romdas

ROad Measurement Data Acquisition System

Data Collection Ltd.

Product Catalogue

For further information on the
ROMDAS road measurement system please visit
www.romdas.com

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Phone: + 64.9.87.7703
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ROMDAS
Manufactured by
Data Collection Ltd.
New Zealand

providers of innovative technology for measuring and managing roads

Overview:

Data Collection Ltd. (DCL) is a company that specializes in developing and manufacturing tools for measuring and managing roads that is marketed under the brand name 'ROMDAS' (ROad Measurement Data Acquisition System).

ROMDAS is the premiere low-cost technology used for collecting data on road condition. Since its inception in the 1990s, Data Collection Limited (DCL) has provided ROMDAS equipment for firms in over 60 different countries spread over all parts of the world from Afghanistan to Zambia.

Mission Statement

"Providing engineers and researchers with innovative technology for measuring and managing roads, which is cost-effective, efficient, reliable, and well supported, while at all times being an ethical business"

The aim of our business is to provide road measurement equipment and software which is innovative, cost-effective, reliable, and better than any other similar product in terms of performance and/or price. Our team focuses on understanding our customers' needs and providing recommendations which satisfy their specifications in the most cost effective manner possible.

DCL is a company that has always valued and maintained ethical values and strived to establish ROMDAS as a brand with honest and reliable business practices. Overwhelmed with the wide range of road data collection equipment available, ROMDAS customers know that the people at DCL are capable of securing the equipment they require and their road management system is cost-effective and sustainable for the long term.

History

ROad Management Data Acquisition System (ROMDAS) was developed in 1989 by Dr. Christopher R. Bennett who led the technical development of the system until 2003 when he sold the company in order to take up a position with the World Bank. The company was purchased by two employees; Paul Hunter and Raj Mallela, who have taken over the management of ROMDAS while keeping to the philosophies with which the company was founded.

ROMDAS is the product of a great deal of teamwork. Gary Carr from the University of Auckland developed the first prototype in 1989 and the early programming of the MS-DOS ROMDAS system was done by Gavin Murray. Paul Hunter was responsible for programming from 1993 until 2002 when he became ROMDAS Technical Manager.

In the last 5 years, DCL has expanded their product range with high end technology modules based upon customer and industry feedback. The Laser Crack Measurement System (LCMS) and Laser Geometry Measurement System (LRMS) are two examples of such modules.

The ROMDAS Remote Support (RRS) is one of the many technical services offered to ROMDAS customers. The RRS allows ROMDAS technicians to log onto a survey computer in order to check settings and resolve issues. The utilization of internet-based services is an integral part of ROMDAS customer service.

Products :

ROMDAS: ROMDAS is a modular system of hardware components & software licenses for data acquisition and processing. The core system also allows for a number of add-on modules for more advanced data collection, including modules for; roughness, rutting, geometry, video and GPS.

ROMDAS Modules: ROMDAS modules are the hardware components in a ROMDAS system which collects specific road data. These modules are selected according to the customer's specifications and manufactured/integrated into a complete ROMDAS system. Below are the ROMDAS modules available:

- **ROMDAS Hardware Interface:** A custom developed data logger which processes the data from hardware modules.
- **Bump Integrator:** Originally modelled on the CNS Farnell bump integrator (BI), the ROMDAS BI has been updated to utilize the latest of technology and eliminate many of the shortcomings of the original and is used to measure roughness data.
- **Laser Profilometers (IRI):** The ROMDAS Laser Profilometer is a Class I inertial profilometer. It uses a combination of a laser and accelerometer to measure the elevation profile of the road with very high accuracy at highway speeds.
- **Transverse Profile Logger (TPL):** The ROMDAS Transverse Profile Logger (TPL) is used to measure the transverse profile (across the lane) of a pavement surface, it outputs an industry standard 13 point transverse profile which is used to calculate rut depths under a theoretical straight edge. Side throw lasers are also used to measure beyond the width of the vehicle.
- **Laser Rut Measurement System (LRMS):** The ROMDAS Transverse Profile Logger Laser Rut Measurement System (TPL-LRMS) is used to measure the transverse profile (across the lane) of the road using two continuous scanning Lasers.
- **Transverse Profile Beam (TPB):** The ROMDAS Transverse Profile Beam (TPB) is used to measure the transverse profile (across the lane) of the road with high accuracy. This is generally used for quality control and monitoring, condition audit and long term pavement performance studies.
- **Laser Crack Measurement System (LCMS):** The ROMDAS Laser Crack Measurement System (LCMS) uses laser line projectors, high speed cameras and advanced optics to acquire high resolution 3D profiles of the road.
- **Pavement and Right-of-Way Video Systems:** The ROMDAS Video System is used to take a video log of the road right-of-way, roadside areas or direct pavement surface.
- **Geometry Unit:** The ROMDAS Geometry System is used to measure Gradient, Radius of Curvature and Cross -fall.
- **GPS:** GPS is used to establish the location of the vehicle using GPS satellites. The data can be used to establish the road centreline or linked to other data like the position of roadside events.
- **Visual Inventory and Condition (Rating Keyboards):** A dedicated keyboard which is used for keyboard rating. With either 20 or 58 keys, they can be programmed by the user to define individual distresses (e.g. cracking, ravelling) or assets (e.g. signs, bridges) of different severities.
- **Z-250 Profilometer:** A class 1 profilometer designed for accurate measurement of longitudinal road profile. The Z-250 is used to measure the road profile for the purposes of either validating/calibrating a roughness meter to IRI or for obtaining a very accurate measure.
- **High Resolution Distance Measurement Instrument (HRDMI):** The high resolution distance measurement instrument (HRDMI) is used in situations where extremely accurate (< 0.1 m) distance measurements are required.
- **Continuous Friction Tester (CFT):** The Side Force Continuous Friction Tester (CFT) is designed to measure the coefficient of friction of a pavement surface as required by Highways and Airports.
- **Falling Weight Deflectometer (FWD):** A Falling Weight Deflectometer is used to measure the vertical deflection response of a surface to an impulse load. The FWD runs as standalone equipment and not integrated with ROMDAS.

miniROMDAS: The miniROMDAS system has been designed as a streamlined version of the full ROMDAS system. miniROMDAS is used for roughness surveys with optional GPS. In contrast to the full ROMDAS system, miniROMDAS runs on a Windows Mobile device instead of a PC

Services :

Pavement maintenance budgets today are under intense pressure. Whether it's main arterials, back country access roads, runways or ports the goal is to do more with less; and this trend is likely to continue. Accurate data has become an essential tool to prioritize and manage maintenance activities on these networks.

Data Collection Ltd specialize in surveying roads, airports, ports, railways and providing data & information on the assets surface and sub-surface condition. We operate a fleet of survey vehicles dedicated to collecting accurate, reliable and relevant data used in making sound engineering judgments

Pavement condition data is critical in understanding how the pavement is performing. Traffic speed surveys provide a relatively quick tool to determine network performance, construction compliance as well as the location and condition of surface defects and assets.

Our current surveying fleet of vehicles range from our top of the range ROMDAS Elite to a cost-effective ROMDAS Roughness Profiler. Because our systems are modular we can configure a vehicle depending on the outputs you require. As all data collection has a cost, this helps keep survey pricing down

The survey vehicle will be selected based on your requirements; typical requirements asked for include

- Roughness Compliance Testing
- High Speed Data (HSD) Survey
  - Roughness
  - Rutting
  - Texture
- Road Geometry
- GIS Information
- Video Logging
- RAMM Condition Rating (Surface Defects)
- Asset Inventory
- Structural Testing
  - Falling or Heavy Weight Deflectometer (FWD/HWD) Testing
  - Deflection and curvature results to target geotechnical testing
  - Structural Number (SNP)
  - Layer moduli results based on pavement layer information.
  - Sub-grade CBR
  - Remaining life and pavement designs based on traffic count data.

To see a full list of our current surveying fleet capabilities and outputs please click here.

To find the best option that meets your needs, please contact us.

"Working closely with the Manufacturing Division ensures the survey equipment meets client requirements and any problems are rectified in-house, quickly and with negligible impact on the project deadline."

- Diana Scruby, Survey Division Manager

Software :

DCL or its subsidiaries or associates have also developed several software products, including:

ROMDAS: ROMDAS Data Acquisition software is used with the ROMDAS system in the survey vehicle for data collection and in the office for processing data into Microsoft Access files.

