LorryLogic Report

An Independent & Scientific Evaluation of the Effectiveness of **BORPower®** Engine Oil Additive on a Truck's Fuel Consumption

Prepared by: **Mr. Roger Denniss**

Date: 23rd October 2008

LorryLogic Report

Section 1 R E P O R T I N D E X

Section 2 THE REPORT

An Independent and Scientific Evaluation of the effectiveness of BORPower® Engine Lubricating oil.

Objective

To evaluate the effect of BORPower® Lubricant Additive on a truck`s fuel consumption through independent, impartial empirical track tests and to produce an open but confidential report.

Further evaluations on the effect of the additive on Power, Torque, engine temperatures, noise and exhaust emissions would follow subject to the initial empirical fuel consumption findings.

Method

1. A simple, three axle, well used 21 tonne gross vehicle weight with a flatbed body was selected for the trial. This vehicle had a well documented operational history and had just satisfactorily passed its annual Ministry of Transport Test.

2. The vehicle was then run on normal service operation with load details, mileage, fuel consumed and weather conditions recorded.

3. The vehicle was then carefully scrutinised for any defects likely to affect the running efficiency, and fitted with a detachable fuel tank. A load of 9.170 tonnes was then carefully positioned and secured on the vehicle's flat bed. The position of the load was documented to enable an identical load to be applied at the time of the second test track run at a later date.

4. The loaded vehicle was then run a distance of over 50 miles to the test tracks at the Motor Industry research Association (MIRA) and a professionally qualified MIRA test driver carried out a IRTE/BTAC (Institute of Road Transport Engineers /British Advisory Consortium) Type 1 test described below. (This was before the BORPower® additive was added)

   The IRTE/BTAC TYPE 1 Test basically comprises:

   Weighing the vehicle on a weighbridge and recording both Individual axle weights in addition to the gross vehicle weight as tested.

Running the vehicle around the MIRA 4.459 km high speed circuit to ensure that normal engine and transmission temperature had been achieved.

Stopping at an identified Start/finish line just off the track where the weight of the fuel in the test tank is recorded together with the fuels temperature and specific gravity.

The vehicle was then driven five laps of the high speed circuit at 60 km/h (37 mph) then five laps at 80 km/h (50 mph) and 5 laps at the vehicle's maximum speed 90 kmh (56 mph).

The vehicle is then returned to the start/ finish line where the weight of the detachable test tank is weighed and the temperature recorded.

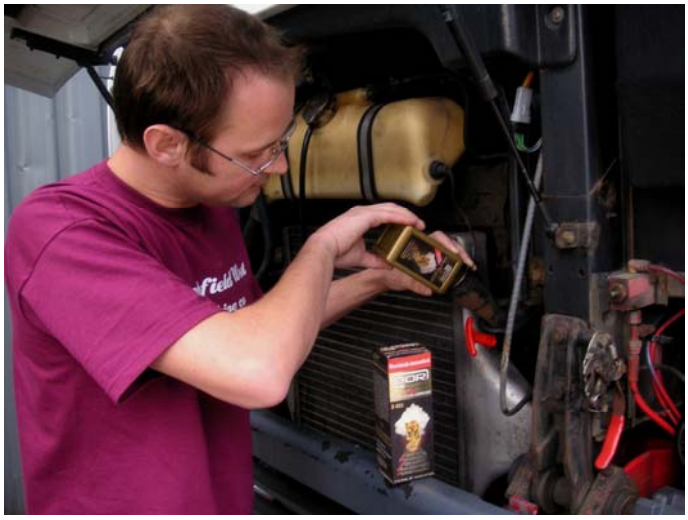
The second part of the standard test procedure is then commenced on the No Two circuit also called the inner durability 3.8 km circuit basically to simulate a stop start operation as opposed to a motorway or trunk road operation.
Here the vehicle completes 5 laps at 50 km/h (31 mph) stopping at the end of each lap before the start of the next lap.

Then running another 6 laps stopping at positioned marker cones. Two Stops at 32 km/h (20 mph) and four 48 km/h (30 mph) stops.

The vehicle then returns to the stop/ start line where the detachable fuel tank is weighed to determine the amount of fuel used .The Temperature of the fuel is again recorded to enable the specific gravity of the fuel to be corrected and the accurate amount of fuel calculated in terms of volume .

