

An Impact-based Approach To Vehicle Emission Management

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Presented to the

Institute of Road Transport Engineers of New Zealand

SEVENTH INTERNATIONAL HEAVY VEHICLE SEMINAR

WELLINGTON

16 & 17 July 1998

VIITH INTERNATIONAL HEAVY VEHICLE SEMINAR - IRTENZ

**IMPACTS BASED APPROACH TO VEHICLE
EMISSIONS MANAGEMENT**

by

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THE HISTORY;

- VEHICLE EMISSIONS CONTROL INTRODUCED OVER 30 YEARS AGO; JAPAN, USA, ECE/EU
- UNIVERSAL APPROACH - REDUCE TAILPIPE EMISSION RATES, TO MEET.....
- EMISSION STANDARDS, REGULATING MAX. LIMITS ALLOWABLE, AS DETERMINED BY.....
- CERTIFICATION TEST PROCEDURES, USING REFERENCE DRIVE CYCLES

THE RESULT;

- TAILPIPE RATES LOWERED BY FACTORS OF 10 OR MORE, AND STILL REDUCING, SO VEHICLES BECOMING CLEANER.....
- AS MEASURED BY STANDARD TEST PROCEDURES
- AIR QUALITY PROBLEMS STILL PREVAIL, IN URBAN LOCATIONS, ATTRIBUTABLE TO MOTOR VEHICLES, SO.....
- MORE BEING ASKED OF THE VEHICLE (AND FUELS) INDUSTRY, BUT....
- DIMINISHING RETURNS AVAILABLE

THE PROBLEM;

- POLLUTION IS A CONCENTRATION FUNCTION, MEASURED IN g/m^3 IN THE AIR(SHED) - THE "IMPACT"
- EMISSION IS A RATE FUNCTION, MEASURED IN g/km OF VEHICLE TRAVEL - THE "SOURCE"
- LACK OF QUANTIFIED CORRELATION, AS BASIS FOR UNDERSTANDING.....
- THE EXTENT OF THE AIR QUALITY CONCERN
- THE CONTRIBUTION OF THE VEHICLE SOURCE
- THE MAIN INFLUENCES ON EMISSION RATE QUANTITIES

IMPACTS BASED APPROACH;

- **DEFINES THE STATE OF THE LOCAL AIR QUALITY, AGAINST ACCEPTED GUIDELINES; "EXCEEDANCES"**
- **DETERMINES THE LOCAL FACTORS CAUSING EXCEEDANCES, CURRENT OR POTENTIAL**
- **QUANTIFIES THE LOCAL CONTRIBUTION OF VEHICLE EMISSIONS, FROM THE TRAFFIC NETWORK, CURRENT AND POTENTIAL; EMISSION CONTROL TARGETS**
- **CONSIDERS BOTH TRAFFIC NETWORK MANAGEMENT AND TAILPIPE CONTROL TECHNIQUES , TO MEET TARGETS**

FUNDAMENTAL VEHICLE EMISSION PROBLEMS;