DATAVIEW: DataView is an advanced data integration and processing program - specifically for engineers or survey managers responsible for handling and processing road data into visual reports for clients or decision makers.

PROMAN: The Project Management System (PROMAN) is an off the shelf web based, integrated Project/Contract Management, Monitoring and Evaluation system. It is designed and developed on the concept of multi- tier distributed and enables the authorities to manage the contracts for Civil Works, Goods and Consultancy Services.

HIMS Asset Management: HIMS is a powerful asset management and analytical system software with in-built GIS and Reporting platforms. HIMS is designed to meet the needs of consultants and road agencies and is capable of storing data on any type of asset-from pavements through bridges to traffic and managing the data to prepare files for analysis.

Association With SATRA I-MAN Pvt. Ltd (India)

SATRA I-MAN Pvt. Ltd are software creators and providers of PROMAN. PROMAN provides tools for integration of various phases of contracts such as Civil Works, Goods and Services through different software modules. The Company Director and major shareholder of SATRA I-MAN Pvt. Ltd, Raj Mallela, is also a co-owner of Data Collection Limited and the brand ROMDAS. DCL is a shareholder of SATRA I-MAN Pvt Ltd. This close relationship with SATRA I MAN Pvt.Ltd is a valuable asset to Data Collection.Ltd and provides road management software and services for ROMDAS customers.

Association with HIMS Ltd (New Zealand)

HIMS Ltd are software creators and providers of HIMS Asset Management System and NODEM on which the DATAVIEW system was built upon. The Company Director and major shareholder of HIMS Ltd is also co-owner of Data Collection Limited and the brand ROMDAS. This close relationship with HIMS Ltd enables Data Collection Ltd to expand its services in the area of asset management for its customer

Contact us :

Data Collection Limited, manufacturers of ROMDAS will work to develop and deliver road data collection equipment customized to your specific requirements. For further inquiries and to arrange a competitive quotation, please contact us at info@romdas.com. You can find more information on us and our products from our website www.romdas.com.

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Modules & Features Cont...

Transverse Profile & Rut Depth Data

There are two options for collecting transverse profile and rut depth data; the ROMDAS TPL-Ultrasonic Ver.2 or the Laser Rut Measurement System (LRMS). The TPL-Ultrasonic Ver.2 uses 24 high accuracy ultrasonic sensors, whereas the LRMS uses two scanning lasers, to measure the transverse profile elevations of the pavement and establish the rut depth.

Keypad Rating Using The ROMDAS Keycode Feature

Condition and inventory surveys can be recorded using the ROMDAS keycode rating system. Keyboards are available in either 20 or 58 key ratings. It is possible to assign a key to an event or asset and allow several observers to perform ratings at the same time. Keycodes are user-defined and can be recorded as either Point, Continuous or Switch styled events.

The keycode feature is also utilised by the ROMDAS DataView software for it's video rating function. Enabling users to collect condition and inventory data in the office using survey videos, improving accuracy and operator safety.

Laser Crack Measurement System (LCMS)

The ROMDAS Laser Crack Measurement System (LCMS) uses laser line projectors, high speed cameras and advanced optics to acquire high resolution 3D profiles of the road. This is the latest and greatest in scanning laser technology currently in the market and along with automated crack and defect detection this unit also measures rutting and macro texture (MPD).

Calibration Equipment

Z250: The Z250 Reference Profiler has been developed for measuring an accurate linear reference profile of pavements. These profiles are analysed to establish the roughness in IRI meters/km. Generally used to calibrate or validate response type roughness meters like the Bump Integrator or for quality control during construction.

Transverse Reference Profile (TPB): The high accuracy of the transverse profiles generated by the TPB are generally used for; calibrating or validating vehicle mounted rutting systems, construction quality control testing and collecting data for research purposes.

ROMDAS DataView Software

DataView is an advanced data integration and processing programme allowing for GIS mapping, video image rating and data presentation.

Remote Data Transmission and Real-Time Monitoring of ROMDAS systems

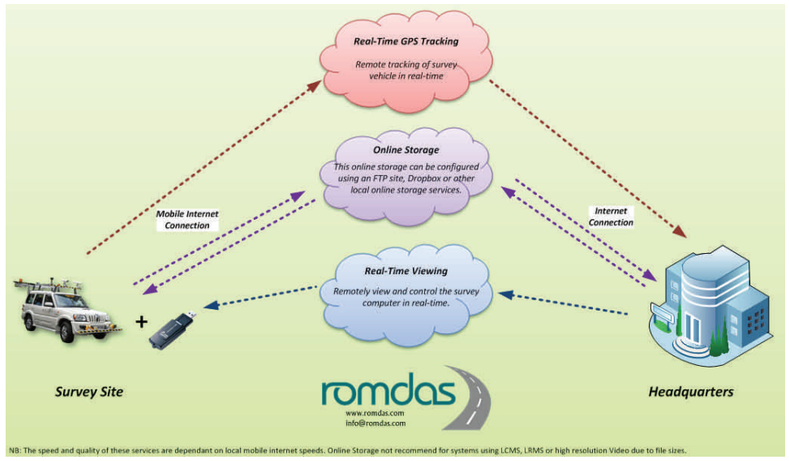
The following options are available to users of ROMDAS equipment.

Real-Time GPS Tracking

Online Storage

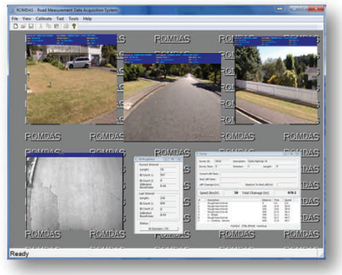
Real-Time Viewing

These services can be setup by ROMDAS technicians for an additional cost during a training and installation visit. Or instructions can be provided to users on how to setup these services at the time of purchase.



romdas System Overview

ROMDAS® (**RO**ad **M**easurement **D**ata **A**cquisition **S**ystem) has been developed by Data Collection Ltd. (DCL) as a low cost modular system designed to collect road and pavement data using any vehicle. ROMDAS offers great flexibility by allowing users to add or remove modules depending on their specific data collection needs. Over the last several decades ROMDAS has been a leader of integrating new data collection technology and with over 200 units in use in over 60 countries, ROMDAS has a level of refinement rarely found in competing systems.



ROMDAS can be used for the following:

⇒ *Roughness surveys;*

⇒ *Transverse profile/rutting surveys;*

⇒ *Collecting surface texture data (MPD or SMTD)*

⇒ *Condition rating surveys;*

⇒ *Location Referencing (spatial GPS/GNSS data or linear LRP data)*

⇒ *Video logging surveys (right-of-way and pavement view);*

⇒ *Road geometry surveys;*

⇒ *Automated crack detection and 3D pavement modelling;*

⇒ *Travel time and congestion surveys;*

⇒ *Inventory and asset surveys;*

⇒ *Recording locations with digital photographs;*

The DCL team has a wealth of knowledge and experience available to new users for customising systems to meet specific needs and providing on-going technical support and advice to existing users.

ROMDAS is...

✓***Flexible:*** Works with any vehicle and on all roads.

✓***Modular:*** Sensors can be added depending on the customer requirements

✓Portable: Most of the system fits in a small suitcase

✓***Easy to install:*** Hardware can be installed in most vehicles in 2 to 4 hours.

✓***Easy to use:*** Simple yet powerful interface

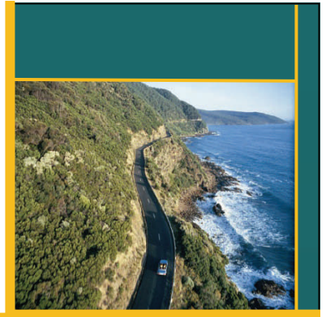
✓***Data acquisition:*** Data can be collected at any speed and all raw data is available for processing and analysis.

✓***Proven:*** Used from Argentina to Zambia, ROMDAS has successfully collected data in developed and developing countries.

✓***Refined:*** The software undergoes regular upgrades to include new features developed from user feedback.

✓***Offers Quality Low Cost Options:*** ROMDAS offers complete system much lower than dedicated survey vehicles.