5. Following the first IRTE/BTAC track test on the 4th October, the vehicle had an engine oil and oil and fuel filter service.

6. The engine was then fed with the BORPower® additive in accordance with the instructions indicated on the BORPower® container. The vehicle was then put into normal service with the fuel consumption was again carefully recorded.



7. Having completed an additional 815 kms (505 miles) after the BORPower® additive had been added, of normal over the road type operation, the vehicle was returned to MIRA for an identical IRTE/BTAC Type 1 fuel evaluation.

8. The results of this second IRTE/BTAC Type 1 evaluation performed on the 9th October 2008 were recorded and carefully compared with those recorded on the first evaluation of the 4th October 2008.

Section 3 RESULTS

Summary of Results.

1. **Prior to addition of BORPower® additive:** On the 4th October the following test results were recorded.

1.1 *IRTE/BTAC Type 1, part 1, Test high speed*: 11.35mpg at average speed of 45.20 mph.

1.2 *IRTE/BTAC Type 1, part 2, Stop start circuit*: 9.72 mpg at an average speed of 22.9mph.

1.3 *Average of part 1 and 2*: 10.73 mpg at an average speed of 33.85 mph ##.

2 After addition of BORPower® additive: On the 9th October the following test results were recorded.

2.1 *IRTE/BTAC Type 1, part 1, Test high speed*: 12.516 mpg at an average speed of 44.4 mph.

2.2 *IRTE/BTAC Type1, part 2, Stop start circuit*: 10.825 mpg at an average speed of 22.825 mph.

2.3 *Average of part 1 and 2*: 11.88 mpg at an average speed of 33 mph **##**

3 Recorded and observed improvement in fuel consumption following the application of BORPower® additive .

3.1 *IRTE/BTAC type 1 test high speed*: 10.274% improvement

3.2 *IRTE/BTAC type 2 stop start circuit*: 11.36% improvement

3.3 *Average of part 1 and part 2*: 10.817% improvement **##**

The average has been calculated on the total distances covered and the fuel consumed on each of the Type 1 Evaluations carried out on the 4th and 9th October 2008. That is the fuel consumed and the distance covered during part I of each test plus the fuel consumed and he distance covered during part 2 of each test.

Section 4 Discussion

Satisfactory determination of commercial vehicles accurate fuel consumption, takes a great deal of careful planning, preparation and patience with checks and balances along the line.

Determining the amount of fuel used by weight and converting to volume by a temperature corrected specific gravity is accepted as a very accurate method by the road transport industry.

As the result of significant increases in diesel costs, operating fleets have witnessed their fleet fuel costs rising from less than 30%, twelve months ago, to over 40% of their total vehicle operating costs today (Source Transport Engineer).

Recording fleet`s fuel consumption has never been easy because of the difficulty in collecting reliable fuel consumed and distances covered data. The introduction of Telematics providing instantaneous, and trip, on board fuel performance has added another complication in that the information is very optimistic and frequently unreliable. Only very expensive fuel flow meters have proved successful and even then experience has indicated that some sort of test back up is advisable.

To evaluate just one fuel saving intervention, for example like low rolling resistant tyres or low viscosity drive train lubricants or aerodynamic devices has also been a challenge to the fleet manager. To help him, the Huge American Truck Association, introduced a Two Truck Test procedure to evaluate such one off fuel saving interventions some years ago.

Here two identical trucks were run over a given route, one fitted with the fuel saving intervention and the other with out it, and fuel used and distance covered recorded. The fuel saving intervention was then taken from one truck and installed on the other truck and the same route was run and the performances were compared.

The results were not as clear cut as one would imagine as it quickly became apparent that although the trucks were to the identical build specification, their over the road performance was as much as 4 % different.

In addition to the differences in performance, as mentioned above, there is the inevitable road hold ups and weather conditions even when vehicles are trying to run side by side as it were . These are referred to as “road noises”. Possibly road noises in this context can best be described as road incidents that prevent the desired over the road plan being achieved.

For the reasons related above, BTAC (British Advisory Consortium) and the IRTE (Institute of Road Transport Engineers) devised the MIRA based Type One test procedure.