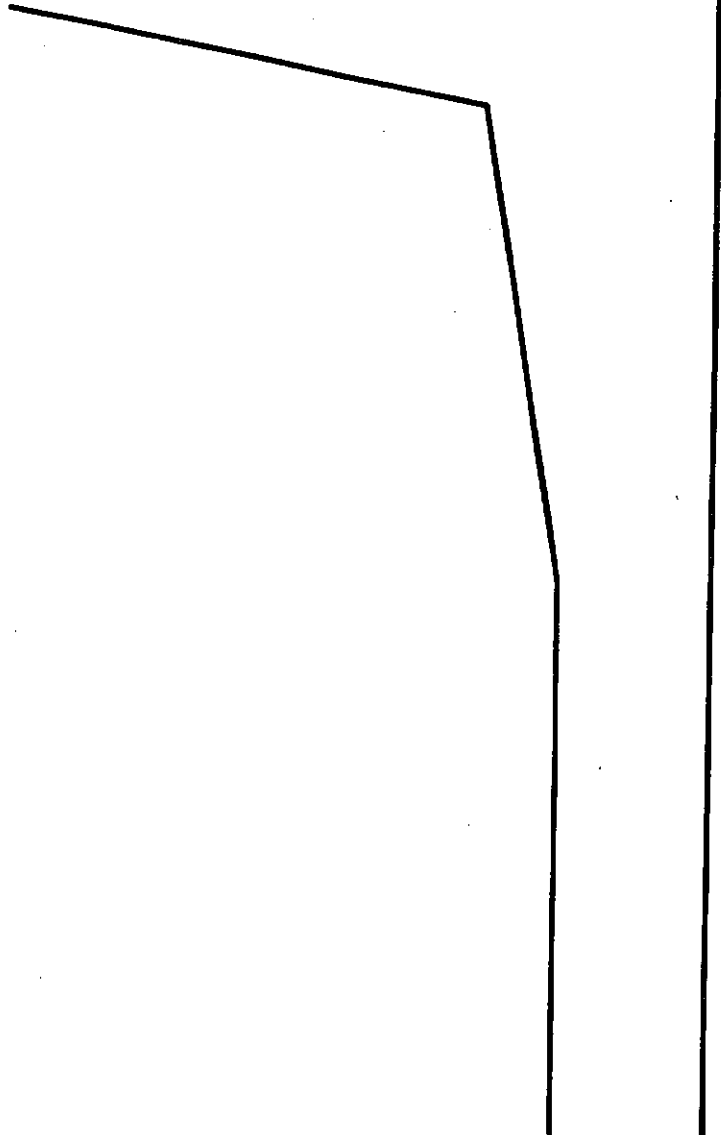
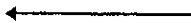
- VEHICLE DEVELOPMENT/CERTIFICATION PROCEDURES, NOT REFLECTING ACTUAL DRIVING CONDITIONS
- GROWTH IN URBAN VEHICLE USE; MORE VEHICLE ACTIVITY IN GIVEN AIRSHED VOLUME
- GROWTH IN URBAN VEHICLE USE; CONGESTION ON GIVEN ROADWAY SPACE INCREASES PER VEHICLE EMISSION RATES
- INEFFICIENT USE OF ROADWAY CAPACITY

EFFECTIVE AIR QUALITY MANAGEMENT REQUIRES;

- MEASUREMENT OF IMPACTS, TO SET TARGETS FOR MANAGEMENT, AND TIMESCALES
- SET TARGETS FOR COMPARING RELATIVE POTENTIAL OF MANAGEMENT STRATEGIES
- LOCAL STRATEGIES TO REFLECT LOCAL INFLUENCES
- MANAGEMENT WITHIN FINITE "ENVIRONMENTAL CAPACITY" OF URBAN AIRSHED