✓***Functional Data:*** Data can be directly downloaded and integrated into road management system databases



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Modular Layout of the ROMDAS System

Automated Crack & Defect Detection

Laser Crack Measurement System (LCMS)

Transverse Profile & Rut Measuring Equipment

Laser Rut Measurement System (LRMS)

OR

TPL-Ultrasonic

Roughness Measuring Equipment

Single or Dual Laser Profilometer

Optional SMTD or MPD Texture Upgrades

OR

Single or Dual Bump Integrators

Hardware Interfaces

GPS

Variety of Receiver Available

ROMDAS Data Acquisition Software

OR

Laptop

Rack Mount Computer

Distance Measuring Instruments (DMI)

Proximity Sensor DMI

OR

High Resolution Distance Measuring Instrument (HRDMI)

Road Geometry

ROMDAS Geometry Unit

Right Of Way and Pavement Video Cameras

Optional High Def. Upgrade

Keypad Rating

20 or 58 Key Rating Keyboard

OR

External Keyboard

Stand-alone Modules*

Calibration Equipment

Transverse Profile Beam (TBP) for Rut Depth

Z250 For Roughness

Falling Weight Deflectometer

Continuous Friction Tester (CFT)

*Does Not Require A ROMDAS System

Modules & Features

Operational Principle

The ROMDAS Software runs on a laptop or rack mounted computer in the vehicle and is interfaced to a number of instruments used to measure and record road data. The modular layout also allows users to customise their system by adding or removing devices depending on their data collection needs.

During the survey, the laptop monitors both the distance travelled and the activities of the other instruments and records the data. At the end of the survey the data is processed into Microsoft Access files.

Location Referencing with ROMDAS

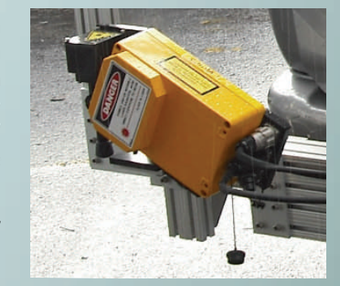
LRP's (Linear Referencing): The ROMDAS Software is designed to make full use of location reference points (LRPs). During surveys operators are prompted for upcoming LRPs and recorded data is used to improve data consistency between surveys.

GPS (Spatial Referencing): When used with a GPS receiver, ROMDAS will reference all recorded data against GPS positions. Standard NMEA and Trimble TSIP connections are both support, allowing for use of almost any GPS receiver. Support for Trimble GPS receivers allows real-time or post-processed DGPS with SBAS, Omnistar, beacon or base station networks. ROMDAS has a built-in Co-ordinate Transformer which allows the GPS data to be processed into any of the 650 local co-ordinate systems and

Video Logging Using ROW & Pavement Views

The ROMDAS Video Systems can be used to record images of the road Right-Of-Way (ROW) and pavement surface into an .AVI files. Key data such as Roughness, Distance, GPS, etc. are superimposed onto the video images using the customisable overlay.

Collect Road Roughness Data



Laser Profilometer: The ROMDAS Laser Profilometer is a Class I inertial Profilometer. It uses a combination of a laser and accelerometer to measure the elevation profile of the road with very high accuracy at highway speeds. The profile is analysed to calculate the IRI in m/km. The Profilometer unit can optionally include texture depth measurements.

MPD & SMTD Texture upgrades are available for Laser Profilometers

Bump Integrator (BI): Used for roughness surveys this Class 3 response type meter has been widely implemented and is a great low cost option for measuring roughness and calculating IRI.

ROMDAS can convert the BI or Laser Profilometer raw data into a variety of accepted roughness indexes (e.g. IRI)

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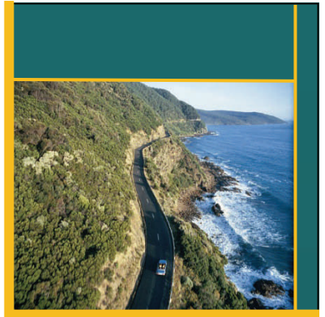

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Bump Integrator

Overview

The ROMDAS® Bump Integrator (BI) for measuring road roughness is a response -type roughness meter. This is a mechanical instrument that measures the relative displacement of a vehicle's suspension in relation to the body of the vehicle. The concept behind Bump Integrator technology has long been established and proven worldwide. The BI readings are used to analyze the linear profile and calculate the 'roughness' of a road's surface. Depending upon the type of vehicle that the BI will be fitted to either one or two BI's may be used.

The raw roughness data from the BI can be recorded directly using either the The ROMDAS® system on a notebook computer or the miniROMDAS® system on a Pocket PC.

The raw roughness data can be converted into a calibrated roughness index such as IRI using user-supplied roughness equations (which are determined during roughness calibration). A well calibrated Bump Integrator will easily rival or exceed the accuracy of other Class 3 roughness profilers, including accelerometer based equipment.

A ROMDAS system with Bump Integrator requires little-to-no operator interaction during surveys and all readings are shown in real-time on the survey computer.

The Bump Integrator excels in rough, unpaved or wet conditions where laser based profiling equipment is unusable and thanks to its low minimum speed (10km/h) it can also be operated areas of high congestion unlike accelerometer based equipment.

Features and Benefits

Features of the BI include:

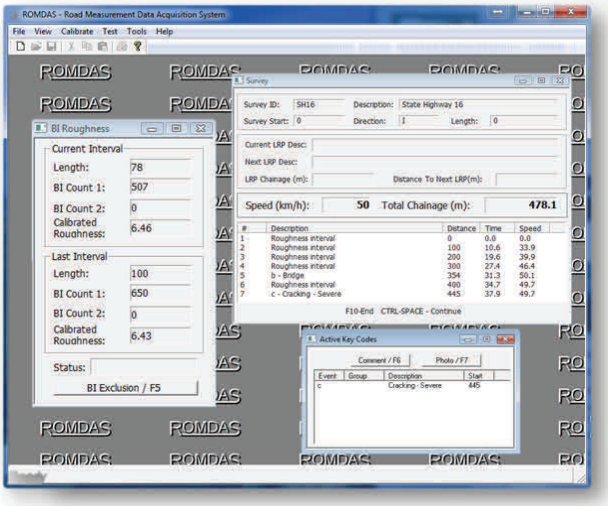
⇒ High resolution, high reliability optical encoder;

⇒ Designed for use in some of the most extreme and rugged road conditions;

⇒ Low minimum operating speed (10km/h);

⇒ Very low cost compared to vehicle mounted accelerometer based equipment.

⇒ Simple design allows for quick and easy installation and full serviceability in the field.



ROMDAS Survey Screen with Bump Integrator Module

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Bump Integrator

Installation

The BI is installed at the rear of the vehicle, above the rear suspension. The instrument is mounted on the floor of the vehicle and a cable is connected to the suspension.

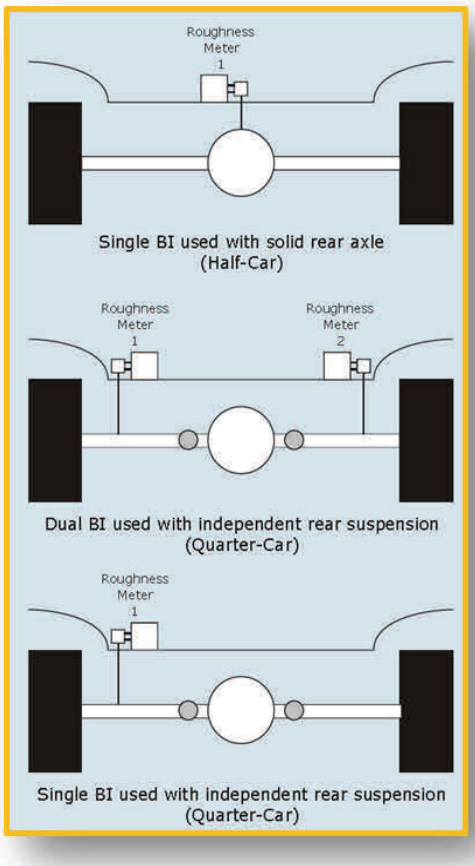
There are three possible configurations for installing the BI in a vehicle:

1 Solid rear axle:
If the vehicle has a solid rear axle the BI should be installed over the centre of the differential. This will measure what is termed a 'Half-Car' roughness reading.