Part one to simulate motorway and trunk road operation and part two the stop /start operation to simulate a delivery operation.

The benefits are to avoid “Road Noises” which enables the vehicle or vehicles to achieve their planned run. In addition data including vehicle weight, type of fuel and quantity used, in addition to distance run can be gathered accurately. Climatic conditions including wind speed and direction and ambient pressures and temperatures are recorded at 10 minute intervals.

It is fair to report that the two IRTE/BTAC Type One evaluations carried out on the 4th and 9th October went without a hitch and accordance with the plan. This was very much due to using a basic 18 tonne truck well prepared by its owner Mr Mick West, and his son Charles, who not only ran his own fleet for 30 years but was familiar with the IRTE/BTAC Part One test procedures at MIRA.

Secondly the driver on each of the test days ,a MIRA employee ,also had previous experience of the IRTE/BTAC trials and it was a great compliment that his average speed recorded over the two test days varied by as little as 1.68 % on the part 1 test and 0.5% on the part 2 test.

The gross weight of the vehicle was 1.3% heavier at 16480k or 210 kg on the second test day which would not have helped its fuel consumption. It should be pointed out that this was a working vehicle and the load had to be delivered next day.

Ambient conditions on the two days were very similar being dry and sunny with prevailing South West and South by South West gusty winds.

The average temperature on the 4th October 2008 was 10.36 C and on the 9th October was 14.37 C during the two hour test periods.

So to all intense and purposes the conditions on the two test days were as near as anybody could reasonably hope for and to be pedantic the slightly stronger wind gusts on the first test day would have been more than compensated by the extra 210 kg load carried on the second test day.

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Section 5 Conclusions

The set Objective “to evaluate the effect of the BORPower® Lubricant Additive, on a truck`s fuel consumption, through an independent track test” has been successfully achieved.

Utilising the recommended procedures, documented in the Fuel Consumption Evaluation Booklet, published by the Institute of Road Transport Engineers two successful events were run using the MIRA proving tracks at Nuneaton

The two test track runs utilising the IRTE/BTAC Type 1 Test procedures were run on the 4th of October and again on the 9th October 2008.

The first test was run prior to the BORPower® being applied to the test vehicle’s engine and an overall fuel consumption of 10.73 mpg was recorded.

Following the application of the BORPower® additive the vehicle was put into normal service and a further IRTE/ BTAC Type 1 Test performed on the 9th October 2008 .

The ambient conditions on each day were very similar and the services of the same MIRA test driver utilised.

On this occasion the overall fuel consumption of 11.88 mpg was achieved and improvement of 10.7%.

In summary the claimed fuel saving through the use of BORPower® has been verified through a successful and accurate IRTE/BTAC Type One Fuel Consumption Evaluation procedure.

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Section 6 Appendices

Appendix 6A Vehicle evaluation Running Sheet Results 04.10.08

Vehicle ERF EC6 N20G WWY

IRTE/BTAC Type One Part 1 High Speed Circuit

Tank Weight Start	71.10 kg
Tank Weight Finish	56.20 kg
Weight used	14.90 kg
Initial fuel Temp	16C
Specific Gravity	0.838 + correction factor 0.0007
	Ie 0.8387
Corrected weight	14.9 kg divided by 0.8387
	Equals 17.766Kg
To bring to gallons	(17.7 kg X 2.2046) ibs Equals 39.167lbs Equals 3.9167 gallons
Gallons used	**3.9167**
Distance Covered	**71.53km= 44.45 miles**
Fuel Consumption	**11.35 mpg or 23.889 litres/100km**
Test Time taken	59 mins
Average speed	45.20 mph

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Vehicle ERF EC6 N20GWWY

IRTE/BTAC Type One Part 2 Test Stop /Start Circuit

Tank weigh Start	56.20 kg
Tank weigh Finish	47.04 Kg
Weight of fuel used	9.16 kg
Initial fuel temp	24C
Specific gravity	0.838 + correction factor 0.0062 Equals 0.8442
Corrected Weight	9.16 kg divided by 0.8442= 10.85kg 10.85kg x 2.2046 equals 23.92lbs or 2.392 gallons
Fuel used	**2.39 gallons**
Distance covered	**37.42 km = 23.25 miles**
Fuel consumption	**9.72 mpg or 29.06 litres /100km**
Time taken	61 minutes
Average speed	22.869mph

Average fuel consumption for part I and part 2 equals 10.73mpg

Average speed for part 1 and part 2 equals 33.85 mph.

