7th International Symposium

Heavy Vehicle Weights & Dimensions

program & abstracts

Challenges in the 21st century

rium Technical University, Delft, The Netherlands

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Naam lezer	Paraaf	Datum

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The 7th International Symposium Heavy Vehicle Weights & Dimensions is an intercontinental forum for researchers, policy makers and industry leaders in the field of freight transportation by road. The specific goal of this symposium is to bring together the worlds of vehicle technology, vehicle-infrastructure interaction, safety, regulations and policy and to listen and to discuss the challenge of economic, safe and environmental friendly transport in the 21st century.

Organising Committee:
Ir.Ing. Boudewijn Hoogvelt
TNO Automotive,
Delft, The Netherlands

Ing. Ronald Henny
Ministry of Transport, Public Works and Water Management,
Road and Hydraulic Engineering Institute,
Delft, The Netherlands

Preface

On behalf of the International Forum for Road Transport Technology, we are indebted to TNO Automotive and The Road and Hydraulic Engineering Institute of The Dutch Ministry of Transport, Public Works and Water Management for hosting our seventh international symposium. What better location than The Netherlands, with leading edge road transport and intermodal practices already in place?

The Forum has been fortunate to sponsor previous successful symposia in North America, Europe and Asia Pacific, fostering important research into heavy vehicle behaviours affecting infrastructure and safety. While many issues confront the road transport industry in all our countries – with important challenges of reducing traffic accidents, congestion and emissions and maintaining a skilled workforce – it is vital to focus on the role of technology in solving some of these problems.

Perusal of the program for our seventh symposium reveals that the research is now being put into practice. In this important stage of innovation in road transport and its regulation, it is even more critical for us to come together to exchange, monitor and inspire.

It is particularly pleasing to see that landmark international scientific collaborations on infrastructure effects will be presented at this symposium, along with new scientifically-based methods of truck regulation which are becoming dynamic and targeted rather than static and monolithic.

On behalf of the International Forum for Road Transport Technology Board, I welcome all members of the Forum and colleagues from around the world to this unique gathering generously supported by transport agencies and companies of The Netherlands.

Dr. Peter Sweatman
President
International Forum for Road Transport Technology

Acknowledgements

This book could not have been published without the input of papers for the '7th International Symposium Heavy Vehicle Weights & Dimensions'. We would like to express our sincere appreciation to the authors and co-authors of the papers.

We are also particularly grateful for the support, review effort and advice of the Technical Committee:
Dr. Reto Cantieni, Prof. dr. David Cebon, Ir. Peter de Coo, Dr.-ing. Wolf Hahn,
Dr. Bernard Jacob, Drs. ir. Peter van der Koogh, Anders Lundström, Prof. dr. ir. Andre Molenaar,
Prof. dr. ir. Joop Pauwelussen, Christophe Penant, Dr. John de Pont, Dr. Peter Sweatman, Ir. Henk van der Weide,
Chris Winkler, and John Woodrooffe.

We are also very grateful to the following organisations for sponsoring the symposium.

Scania Trucks
SE-15187 Södertälje, Sweden

National Road Transport Commission
P.O. Box 13105, Law Courts, Victoria 8010, Australia

The European Vehicle Passive Safety Network
p.a. TNO Automotive, Crash Safety Centre
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RAI Assosiation; Special Vehicles department
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TNO Automotive
P.O. Box 6033, NL-2600 JA Delft, The Netherlands

Contents

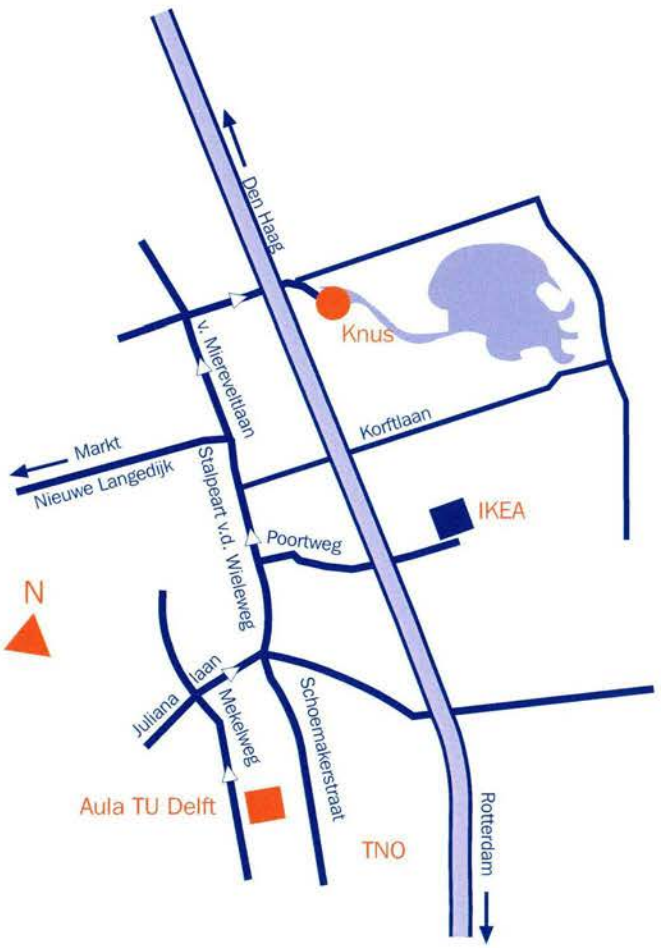
Barbeque & Games on Monday, June 17

On a beautiful spot in Delft you will find "Knus". Knus has been chosen for our informal dinner because it is located at the waterfront of a nice park called "de Delftse Hout".

How to get there

- By bus; from the central station of Delft take bus 60 or 62. Leave the bus at bus stop "Tweemolentjeskade", under the bridge turn right. You will see a parking lot were you can follow the sign to Knus.
- By taxi; takes about ten minutes
- By foot (from the market place app. 20 min.); Nieuwe Langedijk, over the bridge, then turn left v. Miereveltlaan, turn right Tweemolentjeskade, under the bridge turn right. You will see a parking lot were you can follow the sign to "Knus".
- On special request it is possible to go to "Knus" by special transport. Please contact the registration desk.

Dress code: informal



Dinner on Wednesday, June 19

Dinner will take place in an old farmer house with three haystacks named "de drie hooibargen" in Zoetermeer. To get there a bus of 25 metres long will transport you directly after the technical visit.

Technical Visit

Wednesday afternoon, June 19

The technical visit will be held on The TNO 'Zuidpolder' area, a five minutes walk from the University Auditorium where the symposium takes place.
Coffee, tea and other refreshments will be served in one of the TNO Automotive laboratories.

Six long and special vehicles will be presented:

- A Dutch B-double with a two special trailers. Each trailer can be separated into two elements;
- A long Nordic vehicle combination;
- The 'Simon Loos' RoRo (Roll-on/Roll-off) trailer; a quick loading and unloading system;
- A special trailer from Nooteboom;
- The TNO Tyre Test Laboratory (Truck-full-trailer);
- A special tanker vehicle;
- The GVU 25 meter bus (this bus will take us to the symposium dinner).

Please feel free to walk around these vehicles and ask questions which come up in your mind.

In groups of twenty people guided by TNO staff we will demonstrate:

- An automated goods transport vehicle. This vehicle has been developed for Underground Logistic Systems (ULS). It uses a magnet grid to position itself in combination with odometry. The vehicle will drive a pre-determined path on the test track with a speed of up to 20 km/h;
- Vehicle-to-vehicle communication technology, which has a high potential for increasing traffic safety, transport efficiency, driving comfort and for decreasing fuel consumption and pollution. Three passenger cars have been instrumented with actuators, sensors and communication technology. Anticipation by communication is demonstrated in an early-brake warning scenario and Stop&Go traffic.

The Crash Safety Centre of TNO Automotive would like to demonstrate their facilities in co-operation with VTC.

A special 25 meter, three elements GVU bus will take us to the symposium dinner.

PROGRAM

Sunday, June 16, 2002

Registration in Grand Café Verderop	16:00	18:00
Reception in Grand Café Verderop	18:00	20:00

Monday morning, June 17, 2002

	Registration at desk	8:00	11:00

Presentation No.		Begin	End
110	**Opening Session**	**9:00**	**10:00**
	Session Chairman: Boudewijn Hoogvelt		
111	Opening presentation TNO Automotive	9:00	
	Jan Dekker		
112	Opening presentation DWW	9:10	
	Luuk Bosch		
113	Opening presentation President	9:20	
	'International Forum for Road Transport Technology'		
	Peter Sweatman		
114	General information	9:30	
	Boudewijn Hoogvelt		
115	A RAIL-ROAD HYBRID VEHICLE: DYNAMIC STABILITY ANALYSIS	9:35	
	Chris Verheul		
Coffee break		10:00	10:30
120	**Session Chairman: John Aurell**	**10:30**	**12:15**
121	EFFECT OF SURFACE ROUGHNESS ON TRUCK DYNAMIC LOADING AND PAVEMENT DAMAGE	10:30	
	Karim Chatti		
122	SASKATCHEWAN'S CENTRAL TIRE INFLATION SYSTEMS (CTIS) RESULTS FROM THE YEAR 2000 FIELD TRIAL	10:55	
	George Stamatinos		
123	PUTTING THE DRIVER IN THE VEHICLE PERFORMANCE EQUATION WITH ON-ROAD TESTING	11:20	
	Peter Sweatman		
124	APPLYING PERFORMANCE STANDARDS TO THE AUSTRALIAN HEAVY VEHICLE FLEET	11:45	
	John Edgar		
	Review and discussion	12:10	
	John Aurell		
LUNCH		12:15	13:30

Monday afternoon, June 17, 2002

Parallel session

130	**Workshop Performance Based Standards (PBS)**	**13:30**	**17:15**
	Session Chairman: John Egdar		
131	PERFORMANCE BASED STANDARDS IN NORTH AMERICA *John Woodrooffe*	13:30	
132	ASIA-PACIFIC PERFORMANCE BASED STANDARDS OVERVIEW *Peter Sweatman*	13:55	
133	PERFORMANCE BASED STANDARDS IN EUROPE *Anders Lundström*	14:20	
134	OECD PERFORMANCE BASED STANDARDS EXPERT GROUP REPORT *Tony Wilson*	14:45	
135	SETUP OF THE WORKSHOP *John Egdar*	15:10	
Coffee break		15:20	15:45
136	DISCUSSING THE STATEMENTS *John Edgar*	15:45	

Parallel session

140	**Session Chairman: Ronald Henny**	**13:30**	**17:10**
~~141~~	RESEARCH ON THE PERFORMANCE OF THE HGV'S IN THE MAJOR GREEK ROAD NETWORK USING WIM TECHNOLOGY DWW WIM-UID *George Mintsis*	13:30	
142	IMPACT FACTORS ON MEDIUM SPAN BRIDGES DUE TO MULTIPLE VEHICLE PRESENCE *Sean Brady*	13:55	
143	MANAGING ROAD TRAIN ACCESS IN A LARGE CITY: PERTH, WESTERN AUSTRALIA *Bob Peters*	14:20	
144	REVERSE ENGINEERING OF A TRANSIT BUS FOR F.E. CRASHWORTHINESS ASSESSMENT *Jerry Wekezer*	14:45	
	Review and discussion *Ronald Henny*	15:10	
Coffee break		15:15	15:45
145	INSTRUMENTED VEHICLE AND ITS USE FOR CALIBRATION OF WIM-SYSTEMS *Matti Huhtala*	15:45	
146	ROAD USER CHARGING FOR HEAVY GOODS VEHICLES *Nii Amoo Dodoo*	16:10	
147	TRANSLATION OF MEASURED VEHICULAR WEIGHTS INTO DESIGN LOADS TO BE USED FOR BRIDGE ENGINEERING *Sten de Wit*	16:35	
	Review and discussion *Ronald Henny*	17:00	
Barbeque & Games		18:30	23:00

Tuesday morning, June 18, 2002

	Registration at desk	8:00	11:00
210	**Session Chairman: Joop Pauwelussen**	**8:20**	**10:10**
211	PERFORMANCE EVALUATION OF THE TRACKAXLE(TM) STEERABLE AXLE SYSTEM *Hans Prem*	8:20	
212	COMPUTER MODELING OF TRANSIT BUSES IN ASSESSING ROAD DAMAGING POTENTIAL *Bohdan Kulakowski*	8:45	
213	ON DEVELOPMENT OF THE SUPER-SINGLE DRIVE (GMD) TYRE *Kenshiro Kato*	9:10	
214	FUTURE OF THE CHASSIS ELECTRONICS IN COMMERCIAL VEHICLES *Laszlo Palkovics*	9:35	
	Review and discussion *Joop Pauwelussen*	10:00	
Coffee break		10:10	10:40
220	**COST 334 Workshop "Effect of Wide Single and Dual Tyres"** **Session Chairman: Erik Vos**	**10:40**	**10:55**
221	EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES -INTRODUCTION AND AIM OF THE ACTION *Rod Addis*	10:40	
230	**COST 334; Viewpoints of the Industry** **Session Chairman: Erik Vos**	**10:55**	**12:15**
231	ETRTO's VIEWPOINT ON WIDE BASE SINGLES AND OTHER FUTURE TRUCK TYRE TYPES *Leon Chession*	10:55	
232	MICHELIN VIEWPOINT ON WIDE BASE SINGLES AND OTHER FUTURE TRUCK TYRE TYPES *Christophe Penant*	11:10	
233	CONTINENTAL's VIEWPOINT ON WIDE BASE SINGLE AND OTHER FUTURE TRUCK TYRE TYPES *Andreas Faber*	11:25	
234	SOME VIEWS OF THE TRUCK INDUSTRY ON WIDE SINGLE TYRES ON DRIVING AXLES *John Aurell*	11:40	
235	DAIMLERCHRYSLER's AND BRIDGESTONE's VIEW ON WIDE SINGLE TYRES ON DRIVING AXLES *Karsten Wehner / S. Lamp*	11:52	
236	DISCUSSION *Erik Vos*	12:04	
LUNCH		12:15	13:30

Tuesday afternoon, June 18, 2002

Parallel session

240	**COST 334 Workshop; Presentation of the results - I**	**13:30**	**15:30**
	Session Chairman: Rod Addis		
241	EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - QUESTIONS *Erik Vos*	13:30	
242	EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - RUTTING TESTS AND RESULTS *Arthur van Dommelen*	13:45	
243	EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - ANALYSIS *Jacob Groenendijk*	14:00	
244	EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - ANSWERS *Erik Vos*	14:15	
245	DISCUSSION *Klaus-Peter Glaeser*	14:30	
246	WIDE BASE SINGLE TYRES OR DUAL TYRES: ENVIRONMENTAL ASPECTS *Wolf Hahn*	14:40	
247	WIDE BASE SINGLE TYRES OR DUAL TYRES: 'VEHICLE BEHAVIOUR AND SAFETY' *Andreas Faber*	15:00	
248	DISCUSSION *Rod Addis*	15:20	

Coffee break 15:30 15:50

Parallel session

250	**COST 334 Workshop; Presentation of the results - II**	**15:50**	**17:15**
	Session Chairman: Andrew Cook		
251	EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - VEHICLE OPERATION COSTS *Klaus-Peter Glaeser*	15:50	
252	CONSEQUENCES OF USING DIFFERENT TYRE TYPES, EUROPEAN SCENARIO *Christophe Penant*	16:10	
253	EFFECTS OF WIDE SINGLE AND DUAL TYRES - RELEVANCE OF LEGISLATION AND STANDARDS *Andrew Cook*	16:30	
254	EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - SUMMARY AND CONCLUSIONS *Erik Vos*	16:50	
255	DISCUSSION *Andrew Cook*	17:05	

Tuesday afternoon, June 18, 2002

Parallel session

260	**Session Chairman: Bohdan Kulakowski**	**13:30**	**17:10**
261	INCLUDING PERFORMANCE MEASURES IN DIMENSIONS AND MASS REGULATIONS *John de Pont*	13:30	
262	ROAD ROUGHNESS AND IT'S EFFECTS ON THE INFRASTRUCTURE *Bernhard Steinauer*	13:55	
263	EVALUATION OF THE EFFECTS OF HEAVY VEHICLES ON BRIDGES FATIGUE *Bernard Jacob*	14:20	
264	THEORETICAL TESTING OF A MULTIPLE-SENSOR BRIDGE WEIGH-IN-MOTION ALGORITHM *Arturo González*	14:45	
	Review and discussion *Bohdan Kulakowski*	15:10	
Coffee break		15:15	15:50
265	TRAFFIC CHARACTERISATION IN FLEXIBLE PAVEMENT DESIGN *Andrew Collop*	15:50	
266	NEW PAVEMENT ROUGHNESS THRESHOLDS TO REDUCE DYNAMIC TRUCK LOADING *Karim Chatti*	16:15	
267	ADHESION UTILISATION AND COMPATIBILITY OF HEAVY VEHICLE COMBINATIONS *Ferenc Finszter*	16:40	
	Review and discussion *Bohdan Kulakowski*	17:05	

No evening program

Wednesday, June 19, 2002

	Registration at desk	8:00	10:00
310	**Session Chairman: David Cebon**	**8:20**	**12:05**
311	COMPATIBILITY IN TRUCK TO CAR FRONTAL IMPACTS *Lars Forsman*	8:20	
312	TRUCK TYRE WEAR ASSESSMENT AND PREDICTION *Henk Lupker*	8:45	
313	NOVAB AXLE LOAD CALCULATION PROGRAM - CALCULATE THE OPTIMUM LOAD POSITION AND PREVENT OVERLOADING *Han Rekers*	9:10	
314	A PROFILE BASED TRUCK DYNAMIC LOAD INDEX (DLI) *Karim Chatti*	9:35	
	Review and discussion *David Cebon*	10:00	
Coffee break		10:10	10:40
315	PRODUCTIVITY OPPORTUNITIES WITH STEERABLE AXLES *Peter Sweatman*	10:40	
316	PARAMETER SENSITIVITY OF THE DYNAMIC ROLLOVER THRESHOLD *Erik Dahlberg*	11:05	
317	DYNAMIC INTERACTION OF VEHICLES AND BRIDGES *Hans Prem*	11:30	
	Review and discussion *David Cebon*	11:55	
LUNCH		12:05	13:30
Parallel session			
320	**European Heavy Vehicles** **Session Chairman: Anders Lundström**	**13:30**	**15:45**
321	FUTURE EUROPEAN HEAVY GOODS VEHICLES *Christophe Penant*	13:30	
322	INTRODUCING LONGER AND OR HEAVIER VEHICLE COMBINATIONS (LZV'S) IN THE NETHERLANDS, A LONG AND HEAVY PROCESS *Chris Kampfraath*	13:55	
323	NORDIC VS. CENTRAL EUROPEAN VEHICLE CONFIGURATION; FUEL ECONOMY, EMISSIONS, VEHICLE OPERATING COSTS AND ROAD WEAR *Olavi Koskinen*	14:20	
324	DESIGN AND OPERATIONAL CONSIDERATIONS TO ACCOMMODATE LONG COMBINATION VEHICLES AND LOG HAUL TRUCKS ON RURAL HIGHWAYS IN ALBERTA, CANADA *John Morrall*	14:45	
325	IMPROVED PERFORMANCE OF EUROPEAN LONG HAULAGE TRANSPORT (EXTRA) *Rolf Nordström*	15:10	
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Parallel session