2 Independent rear suspension:
This installation method utilises two BI units. If the vehicle has an independent rear suspension it is recommended that two BI units be installed; one for each wheel path. Each of these will measure a 'Quarter-Car' and the average of these two readings will give the overall roughness.

3 Independent rear suspension:
This installation method utilises one BI unit. The use of one BI unit with an independent rear suspension is possible, but not recommended. This is because the vehicle will still measure a 'Quarter-Car' reading but the roughness measurements will be dominated by the roughness in a single wheel path. It does not matter which one is being monitored as it will prove difficult to get a good calibration of the meter because the roughness will vary between wheel paths and test sections.

All mounting accessories are supplied for ease of installation.



Components

The BI kit comes complete with the following components:

⇒ 1 x Bump Integrator;
⇒ 1 x base plate and cover;
⇒ 1 x BI hook;
⇒ 1 x BI wire (spare);
⇒ 1 x BI spring (spare);

Technical Specifications

Encoder resolution:	850 pulse per revolution
Vertical resolution:	1 pulse per 0.25 mm of suspension up movement
Weight:	2.5 kg
BI wire breaking strain:	95 kg

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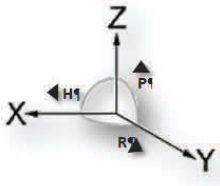
ROMDAS Geometry Unit

Overview

The ROMDAS Geometry unit is an integrated GPS and MEMS Inertial Measurement Unit with a Navigation, Attitude and Heading Reference System processor. The unit provides the data for accurate and reliable Highway geometry data outputs.

The internal low-power signal processor runs a real-time Kalman Filter providing inertial enhanced 3D position and velocity estimates. The Kalman filter, configured specifically for vehicle movement, takes additional inputs from additional aiding sensors; a 3D magnetometer and a static pressure sensor to enhance the output accuracy.

The ROMDAS Geometry unit provides drift-free, GPS enhanced, calibrated 3D acceleration and 3D rate of turn.



The ROMDAS Geometry Sensor is:

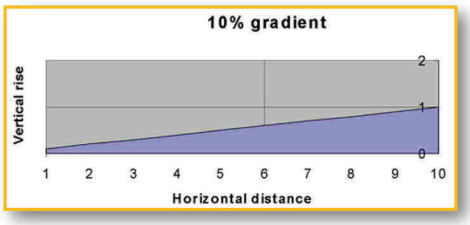
⇒ Individually calibrated for temperature, 3D misalignment and sensor cross-sensitivity

⇒ Built-in test (BIT) feature

⇒ GPS antenna fault detection

⇒ External active antenna status detection circuit

⇒ High update rate of 100Hz

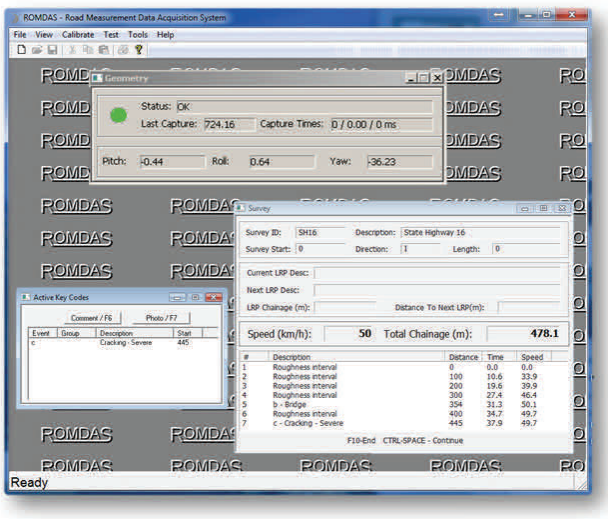


The ROMDAS software does not require any operator interaction during Geometry data collection.

Operation

Easy to install and setup, this module can be integrated into a ROMDAS system within an hour.

A real-time output of vehicle Pitch, Roll and Yaw is displayed in the ROMDAS Data Acquisition software during the survey.



ROMDAS Survey Screen with Geometry Module

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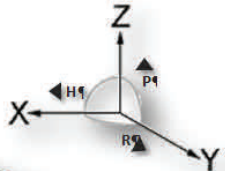
ROMDAS Geometry Unit

Components

The ROMDAS Geometry System is comprised of the following components:

- Inertial Measurement Unit (IMU) mounted inside a small & robust enclosure
- GPS Antenna
- Interface Cable



Technical Specifications

Outputs	♦ Grade (%) ♦ Horizontal curvature (m) ♦ Cross-slope (%)
Update Rate	100 Hz
Output File Format	Microsoft Access Files.
Environmental:	
Shock (any axis)	20,000 m/s^2 (2,000 g) 0.5 ms (half-sine)
Operating/Storage Temperature:	-20° C …. 55° C
Humidity	95%
Integrated GPS	16 Channel with full SBAS support

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ROMDAS Laser Profilometer

Roughness and optional macro-texture

The ROMDAS Laser Profilometer module is a Class I Inertial Profiler and conforms to ASTM-E950. It uses a laser and accelerometer combination to measure the longitudinal elevation profile of the road with very high degrees of accuracy at highway speeds. The profile is then analysed to calculate International Roughness Index (IRI) values.

The ROMDAS Laser Profilometer is an exceptionally portable system and can be used for; construction control surveys, large scale network surveys or generally whenever high accuracy roughness data is required.

The latest version is extremely lightweight and portable, weighing only 3 kg, and offering exceptional value for money when purchased with the central ROMDAS system. The ROMDAS system with Laser Profilometer module is one of the most cost effective laser based systems for recording and analysing roughness data available in the market. With no periodic calibration required the Laser Profilometer saves time and money when collecting high accuracy roughness data.

Often single point laser profilers use a single axis (vertical) accelerometer. The ROMDAS Laser Profilometer utilizes a three axis accelerometer which helps filter inaccuracies caused during cornering or vehicle wander.

Thanks to ROMDAS' customisable design, the system can be purchased as a single (i.e. measure 1 wheel path) or dual laser setup (i.e. measure 2 wheel paths) depending on customer requirements.

Optional Upgrades

MPD or SMTD Texture Upgrade
ROMDAS Lasers can be upgraded to measure macro-texture in terms of Mean Profile Depth (MPD) or Sensor Measured Texture Depth (SMTD). SMTD texture can be measured using the standard lasers, while the MPD texture upgrade includes replacing the standard Laser unit with a higher speed laser.

Additional Lasers
Additional lasers can be purchased separately to give multiple road profiles.

Features and Benefits:

- Extremely Portable weighing around 3kgs,
- World Bank Class 1 Profiler,
- Modular option available,
- 3 Axis accelerometer,
- Highly competitive pricing,
- Easily customizable to include other modules such as: GPS, Video Logging, Transverse Profiler, Geometry...

For further information on the ROMDAS road measurement system please visit www.romdas.com

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ROMDAS Laser Profilometer

Components

The Laser Profilometer is comprised of the following components:

- A Class 3B 48 kHz Laser and Accelerometer unit,
- All necessary power and communication cables,
- A high resolution DMI for data synchronisation,
- External vehicle mounting,
- Laser configuration cable.

Installation

The Laser Profilometer does not require a specialised vehicle, however it is easier to install if the vehicle has a trailer mounting hitch installed to hold the mounting bar.

Technical Specifications

Scan Rate	48 kHz
Laser Class	Class 3B
PC Interface	Ethernet
Configuration	Laser elevation with integrated Accelerometer Inertial Reference
Standoff	245 mm
Range	500 mm (+/- 250 mm)
Resolution	0.01% of full scale
Resolution IRI	+/- 0.01 m/km
Environment	IP65 (MEMA4)
Power	12 V DC 1 A
Weight	3 kg (excluding mounting beam)
Dimensions	170 mm x 120 mm x106 mm (main enclosure, ex. Mounting beams)
Outputs	International Roughness Index (IRI) & Raw longitudinal profile
Output Format	MS Access .MDB (exportable to excel and most other 3rd party programs), .ERD files (viewable in ProVal for further profile analysis)

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ROMDAS-LCMS
Laser Crack Measurement System

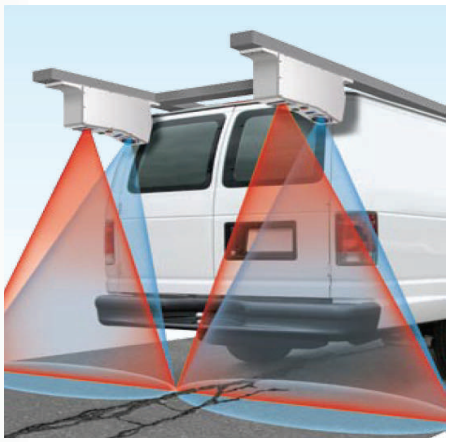
Features

3D Surface Profiles

The ROMDAS Laser Crack Measurement System (LCMS) uses laser line projectors, high speed cameras and advanced optics to acquire high resolution 3D profiles of the road.