Speed conversions

1 mph = 1.6093 kph

1 kph = 0.6214 mph

1 kg = 2.2046 lbs

mpg = 282.5divided by litres per 100km
litres/100km = divide 282.5 by mpg

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Air Temp and wind speed between 11.00am and 13.20 hrs on the 0409.09
When part I and part2 trials were run

Wind ranged between 9 mph 235 SW and 21.8mph 220SW
Moving 198SW to 235 SW
Average temp 10.36 C

Average temp 10.36 C

Range 8.9C to 10.3C ie 1.4C

Rainfall; 0m to 0.2 mm ie not even noticed.

Vehicle weights

FRONT Axle	3950 kg
Second axle	4460 kg
Drive axle	7860Kg
Total Weight as tested	16270 kg
Tare weight	7100kg
Payload	9170 kg

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Appendix 6B Vehicle evaluation Running Sheet Results 09.10.08

Vehicle ERF EC6 N20GWWY

IRTE/BTAC Type One Part I High Speed Circuit

Tank Weight Start	50.90 kg
Tank weight	37.32
Weight of fuel used	13.58 kg
Initial Fuel temp	27C
Specific Gravity	0.832 plus correction factor 0,0083 Ie 0.841
Corrected weight	13.58 kg divided by 0.841 equals 16.148 kg
	Equals 16.148 x 2.2046 equals 35.6 lbs
Gallons	3.56 gallons
Distance	71.7 km = 44.555 miles
Fuel consumption	12.516 mpg or 22,570 litres /100km
Time taken	1 hr. 15 secs equals 60.25 mins
Average speed	44.4 mph

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Vehicle ERF EC6 N20G WWY

IRTE/BTAC Type One Part Two Stop Start Circuit

Tank weigh Start	37.32 kg
Tank weight Finish	29.06 kg
Fuel Used	8.26 kg
Initial Fuel Temp	34C
Specific gravity	0.832 correction factor add 0.0131 Equals 0.8451
Corrected weight	8.26 kg divided by 0.8451 Equals 9.77 kgs
Gallons	Equals 9.77 kgs x 2.2046 equals 2.152 galls
Distance	37.5 km = 23.3 miles
Fuel Consumption	10.825 mpg or 26.096 litres/100 km
Time	1 hour 1 min 20 seconds ie 61.33 mins
Average speed	22.825 mph
Average fuel consumption	for part 1 and part 2 equals 11.88 mpg
Average speed	for part 1 and part 2 equals 33 mph

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Air and wind speed between 14.30hours and 18.00 hours
At the time the tests were being carried out.

Wind speed ranged between 12.6mph in a 234 degree SW direction and 5.8mph in a 219 degree SW direction

Average ambient temp was 14 .37 C

Temperature ranged from 16.10 C to 13.5C

Rain fall was 0 mm

Weights

Front Axle	4545kg
Second Axle	4645kg
Drive axle	7280 kg
Total weight	16480 kg
Tare weight	7100 kg
Payload	9380 kg

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Section 6 C Vehicle specification/ Engine oil Specification

Make and Model	ERF EC6
Reg No	N 20 GWW
Plated weights	
Front axles	6.5 Tonnes
Drive axle	10 tonnes
Gross Vehicle weight	21 tonne
Vehicle configuration	6 x 2 twin steer
Wheel base	7 metres
Engine	EC 6 Cummins 210bhp@1850 rpm
Gear box	Eaton 9 speed
Tyres	11 22.5
Front Axles	New 7mm minimum tread

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Drive axle	New 11 mm minimum tread
Pressures as tested	100 psi all round and no sign of abnormal Tread wear.
Body	Flatbed 7 m Wooden board
Head board	1.3m Wood
Deck height	1.22 m
Vehicle speed	governed to 56 mph.