330	**Session Chairman: Peter de Coo**	**13:30**	**15:45**
331	ABNORMAL LOADS SUPER ROUTES – A STRATEGIC INVESTMENT FOR SOUTH AFRICA'S ECONOMY *Paul Nordengen*	13:30	
332	WHEEL LOAD MEASUREMENT, WIM, ACCURACY, TOP TRIAL *Wolfram Griesbach*	13:55	
333	HEAVY VEHICLE WHEEL SEPARATIONS: EXPLORING THE CAUSES John Woodrooffe	14:20	
334	COMPARISON OF THREE PROGRAMS FOR SIMULATING HEAVY-VEHICLE DYNAMICS *Hans Prem*	14:45	
335	IMPACTS OF DIFFERENT JUNCTION TYPES ON HEAVY DUTY VEHICLES *Jussi Sauna-aho*	15:10	
	Review and discussion *Peter de Coo*	15:35	
	Coffee break at TNO area 'Zuidpolder'	15:45	16:00
340	**Technical Visit**	**16:00**	**18:30**
	Bus tour to the dinner environment in a 25 m bus	18:30	19:00
	Dinner	19:00	23:00

Thursday morning, June 20, 2002

Parallel session

410	**Session Chairman: Peter Sweatman**	**9:00**	**10:50**
411	REVIEW OF TRUCK AND DOG TRAILER OPERATIONS OVER 42.5 TONNES GROSS VEHICLE MASS *Barry Hendry*	9:00	
412	COMPARATIVE PERFORMANCE OF SEMI-TRAILER STEERING SYSTEMS *Brian Jujnovich*	9:25	
413	THE FIRST WIM SYSTEM DESIGNED IN POLAND *Ryszard Sroka*	8:20	
414	THE EFFECT OF MASS LIMIT CHANGES ON THIN-SURFACE PAVEMENT PERFORMANCE *John de Pont*	10:15	
	Review and discussion *Peter Sweatman*	10:40	

Parallel session

420	**Session Chairman: John Woodrooffe**	**9:00**	**10:50**
421	ADVANCES IN CRASH PROTECTION INVOLVING HEAVY GOOD VEHICLES *Jac Wismans*	9:00	
422	DYNAMIC STABILITY OF DOUBLE B-DOUBLE ROAD TRAINS *Hans Prem*	9:25	
423	TANKER TRUCKS IN THE CURRENT ACCIDENT SCENE AND POTENTIALS FOR ENHANCED SAFETY *Johann Gwehenberger*	9:50	
424	DYNAMIC INCREMENT FACTOR IN MODULAR EXPANSION JOINTS OF BRIDGES UNDER HEAVY TRAFFIC LOADING *Johan Maljaars*	10:15	
	Review and discussion *John Woodrooffe*	10:40	

Coffee break	10:50	11:20

430	**Closing Session** **Session Chairman: Boudewijn Hoogvelt**	**11:20**	**12:30**
431	Forum discussion *David Cebon*	11:20	
432	Review of the symposium *Peter Sweatman*	11:50	
433	Finishing the symposium *Boudewijn Hoogvelt*	12:15	

LUNCH	12:30	14:00

End of Symposium

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Abstracts

Presentation: 115

A RAIL-ROAD HYBRID VEHICLE: DYNAMIC STABILITY ANALYSIS

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Presented by: Chris Verheul

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Biography

Chris Verheul is a Mechanical Engineer with a degree in Vehicle Engineering of the Delft University of Technology. He worked for TNO Automotive from 1990 until 1995, where he worked on the development and use of mechanical simulation models for vehicle dynamics simulations. In 1996 he left TNO to start the company Sayfield International which has been the Dutch ADAMS agency since the beginning of 1997. Mr Verheul is supporting and using the ADAMS software as an independent consultant and as an engineer, working free-lance for the Delft University.

Joseph Evers is professor on Logistics Technology at the Delft University of Technology. He studied mechanical engineering, mathematics and econometrics. From 1976 to 1985 he was professor on Operations Research at Twente University. From1985 to 1990 he was professor on Operation Research at Delft University of Technology and from then professor on Logistics Technology. From 1992 to 1997 he was founding scientific director of TRAIL Research School. He was involved in many industrial R&D-projects on intelligent transport systems.

Abstract

Keywords: road/rail vehicles, lateral dynamics, ITS

The paper presents an intelligent logistic system for the area of the Rhine Delta as an alternative for, and complement to, the conventional rail and road transport systems. The system facilitates rail-road hybrid vehicles, which, in addition to the usual road wheels sets, are equipped with rail wheel sets. The road wheels are actively steered, are equipped with brakes and possibly also with drives. The lateral control is electronic. The self-centring rail wheel sets can move vertically. In the low position they run on rails to reduce the support forces on the road wheels, thus significantly reducing the vehicle rolling resistance. The rail wheels have no flanges and are not used for braking, ensuring a low noise production. In this way, the system combines the advantages of road transport (speed, flexibility, fast braking) and of rail transport (low energy consumption).

The mechanical engineering aspects concern the mechanical behaviour of road-rail hybrid vehicles and the rail wheels. The dynamics of the vehicle are modelled and analysed in the software simulation package ADAMS. The results of simulation runs are compared to a model of a reference vehicle with identical mechanical and control parameters but without the rail wheels fitted. The simulations show that the system is robust and stable for the desired operating speed (approximately 55 km/h) of the system. In a succeeding phase, the suspension of the rail wheels and the wheel control system will be designed in detail. The design will be tested with the aid of a specific simulation model.

Notes

Presentation: 121

EFFECT OF SURFACE ROUGHNESS ON TRUCK DYNAMIC LOADING AND PAVEMENT DAMAGE

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Biography

Dr. Chatti holds B.Sc. and M.Sc. degrees in Civil Engineering from Michigan State University, and a Ph.D. degree in Civil Engineering from the University of California at Berkeley (Dec. 1992). He is currently an Assistant Professor in the Department of Civil and Environmental Engineering at Michigan State University. Dr Chatti's research interests are in the areas of pavement analysis and design, rehabilitation and maintenance of pavements, non-destructive testing of pavements, pavement performance, and truck-pavement interaction. He has been involved in some fifteen research projects in the areas of pavement engineering and materials, eight of which as Principal Investigator, and has authored some twenty research papers. Dr. Chatti is a member of TRB and ASCE. His other professional experience includes serving as a consultant to Morrison Knudsen Corporation and the National Highway Authority of Pakistan for the N5 Highway project linking Karachi and Islamabad (1996) and working as Principal Engineering Consultant for STUDI Engineering (Tunisia, 1997).

Abstract

Keywords: roughness, pavement damage, truck dynamic load

In this paper, more than 1,000 pavement sections from ninety-seven projects in Michigan were analyzed to investigate the interaction between pavement surface roughness and distress. The main hypothesis of this research is that an increase in roughness leads to higher dynamic axle loads, which in turn can lead to a tangible acceleration in pavement distress. If this relationship is established, then it will be possible to plan a preventive maintenance (PM) action to smooth the pavement surface. Such a PM action is bound to extend the service life of the pavement by several years. The objectives of this research were to: 1) test the above hypothesis; 2) develop roughness thresholds; and 3) determine the optimal timing of the PM action. The selected projects include all pavement types. The Ride Quality Index (RQI) and Distress Index (DI) were used as measures of surface roughness and distress, respectively. The analysis showed good relationships between DI and RQI for rigid and composite pavements; however for flexible pavements there was significant scatter. A logistic function was used to fit the data. Roughness thresholds were determined as the RQI-values corresponding to peak acceleration in distress. In addition, actual surface profiles of 335 in-service pavement sections from thirty-seven projects were used to generate dynamic axle load using the TruckSim® truck simulation program. Good correlations between dynamic axle load and RQI were obtained. Based on these relationships, roughness threshold values were determined for all pavement types. Rigid pavements had higher RQI threshold values than flexible and composite pavements. The results agreed reasonably with those obtained using MDOT PMS distress data.

Notes

Presentation: 122

SASKATCHEWAN'S CENTRAL TIRE INFLATION SYSTEMS (CTIS) RESULTS FROM THE YEAR 2000 FIELD TRIAL

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Presented by: George Stamatinos

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Biography

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Abstract

Keywords: CTIS, B-train trucks, Saskatchewan, field rails

This paper documents the results of the Central Tire Inflation System (CTIS) field experiments conducted in Saskatchewan in the summer of 2000 as a follow-up to a field demonstration of CTIS technology conducted in the fall of 1999. A paper had been presented on the results from the 1999 field demonstration at the 6th International Symposium on Heavy Vehicles and Dimensions held in Saskatoon, CANADA. The objective of the 2000 field experiment was to investigate the potential benefits of CTIS technology in more detail and specifically to determine to what extent the technology can offset incremental road damage when hauling in excess of regulated weights. The experiment used the same truck configurations as in the 1999 field demonstration trails. The research was sponsored by Saskatchewan Highways and Transportation, Manitoba Highways and Government Services, Agriculture and Agri-food Canada through the Canada Agri-Infrastructure Program (CAIP) and the Saskatchewan Wheat Pool. The author wishes to acknowledge and thank the Rural Municipality of Big Quill for allowing the use of their roads for the experiment. The experiments were conducted in the vicinity of Dafoe, Saskatchewan and comprised of two separate test sites, one site to assess the benefit of CTIS for reducing road damage at equal gross vehicle weights and the other to assess whether the use of CTIS can offset any incremental damage caused by hauling at higher than regulation weights.

Notes

Presentation: 123

PUTTING THE DRIVER IN THE VEHICLE PERFORMANCE EQUATION WITH ON-ROAD TESTING

Author/ co-author(s): Peter Sweatman
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Biography

Peter is MD of Roaduser Systems Pty Ltd and Chairman of ARTSA (Australian Road Transport Suppliers Association).
Roaduser Systems are truck trailer systems engineers well known for innovation in Australia and in other countries.
Dr Sweatman is currently chair of Standards Australia Committee ME/53 (Heavy Road Vehicles) and is active on other committees related to his research. He was elected a Fellow of the Academy of Technological Sciences and Engineering in 1997 and is currently a member of the Driver Education Centre of Australia (DECA) Board of Directors.
Dr Sweatman is currently President of the International Forum for Road Transport Technology and is a Fellow of the Society of Automotive Engineers of Australasia (SAE-A) and served as a member of the SAE-A National Council & Executive, as well as chairing the SAE-A National Conferences Committee. In 1992, Dr Sweatman was invited to join the US Transportation Research Board's Vehicle Size and Weight Committee and he still serves on that committee.
Dr Sweatman was invited to present evidence to the US National Transportation Safety Board's Hearings on Truck and Bus Safety, Washington DC, Nashville and New Orleans in 1999-2000.

Abstract

Keywords: heavy vehicle handling, steering control

The engineering performance of heavy vehicles is a critical element in their access to road systems. Increasingly, vehicle performance must be assessed before permits are granted, or regulations are changed, to allow more productive vehicles to operate on public roads. This is especially true for the larger and heavier vehicle combinations.

Heavy vehicle performance is usually assessed in open-loop manoeuvres under certain sets of conditions. Extensive use of computer simulation has been made for this purpose. However, in order to adequately assess larger vehicle combinations, or problem vehicles, it is often necessary to carry out dynamic testing under typical on-road operating conditions. This allows measurement of vehicle performance plus certain aspects of driver steering performance.

This paper will present the results of several recent studies carried out by Roaduser Systems where both vehicle and driver performance have been measured under actual on-road operating conditions. Results will be presented for a range of vehicle configurations from tractor-semi-trailers through double trailer combinations (including B-doubles) to multi-trailer combinations.

The test results are presented in such a way as to encourage benchmarking of on-road vehicle performance and to encourage the use of some common measures for comparing vehicles from around the world.

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Presentation: 124

APPLYING PERFORMANCE STANDARDS TO THE AUSTRALIAN HEAVY VEHICLE FLEET

Author/ co-author(s): John Edgar
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Biography

John Edgar John Edgar is Operations Director of the National Road Transport Commission based in Melbourne. John's team is responsible for delivering a package of road transport reform initiatives.

He was previously with the New Zealand Land Transport Safety Authority where he managed road safety engineering and rail safety. John's responsibilities included policy development and the provision of rules, regulations, standards and guidelines to improve road engineering and vehicle safety. John played a leading role in successfully implementing the safety management system that regulates the safety performance of all railway operations in New Zealand.

He has 35 years experience in transport engineering and policy and holds a postgraduate degree from the University of New South Wales.

His special interests include safety performance standards for heavy vehicles, Intelligent Transport Systems, and the application of Safety Management Systems.

Abstract

Keywords: Regulation, vehicles, heavy, standards, performance, Australia

In 1999 the National Road Transport Commission (NRTC) and Austroads initiated a major joint project to develop Performance Based Standards (PBS) for heavy vehicle regulation in Australia and New Zealand.

This paper discusses the principles that form the foundations of PBS and the process that will be followed in determining how vehicles can operate under the system. The benefits of moving to Performance Standards and the key issues in implementing a PBS approach are discussed.

A set of 25 proposed performance standards were developed against which the Australian heavy vehicle fleet was tested. Fifteen of these measures have been selected for further development and implementation.

This paper reviews a large body of work being undertaken over a three-year period. A number of reports published by the NRTC provide in-depth technical background on specific issues discussed here; policy principles, selecting and setting performance standards, and assessing computer simulation models. These papers maybe accessed through the NRTC Website (www.nrtc.gov.au), where more information on the wider project may also be obtained.

Notes

Presentation: 131

PERFORMANCE BASED STANDARDS IN NORTH AMERICA

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Biography

Mr. Woodrooffe is Principal of Woodrooffe & Associates Incorporated, an engineering consultancy dedicated to large truck safety. He is also President of Safety Dynamics Incorporated; a company dedicated to the development of enhanced crash data recording and analysis tools. His expertise is in the area of heavy vehicle safety, stability, control and transport productivity. He was principal researcher to the 1986 Canadian Heavy Vehicle Weights and Dimensions study which evolved the first Performance Based Standards used to develop Canadian regulations.

Abstract

Keywords: vehicles, heavy, standards, performance, safety

The HVWD conference series began in 1986 as part of the Canadian Vehicle Weights and Dimensions Study. This study produced the first set of performance measures dedicated to the assessment of large vehicle safety performance in North America. These standards were used to shape a set of national weight and dimension regulations currently in use today. The performance measures are also used by some jurisdictions as screening tools to determine if special purpose vehicles have appropriate performance characteristics or to optimise their safety performance through design.

This discussion will focus on the development of these performance measures, their current use and future prospects for performance-based systems in North America.

Notes

Presentation: 132

ASIA-PACIFIC PERFORMANCE BASED STANDARDS OVERVIEW

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Biography

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He is currently chair of Standards Australia Committee ME/53 (Heavy Road Vehicles) and is active on other committees related to his research. Peter was elected a Fellow of the Academy of Technological Sciences and Engineering in 1997. He is currently a member of the Driver Education Centre of Australia (DECA) Board of Directors and President of the International Forum for Road Transport Technology.
Dr Sweatman is a Fellow of the Society of Automotive Engineers of Australasia (SAE-A) and served as a member of the SAE-A National Council & Executive, as well as chairing the SAE-A National Conferences Committee.
In 1992, Dr Sweatman was invited to join the US Transportation Research Board's Vehicle Size and Weight Committee and he still serves on that committee.
Dr Sweatman was invited to present evidence to the US National Transportation Safety Board's Hearings on Truck and Bus Safety, Washington DC, Nashville and New Orleans in 1999-2000

Abstract

Keywords: performance based standards, vehicle limits

This presentation will review the current status, and future prospects for, Performance Based Standards (PBS) in the Asia-Pacific region. PBS has a growing place in the regulation and permitting of heavy vehicles and in the review of prescriptive size and weight rules.
Australia is in the process of developing a comprehensive, explicit, national PBS regime which has the potential to provide an alternative to some or all-prescriptive limits. The current status of this project, being managed by the National Road Transport Commission, will be reviewed briefly. This project is due for completion and implementation in 2004.
Australia also has a number of innovative and productive vehicle combinations which are being permitted under performance assessments benchmarked against currently operating vehicles. Some examples of these will be provided.
New Zealand was the first country to introduce legislation for extra-mass combinations subject to a core group of performance standards. Performance assessment has also been used extensively in the recent review of mass and dimension limits and the use of high-productivity combinations on certain transport routes.
Transport operators in Thailand, Malaysia and Singapore are actively seeking review of current size and weight legislation and the potential for B-double operations on specific transport links is being investigated. Certain aspects of vehicle performance are of concern with regard to the suitability of B-doubles in these countries.
Larger vehicle combinations are also being permitted in South American countries; the Mercosur countries Argentina and Brazil have permitted some multi-combinations, including B-doubles, with some consideration of vehicle performance issues.

Notes

Presentation: 133

PERFORMANCE BASED STANDARDS IN EUROPE

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Biography

The author has a M.Sc. in Engineering Physics. He has been engaged in solid mechanics during most of his career: in shipbuilding, nuclear power and trucks. He joined Scania in 1986 as manager of the strength laboratory, later became manager of the chassis laboratory and complete vehicle testing. He is an (external) member of the faculty board of the Royal Institute of Technology in Stockholm, Sweden.

Abstract

Keywords: vehicles, heavy, standards, performance, Europe

The directive 96/53/EC is setting the rules for heavy vehicle weights and dimensions in cross-border road freight between the 15 countries within the European Community. The directive has been in effect some six years now and might be regarded as very successful. Rules for weights and dimensions are no longer seen as major obstacles by international hauliers. The workshop presentation summarises some of the PBS features of 96/53/EC: road wear (axle weights)," bridge formulas", turning radius, gradeability, etcetera.

The directive has not led to a complete harmonisation of rules for weight and dimensions within the different countries of the European Community. Far from it, and the presentation will show some of differences between the Nordic countries of Finland, Sweden, Denmark and the directive.

The obvious shortcoming of the directive 96/53/EC is the implicit standardisation of load lengths to 13.6 meters for the semi-trailer ("articulated", 16.5 meter overall) and 7.82 meter for the truck and the trailer ("road train", 18.75 meter overall). Not allowing longer combinations on the Trans-European road network might hamper the growth of the European economy. What PBS features, if any, should be added to some future version of 96/53/EC if longer vehicle combinations are to be permitted ?

Notes

Presentation: 134

OECD PERFORMANCE BASED STANDARDS EXPERT GROUP REPORT

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Biography

Tony Wilson is CEO and a commissioner of the National Road Transport Commission, Australia (NRTC). The NRTC is an independent government commission established to bring about national reform in road transport legislation. Tony has extensive experience in transport and infrastructure planning and management in the private sector and government. He is a Fellow of the Institution of Engineers of Australia and immediate past chair of the Austroads Council. Tony is chair of the recently established Expert Group for the OECD Project "Performance Measures for Heavy Vehicle Safety and Infrastructure Sustainability".

Abstract

Keywords: vehicles, heavy, standards, performance, safety, OECD.

In The OECD's Road Transport and Intermodal Linkages Research (RTR) Programme has recently established a project on performance-based standards called Performance Measures for Heavy Vehicle Safety and Infrastructure Sustainability. An Expert Group under the chairmanship of Tony Wilson, CEO of the National Road Transport Commission Australia, will have its first meeting in Paris just prior to the 7ISHVWD. The first task of Expert Group is to review the present international position and to consider the scope of the project. Mr Wilson will outline OECD project and briefly report on the first Expert Group Meeting.