The LCMS can acquire full 4 m width profiles of a highway lane at normal traffic speeds. The system uses two scanning laser profilers that digitize transverse sections of the pavement. Custom optics and high-power pulsed laser line projectors allow the system to operate in full daylight or in night-time conditions.

Rut Depth Measurements



Using the profiles collected the system can accurately calculate the degree of pavement rutting and overcomes many of the drawbacks of other rut measurement systems that use less contact points and transverse range.

MPD Texture Data

Thanks to the exceptional speed of the scanning lasers, users of the ROMDAS LCMS are able to collect information on surface texture properties in terms of Mean Profile Depth (MPD).

Roughness (Optional Upgrade)

With roughness being one of the primary road characteristic, no system would be complete without the ability to collect roughness data. Linear profiles used to calculate road roughness/unevenness can be extracted from the LCMS data which means there is no need to acquire additional profiling equipment. LCMS users are able to define the exact position of wheel paths and in turn eliminate the influence of driver error when collecting roughness data.

The ROMDAS LCMS Features...

- *Real-time data display. Gives operators immediate feedback on correct operation of system .*
- *Measures full 4 m width profiles of highway lane without protrusion of system beyond 2 m width. Much safer and more manageable than Transverse measuring systems that extend significantly beyond vehicle width.*
- *Operation in day or night time conditions.*
- *Survey speeds up to 100 km/h .*

ROMDAS System with LCMS, Sub Meter GPS, High Resolution DMI, 3 Camera Video Module, Geometry Unit and 2 Laser Profilometers.

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ROMDAS-LCMS
Laser Crack Measurement System

Operation

Real-time outputs of LCMS are displayed during the survey and raw data is automatically saves by the ROMDAS system allowing for further analysis and calculations based on raw data.

The ROMDAS software does not require any operator interaction during LCMS data collection.

Components

The ROMDAS LCMS is comprised of the following components:

⇒ 2 x Laser Profilers

⇒ Rack Mount LCMS Controller

⇒ All necessary cabling

⇒ Laser mounting frame

Technical Specifications

Outputs	♦ Automated Surface Defect Detection & Analysis (Including: Cracks, Potholes, Ravelling) ♦ Rut Depth, Width & Cross-Sectional Area For Each Wheelpath, ♦ Macro-Texture (MPD) In 5 Longitudinal Bands, ♦ Lane Markings. ♦ Roughness (IRI) in 2 wheel paths (optional)
Vehicle Survey Speed	0-100 Km/h
Sampling Rate	5600 Hz (profiles per second) Data compressed in real-time. Storage < 1Gb per km
Depth Accuracy	± 0.5 mm
Transverse Range	4 m nominal (4160 Points/Profile)
Output File Format	Microsoft Access Files, JPEG Image files with Defect Overlay.
Environmental Protection	IP-65 (NEMA 4)
Power Consumption	150 Watts (240 VAC)

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ROMDAS-LRMS
Laser Rut Measurement System

Features

The ROMDAS Laser Rut Measurement System (TPL-LRMS) gives immediate and precise transverse profiles used for the detection and characterization of pavement rutting conditions. The ROMDAS LRMS uses scanning Laser technology from INO (a world leading technology developer and provider of 3D laser systems and sensors).

The TPL-LRMS can acquire full 4 m width profiles of a highway lane at normal traffic speeds. The system uses two laser profilers that digitize transverse sections of the pavement. Custom optics and high-power pulsed laser line projectors allow the system to operate in full daylight or in night-time conditions. LRMS also offers 2 sampling rate options; 30 or 250 Hz.

This system overcomes many of the drawbacks of other rut measurement systems that use less data points and transverse range.

The ROMDAS TPL-LRMS allows for:

⇒ Real-time data processing with display showing rut depth, rut width and rut cross sectional area.

⇒ Measures full 4 m width profiles of highway lane without protrusion of system beyond 2 m width. Much safer and more manageable than Transverse measuring systems that extend significantly beyond vehicle width.

⇒ Operation in day or night-time conditions

⇒ Survey speeds up to 100 km/h

⇒ High update rate of either 30 or 250Hz (transverse profiles per second)

⇒ Immediate feedback on correct operation of system to operators.

ROMDAS System with LRMS, Sub Meter GPS, High Resolution DMI and 2 Laser Profilometers.

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ROMDAS-LRMS
Laser Rut Measurement System

Operation

A real-time output of TPL-LRMS system are displayed in the ROMDAS data acquisitions software during the survey.

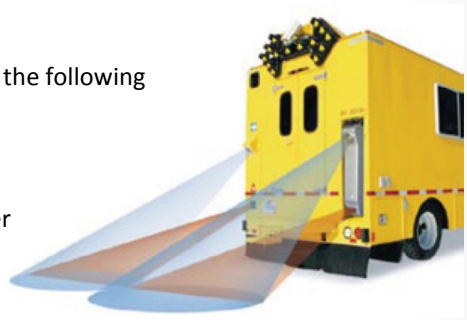
The ROMDAS software does not require any operator interaction during TPL-LRMS data collection.

Raw outputs are also saved by the ROMDAS system allowing for further analysis and calculations based on raw data.

Components

The ROMDAS LRMS is comprised of the following components:

- 2 x Laser Profilers
- Rack Mount TPL-LRMS Controller
- All necessary cabling
- Laser mounting frame



Technical Specifications

Outputs	♦ Rut depth ♦ Rut width ♦ Rut cross-sectional area for each wheelpath ♦ Lane Markings
Vehicle Survey Speed	0—100 Km/H
Sampling Rate	30 or 250 Hz (profiles per second)
Depth Accuracy	± 1 mm
Transverse Range	4 m nominal (1,280 Points/Profile)
Output File Format	Microsoft Access Files.
Environmental Protection	IP-65 (NEMA 4)
Power Consumption	120 Watts (240 VAC)

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ROMDAS—TPL v3
Transverse Profile Logger

Features

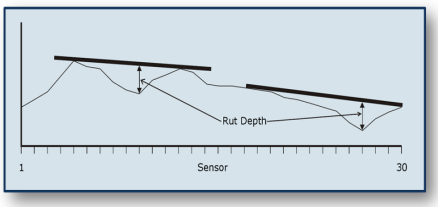
Ultrasonic Version

The ROMDAS Transverse Profile Logger version 3 (TPL ver.3) is used to measure the transverse profile (i.e. across the lane) utilising 17 high quality Ultrasonic sensors and 4 side throw lasers. Compared to most laser based Rut Bar units the TPL ver.3 offers a higher number of contact points to provide high quality transverse profiles equal to laser based units which have fewer points of contact. ROMDAS software then analyses the profiles to calculate the extent of wheel path rutting under a theoretical straight edge.

The ultrasonic TPL ver.3 is one of the most cost effective and efficient ways of collecting rut depth data available in the market today.

Laser Version—New!

Due to requests from our customers we now offer a full laser based version of the TPL ver.3. We have upgraded our proven design by replacing the ultrasonic sensors with new single point lasers. This laser version offers the height accuracy of laser based equipment and also maintains much of its robustness and cost-effective price. This version outputs an industry standard 13 point transverse profile.

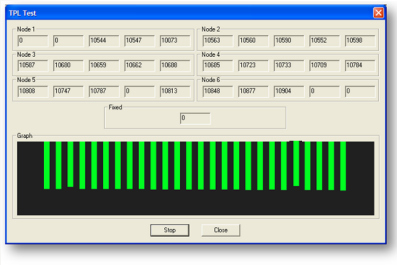


The figure above illustrates using a theoretical 1.2 m straight edge (per wheel path) to calculate rutting from a TPL transverse profile.