Engine oil renewed on the 5th October as was engine oil filters and fuel filters

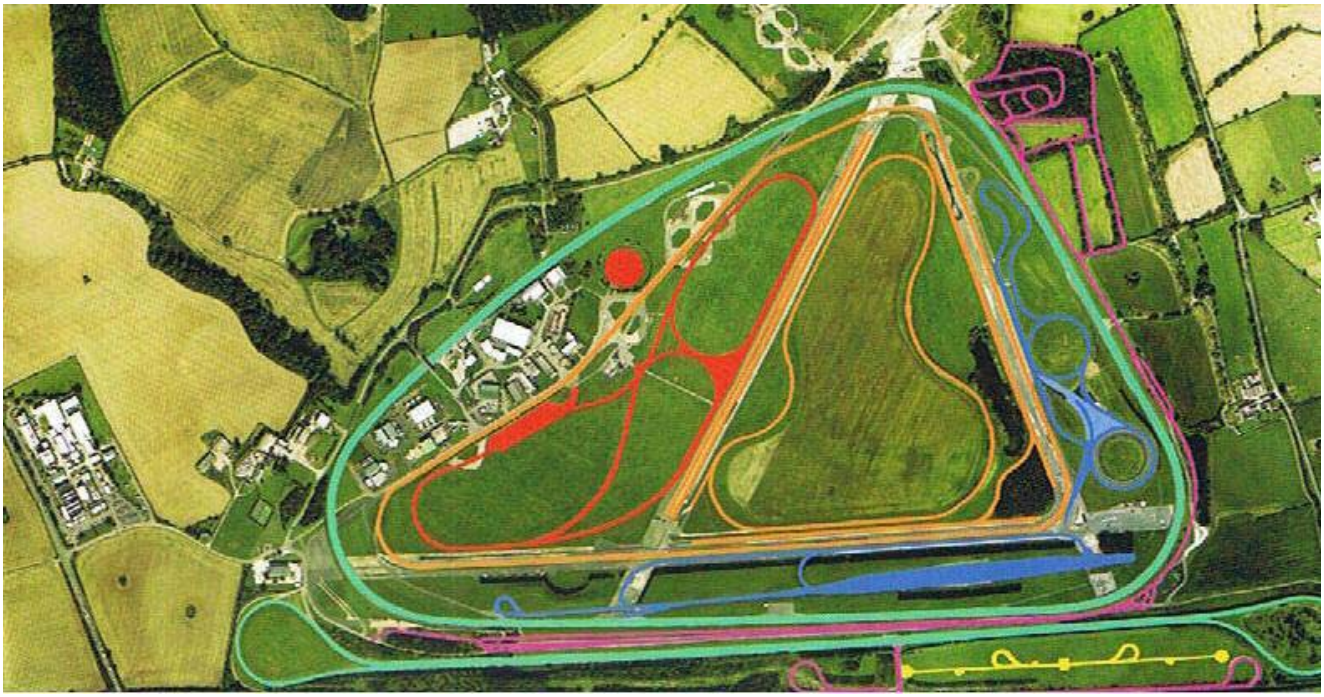
Engine oil used	Comma Super Diesel 15W/40

Meets Cummins engine oil spec CES 20071/ 72/76/77 Approval. Also meets ACEA A3 B3 B4 E5 APISL CF CHH requirements. The oil is mineral based oil ie not a synthetic or semi synthetic . The vehicle owner has used Comma oils for many years with success. He uses Comma EP 90 (Extreme Pressure Hypoid oil)for his gearbox and rear axle .