Notes

Presentation: 141

RESEARCH ON THE PERFORMANCE OF THE HGV'S IN THE MAJOR GREEK ROAD NETWORK USING WIM TECHNOLOGY

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Biography

Prof. Mintsis is a Professor in the Department of Transportation and Hydraulic Engineering, Faculty of Rural and Surveying Engineering, Aristotle University of Thessaloniki. He holds a B.Sc. in Surveying Engineering from the Aristotle University of Thessaloniki, a M.Sc. and a Ph.D. in Transportation Planning and Engineering from the University of Southampton. He has an extensive experience in the field of the impact of the HGV to the road network regarding design, maintenance and pricing, in the development of public transport systems plans in urban/suburban areas, in the design of urban traffic management schemes, in road safety with emphasis in training and examination systems for drivers and in traffic education issues. He is a member of the Technical Secretariat of the Pan-European Corridor X. He was also a member of various Committees of the Greek Ministry of Transport and of the Athens Attiko Metro. He wrote more than 60 papers in national and international scientific journals and conferences, in the areas on transportation planning and engineering.

Abstract

Keywords: WIM, HGV, traffic, road

During the last decade Greece started a major effort to improve and extent its national road network. Two of the major road construction projects in the country is the Patras-Athens-Thessaloniki-Evzonoi (PATHE) road axis and the Egnatia Road. The first projects deals with the improvement of the motorway connecting the southern with the northern part of the country, having a length of 1.050 kilometers. The second projects deals with the construction of a motorway connecting the western with the eastern part of the country, having a length of 680 kilometers. Egnatia Road is also connected to all neighbouring Balkan countries. Both road axes play an important role in the freight transport sector of the country. On this basis, the need to assess the impact of the heavy goods vehicles (HGVs) to the road network is essential. The Ministry of Development, General Secretariat for Research and Technology assigned in November 1998 a project concerning the determination and assessment of the dynamic characteristics of heavy goods vehicles and their impact to the national road network to the Department of Transportation and Hydraulic Engineering, Faculty of Rural and Surveying Engineering, Aristotle University of Thessaloniki in collaboration with the Central Laboratory of Public Works and Egnatia Road S.A.

Within the framework of this paper, the basic steps and findings of this project are presented and discussed. Data were collected at seven specific sites on the two main road axes of the country. A number of 3.053.116 records at all sites were collected concerning all vehicles categories. The results from the recording of the static and dynamic characteristics of heavy goods vehicles using the Weigh-In-Motion technology, with reference to these two road axes will be presented. Results will also be presented concerning the characteristics of the overloaded heavy goods vehicles and on their impact to the road network. Also the analysis and evaluation results of the collected data in order to create a database, in accordance to the guidelines imposed by the European Action COST 323 will be presented. The database will be used for pavement management and the support of the decision making process concerning the budget allocation for road construction, operation and maintenance. It is worth to state, that the results of this project merged with the results of previous, but smaller in size, projects will help towards the creation the first ever database for the HGVs using the Greek transport system.

Notes

Presentation: 142

IMPACT FACTORS ON MEDIUM SPAN BRIDGES DUE TO MULTIPLE VEHICLE PRESENCE

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Biography

Sean Brady completed his Undergraduate Degree in Civil Engineering, from Trinity College Dublin, Ireland in 1998.
He is now working as a lecturer in University College Dublin, Ireland, and is currently working on his PhD, investigating dynamic impact factors on bridges due to multiple vehicle presence.

Abstract

Keywords: impact factor, truck, bridge, dynamics

This paper investigates the dynamic response of medium span bridges for different conditions of traffic flow. Dynamic impact factors have a significant effect on the design and assessment of bridges and there is a need to rationalise the approach used by bridge engineers. Codes of practice commonly calculate impact factors as a function of span length, but the interaction between bridge, trucks and road roughness involves many more parameters that are difficult to identify and allow for when attempting to determine the bridge response. Much of the research to date on this phenomenon has concentrated on the single truck event and has identified situations where 'frequency matching' can occur between the truck and the bridge. However, for the vast majority of bridges, the critical loading event involves more than one truck in which case the impact effects are substantially different. Knowledge of the response of a bridge to multiple-truck crossing events is essential for an accurate calculation of the relevant impact factor for most bridges.

This paper compares the impact factors produced from a single truck and the two truck event. Experiments conducted in Slovenia were carried out to examine the response of a simply supported bridge for both single- and two-truck events. The results from this were used to calibrate a finite element model. The road surface roughness is generated from power spectral density functions based on the International Standards Organisation specifications for 'very good', 'good', 'average' and 'poor' roads. Utilising this model the dynamic amplification factors for a single truck are compared to those obtained with two trucks travelling at different speeds and lag conditions. Important conclusions are drawn for bridge design and assessment purposes.

Notes

Presentation: 143

MANAGING ROAD TRAIN ACCESS IN A LARGE CITY: PERTH, WESTERN AUSTRALIA

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Biography

Mr Peters is the Manager Road Use with Main Roads Western Australia, the state road and traffic authority. He is responsible for Heavy Vehicle Policy, Heavy Vehicle Operations, Road Safety Policy and Traffic Management Policy.

Mr Peters qualified as a civil engineer in 1976, a school teacher in 1977 and in 1994 completed a Masters degree in transport planning and engineering at the Institute for Transport Studies in Leeds (United Kingdom).

In the past 20 years he has worked in many areas of his organisation, from policy through to road construction and maintenance. He has several areas of special interest, including vehicle weigh in motion (WIM) where he invented the Culway system - the dominant WIM system in Australia, and vehicle classification where he developed the Austroads system in 1993. His involvement in heavy vehicles started in the mid 1980s when he assisted in a national review of mass and dimension limits and developed a national guide to statically weighing vehicles. He has had a significant involvement at the national policy level since then in areas such as road cost allocation, performance of heavy vehicles and the development of various national policies. From 1997 to 2000 he chaired the national Heavy Vehicle Reference Group and he is currently a member of the Specialist Advisory Group overseeing the development of a Performance Based Standards approach to regulating heavy vehicles. He is also a member of the Intelligent Access Project Steering Committee - the group charged with developing a national vehicle tracking system for the benefit of industry and regulators.

Abstract

Keywords: road trains, access, policy, consensus, urban

The western third of Australia is the State of Western Australia. It occupies a land area of 2.5 million square kilometres and has a population of 2 million of which 1.3 million live in the city of Perth. The geography of the State – outside Perth, lends itself to the use of road trains. The distances are large; the traffic density is low; the country is flat; and the freight task is quite small and dispersed. Terminating road train use on the outskirts of Perth is annoying and inefficient for the trucking industry and during the 1990s their access and use in Perth grew rapidly. But by the late 1990s the community was objecting and a new Government in early 2001 initiated a far ranging review to establish a consensus policy on the regulation of road trains. The review scope covered the entire State but the policy established for their regulation in Perth is the most relevant for the rest of the world. The consensus approach used was a first for Western Australia and involved engaging a wide range of stakeholders in consensus conferences, followed by a small group distilling the findings into a workable and pragmatic policy. The outcome is a set of rules and regulations developed on a policy framework with the following eight components: 1) Integrating land use and transport planning; 2) Designating freight roads; 3) Involving the community; 4) Improving freight roads and Intermodal facilities; 5) Accrediting operators; 6) Publicising rules and regulations; 7) Enforcing the rules; and 8) Training and informing all road users.

This paper looks at the process used in developing and implementing the policy, and provides details of the policies and guidelines that are now used in Perth.

Notes

managing social/environmental issues not performance measurement

modal shift vs rail → road!

B doubles 97% 67,5 ton

27.5m double road trains 80 ton

- 80 17 m 38 ton

leg 80 17 m 55 ton

mod 80 trials Canada 3-train 212ft

see Sweden overhead, community

1950 → rapid change

end 90 36,5m → road

no research data collected

government realise problem → Community consultation

police enhancement

problem?

people don't like trucks

prefer rail

speeding no problem

guidelines assessing roads for road trains

change of government

road train summit → priority issues

Routes

education

Presentation: 144

REVERSE ENGINEERING OF A TRANSIT BUS FOR F.E. CRASHWORTHINESS ASSESSMENT

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Biography

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Abstract

Keywords: reverse engineering, crashworthiness, impact

The reverse engineering was performed in order to develop a finite element (FE) model of a transit bus for crashworthiness and impact analysis. The reverse engineering process involves disassembly and digitisation of the bus components, creating finite element meshes and merging all parts into one complete bus model. Before tear down process was begun global co-ordinate system was established by marking reference points and taking measurements using portable co-ordinate measurement equipment. All structural components were identified, labelled and removed from the bus structure. Connections between all structural components were identified. At lest three reference points were digitised for each part before its removal to determine the component position in the global co-ordinate system. After disassembly, geometric entities like lines, points and curves were scanned for each component. Geometric data obtained was transformed to the MSC PATRAN graphical pre-processor, where finite element grids were generated, modified and merged. Finite element (FE) model of the transit bus also included data from mass and thickness measurements and material properties obtained from laboratory strength tests, which were conducted for selected material samples. First validation of model components was based on weight comparison between FE models and the actual parts that they represented. Individual parts were assembled using pre-processor. Connections between vehicle components were modelled by merging nodes, applying node constraints and spot welds. Mass distribution, location of the centre of gravity, and moments and products of inertia for the final model were compared and modified based on experimental data from tilt table tests performed for the actual bus.

Non-linear, dynamic finite element analysis is performed using LS-DYNA, an explicit, 3-D, dynamic, non-linear finite element code. Roll over, rear and side impacts are planned to be simulated to evaluate crashworthiness, safety and integrity of the bus structure. Results will be presented on the Symposium.

Notes

Presentation: 145

INSTRUMENTED VEHICLE AND ITS USE FOR CALIBRATION OF WIM-SYSTEMS

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Biography

Matti Huhtala has received his degrees from the Helsinki University of Technology (HUT). He has worked at Technical Research Centre (VTT) where he was the chief research scientist as he retired this year. His main interests have been vehicle-road interaction, accelerated pavement testing and road material research. He has presented papers on these subjects in many international conferences.

Pekka Halonen has gained his degree in vehicle engineering from Helsinki Technical College. He works as a research engineer at VTT. His main interests are vehicle-road interaction, accelerated pavement testing and WIM. He has been a co-author of several papers in international conferences.

Abstract

Keywords: vehicle-pavement interaction, instrumented vehicle.

As a vehicle drives on a road the instantaneous wheel load is not steady, e.g. 10 tons but is varies because of the unevenness of the road. This varying axle load is often called as dynamic axle load. It is usually at least 10 to 15 percent on a good road.

The dynamic axle loads can be measured by an instrumented vehicle. First general review of different methods to measure dynamic axle loads will be presented in the proposed paper. The Technical Research Centre of Finland (VTT) has instrumented two vehicles. The first one was used at EC-RTD project WAVE (Weigh-in-motion of Road Vehicles for Europe) and in OECD/DIVINE and the second in COST 334 project. The instrumentation, calibration and encountered problems will be presented.

Instrumented vehicle seems to be an excellent tool for calibration of Weigh-in-motion systems (WIM). The instrumented vehicle of VTT was used in calibration measurements at WAVE tests near Lulea in Northern Sweden and near Metz in France. The use of instrumented vehicle was more complicated than assumed. It is not only question of the accuracy of the measurement system nor the accuracy of matching the measurements at the vehicle and at WIM-systems but also a problem: what is the real importance of the calibration. The (good) results and problems will be presented in the proposed paper.

Notes

Presentation: 146

ROAD USER CHARGING FOR HEAVY GOODS VEHICLES

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Biography

Nii Amoo Dodoo is a post graduated research student in the Transport Engineering Group at the University of Newcastle upon Tyne. He completed his undergraduate degree in Civil Engineering from Ghana, graduating with a first class honours degree. He studied relevant subjects in Highway Engineering and is a keen computer programmer. He is a member of the Institution of Highways and Transportation.

Abstract

Keywords: HGV, dynamic charging, pavement wear

The aim of this three-year research project funded by the UK Department of Transport, Local Government and the Regions (DTLR) is to develop field trial and evaluate a dynamic road user charging system for HGVs in Europe. The need for fairer and more efficient means of pricing road use through the "polluter pays" principle has prompted many governments throughout Europe and other parts of the world to investigate alternative pricing strategies for urban and inter-urban road networks. Of particular concern is the road freight sector, as HGVs cause a disproportionately high level of road pavement wear per veh-km compared to other vehicle classes, and fixed annual taxation payment systems are highly inefficient at capturing the external costs of pavement wear which vary during trips by pavement type, dynamic axle load, HGV class and configuration. In order to align the actual costs of pavement wear and charges for road use more accurately, various distance and weight based charging approaches have been implemented. For example, in Europe and the USA, Weigh-In-Motion (WIM) systems have been installed on certain roads and bridges to assist infrastructure cost recovery (for example the HELP system in the USA). In Sweden and Norway, HGVs pay a purely distance and HGV-class based charge, Australia and New Zealand operate an axle-weight-based distance charge, and in Switzerland, the recently introduced Heavy Vehicle Fee charges HGVs on the basis of actual distance travelled and gross permissible axle weights.

However, the main drawbacks with extending these systems into a pan-European system for charging for actual pavement wear at the point-of-use include the likely roadside infrastructure costs and serious concerns about using measured static axle loads (as opposed to dynamic axle loads) to estimate actual pavement wear. This paper therefore describes the functional specification of an on-board charging system which seeks to overcome these drawbacks by extending state-of -the-art technologies for variable road-user charging, automatic vehicle locationing and dynamic axle-load measurement to enable HGVs to be charged a price which includes the dynamic effect of loading on structural pavement wear. It is envisaged that the evaluation of the prototype system will lead to recommendations for new approaches to allocating road track costs more efficiently and fairly between individual road-users.

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TRANSLATION OF MEASURED VEHICULAR WEIGHTS INTO DESIGN LOADS TO BE USED FOR BRIDGE ENGINEERING

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Biography

Paul Waarts, born in 1961, got his civil engineering degree at TU Delft, the Netherlands in 1988. He started his professional career at TNO Building & Construction research, department of structural dynamics. From 1995 he started a PhD study at Delft University of Technology, faculty of Civil Engineering into 'Structural reliability using Finite Element Methods' . He received his PhD degree in 2000. At present he is a project engineer at TNO. Main tasks are special dynamic studies in the civil infrastructure department with a special focus on the dynamic behaviour of bridges. Besides he is business manager for structural reliability and risk-analysis studies.

Abstract

Keywords: bridge, traffic load, probabilistic model

The paper describes the results of a study, which aimed at the derivation of a traffic load model for the design of road bridges. Attention is given to the Ultimate Limit State and the Serviceability Limit State.

A set of measurements done in 1978, 1985, 1993, 1995, 1997 and 1999 at three locations in The Netherlands were used to derive a statistical model for the weight of 16 types of lorry configurations. Besides models were derived for the axle loads and axle loads, once the vehicle type and the total vehicle load is given. Statistical distributions are fitted to the data by means of the maximum likelihood criterion. Because of the large set of data, an extensive trend and uncertainty analysis was carried out as well.

Based on various sources, a probabilistic traffic flow model is constructed, comprising traffic intensities, lorry distances and lorry speeds for three types of traffic: free, congested and full stop, each of which governs the traffic flow during some part of the day. With this model, design values with predefined probabilities were derived for the axle, tandem, tridem and vehicle loads and for distributed loads on single and multiple lanes of various influence lengths. The axle and vehicle loads are derived by direct calculation. The distributed lane loads are derived using a simplified numerical traffic model. For short periods (1, 10 and 30 days), this simplified model was verified by Monte Carlo simulations on the full model.

The full paper concludes with a comparison of the Dutch bridge load and Eurocode load models.

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PERFORMANCE EVALUATION OF THE TRACKAXLE(TM) STEERABLE AXLE SYSTEM

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Biography

Hans is a Mechanical Engineering graduate and obtained his PhD in 1984 from the University of Melbourne. He has 21 years of engineering and engineering research experience in vehicle dynamics, which commenced with the study of motorcycles in 1979, and progressed in a series of logical steps to innovative large off-highway mining trucks with gross weights approaching 500 metric tonnes. Hans has been involved in the measurement and analysis of road roughness, and was responsible for the development of a laser-based profilometer used for major surveys at the network level. For a brief period Hans took to the air and helped to design and develop a vibration isolation system for an aerially towed SQUID magnetometer used in minerals exploration. Returning to earth, his interests have extended to heavy vehicle wheel forces and infrastructure impacts, and recent topics include the dynamics of vehicle-bridge interaction. Formally a Chief Scientist with ARRB Transport Research Ltd., Hans now heads RTDynamics, a business unit of Texcel Pty Ltd. His current preoccupation is with the many challenges posed by performance-based standards for heavy vehicles.

Abstract

Keywords: steerable axles, performance standards, simulation

The use of steerable axles on heavy-vehicles has been recognised for some time as both a means of improving vehicle performance and as a method of achieving higher productivity and improved access to the road network. The development in Australia and New Zealand of performance-based standards for the regulation of heavy vehicles provides one method of overcoming the prescriptive regulatory impediments to productivity and network access by directly addressing performance issues. Safety and infrastructure related performance measures were chosen from the initial set developed and proposed for use in Australia and applied to a new and novel steerable axle system known as "Trackaxle". The Trackaxle system, comprising a steerable axle group, allows increased trailer length, and hence productivity, by reducing low-speed offtracking. It utilises a rear, self-steering carriage rotating about its mid-point with respect to the trailer chassis. The front and rear of its three axles can oscillate with respect to the carriage in response to the angle developed between the body of the carriage and the trailer chassis. To assure on-road stability, the self-steer characteristic has two override devices: an automatic highway lock for straight ahead travel, and a spring loaded limiter system which controls the build-up of tyre side forces to limit the degree of rear-steer to a proportion of the articulation of the tractor at the fifth wheel. In the evaluation, full-vehicle computer-based models were created of a representative baseline prime-mover and semi-trailer combination, and another of a near identical vehicle featuring a longer semi-trailer equipped with the Trackaxle system. When compared to the baseline vehicle, the performance of Trackaxle was superior in several areas, including low-speed offtracking and horizontal tyre forces in a turn; the horizontal tyre forces were found to be exceptionally low, suggesting substantial reductions in pavement damage is likely. The evaluation of the prototype Trackaxle system indicates a range of benefits in the areas of safety, infrastructure and productivity, and illustrates a practical application of performance-based standards.

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COMPUTER MODELING OF TRANSIT BUSES IN ASSESSING ROAD DAMAGING POTENTIAL

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Biography

Bohdan T. Kulakowski received his Ph.D. from the Polish Academy of Sciences in 1972. He is currently a professor of Mechanical Engineering and director of the Pennsylvania Transportation Institute at The Pennsylvania State University. Professor Kulakowski teaches courses in dynamic systems and controls. His research interests are in transportation systems and vehicle-road interaction. He is co-author of a book entitled "Dynamic Modeling and Control of Engineering Systems" published by Prentice Hall.