Operation

The ROMDAS® TPL ver.3 is an add-on module to a central ROMDAS system. It can be operated in conjunction with other add-on modules for collection of a wide variety of datasets simultaneously.

The user defines a sampling interval for the transverse profile measurements (e.g. 1 metre) and the PC sends a signal to the TPL to take a measurement at these pre-defined intervals. During surveying the unit requires little to no input from operators.



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ROMDAS—TPL v3
Transverse Profile Logger

Components

The TPL ver.3 is comprised of rugged ultrasonic sensors or single point lasers and an on-board controller in an aluminium housing. There is a 2.2 m main section, with side throw lasers to measure beyond the width of the vehicle.

The sensors are spaced at set intervals of 125mm for Ultrasonic or 250mm for Laser. Sensors measure the distance from the sensor to the pavement with an accuracy, based on static testing, of +0.2 mm for Ultrasonic or +0.05mm for Lasers. Status LEDS on each sensor give a visible indication of measurements for diagnostics and setup.

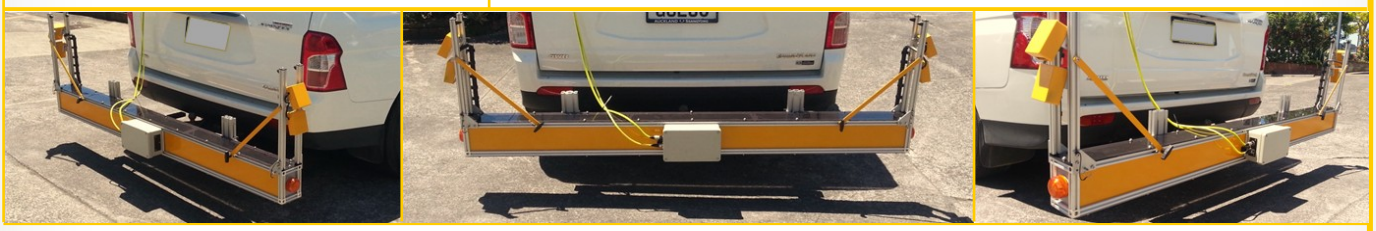
Installation

The TPL does not require a specialised vehicle, it only requires a strong mounting to be welded onto the front of the survey vehicle. Once the mounting is ready, installation of the TPL will take less than one hour. The TPL can also be removed from the vehicle when not in use in a matter of minutes.

Data Processing

The rut depth is defined as the maximum vertical distance between the straight edge and the pavement.

The transverse profiles collected by the TPL v3 are analysed in the ROMDAS software to determine the rut depth under the straight edge for both the left and right wheel paths. The straight edge length is user-definable between 1.0 to 3.0 m in 0.1 m increments.



Technical Specifications

	Ultrasonic Version	*Laser Version*
Sensor Type	Ultrasonic	Laser (Class 3B)
Scan Rate	100 Hz	10 kHz
Number of Sensors (Points of Contact)	23	13
Sensor Spacing	125 mm	250 mm
Sensor Resolution	+/- 0.2 mm	+/- 0.05 mm
Standoff	300 mm	300 mm
Range	285 mm	250 mm
File Format	Post Processed Microsoft Access MDB File	Post Processed Microsoft Access MDB File
PC Connection	Ethernet	Ethernet
Environment	IP68	IP68
Weight	25 Kg	20 Kg
Unit Width	2.2 m	2.2 m

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ROMDAS
Video Logging Modules

Features

The ROMDAS® video logging units include both Right Of Way (ROW) and pavement view cameras. The system allows for distance-based capture which can be defined by the user or continuous image capture. Images are viewable in real time during data collection so quality and aspect can be constantly monitored.

Customisable Image Overlay

ROMDAS® features the option to overlay a range of data onto the recorded image. This video overlay has contrasting field labels and data that can be set in any font, size and colour for maximum readability and contrast between the text and the overlay. The ROMDAS® video overlay is positioned above the video image so that no part of the image is obscured.

Upgrade Options

Multiple Camera Upgrade

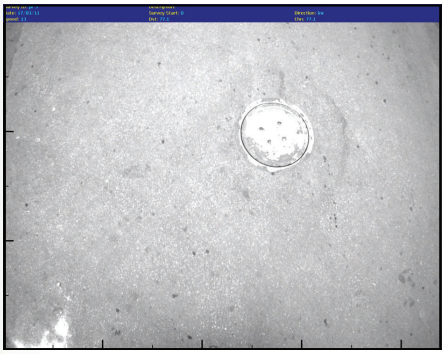
Additional ROW or Pavement View cameras can be purchased to increase the range and scope of video logging surveys.

ROMDAS DataView Software

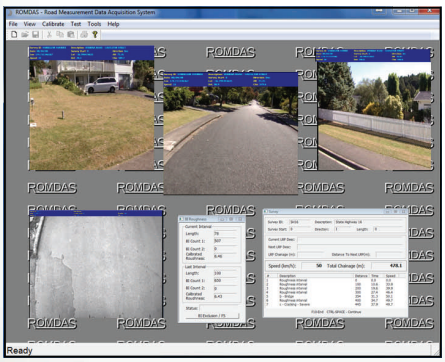
DataView has been specifically designed for advanced data integration and processing. The video rating feature allows users to register condition or event ratings to each image during post processing in the office.

Right Of Way (ROW)

Pavement View



Integrate Multiple Cameras



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ROMDAS
Video Logging Modules

Components

The ROW & Pavement View modules include the following components;

- Gigabit Ethernet progressive scan digital DCAM format camera;
- Gigabit Ethernet cables;
- Environmentally protected camera housing;
- External roof mounting.

Operation

During a survey, ROMDAS® records the distance travelled and this is used to trigger when an image is recorded. The trigger distance can be defined by the operator before beginning the survey. The operator can also record data, such as condition or roadside event ratings, during the survey by using the KeyCode system built into the ROMDAS software.

Any or all of the following data can be displayed on the video overlays;

⇒ Road description and identifier;

⇒ Location reference point (LRP) data;

⇒ Survey date;

⇒ GPS position;

⇒ Speed and chainage;

⇒ Raw or calibration roughness data;

⇒ KeyCode events and ratings

Both ROW & Pavement View video footage are produced in standard AVI file formats. They can be viewed as stand-alone video in Windows Media Player, Quicktime, VLC or any other compatible players. Alternatively, the videos can be imported into applications like DataView or H.I.M.S Asset Management software and integrated with other data.

Technical Specifications

Resolution & Frame Rate	***ROW Standard (2 MP):*** 1600 x 1200 at 25 FPS ***Pavement Standard (5 MP):*** 2448 x 2048 at 18 FPS (Mono)
Frame Capture Rate	Cameras are software configurable (depending on camera/application)
File Format	AVI File (compressed)
Camera Connection Format	Gigabit Ethernet (GigE)
Number of Cameras	Up to 6

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TPB Reference Profiler

Overview

The ROMDAS Transverse Profile Beam (TPB) Reference Profiler has been developed for measuring accurate transverse reference profiles. These profiles are analysed to establish the profile of the road and rut depths in mm.

Reference profile surveys are generally done for:

- Calibrating or validating a high speed transverse profile measurement system (e.g. the TPL);
- Construction quality control for car parks, bridges, airports etc;
- Collecting data for research purposes such as developing a new rut depth model or calibrating/testing the existing HDM rutting model.

Features

The TPB consists of the measurement beam and a tablet PC as the data logger. The measurement beam contains a motorised carriage which moves the measurement wheel along the beam length.

The vertical and horizontal position of the wheel is recorded to provide an accurate profile. The beam contains a battery, optical rotary encoders and a precision inclinometer to measure the profile.

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TPB Reference Profiler

Operation

The elevation of the wheel relative to the beam is recorded. Moving the wheel across the pavement gives the transverse profile. This results in a set of elevation measurements between every placement.

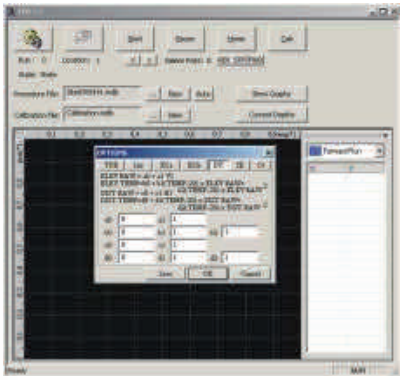
Components

During the survey the TPB displays a graph of the profile in real time along the section.