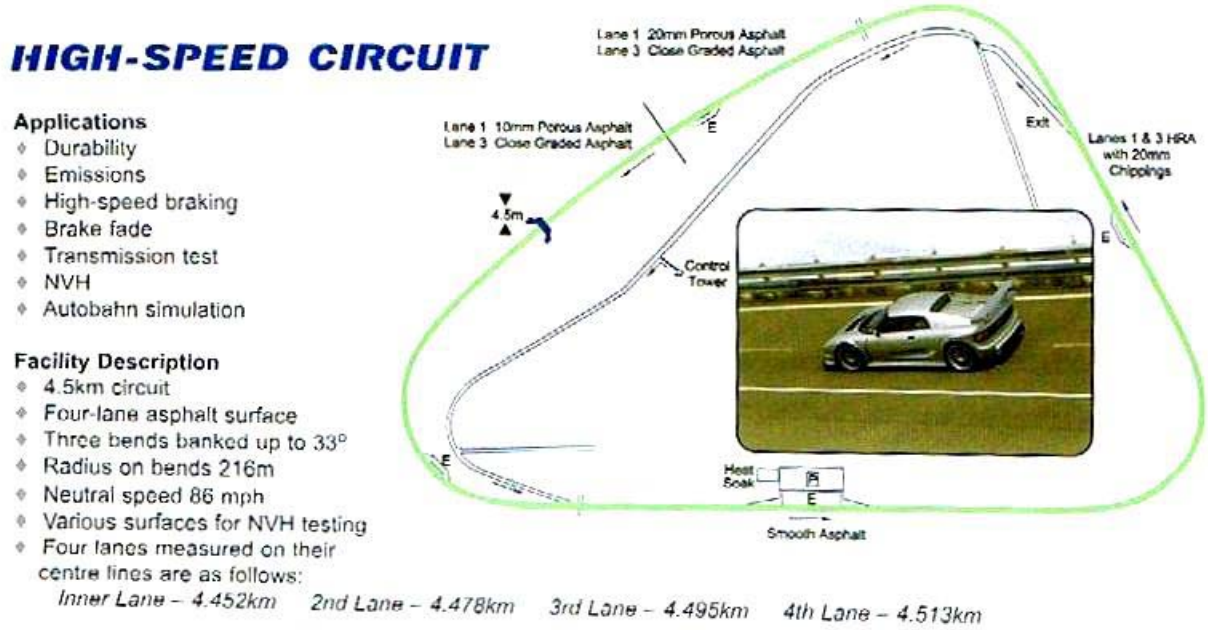
Section 6 D The MIRA Track Details (Utilised on the 4th and 9th of October 2008)

MIRA's extensive proving ground provides an unparalleled venue for product development and validation.

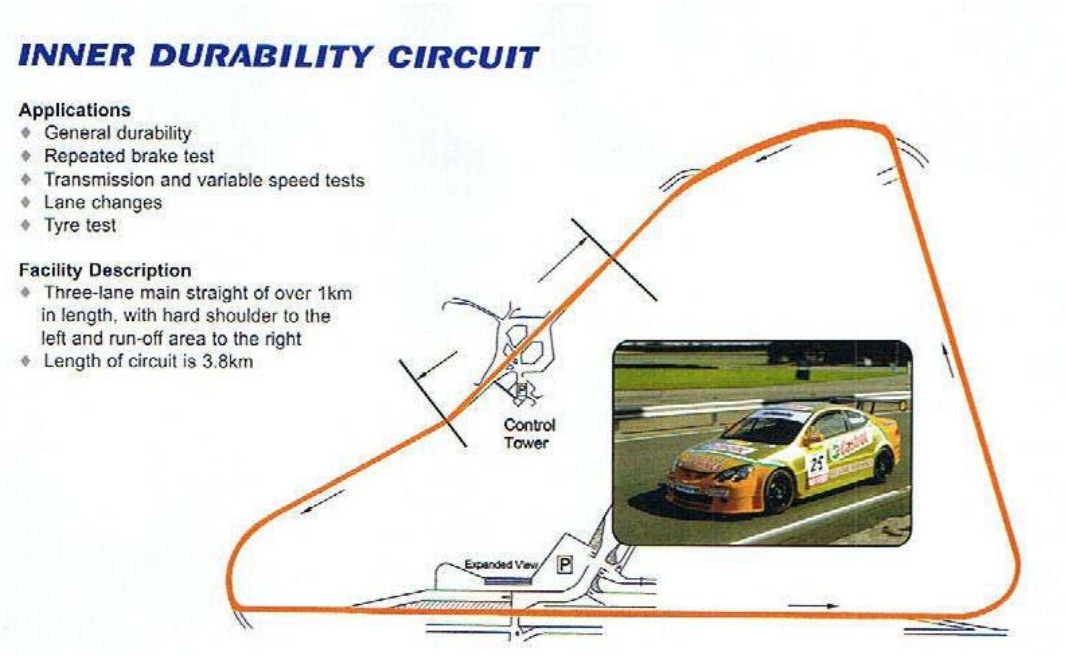
A comprehensive range of circuits and facilities enables our customers to carry out a wide range of tests in a controlled and secure environment, irrespective of vehicle type – motorcycles, cars, commercial, off-highway and military vehicles. Whatever your objectives – vehicle performance, durability, NVH, ride quality, braking or chassis development – you will find a range of solutions including extensive support services to assist you in achieving the levels of quality required for your future test programmes.