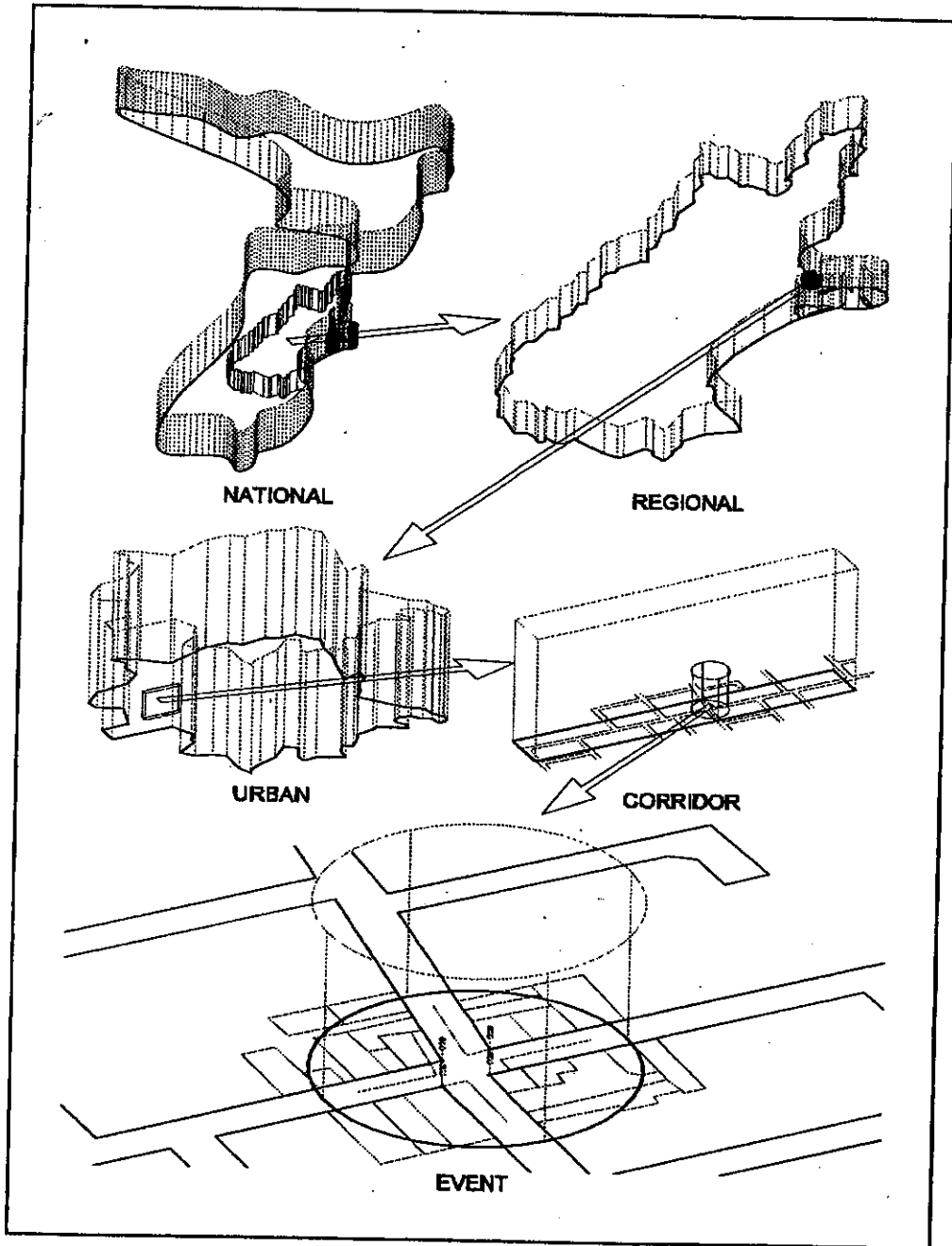
EMISSION RATES V. CONGESTION

Emission
Rate,
g/km



Traffic Density vs. roadway capacity





Gary Hartley – IRTENZ Conference – July 1998

I would like to thank the Institute of Road Transport Engineers for inviting me to present at this seminar. I have structured the presentation to give you some information about Kenworth, our product range, some interesting product applications, a little about our environmental considerations, followed by a look at new materials. I will then finish off with a video showing how each Kenworth is custom engineered in Australia. I will be happy to answer any questions you may have at the end of the presentation.

Kenworth Trucks is part of the Paccar Worldwide Group of Companies which includes Peterbilt and Kenworth in the United States, Foden in the United Kingdom, DAF in Europe and now Leyland in the UK as well.

Paccar is now the second largest heavy truck manufacturer in the world. Kenworth in the United States is this year celebrating 75 years in business, we celebrated our 25th anniversary in 1996. A lot of people don't realise that Kenworth is manufactured, not just assembled, in Australia. We actually make parts on site and have in excess of 300 suppliers. The trucks are engineered in Australia, as you'll see in the video at the end of the presentation. My role as Chief Engineer reports directly to the Managing Director of Kenworth Australia. We therefore have autonomy and utilise this to design for the conditions and customer expectations in Australasia.

Kenworth is conveniently located approximately 1 hour East of Melbourne in a suburb called Bayswater with a 130,000 sq ft manufacturing facility and 32,000 sq ft of administration office space. There are approximately 700 employees on site including 45 in engineering – 12 of which are degreed engineers. The Paccar Parts Warehouse, which has just recently been extended to 100,000 sq ft, is located beside the manufacturing plant as you can see here on the right hand side of the slide.

Our model range starts with the T300, which is typically used in agitator and rigid body applications. It has a horsepower range of 250-300 Hp and 950 ft lbs torque with a maximum GVM rating of 24 tonne. This particular truck is aimed at the lower GVM customer and is only available with limited options.

At the other end of the spectrum, we have the C510. This is a specialised vehicle that was developed for mining applications and it is currently grossing up to 200 tonne GCM hauling gold ore from a mine site to a processing mill. This truck is unique in the world, as the engine is an industrial diesel QSK Cummins engine adapted into automotive applications only in Australia. This vehicle is capable of a horsepower range from 600-750 Hp. The limiting component on this particular vehicle is the transmission. There currently are no manual transmission manufacturers able to provide us with a suitable transmission capable of more than 3050 ft lb torque. This truck model won an SAE award for engineering excellence. Automatic transmissions are available, but their size would dictate a wider chassis frame which would mean that the vehicle was over the 2.5 metre legal width.

