CARSP 2022 Conference

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Sudbury, Ontario

Instructions to Authors

- Use Microsoft Word for submission. If this proves impossible, please contact the conference organizers in order to obtain authorization to submit in some other form.
- Papers should not exceed 15 pages including all the text, illustrations, tables and references.
- Papers must not exceed a file size of 5 MB (and the file must not be compressed).
- Papers must be prepared according to the instructions provided in this document.
- Papers may be written in either English or French.
- Abstracts must be provided in both English and French.
- Papers must be prepared using a letter page format, 21.59 cm x 27.94 cm (8½"x11"), with 2.5 cm margins all around.
- The title must use bold 16 point Arial font.
- Headings, in capital letters, must use bold 14 point Arial font.
- Sub-headings must use bold 14 point Arial font.
- Text must be single spaced using 11 point Arial font and justified.
- Text, headings and sub headings must be flush with the left margin.
- Tables and figures must be inserted within the body of the text and centered on the page.
- Captions for both tables and figures should use bold 11 point Arial font and should be inserted below the table or the figure.
- Any footnotes must use 8 point Arial font.
- All units of measure and abbreviations must be in accordance with the International System of Units (SI).
- Papers for the general conference Call for Papers should be sent as an attached file by email to: info@carsp.ca. Papers entered into the Student Paper Competition, however, should be uploaded at the appropriate point on the Online Submission Form.

Title of the paper (Arial bold 16 points)

- Type the title of the paper centered between the margins.

Author(s) & affiliations (Arial bold 12 points)

- Leave two blank lines. Type the authors' names with authors' affiliations (university, institute or company name) below.

Abstract (Arial bold 14 points)

- Leave three blank lines. Type the heading Abstract.
- Leave one blank line and type the text of the abstract flush with the left margin. Use 11 point Arial font, single spaced and fully justified.

Résumé (Arial bold 14 points)

- Leave two blanks lines. Type the heading Résumé.
- Leave one blank line and type a French translation of the text of the abstract flush with the left margin. Use 11 point Arial font, single spaced and fully justified.

Sections (Arial bold 14 points)

- Leave two blank lines between sections.
- Type each section heading flush with the left margin.
- Leave one blank line. Type the text of each section flush with the left margin.
- Leave a single blank line between paragraphs in each section.
- For a list of the required sections for both paper streams, please refer to http://www.carsp.ca/carsp-conference/carsp-conference-2019/carsp-conference-2019-call-for-abstracts/

Subsections (Arial bold 14 points)

- Leave one blank line. Type the text of each section flush with the left margin.
- Leave a single blank line between paragraphs in each section.

Tables and figures

- All tables and figures (line drawings, graphs and pictures) should be inserted within the body of the text as close as possible to the text where they are mentioned.
- Make sure that the figures have sufficient contrast to be legible.
- Figures are numbered with Arabic numerals but distinctly from the table numbering.
- Figures and tables can cover the page width or only part of the space between margins however they are to be centered on the page.
- In order to keep captions and figures together when using Word, the captions should be placed in a text box grouped with the appropriate table or figure.

Equations

- Equations should be centered between the margins and numbered consecutively, the number being enclosed in parentheses to the right of the equation.

Footer

- Include the text which appears in the footer of this document, including the page number (#), using 9 point Arial font, single spaced, and centered, as a footer on each page of the paper.

References

- References, limited to those cited in the text, are numbered consecutively by order of appearance.
- Use 11 point Arial font, single spaced and fully justified.
- Callouts in the text should appear between square brackets using Arabic numerals. Reference numbers should be separated by a comma [1,3] when two non-consecutive references are cited, and by a hyphen when more than two consecutive references are cited [1-4].
- All references should follow the following model:
  1. the author's surname in capital letters followed by his/her initial(s); when references included more than six authors, only the first six should be listed, followed by "et al.";
  2. the title of the publication;
  3. the abbreviated title of the journal or the name of the editor if a book (in italic);
  4. the number of the volume and/or that of the issue or the name of the publisher if a book;
  5. the numbers of the first and last page of the paper or the place of publishing if a book;
  6. the year of publication.
- Leave one blank line between each reference.

