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Geometric design consistency of multiple horizontal curves on two-lane rural highways

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Abstract

Safety on rural highways is of great concern as nearly two third of road fatalities are found to take place on such roads. High speed of vehicles is the characteristic of rural highways. Geometry is one of the factors that control the speed of vehicles and consequently, the crash occurrence. Alignment is one of the components of geometry and an abrupt change in the alignment is a leading cause for crashes in rural highways. Presence of a curve after a long tangent or a sharp curve after a flat curve is an example for inconsistency in the alignment. Such an alignment brings about unnecessary and unhealthy speed changes that may lead to crashes. Thus, a highway design can be evaluated based on consistency in geometry. Operating speed is the measure adopted for consistency evaluation in this study.

The objectives of this study are to develop operating speed models for different classes of vehicles at salient locations of multiple horizontal curves and to develop criteria for evaluating the geometric design consistency. Data of 30 sites were made use for this purpose. Multiple linear regression technique was adopted for modelling. Models were developed for the tangent section and middle of curved sections. Length of preceding tangent is the variable influencing operating speed at tangent. Radius and length of curve significantly influence operating speed at middle of first curve and radius of first and second curve influences operating speed at middle of second curve. Operating speed Deviation from Design speed (ODD) and Speed Reduction (SR) are the consistency measures and Equivalent Property Damage Only (EPDO) crashes is the safety measure used in the study for developing criteria. The criteria developed can be used to evaluate the curve as a single element, and as successive elements (combinations of tangent/curve or curve/curve). Alignment can then be classified as Good, Fair or Poor using these criteria, and it helps a designer to make suitable modifications in the design of a multiple horizontal curve from safety point of view.

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Keywords: Multiple horizontal curve; Operating speed; Speed reduction; Design consistency criteria

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T. H. Maze



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Geometric Design Consistency on High-speed Rural Two-lane Roadways National Cooperative Highway Research Program,2003 **Human Factors Guidelines for Road Systems** John L. Campbell,2012 This report completes and updates the first edition of NCHRP Report 600 Human Factors Guidelines for Road Systems HFG which was published previously in three collections The HFG contains guidelines that provide human factors principles and findings for consideration by and is a resource document for highway designers traffic engineers and other safety practitioners Foreword

Geometric Design of Roads Handbook Keith Wolhuter,2015-10-05 Explore the Art and Science of Geometric Design The Geometric Design of Roads Handbook covers the design of the visible elements of the road its horizontal and vertical alignments the cross section intersections and interchanges Good practice allows the smooth and safe flow of traffic as well as easy maintenance Geometric design is covered in d *Recent Roadway Geometric Design Research for Improved Safety and Operations* Marcus Brewer,2012 RB s National Cooperative Highway Research Program NCHRP Synthesis 432 Recent Roadway Geometric Design Research for Improved Safety and Operations reviews and summarizes roadway geometric design literature completed and published from 2001 through early 2011 particularly research that identified impacts on safety and operations

Traffic Safety and Human Behavior David Shinar,2017-06-22 This comprehensive 2nd edition covers the key issues that relate human behavior to traffic safety In particular it covers the increasing roles that pedestrians and cyclists have in the traffic system the role of infotainment in driver distraction and the increasing role of driver assistance systems in changing the driver vehicle interaction

Summary of Progress - National Cooperative Highway Research Program National Cooperative Highway Research Program,2009 **Motorcoach Override of**

Elevated Exit Ramp, Interstate 75, Atlanta, Georgia, March 2, 2007 National Transportation Safety Board,2008 The motorcoach then overrode the bridge rail rotated clockwise and fell 19 feet onto the southbound lanes of the interstate The motorcoach came to rest on its left side driver s side perpendicular to the southbound lanes of Interstate 75 Two southbound passenger vehicles received minor damage from debris as the motorcoach fell onto Interstate 75 none of the passenger vehicle occupants were injured Seven motorcoach occupants were killed the driver the driver s wife and five passengers Seven other passengers received serious injuries and 21 passengers received minor injuries Major safety issues identified in this accident include inadequate HOV traffic control devices inadequate motor carrier driver oversight lack of event data recorders on motorcoaches and lack of motorcoach occupant protection

Role and Application of Accident

Modification Factors in the Highway Design Process James A. Bonneson,Dominique Lord,2005 Recent Geometric Design Research for Improved Safety and Operations Kay Fitzpatrick,Mark Douglas Wooldridge,Joe Georges Bared,2001 TRB s National Cooperative Highway Research Program NCHRP Synthesis 299 Recent Geometric Design Research for Improved Safety and Operations reviews and summarizes selected geometric design research published during the 1990s particularly

research with improved safety and operations implication

Geometric Design Consistency on High-speed Rural Two-lane Roadways, 2003 *Horizontal Alignment Design Consistency for Rural Two-lane Highways* Raymond A. Krammes, 1995 *Highway Geometric Design Consistency Related to Driver Expectancy* C. J. Messer, 1981 *Highway Geometric Design Consistency Related to Driver Expectancy. Volume II: Research Report. Final Report* Carroll J. Messer, 1981 *Design Guidance for High-speed to Low-speed Transition Zones for Rural Highways* Darren J. Torbic, 2012

TRBs National Cooperative Highway Research Program NCHRP Report 737 Design Guidance for High Speed to Low Speed Transitions Zones for Rural Highways presents guidance for designing the transition from a high speed rural highway to a lower speed section typically approaching a small town The report includes a methodology for assessing these highway sections and a catalog of potential treatments for addressing problems Publisher s description

Median Intersection Design for Rural High-speed Divided Highways T. H. Maze, 2010 This report describes common safety issues at median intersections on rural divided highways and presents innovative geometric and operational treatments for addressing those issues Ten case studies illustrate how they have been applied in the field The report includes recommendations for modifications to the AASHTO A Policy on Geometric Design of Highways and Streets Green Book and the Manual on Uniform Traffic Control Devices MUTCD

Final Report for NCHRP Report 581, 2006 This document is the contractor s final report on the research activities used to develop NCHRP Report 581 Design of Construction Work Zones on High Speed Highways NCHRP Report 581 explores an approach for the selection of an appropriate construction work zone type offers suggested guidance for the design of geometric features including horizontal and vertical alignment cross sectional features and barrier placement and examines a variety of ancillary features such as drainage systems lighting and surface type As part of the research associated with this activity a work zone prediction model and user s guide were created to help estimate free flow vehicle speeds through two types of construction work zones on four lane freeways single lane closures and median crossovers

Geometric Treatments for Reducing Passing Accidents at Rural Intersections on Two-lane Highways. Volume II - Description of the Computerized Data Base. Final Report M. R. Jr Parker, 1983 *Level of Service of Two-lane Rural Highways with Design Speeds Less Than 60 Mph* Jan L. Botha, Edward C. Sullivan, Xiaohong Zeng, 1992

A Possible Design Procedure to Promote Design Consistency in Highway Geometric Design on Two-lane Rural Roads, 1988 *A Policy on Geometric Design of Rural Highways*, 1965 American Association of State Highway Officials, 1966

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