Abstract

Keywords: transit buses, axle loads

Fully loaded transit buses and coaches often exceed the maximum permissible axle weights allowed by the federal law on the United States Interstate Highway System. While it is widely understood that overweight trucks operating on the Interstate System contribute significantly to road wear, the extent of damage caused by overweight buses and coaches has not been fully investigated. The main objective of the study described in this paper was to determine the level of static and dynamic loads applied by transit buses and coaches to pavements and to assess their road damaging potential. Axle weight data were reviewed for a representative population of buses. A computer simulation was then used to determine loads applied by several models of buses over a range of axle weights. Other parameters, whose effect on bus wheel forces was studied, included road roughness and vehicle speed. The results of the computer simulation were next combined with estimates of highway usage by buses and coaches as a percentage of average daily traffic to evaluate the extent of road wear attributable to transit buses and coaches.

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Presentation: 213

ON DEVELOPMENT OF THE SUPER-SINGLE DRIVE (GMD) TYRE

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1979 now: conduct research on CAE and durability of tires for commercial vehicle

Abstract

Keywords: wide base tire, structure, durability

Technical ingredients for replacing dual mounting of truck and bus tires with single wide base tire are presented. Motivation of developing the technology is underlined by directing dramatic enhancement of tire durability to advantages on utility and environment:

- less tire room occupied to enable new vehicle design;
- less tire weight to save limited resources on earth and reduced rolling resistance to benefit energy efficiency.

Among technical issues in tread were uneven growth due to wide sectional configuration and large stress concentration, while in bead considerable deflection and hence induced strain should effectively be minimised. To overcome the difficulties innovative structures were proposed. The results showed outstanding performance under critical testing conditions.

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Presentation: 214

FUTURE OF THE CHASSIS ELECTRONICS IN COMMERCIAL VEHICLES

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Biography

Laszlo Palkovics graduated from the Technical University of Budapest, Hungary in 1989. He started his PhD studies at Budapest, but participated in programs of universities in Delft, Helsinki. After receiving his PhD degree, he worked as research fellow at the Centre for Surface Transportation Technology of the NRC Canada, in Ottawa. After returning to Hungary in 1994, he was granted a professor position at TU Budapest, at the Department of Automotive Engineering. From 1995 he has been also working as a managing director of the Knorr Bremse R&D Institute in Budapest. Currently works in Germany, as manager of electronic development of Knorr Bremse.

Abstract

Keywords: active safety, commercial vehicles

The target of the paper is to summarise the actual status of the commercial vehicle chassis electronic system affecting the vehicle and traffic safety. The basic conflict, that on hand the vehicle is produced for making return on the investment, and thus has to fulfil very severe economic requirements, on the other hand because of the society/environmental constrains, it has to fulfil high technical requirement, resulted in very rapid development during the last decade. While 15 years ago, the studies has shown that the basic design of an average truck did not differ significantly from the design at the beginning of the Second World War, until a top class heavy vehicle of today technically is at least as advanced as the best passenger cars. In the fields of safety, stability, environmental load, comfort, the commercial vehicles are competitive with passenger cars. The intelligent systems outlined in this paper are mostly taken over from passenger cars, and adapted to the special truck environment, but there are also systems, where commercial vehicles were more advanced, for example the electro-pneumatic braking system is available in trucks since 1994, and today all heavy vehicles are assembled with EBS. The electro-hydraulic braking (analogue to EBS) is under development in passenger cars. Definitely, the developments in the field technology, electronics, navigation and the related fields makes it possible, and projects a very exciting future. It is possible also today to realise a fully autonomous commercial vehicle, which has only electronically controlled systems, starting with steering, braking, engine management, transmission.

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EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES -INTRODUCTION AND AIM OF THE ACTION

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Biography

Born in 1951 in the Netherlands, graduate civil engineering in 1976, doctors thesis in 1983 on bond in reinforced concrete and since 1983 working at DWW of Rijkswaterstaat.Presently in charge of research and development in the field of road monitoring, tyre/road infrastructure interaction and noise mitigation. Vice-chairman of COST 334 and leader of Taskgroup 3 "Pavement wear effects".

Abstract

Keywords: wide base tyres, dual tyres

The main objective of COST Action 334 (Effects of wide single and dual tyres) was to establish the relative effects of the use of wide base single tyres and dual tyre assemblies in respect of road pavement damage, vehicle operating costs, vehicle safety and comfort, and environment, particularly noise. On a broader level, it was expected that the results of the Action would enable road network management at national and international level to become more effective as a result of a greater ability to predict wear rates on pavements.

The anticipated benefits of the proposed work of the Action were as follows:

- a contribution to European harmonisation on vehicle weights and dimensions.
- benefits to European industry and to road users by maximising the efficiency of road transport within the EU and greater competitiveness of European industry, through improvements to road wear, vehicle operating costs, safety, and environmental issues.
- stimulation of the development of new technological ideas in tyres, vehicles and road pavements.
- provision of valuable input data to other COST Actions
- encouragement of co-operation between teams of workers having different expertise, and with access to different facilities.

In addition to the technical benefits, one of the objectives of COST Action 334 was to produce quantified and reliable information that will enable national governments and the EU to consider the policies that might apply in respect of the use of wide base single tyres. These would include the recovery or distribution of any additional costs or benefits arising from their use, and any necessary harmonisation of safety or environmental standards.

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ETRTO'S VIEWPOINT ON WIDE BASE SINGLES AND OTHER FUTURE TRUCK TYRE TYPES

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Biography

E.T.R.T.O. was founded in October 1964 but previously, from 1956 to 1964, it was known as the European Tyre and Wheel Technical Conference (ETWTC).
Since tyres are recognised as making a major contribution to road safety, E.T.R.T.O. is active in its contacts with national and international organisations and legislative bodies in order to make appropriate recommendations.
However, the activities of E.T.R.T.O. are strictly confined to technical aspects of tyres, rims and valves as far as fitting and use are concerned.

Abstract

Keywords: ETRTO; tyres; wide wingle; expectations

ETRTO expectations

- Further European harmonisation on vehicle weights and dimensions
- Improvement of safety and environmental issues.
- Maximising the efficiency of road transport within the EU and by adding to the competitiveness of European industry abroad.
- Stimulate consideration of new technological developments in the tyre, vehicle and road construction industries.

ETRTO comments

- For wide single tyres, COST 334 results considering vehicle operating costs, environmental as well as road surface maintenance costs, make it clear that they reduce the overall societal costs related to heavy commercial transportation
- ETRTO considers that there is no obvious reason to restrict the use of single tyres in the European Union and in particular, the load restriction applied to the tandem drive axles fitted with single tyres (18 tonnes maximum load instead of 19 tonnes with dual tyres) in Directive 92/53 should be deleted
- Based on the knowledge gathered in COST 334 towards the relation between tyre design, pavement wear and efficiency of road transport any new vehicle/tyre concept shall be based on all the leading principles such as the total effect on pavement, fuel consumption, emissions, .. per net tonne loading.

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MICHELIN VIEWPOINT ON WIDE BASE SINGLES AND OTHER FUTURE TRUCK TYRE TYPES

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Biography

Born in 1956 in France.
Graduate Engineer, Ecole Nationale Supérieure des Techniques Avancées, Paris 1978.
Engineer in the Manufacture Française des Pneumatiques Michelin since 1979.
Presently in charge of the prospective marketing for the Truck Tyre Business in Europe.
French representative in COST 334.

Abstract

Keywords: single tyres, drive axle, future tyre types

The White Paper on a common transport policy was published by the European Transport Commissioner in September 2001. For goods transportation, the target in the European Union is to reduce the growth rate of goods road haulage to 38% by 2010 in comparison with its 1998 level. The main concerns leading to this decision are road traffic congestion, road safety and road haulage environmental effects.

As a responsible tyre manufacturer committed to sustainable development, Michelin strives to contribute to an acceleration of road transportation progress regarding these concerns.

The wide base single tyre is part of this commitment. With lower rolling resistance, leading to reduced fuel consumption and subsequent environmental impacts, it has a comparatively lower weight, resulting in a greater payload and a reduced amount of material during manufacture and dismantling after use. The X One tyre range was developed with these criteria in mind. It is already on the European market for urban buses and available in North America for long haul and regional transportation. Other projects are in progress in order to extend this range to other uses.

Other notable and envisaged trends for future truck tyre types are :

- A continuation of traditional tyre performance improvements, such as reliability, wear life, rolling resistance, grip, noise, dynamic active safety
- The introduction of new tyre sizes in order to increase the payload volume, through the design of smaller diameter tyres.
- The introduction of electronically instrumented tyre-wheel assemblies offering new services.
- In general, a more integrated tyre design covering the entire life cycle of the tyre, targeting the reduction of societal impacts, including their effects on the road surface.

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CONTINENTAL'S VIEWPOINT ON WIDE BASE SINGLE AND OTHER FUTURE TRUCK TYRE TYPES

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Biography

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01/2001 Doctor degree (Topic: Investigations concerning standards suitable for simulation of heavy commercial vehicles' driving behaviour)
since 07/2000 employed at the commercial tire Devision of the Continental AG

Abstract

Keywords: tyre sizes, Super single, driving stability

To realise increasing Market Requirements - Operating costs, Fuel consumption (rolling resistance), Mileage (wear picture), Weight reduction, Resource saving (Material), Driving dynamics, Maintenance and Space requirement - leads Continental to the development of a system enhanced, wide base single tyre for the drive axle.

This study examines some of the benefits of a system approach. In particular the results of puncture testing at high lateral acceleration are examined. Results have shown that vehicle lateral stability is lower for the wide tire than that of the dual. However, by adopting a system, Continental can improve these results and also utilise the advantages of the wide single tyre. Therefore Continental recommends with the application of Super Single Tyres on drive axles the combination of a run flat device CST or an electronic Stability system FDR/ESC. The mobility will be realised either with the run flat device or with a Break Down Concept (Conti Euro Service) and additionally with a Tyre Pressure Monitoring System to reduce the probability of a breakdown.

In a first step the following dimensions are under development for the drive axle:

- 495/45 R 22.5 for Heavy Trucks with a maximum axle load of 11.5 tons
- The dimensions 455/45 R 22,5 for maxi busses and the 385/55 R 22.5 for midi busses replaces the duals in the dimension 275/70 R 22.5 with the main goal to get a wider aisle width for busses.
- The 345/45 R 17.5 is under development to replace the dual assemblies mainly for trucks with a total weight of 7.5 tons (driving license C1E).Additional tires with a low aspect ratio for all axle positions are under investigation.

Notes

Presentation: 234

SOME VIEWS OF THE TRUCK INDUSTRY ON WIDE SINGLE TYRES ON DRIVING AXLES

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Biography

John Aurell received his MSc degree in Mechanical Engineering at Chalmers University of Technology in 1967. After a short spell in the field of education, he joined Volvo Trucks in 1969. He worked in the departments for Engine Design, Calculation and Vehicle Testing until 1984. He then joined the department for Vehicle Dynamics where he is now Principal Vehicle Dynamics Engineer.

Abstract

Keywords: regulations, stability, environment, economy

Towing axles both on motor vehicles and trailers are currently equipped with wide single tyres to a very high percentage. Obviously also steering axles have single tyres, which also tend to become wider. It is now a logical development to use wide single tyres also on the driving axles because of the advantages. Wide single tyres instead of dual tyres are in line with the continuos development towards reduced fuel consumption and lower service weight of the vehicles. This contributes to better transport effectiveness for the operator and the society at EU-level.

Wide single tyres also improve the handling and stability of the vehicle and make it better to drive with better road grip due to lower dynamic wheel forces. In addition also the ride and the vibration environment is improved.

There seems to be a certain increase of the road wear with wide single tyres compared to duals, although the impact is very minor on the primary network. The scatter among current tyres is also very large, so that good wide single tyres are better than bad dual tyres.

Wide single tyres improve the environment due to reduced emissions. They also increase the traffic safety due to increased stability of the vehicles. The road maintenance costs may be slightly increased but the overall economic effects are positive.

Current 40 t articulated vehicles, consisting of a 2-axle tractor and a 3-axle semitrailer, may now use wide single tyres on the driving axle with no consequence for the axle load or the GCW. In order to be able to take advantage of wide single tyres also on 3- and 4-axle motor vehicles, directive 96/53/EC has to be modified. In clauses 2.3.2., 2.3.3. and 3.5.3. the requirement for twin tyres on driving axles should be left out. Also in 2.2.4.2. the same modification should be made. It may be justifiable to introduce a general limit on the tyre inflation pressure, for both duals and wide singles, in accordance with the COST 334 proposal.

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DAIMLERCHRYSLER'S AND BRIDGESTONE'S VIEW ON WIDE SINGLE TYRES ON DRIVING AXLES

Presented by: Karsten Wehner or S. Lamp

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EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - QUESTIONS

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Biography

Born in 1951 in the Netherlands, graduate civil engineering in 1976, doctors thesis in 1983 on bond in reinforced concrete and since 1983 working at DWW of Rijkswaterstaat.Presently in charge of research and development in the field of road monitoring, tyre/road infrastructure interaction and noise mitigation. Vice-chairman of COST 334 and leader of Taskgroup 3 "Pavement wear effects".

Abstract

Keywords: wide base tyres, dual tyres

As part of the work of the COST Action (Co-operation on Science and Technology) 334 'Effects of wide base single tyres and dual tyres', active from 1997 to 2000, a special Task Group (TG3) has carried out an extensive research programme on the effects on road pavements. The aim was to investigate the relative effects of standard single tyres, wide base single tyres and dual tyres on the wear of flexible pavement structures.
On the basis of earlier work of OECD in 1982, a single axle with wide base single tyres inflicts about equal pavement damage to two axles with dual tyres, without taking account of the different tyre or pavement parameters. The principal objective of TG3 was to determine this value for modern tyre types, to relate it to tyre characteristics such as size and inflation pressure, and to determine a means of calculating relative effects of current and future tyre types.
As a first step, the most relevant aspects of tyre-pavement interaction were identified, on which to focus the study. Next, a literature review was carried out specifically to address these questions, which concluded that a better understanding of the tyre-pavement interaction parameters was limited by a lack of appropriate data.

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EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - RUTTING TESTS AND RESULTS

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Biography

Working at DWW since 1986. Principal field of occupation is pavement design methodology and the related research, development of pavement design manuals and software. Presently also in charge of the accelerated loading testing facility and the related research on behalf of DWW, who is joint owner of this facility together with Delft University.

Abstract

Keywords: wide base tyres, dual tyres, ALT, modelling

To better understand tyre – pavement interaction, a program of laboratory tests, Accelerated Loading Tests, experiments, field tests and numerical studies was executed by six European countries.

In the TRL Accelerated Loading Facility (ALF) in the United Kingdom, a 100 mm and a 200 mm pavement structure were tested for rutting at 20°C and 30°C with a 385/65R22.5 single tyre and a 495/45R22.5 tyre. It was concluded that the 385/65R22.5 tyre gave 1.5 (thin pavement) to 1.7 (thick pavement) more rutting than the 495/45R22.5 tyre.

In the LinTrack ALF (the Netherlands), a rutting experiment was done on two heavy motorway structures with different wearing courses. Both were loaded at 40°C by a 295/60 dual tyre, a 315/80 dual tyre, a 495/45 single tyre and a 385/65 single tyre. On both test pavements the rutting for the twin tyres was more or less comparable. The 385/65 wide base tyre gave in both cases by far the most rutting, namely 1.8 to 2.2 times more than the 315/80 twin tyre. The rutting under the 495/45 wide base tyre was less consistent, but in both cases less than the 385/65 tyre.

In the French LCPC testing facility the effects of tyre pressure, external tyre diameter, uneven loading of twin tyres and under- or over-inflation was investigated using the same tyres as in the Dutch tests. These tests were aimed at results in terms of strains and were followed by extensive numerical study.

In the Finnish VTT Virttaa test site experiments were done with a 315/70 twin tyre and a 495/45 tyre, to determine the effects of tyre configuration and differences in dynamic loading on pavement strains.

In Germany, laboratory testing was done to determine tyre footprints. In Portugal analytical studies were done to compare the rutting effects of different tyres.

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EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - ANALYSIS

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Biography

Born in 1961 in the Netherlands; MSc. civil engineering in 1988; pavement engineering consultant with Netherlands Pavement Consultants until 1991; research engineer at Delft University of Technology until 1998, working with the Lintrack accelerated pavement testing facility; Ph.D. in 1998 on Surface cracking in asphalt pavements; since then senior pavement consultant with KOAC•WMD.

Abstract

Keywords: wide base tyres, dual tyres

As part of the work of the COST Action (Co-operation on Science and Technology) 334 'Effects of wide base single tyres and dual tyres', active from 1997 to 2000, a special Task Group (TG3) has carried out an extensive research programme on the effects on road pavements. The aim was to investigate the relative effects of standard single tyres, wide base single tyres and dual tyres on the wear of flexible pavement structures.
A literature review was carried out, gathering available experimental data regarding the pavement wear effects of different types of tyres, at several wheel loads and inflation pressures. This data was augmented by comprehensive experimental research executed for COST 334, incorporating laboratory tests, full-scale experiments, field tests and numerical studies. Six European participating countries contributed to this research, namely France, United Kingdom, Germany, Finland, Portugal and the Netherlands.
In an overall statistical analysis of the data obtained from the literature survey and the COST 334 tests, a set of formulae for a new parameter, the so-called Tyre Configuration Factors (TCF) was developed. This TCF expresses the amount of pavement wear of a specific tyre relative to an arbitrarily chosen reference tyre. The TCF proved to be dependent on tyre size dimensions and on the inflation conditions of the tyre. Different TCF formulae were obtained for different distress modes and pavement thickness.

Notes

Presentation: 244

EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - PAVEMENT WEAR EFFECTS - ANSWERS

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Biography

Born in 1951 in the Netherlands, graduate civil engineering in 1976, doctors thesis in 1983 on bond in reinforced concrete and since 1983 working at DWW of Rijkswaterstaat.Presently in charge of research and development in the field of road monitoring, tyre/road infrastructure interaction and noise mitigation. Vice-chairman of COST 334 and leader of Taskgroup 3 "Pavement wear effects".

Abstract

Keywords: wide base tyres, dual tyres

The developed TyreConfigurationFactor can be used to quantify the relative amount of distress caused by different tyre configurations, depending on the pavement thickness and distress mode considered. TCF values were calculated as an example for several tyre types. Sensitivity analyses of the TCF values were executed for variations in relevant parameters such as tread pattern width, tyre-pavement contact area, tyre diameter and over-inflation. Because the TCF relies on tyre-related parameters, it may be used to calculate the distress caused by current and future tyres, relative to the adopted reference tyre. Finally, TG3 examined and assessed the possible use of simple criteria, based on the TCF, that might be used to limit pavement wear. These criteria may equally well be used to guide the development of new tyre types.

Notes

Presentation: 246

WIDE BASE SINGLE TYRES OR DUAL TYRES: ENVIRONMENTAL ASPECTS

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Biography

Born 1933 in Germany. Graduated from Hannover University in mechanical engineering on fatigue problems. Changed to automotive engineering where he worked on tyre problems (Ph.D. Thesis). He then focussed on HGV research (mainly combined traffic road/rail, lateral stability, dynamic interaction vehicle/pavement and vehicle/payload). From 1972 he worked as a scientific adviser (Akademischer Oberrat) and senior researcher at the Institute for Automotive Engineering, University of Hannover. Chairman of Task Group 5 "Non Pavement Effects' of COST 334. Retired in 1998.