Notes

- The following is an example of the **document format** and may be used as a template for your paper. The list of required content is listed on http://www.carsp.ca/carsp-conference/2020-joint-conference/joint-conference-2020-call-for-abstracts/#requirements. Use the following document for guidance with the formatting only.

Impact of Heavy Vehicles on Grade Crossing Safety - Conceptualization of a Design Tool

Michel Gou, P. Eng., M.Sc.A
École Polytechnique de Montréal

Olivier Bellavigna-Ladoux, ing.
Track Test Inc.

Abstract

As part of a study commissioned by Transport Quebec aimed at evaluating the impact of commercial vehicles on the safety of railway crossings, we tested various heavy vehicles (buses, straight trucks and tractor trailer combinations) in order to determine their acceleration and braking performances. The goal of these tests was to identify the typical braking and acceleration performances of classes of commercial vehicles used in the calculations of visibility triangles at grade crossings. Results then allowed us to develop a railway crossings design and verification tool to be integrated in the proposed Canadian RTD10 standard.

Résumé

Dans le cadre de ce projet réalisé à la demande de Transports Québec et visant à mesurer l'impact des véhicules lourds sur la sécurité aux passages à niveau, nous avons procédé à des essais pour mesurer les temps d'accélération et les distances de freinage de divers véhicules lourds (autobus, camions et tracteurs semi-remorques) typiques. L'objectif de ces essais était d'identifier les performances typiques en freinage et accélération de diverses classes de véhicules lourds utilisées dans le calcul des triangles de visibilité des passages à niveau. Les résultats obtenus ont ensuite été utilisés pour développer un outil de conception et de vérification des passages à niveau qui pourra être intégré à la nouvelle norme RTD10.

INTRODUCTION

There are 22,424 rail-highway grade crossings in Canada and even though, as shown in Table1, the number of collisions at grade crossings has been steadily decreasing over the past ten years, they still numbered 262 in the year 2000, causing 96 deaths and injuries to a further 71 individuals. Tardif [1] estimated that 17% of all grade crossings collisions involved a heavy vehicle and that many of these incidents resulted from visibility problems.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total number of collisions	386	407	386	379	390	380	366	307	273	282	262
Number of collisions involving commercial vehicles	54	53	35	55	47	65	53	49	33	49	46
% of collisions with commercial vehicles	13.9	13.0	9.0	14.5	12.0	17.1	14.4	15.9	12.0	17.3	17.5

Table 1 - Number of Collisions at Grade Crossings between 1990 and 2000

1. RDT-10 procedure for designing rail-highway crossings

As shown on the following figures *DRAFT RTD 10* defines a sight triangle for grade crossings without a grade crossing warning system. Figure 1 shows the minimum sight lines for drivers approaching a grade crossing.

In the case of a driver approaching a grade crossing it is possible to define a visibility triangle for which the first leg, defined as the stopping sight distance (SSD), is the distance required for drivers to bring a vehicle to a stop before a crossing if they see a train coming, in the case of a passive crossing, or if the light signals are activated, in the case of an active crossing. This distance is the sum of the distance travelled during the driver's perception and reaction time and the braking distance of the vehicle if the driver is travelling at the prescribed speed limit. The second leg must, at least, be equal to the distance travelled by the train (D_{ssd}), at normal speed, during the time it takes a heavy vehicle to cover, at its initial speed, the total of the stopping sight distance, crossing clearance distance and length of the vehicle.