The TPB software can record up to 100 different location runs. The data is automatically compensated for temperature and the level of the beam.

The output for each survey site is a Microsoft Access database file with the following tables:

- **Location Tables:** Up to 100 Location tables per site with each Location Table containing raw profile, temperature and inclination data for each Transverse Profile;
- **Results Table:** Processed data containing rut depths for each wheel path and pavement distortion calculations.



Technical Specifications

Beam length:	3.8 m
Method of measurement:	High resolution optical encoders and precision inclinometer
Vertical resolution:	0.01 mm
Horizontal resolution:	0.1 mm
Battery life:	10 hours with continuous operation
Weight:	30 kg including battery

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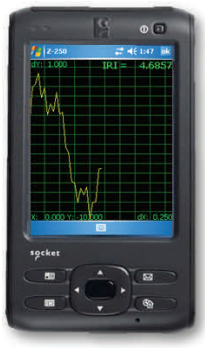
Z-250 Reference Profiler

Overview

The ROMDAS® Z-250 Reference Profiler has been developed to measure high accuracy reference profiles. The linear elevation profiles it measures are analysed and used to determine the road roughness in terms of IRI (m/km). This Class 1 profiler can easily be packed into a suitcase and is an excellent tool for measuring roughness profiles on calibration/validation sites.

Application

Survey Screen



Plot Survey Data Feature

Reference profile surveys are generally done for:

- Calibrating or validating a roughness measurement system (e.g. the ROMDAS® or TRL Bump Integrator);
- Quality control for large scale construction and infrastructure projects such as car parks, bridges, airport runways etc...;
- Collecting data for research purposes such as developing a new roughness deterioration model or calibrating/testing the existing HDM roughness model.

Operation

The Z-250 is 'walked' along the road by rotating the Z-250 on its 'feet', as shown in the figure below. This action produces a set of elevation measurements for every foot placement.

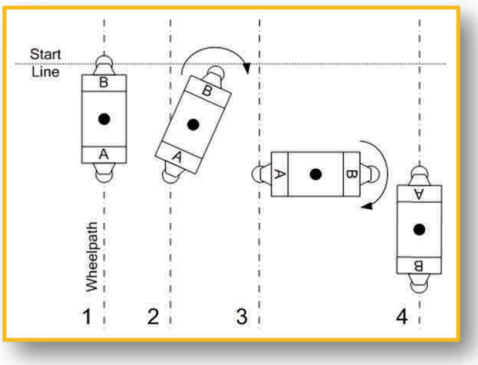
During the survey the Z-250 displays the chainage data along the section (in metres), the elevation (in mm) as well as the IRI (metres/km).

The survey can be paused or, if an error is made, can be erased and the data re-measured. Upon completion of the survey the final IRI is displayed and the user has the option to plot the elevation profile.

Two files are output for each survey:

⇒ **Text file:** A text file with 3 columns; distance, logged elevation data and summed or longitudinal profile data.

⇒ **.ERD file:** An .erd file that can be imported into ProVal or RoadRuf freeware software for further analysis of the road profiles.



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Z-250 Reference Profiler

Components

The Z-250 consists of two main components; a measuring unit and a hand held Pocket PC which acts as a data logger.

The measuring unit contains a battery, precision inclinometer and power circuitry. The inclinometer outputs a serial signal which is recorded and processed by the data logger.

The data is stored and can be downloaded to a PC for further analysis using ProVal software.

The following components are provided with the Z-250:

⇒ Z-250 unit with 3 piece extendable handle and Bluetooth module;

⇒ ROMDAS CD with software (including Proval) and manuals;

⇒ A durable carry case;

⇒ RS-232 cable for Z-250 to PC;

⇒ Calibration shims;

⇒ Operator headphone

⇒ Spare adhesive friction paper for feet

⇒ Maintenance tools and oil.

Technical Specifications

Sampling Interval	250 mm (other lengths available)
Display Output	IRI (m/km)
Operating speed	Controlled walking pace with audible placement prompt
Method of Measurment	High Accuracy Inclinometer
Height Measurement Resolution	0.05 mm
Battery Life	14 Hours (with continuous operation)
Weight	3.5 Kg incl. battery/10 Kg in packing case
Dimensions (excl. handle) Length x Width x Height	250 mm x 80 mm x 140 mm
Foot Diameter	38 mm

Validation

The Z-250 was validated against a Face Dipstick® and the two instruments were found to have excellent correlation. The validation report is available for download from *www.ROMDAS.com*

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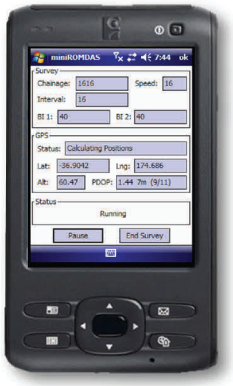
MiniROMDAS
Roughness Measurement System

Overview

MiniROMDAS® is a streamline version of the full ROMDAS system. It is designed as an easy to install, portable and cost effective option for customers who need to collect road roughness and/or GPS data.

The miniROMDAS® software was created to run on the Windows Mobile operating system and once installed will automatically collect and integrate distance, speed and road roughness data (GPS optional).

The system records roughness data from either one or two Bump Integrators (BI). The most common configuration uses a single Bump Integrator connected to the centre of the axle. In the case of vehicles with independent rear suspension two Bump Integrators are used to collect data from each wheel path.



Data Logger

Similar to the full ROMDAS® the miniROMDAS® system also connects to the ROMDAS Hardware Interface. However, the full ROMDAS system runs on a PC computer, while miniROMDAS® uses a hand held Windows Mobile devices.

All roughness measurements are recorded automatically and based on the user-defined roughness sampling interval, as per the full ® ROMDAS system.

The miniROMDAS stands out from other response-type roughness measuring systems thanks to its competitive price and use of proven technology.

Features & Benefits

miniROMDAS offers a more cost effective and simpler solution for users wanting only roughness or GPS data.

Features of miniROMDAS® include:

⇒ One screen display for easy and reliable use;
⇒ Simple to operate so minimal training is required;
⇒ Easy to download data to computer with USB or Bluetooth;
⇒ A step by step calibration wizard for odometer calibration;
⇒ Roughness recording that is fully automated over user-defined sampling intervals;
⇒ Data is processed in the ROMDAS PC software and output in Microsoft Access files.
⇒ Optional GPS integration;

The data is uploaded from the hand held data logger to a PC with ROMDAS® software and data is automatically processed using roughness calibration coefficients into a Microsoft Access .mdb file with the roughness output in IRI (or any other roughness index that the system is calibrated to).

Data Logger and GPS Receiver

For further information on the ROMDAS road measurement system please visit www.romdas.com

Email: info@romdas.com
Phone: + 64.9.87.7703
Fax: +64.9.87.7704

ROMDAS
Manufactured by
Data Collection Ltd.
New Zealand

providers of innovative technology for measuring and managing roads

MiniROMDAS
Roughness Measurement System

Installation

There are only two components to install in the vehicle; the odometer sensor and the Bump Integrator (BI). In addition, cabling must be run to the iPAQ data logger. All the hardware and cabling needed for installation are supplied with the product.
miniROMDAS® installation depends on the layout of the vehicle and the dashboard. It can be hand held or affixed to the top of the dashboard.

Bump Integrator

The BI is installed at the rear of the vehicle, above the rear suspension. The instrument is mounted to the floor of the vehicle and a wire is connected to the suspension.

Cabling

The following cables are supplied:

- **Power:** a 12 V vehicle charger is provided to power the data logger;
- **Odometer:** the odometer is connected to the ROMDAS hardware interface through a 5-pin DIN connector;
- **BI:** the BI unit(s) are connected to the ROMDAS hardware interface through a 5-pin DIN connector.

All cabling is supplied with the unit. Since the cables are industry standard, replacement cables are readily available at low cost.