Abstract

Keywords: rolling resistance, CO_2 emission, tyre noise

Task Group 5 of COST 334, competent for the so-called "Non-Pavement Effects", had to look for all effects which are not directly connected to the pavement construction itself, primarily vehicle behaviour respectively safety and environmental aspects. About vehicle behaviour and safety will be reported separately.
Environmental aspects are mainly rolling resistance, fuel consumption respectively CO_2 emissions and tyre noise. Rolling resistance and CO_2 emissions cohere naturally. Up to now only few reports are available in which dual tyre and wide base single tyre assemblies are compared in these fields. Therefore additional inquiries and measurements were necessary. Rolling resistance measurements were made by tyre companies co-operating in ETRTO. It is known that exact rolling resistance measurements can only be made on flat bed test facilities. Therefore only differences in rolling resistance could be derived. The values amounted to between 5% and 33% less for wide base single tyres compared with dual tyre assemblies. As average value for further calculations it was decided to use an average value of 20% less for wide base single tyres compared with dual tyre assemblies. For evaluation tyre noise levels it was decided to make measurements according to the new European Union Tyre Noise Type Approval Test 92/23/EEC which is a far field coast by test. Measurements have been made both by tyre companies and by TRL/UK.
The results differ mainly due to tyre construction and design and also to some test conditions mainly velocity. The maximum noise levels for wide base single tyres were measured between - 4,3 and +1,3 dB(A) compared with dual tyre assemblies.

Notes

Presentation: 247

WIDE BASE SINGLE TYRES OR DUAL TYRES: 'VEHICLE BEHAVIOUR AND SAFETY'

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Biography

17.09.1968 born in Hannover. 1989-1996 study of mechanical engineering. 1996-2000 Institute for Automotive Engineering of Hannover University.
In 01/2001 Doctor degree (Topic: Investigations concerning standards suitable for simulation of HGV's driving behaviour)
Since 07/2000 employed at the commercial tire Division of the Continental AG.

Abstract

Keywords: driving behaviour, vehicle safety, HGV construction

Task Group 5 of COST 334, competent for the so-called "Non-Pavement Effects", had to look for all effects which are not directly connected to the pavement construction itself, primarily vehicle behaviour respectively safety and environmental aspects. About environmental aspects will be reported separately.
The most important topics are:
Lateral stability (e.g. manoeuvring and roll over behaviour), safety (e.g. case of tyre failure) and vertical stability (e.g. concerning dynamic loading). For this aim computer simulation models as well as full scale driving tests were used to study the driving behaviour. Full scale tests were necessary to validate the corresponding simulation models. The vehicles investigated were a rigid truck, a road train and an articulated vehicle (all according to ISO 3833). The tyre contact area is very important for the behaviour of the vehicle. It influences to a high degree the lateral stability. A higher cornering stiffness on the driven axle leads to a more understeering behaviour. This was proved by the driving tests and also by the simulation work.
A wide base single tyre is about 15 cm smaller than a dual tyre assembly is. Therefore a wider spring base of the vehicle be realised. This and also the wider track on ground lead to a higher roll over stability. The additional space between the wheels can be used for a new frame concept. For busses a larger aisle width could be realised, so a better accessibility to the rear part becomes possible for people with baby carriages or disabled persons.

Notes

Presentation: 251

EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - VEHICLE OPERATION COSTS

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Biography

Dr. Glaeser studied "Automotive Engineering" in Cologne and Berlin with the final degrees Ing. grad. and Dipl.-Ing. Since 1980 he is working for the Federal Highway Research Institute (BASt), first in the section passive automotive safety and biomechanics and since 1993 he is head of the section vehicle pavement interaction in the department of automotive engineering of BASt. 1996 he was graduated to Dr.-Ing. from the University of Wuppertal.

The main topics of actual research are:

- tyre/road noise
- friction problems
- truck tyres and rutting

Several test facilities for testing tyres and road materials are in operation in his sector.

Abstract

Keywords: super single tyres, vehicle operation costs

This paper presents the work of COST 334 in establishing the effects of the use of wide single and dual tyres on the costs of operation of road freight vehicles. It was not possible to carry out fuel consumption tests on vehicles equipped with a wide range of single and dual tyres. COST 334 therefore carried out theoretical calculations using so called vehicle operation cost models (VOC). In such models, fixed costs, variable costs for different truck operating conditions and vehicle configuration parameters (e.g. tyres) can be input to the model, in order to calculate the overall cost of operating the vehicle over a period of time, or over a distance travelled. COST 334 focused on the use of truck manufacturer's VOC models available in Europe. Of these, the operation of one was supported by input data from the fleet of 50,000 leased trucks that the company has in operation in Europe, and this gave confidence in its forecasts. Therefore the DaimlerCrysler (Mercedes Benz) Charterway VOC Model was selected for use. Because of the prevalence of the 5-axle 40 t tractor / semi-trailer unit in operation in many European countries it was chosen as the basis for the calculations, but the results are also valid for 5-axle 40t trucks with trailers (50%-80% of heavy goods vehicles are covered). It was only possible to establish sufficient input data for Germany and Great Britain. In case of Germany, two scenarios were examined: An articulated vehicle running the whole time on new tyres, and a vehicle running on re-grooved and re-treaded tyres. For economic comparisons the calculations were made without tax, but including subventions, too.

Results: In long travel transport the 20% less rolling resistance of super single tyres on the drive axle of 40t units lead to about 2% less fuel consumption of the truck to about 1% less vehicle operation costs and to a saving of 1,100 lt. Diesel per year (and to 2,8t less CO_2 emission). Because of the lighter wheels (two super single tyres on rims are 130 kg – 150 kg lighter than two pairs of twin tyres) another 1% gain in operation costs could be at maximum achieved, if the extra pay load can realised.

This 1% to 2% gain in VOC is the direct advantage for forwarders (truck operators).

Notes

Presentation: 252

CONSEQUENCES OF USING DIFFERENT TYRE TYPES, EUROPEAN SCENARIO

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Biography

Born in 1956 in France.
Graduate Engineer, Ecole Nationale Supérieure des Techniques Avancées, Paris 1978.
Engineer in the Manufacture Française des Pneumatiques Michelin since 1979.
Presently in charge of the prospective marketing for the Truck Tyre Business in Europe.
French representative in COST 334.

Abstract

Keywords: COST 334, cost-benefit analysis

According to the COST 334 Memorandum of Understanding, the objective of this part is to examine the total financial consequences of the use of wide base single tyres on heavy goods vehicles.
An wide cost-benefit analysis was carried out, considering the most representative vehicle and tyre configurations. This cost-benefit analysis dealt with pavement maintenance costs, vehicle operating costs and environmental costs (mainly polluting emissions and material manufacturing and dismantling). Other aspects could not be translated into financial consequences, in particular the advantages of the wide base single tyres concerning road safety, comfort of the driver and payload, and possible improvements of the truck and bus designs.
The main comparisons were made between current configurations with 80 series tyres on the motor vehicles and wide base singles on the towed axles on one hand, wide base singles on the driven axles on the other hand and, also, all-wide-base-single tyre solutions. In addition to these possible scenarios, other future scenarios were considered, in order to explore new solutions that may be outside of today's regulations.
It was shown that the envisaged solutions slightly decrease the pavement maintenance costs with wide base single tyres on the driven axle and lead to benefits on the vehicle operating costs and environmental costs.
These results do not reveal any reasons to restrict the use of the wide base single tyres in the European Union, especially if both the front and the drive axles of the motor vehicles are equipped, which is likely to happen in practice.
In particular, the load restriction applied to the tandem drive axles fitted with single tyres (18 tonnes maximum load instead of 19 tonnes) in directive 92/53 should be deleted.
Finally, the introduction of possible heavier articulated combinations should be examined at EU level.

Notes

Presentation: 253

EFFECTS OF WIDE SINGLE AND DUAL TYRES - RELEVANCE OF LEGISLATION & STANDARDS

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Biography

Andrew Cook studied Mechanical Engineering in London where he received an Honours Degree. He has worked for the Departartment of Transport's(DTLR) Vehicle Standards and Engineering division since 1992, where he has been involved in negotiating technical standards and introducing legislation at national and European level. The topics have inlcuded seatbelt legislation on trucks and public service vehicles, truck suspension, vehicle weights and dimensions and truck tyre/road interaction. He currently heads up the branch responsible for authorising the movement of very large and heavy abnormal and indivisible loads.

Abstract

Keywords: vehicle, legislation, technical standards

For many years technical standards have been widely used in the automobile industry. Technical standards and legislation can take many forms. The processes and an understanding of the different types of legislation are important to ensure the most effective use of technical standards. Standards linked to legislation can be used to reduce road pavement wear. In some Member States fiscal or other incentives have also been applied to encourage change in vehicle standards.

The findings of this COST action should be employed to revise certain vehicle and use standards. They can either apply at the vehicle design phase or when the vehicle is in use. Both methods have their merits and both should be pursued.

However, the effectiveness of just revising technical standards is questionable. Without the force of legislation or other incentives, tyre manufacturers, vehicle manufacturers and hauliers may be very resilient to change their vehicle designs and make them more environmentally road friendly.

It is possible to change legislation at European or national level. At the national level it may be possible to bring about changes earlier, and to deal with specific problems, for example linking the findings of this COST action to national maximum vehicle weight limits. But to achieve maximum impact, measures at the European level should be the preferred route. International co-operation - as shown with the participants in this COST action - can give the greatest benefit overall and that is why the work of changing legislation should be taken forward at an international level at the earliest opportunity.

Notes

Presentation: 254

EFFECTS OF WIDE SINGLE TYRES AND DUAL TYRES - SUMMARY AND CONCLUSIONS

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Biography

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Abstract

Keywords: wide base tyres, dual tyres

The conclusions of the work relate to:

- Tyre fitment and pavement wear
- Tyre fitment and vehicle handling
- Tyre fitment and environmental effects
- Tyre fitment and vehicle operating costs
- Overall economic effects of the use of different tyre fitments.

On the basis of the conclusions drawn from the work, it was also possible to make recommendations on the development of future tyre fitments, including current sizes, and on the use of the results obtained in pavement design. .

Notes

Presentation: 261

INCLUDING PERFORMANCE MEASURES IN DIMENSIONS AND MASS REGULATIONS

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Biography

John holds BSc, BE(hons), ME degrees from the University of Auckland and a PhD from Cambridge University, He has over 25 years experience as a practising researcher. For the past 12 years his main area of research activity has been in vehicle dynamics, dynamic loading of pavements, vehicle-road interaction and pavement performance. John represented New Zealand on OECD Scientific Expert Group IR2, which investigated dynamic loading of pavements and following this he was a member of OECD Scientific Expert Group IR6 which conducted the DIVINE (Dynamic Interaction of Vehicles and INfrastructure Experiment) experiment. He was instrumental in having element one of this experiment conducted in New Zealand at the CAPTIF facility and acted as Transit New Zealand's Project Manager for this work. Since its inception, he has been the project leader for the suspension dynamics and pavement performance objectives in the FRST funded Vehicle-Road Interaction programme. In 1995 he was awarded a New Zealand Science and Technology Medal by the Royal Society of New Zealand for his contribution to this research.
Together with Peter Baas he established Transport Engineering Research New Zealand (TERNZ) Ltd in 1997. TERNZ has now grown to ten research staff (some part-time) and is regarded as the New Zealand centre of expertise in heavy vehicle-related research.

Abstract

Keywords: performance based standards, regulations

Heavy vehicle dimensions and mass regulations exist primarily to maintain safety and to preserve the infrastructure. In terms of these aims, the regulations are a crude mechanism but they are straightforward to measure and thus compliance checking is relatively simple and cheap. Since the RTAC study, which led to the first of these symposia in 1987, there has been increasing interest by regulators and users in the potential use of performance-based standards either in lieu of or as an adjunct to dimensions and mass rules.
In New Zealand the performance-based approach was adopted very early on for vehicles operating under permit. Vehicles operating within the existing dimensions and mass limits are not required to meet any performance standards for stability. However, New Zealand's dimensions and mass regulations are currently under review with the new rule scheduled for implementation in July 2002. The new rule includes a requirement that all heavy vehicles have a static roll threshold (SRT) greater than 0.35g.
In order to keep compliance costs reasonable an analytical method for determining SRT has been developed and implemented as an internet-based calculator. The calculator has been designed so that the required user inputs are easily obtainable. Default values are used for the other vehicle parameters. For the most significant parameters the user has the option to replace the defaults with real data. Where a vehicle fails to meet the target SRT, the load reduction at current height and the load height reduction at current mass required to achieve the target are both calculated. Validation tests comparing the calculator results with those obtained from tilt table testing and from computer simulations have shown a remarkably good level of accuracy.

Notes

Presentation: 262

ROAD ROUGHNESS AND IT'S EFFECTS ON THE INFRASTRUCTURE

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Biography

Professor Steinauer is the head of the institute of road and traffic research at the Technical University of Aachen since October 1995 . After graduating from university he started his career as a young trainee at the Bavarian Administration and then worked a couple of years as the head of department at the "planning department and building control office" in Landshut (Bav.). After that he became head of the road and traffic planning department of the Northern Bavarian Highway Administration and some years later head of the planning department of the Southern Bavarian Highway Administration. Finally he became official at the Supreme Building Authority of the Bavarian Department of the Interior, before having been called to the University of Aachen.

Abstract

Keywords: roads, roughness, loading, damage, simulation

The intention of this paper is to shed light on the interaction between road roughness and the resulting road damage caused by static and dynamic wheel forces. For this purpose several trucks have been mathematically modelled as multi-body systems in great detail. The models are based on actual data of the truck industry, taking concern of geometric details as well as non-linear behaviour, such as Coulomb damping in leaf springs and characteristic curves of springs and dampers.

In order to describe the relation between road roughness and its effects on road damage in a mathematical manner the first chapter of this paper deals with the description of the road in terms of the power spectral density.

Assuming that the road damage depends on the fourth power of the instantaneous wheel force, and the wheel force itself is distributed Gaussian, a relationship to the road roughness can be found. Based on this mathematical approach an easy to use formula has been deduced that allows to relate road roughness data to road damage.

In order to prove, whether and under which circumstances the above mentioned formula can give a realistic estimate of road loading the previously described complex vehicle models have been used to simulate test rides over a variety of different road surfaces. The results of these runs gave the necessary information to feed the formula, especially concerning the dynamic characteristics of the single axles and axle configurations. They showed that despite of the complex and clearly non-linear behaviour of the vehicles the amount of dynamic loading on the road as well as the road damage can be estimated by a rather simple formula based on the theory of linear vibrations. This formula even takes into account that there might be distinct periodic phenomena contained in the road profiles.

Notes

Presentation: 263

EVALUATION OF THE EFFECTS OF HEAVY VEHICLES ON BRIDGES FATIGUE

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Biography

Bernard Jacob is graduated from Ecole Polytechnique and Ecole Nationale des Ponts et Chaussées. He worked as bridge engineer with SETRA and LCPC for ten years and was involved in the scientific and technical studies for EN1991-3 (traffic load on bridges). Leader of the Element 5 of OECD/DIVINE project on dynamic interaction between trucks and infrastructures, he also co-ordinated European projects on Weigh-in-motion of road vehicles (COST323 and WAVE). He is actually head of the division for Road Operation, Measurements, Signing and Lightening with LCPC.
Delphine Labry was graduated in 1999 from Institut National des Sciences Appliquées (Lyon). She is in charge of the WIM activity for road vehicles and for aircraft in LCPC since year 2000.

Abstract

Keywords: bridge, fatigue, castor software, WIM

Fatigue is a progressive deterioration of a structure by crack growth, due to a series of stress variations (cycles) resulting from the application of repeated loads. The stress amplitudes are much lower than the failure strength of the material, and are experienced very often or even continuously during the structure lifetime. Fatigue damage is a function of the magnitude and frequency of load effect cycles as well as the fatigue strength or behaviour of a structural detail.
This paper aims at presenting and comparing the effect of several heavy traffics on bridge lifetime, using real traffic data recorded by weigh-in-motion systems and computed with CASTOR-LCPC software.
CASTOR-LCPC was developed to compute load effects on bridges induced by traffic loads, in order to verify structural design, to calibrate code load models, or to evaluate fatigue damages and lifetimes. Load effects (such as stresses) vs time, are computed using multi-lane traffic data files and theoretical or experimental influence surfaces. Especially, CASTOR-LCPC provides a "rain-flow'" histogram of the stress cycles counting allowing to evaluate fatigue, once combined with Miner law.
Two main types of structures are sensitive to fatigue: steel bridges with orthotropic decks and girder details of composite bridges. Both structures are considered in this paper, using existing French bridges.
A comparison will be carried out between long term measurements of strains on an orthotropic deck bridge (Autreville on the A31 motorway in eastern France) and stresses computed by WIM data and CASTOR-LCPC. Differences may be partially explained by dynamic effects which could lead to some lifetime reduction.
Also, the possibility to combine a vehicle dynamic model (by software) with CASTOR-LCPC will be investigated, to better account for dynamic effects.

Notes

Presentation: 264

THEORETICAL TESTING OF A MULTIPLE-SENSOR BRIDGE WEIGH-IN-MOTION ALGORITHM

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Biography

Civil Engineering degree from University of Cantabria, Spain, 1995. MSc and PhD degrees from Trinity College Dublin, Ireland, 1996 & 2001, specialising in Bridge Weigh In Motion. Currently post-doctoral Pierse Newman fellow in University College Dublin, Ireland.

Abstract

Keywords: accuracy, bridge, vehicle, dynamics, WIM.

A Bridge Weigh-In-Motion (B-WIM) system is based on the measurement of the flexure in a bridge and the use of the measurements to estimate the attributes of passing traffic loads. The information provided by strain sensors and axle detectors is converted into axle weights through the application of an algorithm. Because the dynamic interaction between bridge and vehicle has many parameters for which estimation is very difficult from purely bridge strains, the traditional B-WIM algorithm consists of static equations of equilibrium. Hence, dynamics can be a significant source of inaccuracy in B-WIM systems depending on the bridge and vehicle characteristics. In this paper, the influence of dynamics on B-WIM accuracy is assessed by simulating the passage of a number of vehicles over a bridge numerically. Then, the theoretical bridge response is used to test a new B-WIM algorithm based on multiple longitudinal sensor locations and the traditional algorithm based on one single location. In smooth road conditions, the multiple sensor B-WIM achieved the best results, while traditional B-WIM failed to predict individual axle weights accurately. In rough conditions, results were much poorer due to high dynamic excitation and only gross vehicle weight was predicted accurately.

Notes

Presentation: 265

TRAFFIC CHARACTERISATION IN FLEXIBLE PAVEMENT DESIGN

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Biography

After a Bachelor's Degree in Mechanical Engineering Andrew joined the Applied Dynamics Research Group at Cambridge University Engineering Department researching into the interaction between heavy goods vehicles, road damage and the environment. He completed his PhD 1994 and in September 1995 he was appointed to a Lectureship in the School of Civil Engineering at the University of Nottingham. where he has joined the well established Division of Pavement and Geotechnical Engineering. He has recently been promoted to a Senior Lectureship at Nottingham and he is currently an investigator on research grants in excess of £1 million. He has over 85 technical publications and is regularly invited to give technical presentations. Andrew's main research interests are in most aspects of pavement engineering including vehicle/pavement interaction, the mechanical performance of bituminous materials, pavement design and non-destructive pavement evaluation.