Aerial view of MIRA proving ground and test track facility – The triangular mint green circuit is the high speed circuit used in part one of the evaluation.



A separate view of the high speed circuit



A view of the inner durability circuit used for part 2 or the stop start circuit

Section 6 E CONSULTANCY PROFILE / CURRICULUM VITAE

Name: Roger Denniss

Company: Lorry.Logic (1980)

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Mount Pleasant Road
Repton
Derbyshire
DE65 6GQ

Telephone: 01283 702269
Fax: 01283 703909
Mob: 07951 998826
Email: lorrylogic@virgin.net

Date of Birth: 14th March 1935

QUALIFICATIONS

- Chartered Engineer.
- Fellow of the Institution of Mechanical Engineers.
- Honorary Fellow of the Institute of Road Transport Engineers.
- Honorary Fellow of the Society of Operation Engineers.
- One time Associate Member of the Institute of Motor Claims Assessors.
- One time Associate Member of the Institute of the Motor Industry.

AWARDS

- 1947 : Scholarship to the Guildhall School of Music (London) Violin
- 1955 : Stewart and Arden Prize for Student of the Year (Action Technical College).
- 1981 : McKenzie Junner IRTE National Award for Introduction of VMRS to Europe.
- 1991 : Motor Transport Award for Services to the Road Transport Industry

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ACTIVITIES

- Served on the Board of the Automobile Division of the Institution of Mechanical Engineers and Chairman of Operator User Committee.
- Ex-Chairman and Vice President of the Institute of Road Transport Engineers.
- Founder Member of the Brewery Transport Advisory Committee and one time Chairman.
- Founder Member of the European Transport Maintenance Council and one time Chairman.

CAREER

Job Title	Approximate Dates	Company
Proprietor	Current	Lorry Logic
Director of Distribution Services	1988 - 1992	Bass Brewers
Director of Distribution	1984 - 1988	Bass UK
Director of Fleet Engineering Services	1976 - 1984	Bass Production
Group Fleet Engineer	1971 - 1976	Bass Charrington
Chief Vehicle Examiner	1969 - 1971	Bass Charrington
Automotive Engineer	1965 - 1969	Shell Mex & BP
Motor Claims Assessor	1962 – 1965	Eclipse Motor Policies at Lloyds
Shoe Repairer	1959 - 1962	Denniss Bespoke Shoes
Garage Manager	1958 - 1959	Joe Lyons
M.T. Fitter	1956 – 1958	RAF Cyprus
Evening School Lecturer	1954 - 1956	Acton Technical College
Apprentice Motor Technician	1951 – 1954	Shaw & Kilburn
Pupil	1946 – 1951	Walpole Grammar School

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Education

Location	Subjects	Achievements
St Mary's Primary School 1940-1946		
Hanwell London W7		11 plus
Walpole Grammar School 1946-1951	General and Science Maths & Music	0 level
		School Soccer Captain
		House Captain
Northfields West London		
Guildhall School of Music 1951-1952	Violin	Grade 5
Temple London.		
RAF Hednesford and	Military Training	Overseas Active Service Medal
Akrotiri Cyprus !956-58		O level English Language
Acton Technical College	City and Guilds Motor Mechanics	Distinction
	City and Guilds Technicians	Distinction
	NJIC Craftsman Certificate	Pass
Southall Technical college	ONC & HNC Mechanical Engineering	Distinction
1951-1956	(Maths ,Strength of Materials Theory of Machines ,Heat Engines. Theory of Combustion & Engineering Drawing.	
1958-1961	Endorsements (5) for IMechE	Pass
Correspondence Course	Institute of Motor Claims Assessors	Credit
1960	(Insurance and the law)	
University College Cambridge	Psychology of Innovation	Credit
1961		