Odometer Sensor

miniROMDAS omes with one of four types of odometer sensors:

- **Proximity sensor:** General purpose fits all vehicles;
- **Electronic:** These sensors are used with electronic speedometers. A wire is connected to the 'pulse' line of the transmission;
- **Speedometer cable - spliced in:** These are used with older vehicles that use speedometer cables. The cable is removed from the outer housing and a sensor is spliced in;
- **Speedometer cable—transmission connection:** This sensor works on newer Japanese vehicles. It connects the existing speedometer cable and the transmission.

Technical Specifications

Roughness Output	Typically IRI but can be calibrated to any roughness index
Data Storage	More than 100,000 km
Output File Format	Microsoft Access files
Integrated GPS	12 Chanel with full SBAS
GPS Rate	1 Hz
GPS Output	Can output into any datum and co-ordinate system with ROMDAS Co-Ordinate Converter

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Remote Data Transmission and Real-Time Monitoring of ROMDAS systems

The following options are available to users of ROMDAS equipment.

Real-Time GPS Tracking:

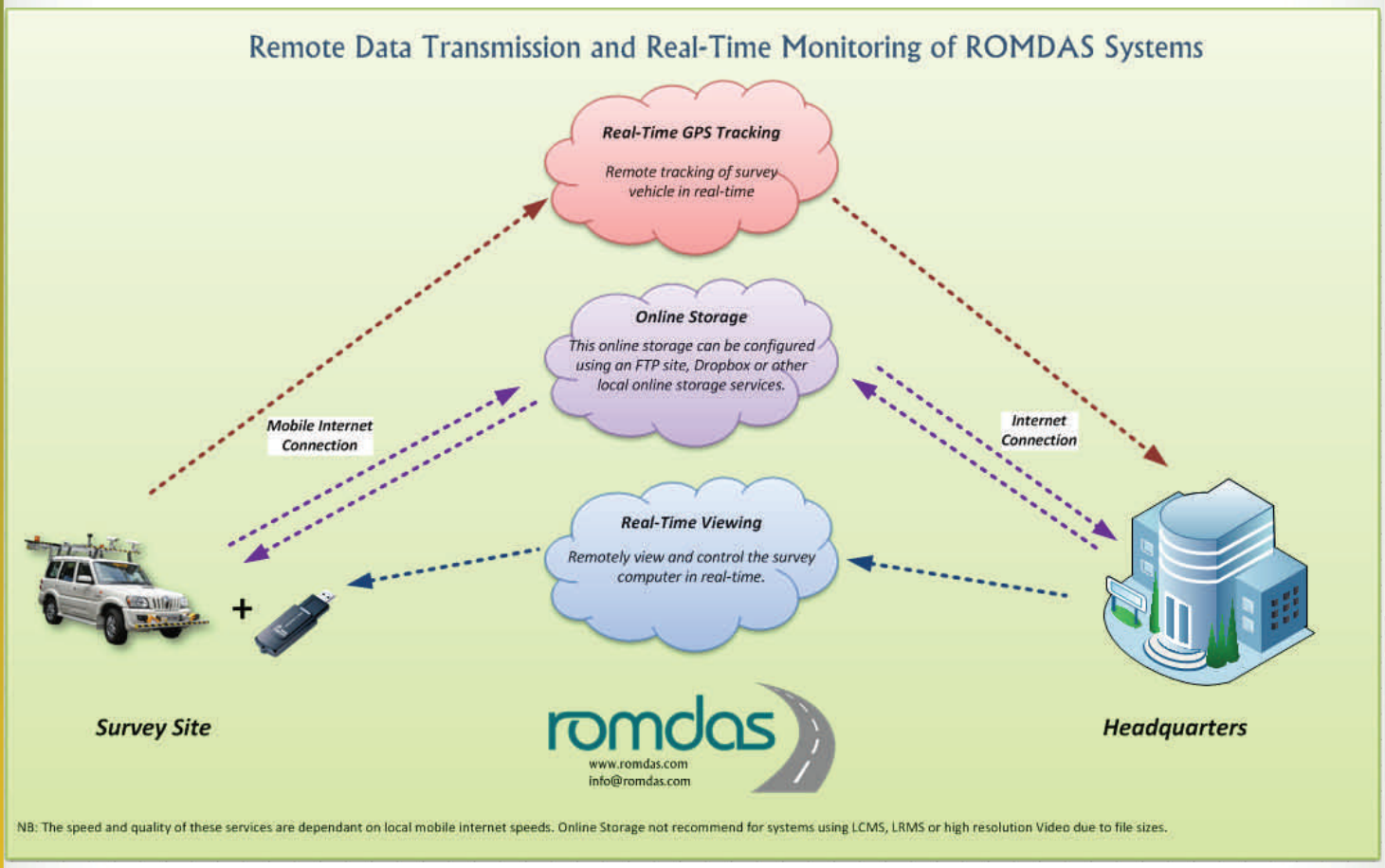
This allows for supervisors at regional or national headquarters to tracks the location of their survey vehicles in Real-Time.

Online Storage:

After the completion of a survey the ROMDAS operators can immediately upload their raw or processed survey files to an online storage location. This storage location can also be accessed by any other personnel with an internet connection allowing for the quick and easy transfer of files to and from remote survey sites.

Real-Time Viewing:

ROMDAS' Remote Support software is used to remotely view and control a survey computer to quickly resolve any technical issues. This software can be configured to allow ROMDAS users to remotely view and control their survey computers on site.



These services can be setup by ROMDAS engineers for an additional cost during training and installation visits. Alternatively, instructions can be provided to users on how to setup these services at the time of purchase.

Software Comparison Sheet

2011

Providers of Innovative Technology for Measuring and Managing Roads

SOFTWARE OPTIONS AVAILABLE WITH ROMDAS

Data Collection Features *(On-Site)*	*ROMDAS DataView*	*Z250 Profiler*	*miniROMDAS System with ROMDAS in office mode (free)*	*ROMDAS Data Collection*
• Distance/Speed		✓	✓	✓
• Distance/Speed - *High Resolution Option*				✓
• Roughness:				
○ *Laser Profilometer (Class 1)*				✓
○ *Bump Integrator (Class 3)*			✓	✓
○ *Z250 Reference Profiler*		✓		
○ *User Defined Sampling Intervals*		✓	✓	✓
• GPS/GNSS:				
○ *< 1 meter – Real-time DGPS*				✓
○ *+/- 3-7 meter accuracy*			✓*	✓
○ *+/- 7+ meters accuracy*			✓	✓
• Transverse Profile (Rutting):				
○ *Ultrasonic TPL*				✓
○ *LRMS (Laser Rut Measurement System)*				✓
• Macro Texture (MPD & STMD)				✓
• Automated Crack/Defect Detection (LCMS)				✓
• Road Geometry				✓
• Video Logging:				
○ *Pavement Video*				✓
○ *Right Of Way (ROW)*				✓
• Keycode Rating System:				
○ *Condition Rating*				✓
○ *Inventory Surveys*				✓
• Location Referencing System (LRP)				✓
• Travel Time Surveys				✓
• Reference Digital Photos				✓
• Data Logger:				
○ *Laptop*				✓
○ *Pocket PC (IPAQ)*		✓	✓	
• Built In Calibration Process				
○ *Roughness*		✓	✓	✓
○ *Odometer*			✓	✓
○ *Ultrasonic TPL*				✓

Data Processing Features *(In Office)*				
• Create Raw Survey Files in Unchangeable .RBF Files.			✓	✓
• Create Survey Data in .ERD files		✓		
• Process Surveys Into Microsoft Access Databases			✓	✓
• Data Referenced to Distance and/or GPS Position			✓	✓
• Format/Modify Data Tables	✓		✓	✓
• Data Graphing & Presentation	✓			
• Synchronise Data Viewing	✓			
• Generate GPS Maps for Roads, Events & LRPs	✓			
• Video Image Processing:	✓			
○ Collect Inventory & Asset Data	✓			
○ Collect Crack/Defect/Condition Data	✓			
• Integrate Multiply Survey Files Into Central Database	✓			
• Export Data To:				
○ HDM-4, Word/Excel, PMS	✓		✓**	✓ **
○ Proval & RoadRuf		✓		
○ GIS Mapping Programmes (e.g. ArcView, MapInfo)	✓**			
○ Google Maps, GPS Shape Files	✓			

*** (when connected to SBAS network)**

**** (Export From Processed Microsoft Access Databases)**