASH tests.
Note the quarter (W/4) offset from centreline of test vehicle.

Source: MASH 2009. AASHTO
Results of UNB Study

- 68% of energy was absorbed by End Treatment.
- 14/18 Vehicles struck outside of the w/4 offset from centre
- 15/18 Rail became kinked during collision
- 14/18 did not match test conditions
- 3/18 Intrusions into occupant compartment.
- 3 rollovers
- 58% of collisions on left shoulder (greater incidence than expected due to absence of rumble strips)
Right side of Ranger

Edited photo demonstrating position of Altima at FRP

Guide rail intruded through front passenger window
Additional crash in February 2013
How can we eliminate this problem?

Flexible – High Tension Cable Barrier system
GDSC Revisions & Additions Sub-Committee

Spring 2013 - Meeting

Proposed Changes
Direct Taper Two-Lane On-Ramps

- Figure 2.4.8.7
- Designers using detail for line painting
- Left lane merge
- Parallel preferred rather than taper

Add notes:
- For a two lane entrance, the parallel entrance terminal treatment is preferred (see figure 2.4.8.6).
- Figure not intended to be used for line painting purposes.
Critical Grade Lengths

- Current design control = 180 kg/kW
- AASHTO 2011 and NCHRP 505
  - Design control = 120 kg/kW
  - 85th percentile weight/power ratio on main highways and intercity routes
  - 120 kg/kW performance curves - 110 km/h
- Add text to reflect US experience
As shown in Figure 21.8.1, the collision incidence rate increases significantly when the truck speed reduction exceeds 10 km/h and or when the speed reduction is being 15 km/h for a 14-km/h reduction. On the basis of these relationships, it is recommended that a maximum threshold for speed reductions should be determined to maintain a safe and efficient traffic flow. The performance of three different vehicle mass/power ratios for a 10 km/h entering speed is illustrated in Figures 21.8.9 to 21.8.10 for various grades. Figure 21.8.9 illustrates a deceleration performance curve for a 120 kg/ft² mass/power ratio with a 110 km/h entering speed.

Figure 21.8.2: Performance Curves for Heavy Trucks, 100 g/kW Decelerations & Accelerations

As indicated earlier, the 120 g/kW performance curve (Figures 21.8.9 and 21.8.10) is not recommended for design of vehicle design with a maximum speed of 150 km/h. However, the performance of the vehicle mass/power ratio can be significantly increased by 50% to 60% by maintaining the design speed of 140 km/h. This approach can be used to determine the design speed for a given mass/power ratio. The performance of the vehicle mass/power ratio can be significantly increased by 50% to 60% by maintaining the design speed of 140 km/h. This approach can be used to determine the design speed for a given mass/power ratio.
Spiral Curve Lengths

- Spiral lengths calculated using spiral parameters (A) are not consistent with AASHTO and design software values
  - Result of rounding A values
- Issues associated with transition length formula
  - Number of lanes rotated
- Requires further review
Table 2.1.2.5  Superelevation and Minimum Spiral Parameters, $\alpha_{\text{max}} = 0.04 \text{ m/m}$

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
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</table>

Note: The spiral parameter values in this table have been converted from imperial values and rounded to the nearest 5 m increment. As a result, these values may not match those used in industry accepted geometric design software packages.

$\theta_{\text{max}} = 0.04$

Table 2.1.2.6  Superelevation and Minimum Spiral Parameters, $\alpha_{\text{max}} = 0.06 \text{ m/m}$

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</tbody>
</table>

Note: The spiral parameter values in this table have been converted from imperial values and rounded to the nearest 5 m increment. As a result, these values may not match those used in industry accepted geometric design software packages.

$\phi_{\text{max}} = 0.06$
Table 2.1.2.7: Super-elevation and Minimum Spiral Parameters, $\theta_{max} = 0.08$ mm

<table>
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<th>Design Speed (Km/h)</th>
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<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
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<td>2.5</td>
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<td>4.5</td>
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<td>0.08</td>
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</table>

Notes:
- $\theta_{max}$ is super-elevation.
- $\alpha$ is spiral parameter index.
- $\lambda$ is maximum value of $\alpha$.
- $\lambda_{min}$ is minimum value of $\alpha$.

Additional note:
The spiral parameter values in this table have been converted from imperial values and rounded to the nearest 5 m increment. As a result, these values may not match those used in industry accepted geometric design software packages.

\[ \theta_{max} = 0.08 \]
Parking Lot 1

- Examined as part of GDG Update
  - Intersection Chapter
    - Accommodating HOV and buses at intersections
    - Design vehicle guidance for Gap Acceptance
  - Design Exceptions
    - Lane width design flexibility
    - Accommodating AT
      - Accommodating cycling on existing roads
      - NACTO guide

- Examine as part of Roundabout Guide
  - LRT in roundabouts

Parking Lot 2

- Other topics for consideration:
  - Adoption of AASHTO SSD model
    - NCHRP 400
    - Vehicle deceleration/object heights
  - Rewrite Section 2.1.2.3 Spiral Curves
    - Clarify guidance offered to designers for facilities with 3 or more lanes
    - Consistency with AASHTO and design software
Request For Information

- Accommodating ATV's on structures (sight distance concerns)
  - Does Quebec have any guidance?

Questions