The model with the highest share of build rate is the T401, which you typically see in single trailer work or 44 tonne GCM B-train applications on line-haul work. This model support 11 and 12 litre engines with ratings from 350 horsepower up to 430 horsepower and 1650 ft lb of torque.

An equal share of our production capacity is claimed by the K100G. This truck takes 12 and 14 litre engines and the new 15 and 15.8 litre engines from Cummins and Caterpillar with a capability up to 600 horsepower and 2050 ft lbs of torque. To our knowledge, our K100G is the only production cab-over in the world with a 600 Hp capability. The COE is essential when overall length is critical and can be specified as a tractor or rigid configuration.

This is by no means the limit of our model range, only a sample. A model range brochure is included in your seminar satchel. Everything we build is uniquely Australasian, operating in conditions much more severe than those in the US or Europe, usually in applications pulling far more weight in higher ambient temperatures.

This makes a local design capability and supplier base essential, typically an Australasian built Kenworth has 50% local content.

From an environmental perspective, Kenworth Trucks in Australia exceed all the Australian Design Rules. We take engines sourced from the USA which comply with the latest 1998 United States EPS standards, which means we exceed the Australian Design Rule currently set at 1991 USA EPA, resulting in much cleaner emissions than the legislated requirements.

From a noise stand-point, we design to meet the Australian Design Rules drive-by noise levels which are far more stringent than the United States requirement. Therefore, our trucks have more sound shielding to provide a quieter pass-by. Kenworth Australia has also developed a muffler to enable the specifications to be met.

In general, our chassis is recyclable by virtue of the bolted construction philosophy that enables them to be easily maintained, modified and updated. Our research shows that 70% of the trucks that have been built since we commenced manufacture in Australia over 27 years ago are still operating.

Collision repair of our cab is relatively easy due to the aluminium and fibreglass construction assembled using huck-bolt technology from the Aerospace industry.

Service and parts outlets are conveniently located throughout Australasia, in New Zealand alone, there are 14 parts and service outlets.

There are some interesting developments in truck design and construction emerging from the United States, particularly the Kenworth T2000, which is the latest line-haul aerodynamic model. The T2000 is not yet offered in Australasia, but a unit is being tested in Australia. The construction includes the use of a special aircraft style self-piercing fastener that deforms when

applied to the mating sheets, thus securing the joint. The countersunk head design results in a flush surface finish.

Adhesives are used extensively throughout the cab. In some locations, the adhesive is all that is holding the component to the vehicle. There are no mechanical fasteners, just in case. Here you can see a door check bracket. The use of adhesives as opposed to huck-bolts makes for a much quieter working environment for the assembly operators.

SMC or sheet moulded compound, is used extensively where finish is important. For example, the hood and the doors are made from SMC. This material is recyclable and gives greater design freedom and more consistent material thickness than fibreglass. SMC is a closed mould process enabling any volatiles emitted to be controlled reducing the effect on the environment. This is difficult with current open mould fibreglass techniques. The bumper is Metton, a liquid moulding resin, which is good for resisting impact damage typically expected while the vehicle is in operation. Metton was chosen also because it can be burnt safely and cleanly if disposal is necessary. The floor is an aircraft organic composite consisting of lightweight wood between two layers of fibreglass. The lightweight wood is balsa farmed in South America. All of the cab side panels are adhered to the edge of the floor.

All the US testing has shown this flat floor cab arrangement to be extremely stiff and strong. Paccar is working closely with the US Government to develop a heavy vehicle roll-over standard. The T2000 has been used in the development process and has been found to perform very well. An interesting spin-off to the new technology in the cabin was the training that was required for smash repairs around the United States on how to repair adhered construction cabs. There is a heat gun technique used to release the joint to replace the panel.

Down at the business end of the vehicle, a lot of the suspension components are now cast aluminium, whereas in the past steel was always used. All of our testing at our technical centre and in field has shown results exceeding that of the steel equivalent. This suspension, shown, represents a weight saving of 110 kg over the equivalent steel version. Extensive testing is done at our technical centre in the United States where the capability exists to shake testing entire vehicles as well as cabs. The centre is also equipped with material labs, durability road testing with a special test track with both high speed and low speed severe operation events. Typically, line-haul vehicles designed for Australasia are put through tests designated for severe US applications because of the vast differences in road conditions. It's always pleasing to see that the vehicles that we are designing in Australia pass with flying colours.

To conclude, we will now view the video about how we custom engineer our trucks.