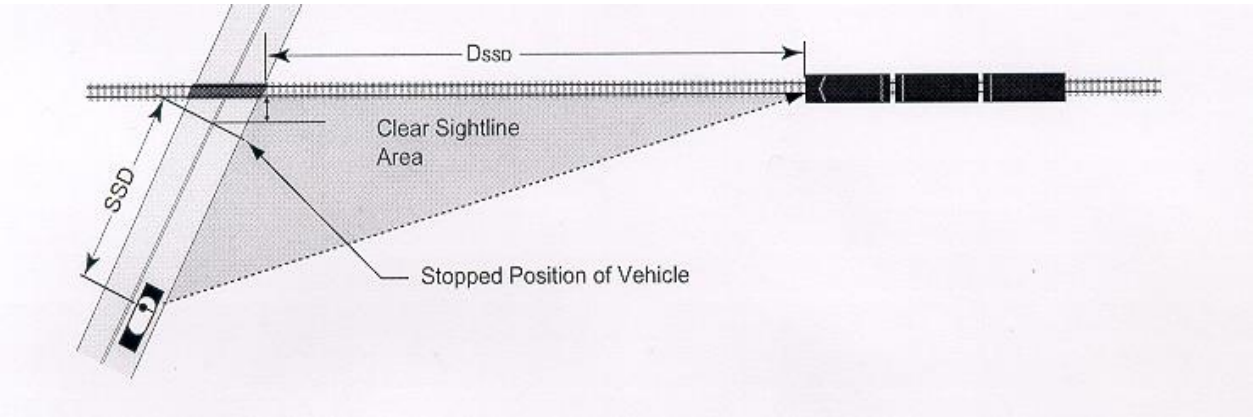

Figure 1 - Minimum sightlines for drivers approaching a grade crossing

2. Heavy vehicle acceleration and braking tests

In order to determine the lengths of the various sightlines required to insure safety requirements at grade crossings it is necessary to know, with a sufficient degree of accuracy, stopping distances and acceleration distances of various modern commercial vehicles together with driver behaviour at crossings. In order to obtain these values we conducted three series of tests in the order listed below:

- acceleration tests on dry asphalt surfaces over a maximum of 125 m, and on gravel roads over a maximum of 55 m;
- braking tests at 90 km/h on a wet asphalt surface;
- acceleration tests from a stop line to the clearance point of nine typical grade crossings.

A total of 21 commercial vehicles were subjected to testing. The first series of testing was performed on the test tracks of the “Centre de Formation en Transport Routier (CFTR)” located in Saint-Janvier, the second series of brake testing was conducted on the test tracks of PMG Technologies in Blainville.

2.1 Test vehicles

The Centre de Formation en Transport Routier (CFTR) made its fleet of commercial vehicles available for our use. This fleet of 58 tractors, 5 straight trucks and 67 trailers of various types provided us with a very large choice for selecting the test vehicles. In order to choose the best range of vehicles that most closely represented the composition of heavy vehicle traffic on Canadian roads, we defined a number of significant vehicle selection criteria. These criteria were chosen because they have the most impact on vehicle acceleration and braking performances [2]. In general, they included engine horsepower, transmission ratios, number of axles and gross vehicle weight. Since the tests needed to be representative of the worst performance that can be obtained on the road, the test vehicles were loaded to their full legal capacity.

$$\text{Engineforce} = \frac{\text{enginetorque} \times \text{reductionratio} \times \text{effectiveness}}{\text{wheelrollingradius}} \qquad (1)$$

CONCLUSIONS

By using conservative hypotheses, the mathematical acceleration model and the results from acceleration and braking tests have made it possible to develop a grade crossing design and verification tool that ensures the safety of the heavy vehicles that uses them. The first part of the tool consists of monograms of departure times that depend on the road profile, design vehicle chosen, crossing clearance distance and road condition or prohibition from changing gears. Methods for using the reference graphs are also proposed for tanker trucks.

REFERENCES

[1] TARDIF, L.P. & Associates Inc., Grade crossing contraventions and motor carrier safety assessment*, Technical report presented to Transport Canada*, Transportation Development Center, March 2001.

[2] HARWOOD, Douglas W., GLAUZ, William D., MASON John M. Jr. Truck characteristics for use in highway design and operation. *Federal Highway Administration Research Report,* 1990.

[3] CAIRD, J.K., CREASER, J.L., EDWARDS, C.J., DEWAR, R.E., A human factors analysis of highway-rail grade crossing occurrences in Canada, *Cognitive Ergonomics Research Laboratory*, Department of Psychology, University of Calgary, 112 p., September 2002.