Abstract

Keywords: performance, dynamic loads, traffic

This paper investigates the way in which traffic data is used in flexible pavement design and analysis procedures. A deterministic Long Term Pavement Performance Model (LTPPM) is used to calculate flexible pavement damage caused by trafficking from three realistic fleets of commercial vehicles. The fleets have been modelled using seven axle group models representing steer axles, drive axles (single or tandem) and trailer axles (tandem or tridem) with either steel suspensions or air suspensions. Results are compared to the calculated flexible pavement damage caused by a fleet of 80kN standard axles and predictions from the currently used method of traffic characterisation for UK pavement design procedures. Results show that pavements that fail by rutting last longer when trafficked by the realistic vehicle fleets compared to the fleet of 80kN standard axles whereas the pavements that are predicted to fail by fatigue last longer when trafficked by the fleet of 80kN standard axles. Results also show that current UK pavement design procedures are more sensitive to differences in the vehicle fleet compared to LTPPM predictions.

Notes

Presentation: 266

NEW PAVEMENT ROUGHNESS THRESHOLDS TO REDUCE DYNAMIC TRUCK LOADING

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Biography

Dr. Chatti holds B.Sc. and M.Sc. degrees in Civil Engineering from Michigan State University, and a Ph.D. degree in Civil Engineering from the University of California at Berkeley (Dec. 1992). He is currently an Assistant Professor in the Department of Civil and Environmental Engineering at Michigan State University. Dr Chatti's research interests are in the areas of pavement analysis and design, rehabilitation and maintenance of pavements, non-destructive testing of pavements, pavement performance, and truck-pavement interaction. He has been involved in some fifteen research projects in the areas of pavement engineering and materials, eight of which as Principal Investigator, and has authored some twenty research papers. Dr. Chatti is a member of TRB and ASCE. His other professional experience includes serving as a consultant to Morrison Knudsen Corporation and the National Highway Authority of Pakistan for the N5 Highway project linking Karachi and Islamabad (1996) and working as Principal Engineering Consultant for STUDI Engineering (Tunisia, 1997).

Abstract

Keywords: roughness, thresholds, truck dynamic load

In this paper, roughness threshold values and corresponding life extensions are determined using relative damage and reduction in pavement life concepts. Using the 4th power law, relative damages from the 95th percentile dynamic load at different roughness index values, and the corresponding percent reduction in life were calculated and plotted for 333 pavement sections. A newly developed roughness index called the dynamic load index (DLI) was used for this purpose. Estimates of pavement life extension resulting from smoothing its surface were then generated for different Remaining Service Life (RSL) values. The results were presented in tables showing the expected life extension for a range of RSL- and DLI- values. These tables would enable a highway agency to determine when a particular pavement needs to be smoothed to obtain a given (desired) life extension. The analysis was done for the three pavement types (rigid, flexible and composite).

RSL-values were calculated for 805-m (0.5-mile) sections using actual distress growth over time. The results showed that for rigid pavements, 17 to 51% of sections would have life extensions of more than 3 years depending on roughness level. For composite pavements, none of the sections would have life extensions of 3 years or more. For flexible pavements, 9 to 34% of sections would have life extensions of more than 3 years depending on roughness level. These results indicate that preventive maintenance by smoothing action is best suited for rigid pavements.

Notes

Presentation: 267

ADHESION UTILISATION AND COMPATIBILITY OF HEAVY VEHICLE COMBINATIONS

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Biography

Mr. Finster is born is Budapest, June 29, 1965.
From 1979-1983 he studied at the "Kossuth Lajos" Special Secondary School in Budapest. Graduated here in 1983 as skilled automobile mechanic with a Certificate of final examination. Placed fourth on the occasion of the national inter-school competition.
From 1984-1989 he studied at the Technical University Budapest, Traffic Engineering Department. In 1989 taking a degree in automobile engineering. He now is an Automobile Engineer
Since 1989 he employed at the actual working place (Institute for Transport Sciences/KTI/; TÜV-Hannover-KTI Ltd.; Vehicle Engineering Department). Engaged in the elaboration, implementation and evaluation of motor-vehicle test measurements.
Co-operation in major topics, as:
1. transverse vibration tests of passenger car trailers;
2. overrun braking tests of passenger cars;
3. restructuring of the passive safety testing equipment, equipment-related measurements;
4. comparative assessment of commercial vehicle tires on the basis of running behaviour measurements;
5. road use tests of commercial vehicles; and
6. adaptability tests of wide commercial vehicle tires.

Since 1994 mainly dealing with vehicle braking systems tests implemented in compliance with domestic and ECE regulations.
Since 1999 engaged in the work of the ISO/SWG11 working group.

Abstract

Keywords: adhesion utilisation, heavy vehicle combination

The analysis is based upon the principle of a former dynamic calculation method, frequently used at single vehicle approvals in Hungary for harmonising the braking characteristics upon the adhesion utilisation of the vehicle combination members.

It should be assessed

- what adhesion utilisation demand-characteristics belong to the present compatibility requirements;
- how influences the possible narrowing of the compatibility bands in the future the adhesion utilisation demand?

The calculation uses the technical parameters of the present brake valves and wheel brakes. Also the production tolerances of the brake parts shall be taken into account.

The analysis is an attempt to investigate the potential of the direct application of the adhesion utilisation terms in order to "fine-tune" the braking compatibility within the vehicle combination and to investigate the possibilities of a more generous type approval application of the method.

Notes

Presentation: 311

COMPATIBILITY IN TRUCK TO CAR FRONTAL IMPACTS

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Biography

I graduated from Chalmers University of Technology in 1997. I joined the Cab Analysis Group at Volvo Truck Corporation in 1999 where I was responsible for the structural development of the Front Underrun Protection System for the new Volvo FH and FM series. Since 2001, I am managing the Cab Analysis Group.

Abstract

Keywords: FUPS, compatibility, crash, FEM, FEA

One of Volvo's core values is safety. In our policy it is stated that we should not only comply with legal demands regarding safety, but also develop vehicles that are safe in a real traffic environment.

The demands from the public on trucks with more friendly behaviour are constantly increasing. Today, only a few percent of the collisions where trucks are involved causes serious injuries or fatalities to the truck occupants, the majority (about 54 %) of injured persons are car occupants. This means that the FUPS is one of the most effective tool to reduce the number of fatalities in accidents involving trucks.

The use of an effective FUPS on the truck will dramatically reduce the number of fatalities in truck to car collisions. In Europe, an estimate is 800 saved lifes per year if all trucks were equipped.

The FUPS for the new Volvo FH and FM trucks has been designed not only to comply with legal demand effective August 2003, but also to absorb energy for smaller cars while still being rigid enough to withstand the force from a large car. This has been achieved by optimising a crumpling tube behind the FUPS beam that connects to rigid parts on the chassis.

The system was developed using FE simulations and verified in full scale testing.

Sensitivity studies were performed using an FE car model with different impact heights and offset ratios. The influence of impact angle between the car and the truck was also analysed.

For future systems, increased ability for the front of the truck to absorb energy is needed to further reduce the number of fatalities in truck to car accidents.

Notes

Presentation: 312

TRUCK TYRE WEAR ASSESSMENT AND PREDICTION

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Biography

Henk Lupker was born in 1956 in Wateringen, the Netherlands.
He obtained his masters degree in Mechanical Engineering at the Delft University of Technology.
In spring 1984 he started at the TNO Institute of Mechanical Engineering with a study for the Dutch government on risks involved in the transportation of dangerous goods by trucks, railcars and ships. Next, a series of consultancies on the buckling and failure of submarines and naval ships due to underwater shock loading was carried out for the Dutch, Belgian and US Navy. In 1988 he was appointed unit manager of the Mechanical Engineering group.
In 1990 he transferred to TNO Automotive as MADYMO product manager. MADYMO is a combined multibody and finite element software package used by the automotive industry world-wide for occupant safety and structural crash analyses. In 1998 he formed a new group on vehicle and tyre modelling in the Vehicle Dynamics department, expanding, amongst others, on the Delft-Tyre product range. He is the project leader of the TROWS project. Since summer 2001 he has been employed as manager of the Advanced Chassis and Transport Systems department. The focus of this department is on tyre assessment, vehicle intelligence and vehicle guidance.

Abstract

Keywords: tyre wear, truck, testing, modelling, software integration

Tyre wear is a complex phenomenon. It depends non-linearly on numerous parameters, like tyre compound and design, vehicle type and usage, road conditions and road surface characteristics, environmental conditions (e.g., temperature) and many others. Yet, tyre wear has many economic and ecological implications. The possibility to predict tyre wear is therefore of major importance to tyre manufacturers, fleet owners and governments. Analogous observations can be made for road wear prediction due to the high road maintenance costs and traffic safety implications. Tyre and road wear is strongly related; the energy that wears the road is the energy that wears the tyre. There is therefore much to gain from an integrated approach to studying the mechanisms behind both wear phenomena.
Based on these observations, in 2000 we started the three-year 5th framework EU project TROWS (Tyre and ROad Wear and Slip assessment). The results include tools to analyse tyre wear and road polishing. These will be combined in a suitable wear prediction environment.
This paper focuses on the followed methods and results so far of TROWS for truck tyre wear. Several types of tests were performed to obtain insight in the mechanisms behind the truck tyre wear phenomenon. These include material tests on tyre compounds, carousel tests with truck tyres, and tests with an articulated MAN truck on a public road course in Italy. Truck tyre wear mechanisms are presented and explained in relation to results from the performed tyre wear tests. Some modelling activities are discussed, as well as the wear prediction environment (Prolinx) that was developed to integrate the vast amount of test and modelling results from partners working at different locations with different tools. The relation between tyre and road wear is briefly touched upon. A discussion on the remaining challenges in predicting tyre wear concludes this paper.

Notes

Presentation: 313

NOVAB AXLE LOAD CALCULATION PROGRAM - CALCULATE THE OPTIMUM LOAD POSITION AND PREVENT OVERLOADING

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Biography

Mr. Han Rekers, born in 1965, graduated in 1988 as engineer on the HTS-Automotive. During his study he did a trainee at GM, Flint Michigan USA. He started his career as quality manager at a major truck dealer. In 1990 he started at Royal Nooteboom Trailers in Wijchen (NL) as Product Manager and salesman for The Netherlands. Nowadays he is Manager Sales Europe and in this function he is responsible for the total sales force in: The Netherlands, Belgium, Spain, Portugal, Italy, Denmark, Finland, Norway and Czech Republic.

Abstract

In 1998 the Dutch government wanted to put an end to overloading on Dutch roads with the arrival of the new weighing systems. They were talking about more then 50 of these systems on the major Dutch roads. The hauliers were really anxious about it, because penalties on overloading were very high and there was hardly no instrument for the haulier how he could accurate calculate the axle loads. Overloading is not only a matter of exceeding the Gross Vehicle Weight but also overloading the individual axle load.

To anticipate on this trend and to supply the heavy hauliers a tool to prevent overloading, Nooteboom Trailers developed a software programme called "NoVAB Axle Load Calculation".

With the software programme – supplied on CD-rom - the haulier can quickly and easily calculate the axle loads for a given cargo and also determine the optimum location of the cargo on the loading platform. In only a few months, NoVAB has proved to be very successful.

The latest version of this programme is NoVAB-2000 and is available in English, German, Dutch, French and Spanish. NoVAB-2000 has been a resounding success internationally. Hauliers world wide use it to prevent axle overload and to employ the right vehicle combination. The programme can be used for all brands of trailers and trucks, so it is not limited to trailer of Nooteboom brand. NoVAB-2000 is also a very useful tool for the application of special permits, necessary to execute special transport.

NoVAB-2000 offers the following functions:

- To place several loads on one trailer;
- To display and view the actual load on the trailer by using the cargo library;
- To import loads from other software programmes into the cargo library;
- Drawing loads yourself with the drawing module.

Notes

Presentation: 314

A PROFILE BASED TRUCK DYNAMIC LOAD INDEX (DLI)

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Biography

Dr. Chatti holds B.Sc. and M.Sc. degrees in Civil Engineering from Michigan State University, and a Ph.D. degree in Civil Engineering from the University of California at Berkeley (Dec. 1992). He is currently an Assistant Professor in the Department of Civil and Environmental Engineering at Michigan State University. Dr Chatti's research interests are in the areas of pavement analysis and design, rehabilitation and maintenance of pavements, non-destructive testing of pavements, pavement performance, and truck-pavement interaction. He has been involved in some fifteen research projects in the areas of pavement engineering and materials, eight of which as Principal Investigator, and has authored some twenty research papers. Dr. Chatti is a member of TRB and ASCE. His other professional experience includes serving as a consultant to Morrison Knudsen Corporation and the National Highway Authority of Pakistan for the N5 Highway project linking Karachi and Islamabad (1996) and working as Principal Engineering Consultant for STUDI Engineering (Tunisia, 1997).

Abstract

Keywords: roughness, profile, truck dynamic load, index

In this paper, a new roughness index called the Dynamic Load Index (DLI) is developed for the purpose of identifying pavement profiles that are likely to generate high dynamic truck-axle loads. The DLI is calculated as a weighted index of variances of the profile elevation in the frequency ranges 1.5-4 Hz and 8-15 Hz. The first frequency range corresponds to truck body bounce, while the second frequency range corresponds to axle bounce. The analysis showed a very good relationship between DLI and dynamic load. The DLI was tested on a range of road profiles from in-service pavements, and it was found that for any particular value of ride quality index (RQI), the DLI can cover a wide range of values, and this variation in DLI was found to correlate very well with dynamic load, as predicted by a truck simulation program. This was not the case for the International Roughness Index (IRI), which gave a low coefficient of correlation with dynamic load for the same range of profiles. Therefore, the new index can differentiate between profiles that generate high dynamic loads and those having the same RQI but generating low dynamic loads. Most importantly, the use of the DLI index negates the need for running a truck simulation program. This makes it possible for a state highway agency to decide whether a particular pavement with a given surface profile needs smoothing (to extend its service life) based on the DLI-value.

Notes

Presentation: 315

PRODUCTIVITY OPPORTUNITIES WITH STEERABLE AXLES

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Biography

Peter is MD of Roaduser Systems Pty Ltd and Chairman of ARTSA (Australian Road Transport Suppliers Association).
Roaduser Systems are truck trailer systems engineers well known for innovation in Australia and in other countries.
Dr Sweatman is currently chair of Standards Australia Committee ME/53 (Heavy Road Vehicles) and is active on other committees related to his research. He was elected a Fellow of the Academy of Technological Sciences and Engineering in 1997 and is currently a member of the Driver Education Centre of Australia (DECA) Board of Directors.
Dr Sweatman is currently President of the International Forum for Road Transport Technology and is a Fellow of the Society of Automotive Engineers of Australasia (SAE-A) and served as a member of the SAE-A National Council & Executive, as well as chairing the SAE-A National Conferences Committee. In 1992, Dr Sweatman was invited to join the US Transportation Research Board's Vehicle Size and Weight Committee and he still serves on that committee.
Dr Sweatman was invited to present evidence to the US National Transportation Safety Board's Hearings on Truck and Bus Safety, Washington DC, Nashville and New Orleans in 1999-2000.

Abstract

Keywords: steerable axle, dynamic performance, safety

Setting aside the primary (front) steering axles fitted to trucks and prime movers, a wide variety of steerables axles are available for use on multi-axle vehicles. These steerable axles are designed for both trailing (un-powered) axles and driven axles. All of these steerable axle types address, in different ways, the fact that vehicle tyres operate in a sub-optimal way as soon as a vehicle unit is fitted with more than two axles and/or more than one "fixed" axle. This degradation in tyre and vehicle performance can be exhibited in: 1) Increased tyre wear; 2) Increased vehicle swept path; 3) Increased pavement surface wear; 4) Increased resistance to forward motion (and increased fuel consumption); and 5) Potentially undesirable effects on vehicle steering control.

Steerable axles offer performance improvements for all classes of heavy vehicle and provide direct benefits to transport operators who choose to use them. Such performance improvements also open the way to productivity gains in road freight transport operations because longer or heavier vehicles may be enabled within the constraints of the infrastructure, traffic and safety.

Steerable axles may also adversely affect certain areas of heavy vehicle performance, depending on the vehicle configuration and the characteristics of the steerable axle. To address these issues, the dynamic performance of selected vehicles fitted with steerable axles was compared with that of currently-operating vehicle configurations and with the performance parameters being developed in the Performance Based Standards (PBS) project being carried out by the NRTC and Austroads.

This paper will describe the results of an Australian study of current steerable axle practices, performance effects on a range of vehicle configurations, safety and geometric impacts, productivity benefits, net economic benefits and regulatory implications.

Notes

Presentation: 316

PARAMETER SENSITIVITY OF THE DYNAMIC ROLLOVER THRESHOLD

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Biography

The author, who lives with his wife Jennie in Solna close to Stockholm in Sweden, holds a Masters and a Doctorate degree in Vehicle Dynamics from the Royal Institute of Technology (KTH) in Stockholm.
In 1997, after finishing his MSc, he started working at KTH in a research project on active safety of commercial vehicles, but in 1998 he changed employer to Scania Commercial Vehicles. At Scania he started at the Vehicle dynamics department where he besides development work finished his PhD studies. Since 2001 he is working at the Road safety research department.

Abstract

Keywords: rollover, vehicle dynamics, simulation, taguchi

Knowledge of commercial vehicle rollover mechanics, required in the development of active dynamic control systems and when designing for increased safety, commonly relies on static analysis providing the steady state rollover threshold, SSRT. In a rolling vehicle however, kinetic energy is always present and that deteriorates the analysis of roll stability from SSRT. Therefore, knowledge of the dynamic rollover threshold, DRT, is equally relevant.

In order to investigate the parameter sensitivity of the dynamic rollover threshold, the Taguchi method is applied: simulations are performed according to a specific plan forming an orthogonal matrix existing of high, medium and low parameter values. The influences from five test parameters on SSRT as well as DRT of a truck and a tractor semitrailer combination are calculated, including the corresponding parameter interaction effects. Investigated parameters are frame roll stiffness plus axle roll stiffnesses and roll centre heights of front and rear axles.

Results show that the different vehicles are unequally sensitive to parameter changes: the rear axle roll characteristics are the most important semitrailer parameters, while the front axle roll stiffness is most important for the truck. Two vehicles can thereby be equally stable statically but differently dynamically. The frame stiffness is less important for both vehicles, but when interacting with the front axle roll stiffness, the effect on DRT is noticeable.

Notes

Presentation: 317

DYNAMIC INTERACTION OF VEHICLES AND BRIDGES

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Biography

Dr Wayne Roberts is a Civil Engineer and Senior Project Manager with Infratech Systems & Services. He has extensive experience in the evaluation and testing of bridges and other structures subjected to static and dynamic loads. Wayne has been responsible for the field testing of over 100 bridges and other structures in Australia and New Zealand. Recently, he has been involved in the economic assessment of the effects of higher vehicle mass limits on bridges in New Zealand and has been involved in the development of the fatigue design load for bridges for the new Australian Standard for Bridge Design.

Abstract

Keywords: simulation, vehicles, bridges, dynamics

Many studies conducted world-wide over a period of more than a decade have confirmed that large dynamic effects can be induced in bridges by the combination of heavy vehicles and uneven road profiles. In Australia, approximately 75% of the bridges have spans between 5 and 15m. Many of these short span bridges have shown dynamic effects due to vehicle-bridge interaction that far exceed the provisions of the current Australian Bridge Design Code, and in some cases dynamic increments in excess of 100% have been recorded, even for heavily loaded events. The introduction of the new Australian Bridge Design Standard will see the design load for bridges increase to allow for heavier and more innovative vehicles in the future, and it is important to investigate vehicle-bridge interaction associated with these future vehicle types.