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The Learning Shop Burton GCSE IT
Distinction

2006

MAJOR AREAS OF WORK

- Organising UK ,USA and European technical conferences.
- Reducing manual handling accidents and incident rates in large national fleets.
- Improving vehicle workshop efficiency and reducing costs through audit.
- Reducing HGV fixed and operating costs.
- Optimising distribution service and cost levels.
- Motivating staff.
- Management and technical training.
- Concept vehicle development from concept to hardware.
- **Investigating accidents on the road and in the depot and factory.**
- **Registered Expert Witness.**
- Bar-code activated repair and maintenance recording / analysis systems.
- Driver activity sampling and driver training to reduce accidents and operating costs.
- Promoting the adoption of a universal standard bar-code symbology for the motor industry, i.e. EAN 128.
- Promoting the adoption of a UK recognised vehicle maintenance repair standard code, i.e. VMRS.
- Promoting the adoption of scientific methods of staff recruitment and development, including psychometric assessment methods.
- **Fuel Efficiency Adviser – vehicle fleets.**
- Author of Best Practice Case Studies – A.E.A.
- Author of Bridgestone Wheel nut re torque manual 2005

EXPERTISE HAS BEEN GAINED RESOLVING CLIENTS' CONCERNS WITH;

- Motor Industry Research Association
- Transport Road Research Laboratory
- Cranfield College of Technology Materials Handling
- Robens Ergonomic Laboratory at Surrey University
- Institute of Road Transport Engineers
- Institution of Mechanical Engineers
- Society of Motor Manufacturers and Traders
- Brewers Society
- Shell UK
- Bass Brewers
- Parcel Force
- British Telecommunications
- Volvo Bus and Truck
- Marshalls of Cambridge
- Fletcher Computer Services (Sheldon, Birmingham) Sanderson
- Gulf Oil Company
- Translitre (Swadlincote)
- Hackney Inc. (USA)
- Royal Automobile Club
- Ratcliffe Forklift Trucks
- Radius Computers Ltd
- Equipment Maintenance Council, USA
- Midland Lead Manufacturers Ltd
- Transport Efficiency, Auckland, New Zealand
- New Zealand Department of Scientific & Industrial Research
- Lee Wai Lee Technical Institute, Kowloon, Hong Kong
- The National University of Singapore
- EES Automotive Consultancy, Singapore
- Mitsubishi Motors New Zealand Ltd
- Don-Bur
- Continental Tyres UK
- City Bus, Hong Kong
- NAMDX, USA
- Clarkson & Rogers Group, Plymouth, New Zealand
- Dennis Eagle
- Transport Engineer
- Brewing & Distilling International
- Eaton Transmissions UK
- E.L.J. Smedley Ltd, Derby
- A.E.A. Technology, Harwell
- Bridgestone Tyre Company

- The American Trucking Associations
- The Technology and Maintenance Council, USA
- The Home Office, Uttoxeter
- Huddersfield University
- Terry Bushell Coaches
- Wrekin Construction Limited
- Faber Maunsell Consultants
- Swedish Rail Services
- British Commonwealth Agents Worthing

EXPERT WITNESS SERVICES HAVE BEEN PROVIDED TO;

- British Telecommunications Plc. Legal Department
- Peter Scaiff Co., Solicitors of Worcester
- Gambrills, Solicitors of Folkestone
- Keely Smith Primmer Parkes, Solicitors of Lichfield
- Wilkins & Thompson, Solicitors of Uttoxeter
- Broadbents, Solicitors of Alfreton
- Browning & Co., Solicitors of Redditch
- Hart & Company, Solicitors of Wetherby
- Jennings, Perks & Breakwell, Solicitors of Walsall
- Paterson Robertson & Graham of Glasgow
- Hay Kilmer, Solicitors of Newcastle-upon-Tyne
- Gabb & Co., Solicitors of Abergavenny, Monmouthshire
- Brown & Corbishley, Solicitors of Newcastle-under-Lyne
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- Cruickshank , Solicitors Swadlincote
- London Borough of Havering
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Section 6F Acknowledgements

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Mr Martin Parrack Central Weighing

IRTE

BTAC

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