This paper presents results from computer-based dynamic models that were developed to investigate the complex problem of dynamic interaction between heavy vehicles and bridges in the presence of uneven road profiles. The models were used to investigate the influence of the main parameters governing dynamic responses of bridges to the crossing of heavy vehicles, such as bridge natural frequency and damping, vehicle mass and suspension characteristics, road profiles on the bridge approaches and deck, and vehicle speed. Results from parametric studies were found to be generally consistent with field measurements and experience. The work described in this paper is part of an ongoing program of research in Australia that is aimed at delivering recommendations to AUSTROADS with respect to the dynamic load allowance both for the design of new bridges and the assessment of existing bridges.

Notes

Presentation: 321

FUTURE EUROPEAN HEAVY GOODS VEHICLES

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Biography

Born in 1956 in France.
Graduate Engineer, Ecole Nationale Supérieure des Techniques Avancées, Paris 1978.
Engineer in the Manufacture Française des Pneumatiques Michelin since 1979.
Presently in charge of the prospective marketing for the Truck Tyres Business in Europe.
French representative in COST 334.

Abstract

Keywords: vehicle configuration, environment, congestion

The White Paper on a common transport policy is about to be published by the Transports European Commissioner.
The broad outlines of this document and its policy guidelines were already published.
For goods transportation, unless major new measures are taken by 2010 in the European Union, heavy goods vehicle traffic on the road will increase by nearly 50% over its 1998 level. The approach the White Paper is based on comprises a number of measures to reduce the growth rate of road haulage to 38%, due to a better use of the other means of transport. This level corresponds to a return to the 1998 levels of market shares of the different transport modes.
Even in those conditions, important and urgent efforts are to be made by the road transport industry (including truck and tyre manufacturers, road authorities, etc) to progress towards sustainability and have by 2010 acceptable or improved levels of road congestion, polluting emissions, noise, road safety and transport efficiency.
This is a difficult challenge. However it has to be achieved and, taking into account the present and foreseen by 2010 infrastructure geometry, several new vehicle configurations can be defined in a win-win approach. They are intended to reduce the number of vehicles and the congestion they contribute to, the fuel consumption and the corresponding polluting emissions, the pavement damage and maintenance costs and to improve the vehicle stability and safety as well as to improve the road transport efficiency. These vehicle configurations do not meet present European Regulations but are viewed to be possible responses to the challenge mentioned above. They are described and discussed , with an evaluation as precise as possible of their main characteristics, advantages and drawbacks.
The acceptability of these future new trucks by the existing infrastructures will be checked with respect to fatigue of pavements and bridges, as well as to traffic safety conditions.

Notes

Presentation: 322

INTRODUCING LONGER AND OR HEAVIER VEHICLE COMBINATIONS (LZV'S) IN THE NETHERLANDS, A LONG AND HEAVY PROCESS

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Biography

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Graduation of Business Administration University of Groningen, 1982- 1989
Market researcher 1990
Business Consultant logistics EVO, 1991
Secretary of Express Services and Distribution, TLN, 1992-1995
Worked at Novem on Environmentally-friendly Vehicle technology (Programme SSZ), 1995-1999
Policy Advisor Ministry of Transport, Public Works and Water management, at the Road Traffic Department, 1999-present.

Abstract

Keywords: longer heavier lorries, Holland

Presentation will include the history, present and future position of the modular concept in The Netherlands, the first outcomes of the project with a maximum of 15 combinations allowed 60 tons and/or 25,25 m in the Netherlands.
Specific points will be the logistic consequences, safety, fuel consumption and vehicle demands.

Notes

Presentation: 323

NORDIC VS. CENTRAL EUROPEAN VEHICLE CONFIGURATION; FUEL ECONOMY, EMISSIONS, VEHICLE OPERATING COSTS AND ROAD WEAR

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Biography

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- Road Administration of Finland (economic analyses and benefit-cost analyses of road investments),
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- Ministry of Transport and Communications Finland (technical and economic analyses, ADP systems and simulation systems for traffic and transport policy),
- FINNRA (technical and economic analyses, ADP systems and simulation systems for traffic and transport policy)

Abstract

Keywords: vehicle configuration, payload, energy, emissions

The paper includes, firstly, description of the Finnish Vehicle Motion Simulator, VEMOSIM, its principles, input and output data and analysis output data. Secondly, the paper gives among other the following results: 1) The so-called Nordic Vehicle Configuration in Finland and Sweden (truck + trailer, gross mass 60t and maximum length 25.25m) is much more effective measured in the transport power (tkm/h) and energy consumption (fuel, l//100tkm) and much more environmental friendly (emission amounts, g/tkm) than the Central European vehicle combinations (gross mass 40t, maxi-mum length 18.75m); 2) The payload of the Nordic vehicle configuration is approximately 42t, but the one of the Central European is only approximately 25t; 3) Though the fuel consumption per the traffic product unit (vehicle*km) increases with the mass, but calculated per the transport product unit (ton*kilometer) it decreases remarkably as well as the emissions.

These results and many more have been obtained by using the VEMOSIM together with digital road and street data, DIGIROAD. The VEMOSIM results have been validated with field measurements. The VEMOSIM-DIGIROAD system will be the future tool for analysing effectively, fast and economically the effects of road and traffic conditions, traffic management, alternative routes, vehicle and engine characteristics, driving technique, etc. on the energy consumption, emission amounts, etc. of transport and traffic systems. The VEMOSIM is based on vehicle dynamics - on one of the basic laws of physics, namely Force = Mass * Acceleration (F = m*a).

In the case of road traffic, input data of the VEMOSIM includes three data categories: 1) engine and vehicle data, 2) road data and 3) driving patterns. The principal engine data consist of engine maps for fuel consumption and different emission components.

Notes

Presentation: 324

DESIGN AND OPERATIONAL CONSIDERATIONS TO ACCOMMODATE LONG COMBINATION VEHICLES AND LOG HAUL TRUCKS ON RURAL HIGHWAYS IN ALBERTA, CANADA

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Biography

BILL KENNY P.Eng., is a graduate of the National University of Ireland (University College Galway) and is a professional engineer in Alberta. He has worked extensively on road and civil engineering construction industries in Ireland and Canada. He has many years of experience in development of highway geometric standards, practices and guidelines for use in Alberta. He is the principal author of Alberta's Highway Geometric Design Guide. His current position is Geometric Standards Specialist with Alberta Transportation in Edmonton, Alberta

JOHN MORRALL, PhD, P.Eng., is a professor of Civil Engineering at the University of Calgary. He joined the University of Calgary after completing his Ph.D. at the University of Waterloo. John was a visiting fellow at the Australian Road Research Board in 1984 and 1985. He was a research associate at the Institute of Transportation Studies at the University of California (Berkeley) in 1977 and 1978 and visiting professor at the School of Mountain Highway Engineering at the National University of San Juan, Argentina in 1996. His research and professional interests include all aspects of the planning design, operations and maintenance of urban and rural highways He is a three time winner of the Transportation Association of Canada (TAC) gold medal for the best technical paper presented at the TAC Annual Conference (1974, 1984 and 1993). He is a member of the Transportation Research Board, Committee A3A10-Highway Capacity and Quality of Service, Washington, D.C. His main contributions to the Highway Capacity Manual (HCM) include two-lane analysis procedures in the 1985 and 1994 Manuals, and HCM 2000.He is currently director of the Centre for Transportation Engineering and Planning (C-TEP) and has given a series of short courses on road safety audits and advanced geometric design. International activities have included highway projects in Peru, Argentina, Australia and the United States. He is a founding member of the Road Safety Science Group and is involved in a wide range of road safety audits.

Abstract

Keywords: highway, design, safety, vehicle, dimensions

The purpose of this paper is to outline the geometric design features that have been developed to accommodate Long Combination Vehicles (LCVs) and log haul trucks on rural highways in Alberta, Canada. Vehicles longer than 25 m are referred to as LCVs and include the following vehicles: Triple Trailer combinations, 35 m in length; Rocky Mountain Doubles, 30 m in length; log haul trucks which can be up to 30.5 m in length, with a 9 m overhang and Turnpike Doubles, 38 m in length. The paper presents the vehicle dimensions, swept path and off-tracking characteristics of each vehicle type. Geometric design features include intersections, ramps and centre-line spacing on two-lane highways. The paper also presents the criteria used to develop the LCV and log haul truck route networks for the province. The movement of over-dimensional equipment, machinery and pre-assembled components is accommodated on the high-wide-load (HWL) corridor. This 450 km HWL corridor allows loads up to 9 m high and weights from 122 tonnes in the summer and 177 tonnes in the winter. Weights as high as 380 tonnes may be conveyed providing size and space requirements of undercarriage wheel assemblies are met for critical bridge structures. The paper also includes the findings of a recently completed study on the safety of LCVs. Alberta Transportation has been monitoring the operations of LCVs and log haul trucks since their introduction on Alberta Highways in the 1960's. The findings indicate that LCVs have one of the best safety records of all heavy vehicle fleets in the province.

Notes

Presentation: 325

IMPROVED PERFORMANCE OF EUROPEAN LONG HAULAGE TRANSPORT (EXTRA)

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Biography

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EXAMINATIONS	1969; Master of Science in Mechanical Engineering	
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Abstract

Keywords: heavy vehicle, modules, load, capacity

The TFK project EXTRA with participants from Sweden, Finland, Denmark and the Netherlands started in March 2001 and will be finished in May 2002. By use of authentic freight information collected during a three-month period from hauliers operating on the European continent the advantage of an extended modular heavy vehicle system will be demonstrated. The reduced number of road trains needed for the same transport volume will be calculated showing the potential in savings of vehicle kilometres, fuel consumption, CO2 emissions and cost etc. Other identifiable positive effects such as decreased traffic density and road wear as well as improved traffic safety are also expected.

In 1997 Sweden and Finland, by exception from the EU Council Directive 96/53/EC, was permitted to retain longer lengths and 60 tonnes maximum weight for vehicles in national traffic. To avoid unfair competition the exception required that the maximum lengths should be extended to contain either truck or semi-trailer combination and an attached continental trailer unit. This way foreign road trains can be extended with an available extra trailer for additional capacity when entering Sweden and Finland. Theoretically the loading capacity of a semi-trailer combination may be increased by about 60 % consisting of 51 m3 and 16 tonnes. The extra loading capacity for a truck and trailer combination is about 40 % consisting of 37 m3 and 11 tonnes. The system is based on modules consisting of the CEN standardised 7.82-metre long unit load carrier and the 13.6-metre long semi-trailer being the longest single vehicle allowed in EU and largely used. The units are well adapted for rail transport in combined transport either as single vehicle units or as separate load carrier units. It is built on existing vehicles and load carriers available in large quantities on the European continent.

Notes

Presentation: 331

ABNORMAL LOADS SUPER ROUTES – A STRATEGIC INVESTMENT FOR SOUTH AFRICA'S ECONOMY

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Biography

Paul Nordengen was born in Durban, South Africa, where he completed his bachelor's degree in civil engineering at the University of Natal in 1981. He joined the South African Railways and worked in the bridge design office and on a construction site as resident engineer. He joined the CSIR in 1986 as a researcher in the Bridges section. In 1988 he completed an MSc in structural engineering at the University of the Witwatersrand. At the CSIR his main areas of research have been management systems (bridges, vehicle overloading, abnormal load vehicles, heavy vehicle cross-border freight) and heavy vehicle overload control strategies for various road authorities in Southern Africa. He is a member of the SADC Overload Control Working Group, which has the objective of addressing problems related to overload control in the SADC region. He has been involved in the development of management systems for various road and railway authorities in South Africa, Malawi, Botswana, Namibia, Swaziland and Taiwan. He is currently project leader of a technology transfer project between South Africa and China regarding infrastructure management systems. He has presented papers on heavy vehicle overloading and bridge management systems at conferences both locally and overseas. Mr Nordengen is a member of the S.A. Institute of Civil Engineers and is registered as a professional engineer with the Engineering Council of South Africa.

Abstract

Keywords: abnormal loads, super routes, heavy vehicles

Because of a lack of inland waterways and the limited capacity of the railway network in southern Africa, the transportation of heavy industrial equipment to and from manufacturing, processing, power generating and other industries, in many cases, has to take place by road. When these large indivisible payloads, together with the combination of vehicles used to transport them, exceed 150 tons, 8 metres in width or 4,8 metres in height they are defined as Superloads and are of paramount interest to highway and traffic officials responsible for preserving the road network, infrastructure and furniture and minimising traffic congestion. The routes that they are allowed to travel are limited by bridge capacity and geometrics, involving mass, height, width and length restrictions. These critical routes are known as Super Routes. Failing to establish and maintain such Super Routes will place unfortunate limits on the South African industry by limiting opportunities for importing, exporting and moving superloads such as large machinery and transformers within the country. The national Abnormal Loads Technical Committee recognised a need to identify and monitor a minimum number of strategic routes that need to be preserved for the movement of Superloads. Short-sighted planning has in the past caused a reduction in the capacity of existing routes by the construction of overpasses with restrictive clearances on particular routes. CSIR Transportek was appointed by the Gauteng Department of Transport to develop a computerised tool for graphically displaying all relevant data related to these Super Routes. The system will be a useful tool for indicating to planning authorities the effect that a particular project such as a new bridge or a cable across a road could have on reducing or improving the capacity of a given route. The primary consideration is to arrest the increasing constraints being placed on existing routes by the encroachment of restrictive features. Route improvement based on favourable cost/benefit ratios will become a reality. The effectiveness of given routes may, for instance, be improved by raising a power line cable or a single bridge.

Notes

Presentation: 332

WHEEL LOAD MEASUREMENT, WIM, ACCURACY, TOP TRIAL

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Biography

Obtained in 1986 Dr. Ing. from Bauhaus-University of Weimar. Over 28 years scientific work in Mathematics and Simulation Technology. Now Academic Assistant of professorship Transportation planning and Traffic engineering. Design of WIM sensor arrays.

Abstract

Keywords: wheel load measurement, WIM, accuracy, TOP TRIAL

The article focuses on methods for the design of WIM - sensor fields and algorithms for evaluation of dynamic axle load measurement data developed in the TOP TRIAL project.

Design methods and evaluation algorithms aim to increase measurement accuracy of dynamic weighing systems and to reliably determine static axle loads and gross vehicle weights with a high degree of precision. Introduced are simulative, graphic and analytical methods for calculating and designing WIM sensor fields to minimise dynamic axle load variations measurement errors.

The various methods of calculation and design are based on deterministic as well as stochastic 1- and 2-sinusoidal wave approaches for modelling actual dynamic gross vehicle weight and axle load vibrations. The error minimisation methods developed are based on the use of mean value and tolerance interval methods as well as the curve fitting method.

All methods introduced have been programmed and tested under real-life conditions.

Utilisation and validation of methods and procedures are described using a real-life example.

Notes

Presentation: 333

HEAVY VEHICLE WHEEL SEPARATIONS: EXPLORING THE CAUSES

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Biography

Mr. Woodrooffe is Principal of Woodrooffe & Associates Incorporated, an engineering consultancy dedicated to large truck safety located near Ottawa Canada. He is also President of Safety Dynamics Incorporated; a company dedicated to the development of enhanced crash data recording and analysis tools. He is known internationally for his work on heavy vehicle safety, stability and control and has a wide reputation for his investigations of truck safety, accident reconstruction, and transport productivity.
In 1994 Mr. Woodrooffe was awarded the Commemorative Medal for the 125th anniversary of Canadian Confederation, on behalf of His Excellency, the Right Honourable R.J. Hnatyshyn, Governor General of Canada, for contributions to the National Research Council of Canada.
Mr. Woodrooffe serves as Adjunct Professor at the University of Manitoba.

Abstract

Keywords: heavy vehicles, wheel separation, wheel off, truck safety

Large truck wheel separations have resulted in 6 fatalities in the Province of Ontario, Canada since 1995. As a result of public concern, and by concluding that the wheel separations were the result of sub-standard maintenance practices, the Province of Ontario enacted severe penalties in an effort to reduce the problem. Despite the new measures and a significant effort from industry to improve wheel maintenance practices, wheel separations continue to occur in Ontario at a rate of 7 reported incidents per month. This paper examines the heavy truck wheel separation problem and discusses some unique technical factors that may be influencing the integrity of wheel systems.

Notes

Presentation: 334

COMPARISON OF THREE PROGRAMS FOR SIMULATING HEAVY-VEHICLE DYNAMICS

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Biography

Hans is a Mechanical Engineering graduate and obtained his PhD in 1984 from the University of Melbourne. He has 21 years of engineering and engineering research experience in vehicle dynamics, which commenced with the study of motorcycles in 1979, and progressed in a series of logical steps to innovative large off-highway mining trucks with gross weights approaching 500 metric tonnes. Hans has been involved in the measurement and analysis of road roughness, and was responsible for the development of a laser-based profilometer used for major surveys at the network level. For a brief period Hans took to the air and helped to design and develop a vibration isolation system for an aerially towed SQUID magnetometer used in minerals exploration. Returning to earth, his interests have extended to heavy vehicle wheel forces and infrastructure impacts, and recent topics include the dynamics of vehicle-bridge interaction. Formally a Chief Scientist with ARRB Transport Research Ltd., Hans now heads RTDynamics, a business unit of Texcel Pty Ltd. His current preoccupation is with the many challenges posed by performance-based standards for heavy vehicles.

Abstract

Keywords: heavy vehicles, simulations, performance standards

Australia and New Zealand are developing a performance-based standards approach to the regulation of heavy vehicles which is intended to encourage and foster innovation in road transport with the expected outcomes of enhanced productivity, improved road safety, better use of the infrastructure, and reduced environmental impacts. While computer-based modelling is expected to play a central role in both the development and initial demonstration of innovative vehicles and concepts, some Stakeholders have expressed the concern that performance predictions from computer-based models may not be reliable and may substantially differ with software package and with the Service Providers that use them. To address these concerns three computer-based modelling packages were compared: ADAMS, The University of Michigan Transport Research Institute (UMTRI) constant velocity Yaw/Roll model and AUTOSIM. Models of two heavy vehicles were created by two Consultants using the three packages. The same input datasets were provided to each Consultant and simulations were performed using the same test manoeuvres. Time histories of a wide range of variables from the simulations were compared as well as numeric values from a selection of performance measures. Simulations that provide a direct measure of vehicle responses to precisely defined steer inputs (open-loop control) showed excellent agreement and the results were generally more consistent than simulations requiring steer controllers and closed-loop path following. With due care, acceptable agreement between modelling packages can be achieved. Recommendations are made that will reduce variability between models to acceptable levels in path following tasks. .

Notes

Presentation: 335

IMPACTS OF DIFFERENT JUNCTION TYPES ON HEAVY DUTY VEHICLES

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Abstract

Keywords: junctions, impacts, hdv, dynamic, simulation

The paper includes the impacts which four different junction types cause on heavy duty vehicles. These impacts are estimated in quantitative units and in money terms. The junction alternatives are: an intersection, a roundabout, an interchange with one loop ramp and a diamond interchange. The type vehicles are a coach, a single unit truck, a truck + semitrailer combination and a truck + trailer combination. The impacts are estimated by using a vehicle motion simulator based on dynamics. It is called VEMOSIM and developed in Finland.

The VEMOSIM outputs directly the data needed for quantifying the impacts, when vehicles move through the junctions. The impacts are: the time consumed, the fuel amount (and thus the varying vehicle operating costs), the emission amounts by components (NO_x, CO, HC, PM and CO_2), gear changes, etc.

Based on these output data the following cost items are calculated: the varying vehicle operating costs, the time costs and the emission costs and, additionally, the gear changes and information about the benefit distribution between the vehicle categories. The case study concerns a 4-leg junction of the main roads no. 5 and no. 14 in Finland (ADT ca 8500; 89% of light vehicles and 11% of HDVs).

The results and the preliminary conclusions are: the best alternative is the diamond interchange. However, its benefit/cost ratio is not high enough, because the construction costs are high and the traffic volume low. The roundabout causes extra costs compared with the present intersection, because of decelerations and accelerations, when the vehicles move through the roundabout. Concerning the different vehicle categories the greatest impact is involved in the truck + trailer combination. Especially, the fuel consumption and emissions increase remarkably in the case of the roundabout. The VEMOSIM system is an effective tool for analysing impacts of different junction types.

Notes

Presentation: 411

REVIEW OF TRUCK AND DOG TRAILER OPERATIONS OVER 42.5 TONNES GROSS VEHICLE MASS

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Biography

Barry Hendry is a Senior Project Manager with the National Road Transport Commission (NRTC). Barry has been with the NRTC since March 1996 following career positions related to road transport and materials handling equipment in the Royal Australian Air Force and the State Electricity Commission of Victoria. He has also occupied maintenance management and project management positions with the Freight Services and Maintenance Divisions of the Victorian Railways. At ABBFANS, a manufacturer of heavy industrial and mining ventilation fans, he was responsible for Total Quality Management systems and Human Resources. He is a Mechanical Engineer and has recently completed a post graduate certificate course in logistics. At the NRTC he is responsible for national Vehicle Standards (Heavy and Light Vehicles) and is currently involved with the review of

1. Mass limits for Truck and Dog Trailer operations; 2. Vehicle Axle Spacing Mass Schedules (Bridge Formula); and
3. Mobile Crane regulations.

Barry has had a role in the introduction of higher mass limits for heavy vehicles and contributes to the NRTC's Heavy Vehicle Regulation Performance-Based Standards project.

Qualifications: 1. Associateship Diploma of Mechanical Engineering; 2. Master of Business Administration (Technology Management); 3. Graduate Certificate of Logistics

Abstract

Keywords: truck/trailer, performance based standards

In Australia, the national Road Transport Reform Regulations only allow operation of truck and dog trailers to 42.5 tonnes gross combination mass (GCM) and a mass ratio of 1:1. However, many jurisdictions allow higher mass limits/mass ratios and operation up to 50 tonnes GCM on their general road network.

The Australian National Road Transport Commission (NRTC) has proposed a scheme (based on a Performance Based Standards (PBS) approach) which provides specific dimensional limits for truck-trailer combinations above 42.5 tonnes and up to 50 tonnes GCM with the options of providing separate evidence that showed compliance with a performance-based formula or a full PBS assessment.

While the most common usage for truck-trailers in Australia appears to be for transportation of quarry products, there is a growing application in logging and other sectors (such as fuel transportation) where stability factors are of concern.

The objective of the NRTC review was to develop appropriate performance-based controls for the design and operation of truck trailers at higher mass limits to deliver a consistent road safety performance. A national policy is considered desirable to: 1. Improve consistency; 2. Introduce a common set of conditions; 3. Facilitate cross jurisdiction operations even though the percentage of interstate operation is expected to remain low; and 4. Ensure a consistent on-road safety performance for the truck trailer fleet.

This project has provided a useful example of the potential for a PBS approach. In part, it suggests that traditional assessment techniques have potential shortcomings that can now be better addressed.

This paper will outline the various approaches taken in developing the operational conditions for general access operation of truck and dog trailers above 42.5 tonnes GCM and the process in obtaining agreement by operators, regulators and truck/trailer manufacturers to the proposal.

Notes

Presentation: 412

COMPARATIVE PERFORMANCE OF SEMI-TRAILER STEERING SYSTEMS

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Biography

Brian Jujnovich graduated with a Bachelor of Engineering from Curtin University, Perth Western Australia in 1997. His final year thesis was entitled "Tthe Dynamic Response of Heavy Duty Trailer Suspensions".
Following graduation Brian worked as a specialist engineer for leading Australian consultancy firm Sinclair Knight Merz. Within this organisation he was responsible for computer simulation of mechanical systems, finite element analysis, vibration analysis and field testing. Brian also worked part time as a design engineer and manager in his family's general transport engineering company.
In 2001 Brian joined the University of Cambridge Transport Research Group as a PhD student. He is currently undertaking research into active steering of articulated vehicles.

Abstract

Keywords: articulated, vehicle, steering, trailer, handling

In recent years a number of systems have been developed which allow the rear axles of semi trailers to be steered. By steering the rear axles such systems improve the low speed manoeuvrability of the vehicle as well as reduce tire scrub. This is important for transporting goods in urban areas where vehicles need to negotiate sharp corners and small roundabouts.

The steering systems that are available differ vastly in their design. Some systems use self-steering spring-centred axles while others incorporate linkages to the fifth wheel or steerable bogies. As a result of these design differences vehicles fitted with various steering systems do not perform the same way.

In this paper the performance of various steerable trailer systems will be discussed and comparisons made. A yaw plane model will be described that was used to determine the performance of each steering system. The model incorporates affects such as non-linear tires and load transfer, which are important in heavy vehicle handling. Within the model a simple driver sub-model is used to steer the vehicle down the desired path at a desired velocity.

Results from simulations using the model will be presented. These results will show how the various steering systems perform under common manoeuvres. The manoeuvres will include high-speed lane changes, high-speed cornering, low-speed j-turns and low speed roundabouts. Performance will be characterised by the vehicle's ability to follow the desired path, its handling characteristics, the lateral tyre forces and load transfer, rearward amplification etc.

Results from experimental measurements will also be presented to show the validity of the model and accuracy of simulated results. The test data will be obtained by instrumenting both a non-steering trailer and steerable bogie trailer and performing staged manoeuvres on a test track.

Finally the performance of the various steering systems will be compared. Comparisons will be made between each design as well as to a non-steering trailer. Reasons for the differences in performance will be discussed and recommendations made to improve the performance of each system.

Notes

Presentation: 413

THE FIRST WIM SYSTEM DESIGNED IN POLAND

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Biography

Janusz Gajda was born in Jaroslaw, Poland, on May 21, 1954. He received the M.Sc., Ph.D., and D.Sc. degrees from University of Mining and Metallurgy in Kraków, Faculty of Electrical Engineering, Automatics and Electronics, in 1978, 1985 and 1992, respectively. Now he is working as academic lecturer at University of Mining and Metallurgy. He is the Head of the Department of Instrumentation and Measurement. His research interests include identification of industrial objects, analysis of the influence of measuring equipment parameters on identification errors, modelling and simulation of measuring systems and their elements, optimisation of the measuring systems and data processing algorithms used in the identification experiments, as well as road traffic and biomedical measurements. He has published 2 books and 93 conference and journal papers in these fields.

Abstract

Keywords: heavy vehicle weights, WIM systems

In April 2001 has been installed the first Weighting in Motion - WIM system, fully designed, programmed and assembled in Poland. The system operates in standard configuration i.e. is equipped with two strip piezoelectric WIM sensors and one inductive loop installed between them. Each axle is weighted twice using two WIM sensors. The arithmetic mean value of both results is assumed as the final axle load. The measuring range of the system is included between few hundreds of kilograms to 20 tons for the vehicle velocity included in range 25 - 100 km/h. The described system allows estimation of single axle and whole vehicle loads, as well as vehicle detection in the measurement zone, measurement its velocity, number of axles, distance between successive axles and trailer detection, based on vehicle magnetic profile registered by using inductive loop. The system calibration has been done using the method of testing, pre-weighted goods vehicles; two axle vehicle with total load equal to 17,100 kg and four axle vehicle with total load equal to 33,940 kg respectively. Calibration coefficients calculated on this basses for each from four WIM sensors allows the permanent weighting of the moving vehicles for statistical purpose and for pre-selection of the overloaded vehicles, which are guided to detailed control on the static weighbridge co-operated with the WIM system. The standard deviation of the moving vehicles weighting results, obtained in the described system does not exceed 7% and the bias error is less than 1.5%. The statistical characteristics describing the road traffic observed on tested road section are presented in the paper. Specially the distribution in day time and day of week of the vehicles number crossing the WIM system, mean traffic velocity, total load and mean axle load. The effectiveness of the overloaded trucks detection is also estimated.

Notes

Presentation: 414

THE EFFECT OF MASS LIMIT CHANGES ON THIN-SURFACE PAVEMENT PERFORMANCE

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Biography

John de Pont holds BSc, BE(hons), ME degrees from the University of Auckland and a PhD from Cambridge University, He has over 25 years experience as a practising researcher. For the past 12 years his main area of research activity has been in vehicle dynamics, dynamic loading of pavements, vehicle-road interaction and pavement performance. John represented New Zealand on OECD Scientific Expert Group IR2, which investigated dynamic loading of pavements and following this he was a member of OECD Scientific Expert Group IR6 which conducted the DIVINE (Dynamic Interaction of Vehicles and INfrastructure Experiment) experiment. He was instrumental in having element one of this experiment conducted in New Zealand at the CAPTIF facility and acted as Transit New Zealand's Project Manager for this work. Since its inception, he has been the project leader for the suspension dynamics and pavement performance objectives in the FRST funded Vehicle-Road Interaction programme. In 1995 he was awarded a New Zealand Science and Technology Medal by the Royal Society of New Zealand for his contribution to this research.
Together with Peter Baas he established Transport Engineering Research New Zealand (TERNZ) Ltd in 1997. TERNZ has now grown to ten research staff (some part-time) and is regarded as the New Zealand centre of expertise in heavy vehicle-related research.

Abstract

Keywords: pavement performance, accelerated pavement testing

Pavement design and management including road user charging in New Zealand is largely based on the well known fourth power relationship between axle loads and pavement wear. However, the vast majority of the New Zealand highway network consists of thin surface unbound pavements, which are quite different from the pavements used in the AASHO road test where the fourth power law originated. Recent proposals to improve the efficiency of the road transport system have included options to raise the axle load limits as well as the GVM and GCM. Although the fourth power law predicts an effect, the true impact of these higher axle loads on the performance of the pavements is unknown.

To determine the impact on pavement wear, an accelerated pavement test was undertaken at the Canterbury Accelerated Pavement Testing Indoor Facility (CAPTIF) to compare the wear from a 10 tonne axle with that from an 8.2 tonne axle. The two loading units at CAPTIF were configured to be the same in all respects except load. They trafficked parallel paths on four different thin-surface pavements for approximately 1 million load cycles. The pavement was extensively monitored throughout the test.

From the data collected a new empirical model of the relationship between load and vertical surface deformation has been developed. This predicts a quite different relationship between load and wear to the fourth power law and has major implications for pavement management, particularly if the mass increase is implemented, and for the road user charging regime.

Notes

Presentation: 421

ADVANCES IN CRASH PROTECTION INVOLVING HEAVY GOOD VEHICLES

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Biography

Prof. dr. Jac Wismans is manager R&D of TNO-Automotive, Crash-Safety Centre in Delft, the Netherlands and Professor in Injury Biomechanics at the Eindhoven University of Technology. He received his Ph.D degree from Eindhoven University of Technology in 1980. In 1978 he joined TNO. He is a board member of IRCOBI and member of the Stapp Car Crash Conference Advisory Board. He is co-ordinator of the European Passive Safety Network and chairman of the EEVC WG 12 "Adult crash dummies". He is member of the Commission Road Transport (Kamer Wegverkeer) of the Dutch Traffic Safety Board (Raad voor de Transport Veiligheid).

Abstract

Keywords: accidents, safety, passive, truck, compatibility

Injuries due to motor vehicle crashes are one of the leading causes of death and disability in our motorised society. A significant number of these road trauma involve heavy good vehicles The problem can be reduced considerably if adequate attention is given to accident and injury control strategies. Injury control (or passive safety) measures are based on the recognition that deaths and injuries can be reduced in number and severity if the actual operating conditions during the crash phase are modified. Typical examples of passive safety measures are seat belts, airbags, energy absorbing padding, vehicle crush zones, etc..

The objective of this paper is to provide an overview of developments in the field of crash protection in accidents involving heavy truck vehicles. In particular the crash compatibility of heavy good vehicles in crashes with other road vehicles and with other road users will be addressed. A review of European accident data will be provided of heavy truck related accidents. Different injury control strategies will be discussed and in particular attention will be given to the possibilities of energy absorbing underrun protection systems. Results of European research in this field will be presented and it will be shown that also without large changes in the framework of current European regulations significant reductions in truck related road victims can be achieved among others by the introduction of add-on devices.

Notes

Presentation: 422

DYNAMIC STABILITY OF DOUBLE B-DOUBLE ROAD TRAINS

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Biography

Hans is a Mechanical Engineering graduate and obtained his PhD in 1984 from the University of Melbourne. He has 21 years of engineering and engineering research experience in vehicle dynamics, which commenced with the study of motorcycles in 1979, and progressed in a series of logical steps to innovative large off-highway mining trucks with gross weights approaching 500 metric tonnes. Hans has been involved in the measurement and analysis of road roughness, and was responsible for the development of a laser-based profilometer used for major surveys at the network level. For a brief period Hans took to the air and helped to design and develop a vibration isolation system for an aerially towed SQUID magnetometer used in minerals exploration. Returning to earth, his interests have extended to heavy vehicle wheel forces and infrastructure impacts, and recent topics include the dynamics of vehicle-bridge interaction. Formally a Chief Scientist with ARRB Transport Research Ltd., Hans now heads RTDynamics, a business unit of Texcel Pty Ltd. His current preoccupation is with the many challenges posed by performance-based standards for heavy vehicles.

Abstract

Keywords: road trains, stability, simulation, road space

In response to concerns over the lateral road space requirements and stability of a fleet of rigid plus double B-double (R2B2) road trains operating in remote Western Australia, investigations were conducted of various options for improving the on-road performance of the vehicles. The vehicles, having a gross mass of over 150t and an overall length of 51.4m, were observed in operation to exhibit excessive swaying of the rearmost trailers. This swaying was found to increase with vehicle speed, and has been raised as being of concern by other road users. An inspection of the vehicles revealed a rearward location of the tow coupling on the rigid truck, and elevated positions of the load bins, both of which contribute to increased rearward amplification, and hence to swaying and increased road space requirements. A change to a double B-double (2B2) configuration was proposed, replacing one of the load bins on the rigid truck and the first dolly with a turntable on the rear of the truck. This removes one articulation point and the long coupling rear overhang, with a slight reduction in payload capacity. In order to quantify the effect on swaying and road space requirements of the proposed change in configuration, comprehensive whole-of-vehicle computer-based models of the two vehicle configurations were created. In simulations of a standard lane change and pulse steer manoeuvres, the 2B2 exhibited superior dynamic stability. Additional simulations were conducted, revealing that reducing the load centre-of-gravity height, increasing the trailer suspension roll stiffness, and increasing tyre cornering stiffness all would lead to further improvements in dynamic stability and road space requirements

Notes

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TANKER TRUCKS IN THE CURRENT ACCIDENT SCENE AND POTENTIALS FOR ENHANCED SAFETY

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Biography

Dr. Johann Gwehenberger, born 1960, in Schwarzach, Austria.
1984, completed master mechanic's qualifications in automotive engineering. This was followed by a degree in physics and engineering at the Munich University of Applied Sciences, where he graduated in 1993. Between 1994 and 1999 he worked at DBV-Winterthur insurance, one of the largest insurers in Germany, as a Risk Management adviser for small to medium-size enterprises, concentrating on vehicle fleets. In 1998, he was awarded a doctorate by the Albert-Ludwigs-Universität in Freiburg for his thesis on "The damage potential of accidents involving tankers transporting gasoline, diesel, fuel oil and liquid gas".
Since 1999, he has been employed as the head of the commercial vehicle safety department at the Institut für Fahrzeugsicherheit (Institute for Vehicle Safety) in Munich which is part of the German Insurance Association. During this time, he has also acted as task leader for various projects sponsored by the European Commission, for example, "Enhanced Coach and Occupant Safety" (ECBOS, "Passive Safety Network" (PSN 2) and VC-COMPAT. Since 1998, he has also lectured on technical risk management at the Munich University of Applied Sciences and is the author of "Mehr Sicherheit für Fahrzeugflotten" (an advisory document on safety for vehicle fleets).

Abstract

Keywords: truck, safety, tank, rollover, hazardous goods

The transport of hazardous goods, which today is governed by extremely restrictive laws, and which constitutes approximately 10% of road transport, involves great risks to people, the environment and material objects. This is especially true if flammable liquid hazardous goods are released. Large-scale damage or even disasters may be the result. Terrifying incidents in the past, such as Herborn, Germany (1987) or San Carlos de la Rapita Alfaques, Spain (1978), clearly illustrate the scale of the damage that could be involved. Under this circumstances the development of road accidents involving vehicles carrying hazardous goods will be shown by using statistical data of Germany. In summary, due to a variety of measurements a decrease in road accidents involving dangerous substances can be recognised. Nevertheless, a risk analysis of hazardous goods transport shows that the road transport accident rate is at least seven times higher than that of rail and inland waterway transport. Furthermore, major accidents (involving the escape of more than 10,000 liters) occur most frequently on the road and least frequently by rail.
Therefore the primary sources of risk leading to hazardous substances escaping from a tank will be focused. These are mainly single accidents with rollover of the tank vehicle (roughly 60%) and collisions with other heavy vehicles, in which the rear or side of the tank are involved. Finally active and passive safety measures will be proposed which are in line with the state-of-the-art technology and which are effective to reduce the probability of accidents resulting in the release of liquid hazardous goods from protective tanks.

Notes

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DYNAMIC INCREMENT FACTOR IN MODULAR EXPANSION JOINTS OF BRIDGES UNDER HEAVY TRAFFIC LOADING

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Biography

Johan Maljaars graduated cum laude in Civil Engineering at Delft University of Technology, The Netherlands in 2001. He obtained an extra certificate for the design of buildings at the same university. His graduation subject was Lateral-Torsional Buckling of Coped Girders, for which he developed a Finite Element model and carried out full scale laboratory tests. As a traineeship, Johan was involved in the design and construction of two suspension bridges in Norway with contractor HBG Civil. Since August 2001, Johan works for TNO Building and Construction Research, where he researches aluminium structures, fatigue of steel and aluminium bridges and dynamic behaviour of bridges and floors.

Abstract

Keywords: dynamic impact loads, bridge modular expansion joint, strain gauges, accelerometers

Dynamic impact loads caused by lorries play an important role in the durability of the joint and its environment.

The static and fatigue behaviour of the joint structure and the adjacent transition strips and wearing course are strongly affected by the magnitude of the loads. The dynamic impact factor depends on the road profile and the loading time together with the eigenfrequency of each structural element. Recent damage in modular expansion joints caused the need for investigation into the vehicle expansion joint interaction. A typical two axle vehicle has been instrumented with accelerometers and strain gauges have been applied on the cross beams of the expansion joints. The vehicle passed the joint with various speeds. The dynamic impact factors and the damping in the cross beam have been derived. Further the applied loads by the vehicle axles at each location have been derived from the accelerometers.

Notes

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