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Summary of RoadMark System

The RoadMark system comprises of two linked applications, allowing inventory and condition data about a wide range of road-related assets to be collected, stored and reported:

- **RoadMark** is an Android based Smartphone application designed to quickly collect road-related inventory and condition data during road surveys, using commonly available technology. It does not require any internet or mobile connection, nor extensive training beforehand.
- **RoadMark Analysis** (RMA) is a Windows 10 based computer application that allows the data captured using RoadMark to be stored in a relational database. RMA provides data editing and detailed and summary reporting. All data can be exported in a range of CSV files, that can be easily used by many other applications.

RoadMark is designed to provide the maximum level of useful information about a road network, with minimal surveying time, expertise and equipment and at low cost.

Inventory & Condition Data Collection:
RoadMark Smartphone App

This app is designed to work on any commonly available Android Smartphone device, collecting key data about a road network (carriageway and shoulders) and associated assets (bridges, culverts, drainage and other street furniture), plus administrative and land use data.

It was specifically designed to be used on rural roads, even where no referencing system has been adopted and where the level of existing data, technical capacity and funding is frequently very low. (It could however, easily be used on most types/classes of road.)

Key features:

- It allows the location and condition[1] of all the key road features to be recorded (with the ability to add any comments). Road-related features that can be captured include:
  - **Carriageway** (pavement type, width, administrative data, condition, dual or single);
  - **Shoulders** (type, width, condition);
  - **Culverts** (Type, size and condition);
  - **Side drainage** (type, condition);
  - **Bridges** (including type, dimensions and condition for the key components: substructure, deck, parapets, carriageway and footpaths);
  - **Adjacent land use** (for each side);

[1] Users select one of 5 condition categories, based on the estimated level (or cost) of treatment required to return the asset into a "Good" (as new) condition within the next 12-18 months. This approach is fast, simple to understand and can be readily used by non-engineering surveyors. This level of detail is generally adequate for network planning purposes. Whilst additional condition criteria (e.g. structural and surface damage on paved roads) could be recorded, these inevitably increase the survey times, require additional user skills and increase subsequent analysis complexity (such as how to objectively interpret this data).

  - **Point items** (e.g. signs (type and condition), access points (e.g. driveways), river crossings (fords), intersections and level crossings, schools, markets, places of worship, location of various government and community services, major structures, etc.);
  - **Any road corridor restrictions**, such as the presence of embankments, cuttings, bodies of water, land encroachment (e.g. from buildings), utility posts and significant trees.

- RoadMark does not require any referencing system (e.g. road numbering) to be established for the roads or other assets being surveyed.
- RoadMark is fast to use: in surveys on rural roads, it typically averaged 10kph. (However, this depends on the number of features to be captured on the roads being surveyed).
- It is quick to learn, requiring minimal specialised knowledge or training: local operators were able to use the application after only a few hours of on-site training.
- It does not require any specialised or difficult-to-access equipment: it uses any Android Smartphone device running Android (any version after 2015) with a dedicated GPS chip.
- Distances are calculated automatically (in RMA) using the GPS data, avoiding the need for surveyors to do this on site.
- The RoadMark application is small and fast: it is less than 1.5Mb in size. The data files are approximately 10-15kb per km of road.
- When surveying, RoadMark does not require a mobile or Wi-Fi signal, only a GPS signal.
- Surveys can be paused and restarted. (A locational check ensures that the user is close to where the survey was previously paused before restarting.)
- Dropdown menus are provided for many items, and numerous checks are carried out when data is being entered, to minimise future data validity problems.
- All data collected is geo-located and time and date-stamped, meaning that data cannot be falsified.
- Because all data is time and date stamped, reports can be produced (using RoadMark Analysis) providing information on survey rates and performance monitoring.
- Even if the power fails or a survey is interrupted (by say, an incoming call), the data is stored safely and securely on the mobile device, until it has been successfully sent to the RoadMark Analysis application (see below), after which it can be deleted from the smartphone.
- Data can be easily transferred to a remote computer, when the Smartphone has internet access. No physical connection is required. Given the small file sizes, this is also fast and uses minimal data allowance, even for poor quality connections.
- The application is free to install and use on any Android Smartphone[2].
- The software can be provided in languages other than English (for an additional cost).

[2] However, the data collected cannot be decrypted without a valid RoadMark Analysis application licence.

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Data Storage & Management:
RoadMark Analysis

This corresponding application runs on a stand-alone Windows 10 computer. Data collected by the RoadMark application (using a Smartphone – see details above) can be imported, stored, managed and exported in a series of reports/outputs.

This application (which requires a licence to import data) is scalable to accommodate large networks[3]. It receives the data imported from the Smartphone RoadMark application, allowing the user to:

- Easily import, check, edit and securely store the survey data.
- Calculate road lengths automatically for all surveyed roads, to an accuracy of approximately 2 metres[4], using the automatically recorded GPS data.
- Store and report on all road features with their GPS locations, associated with the relevant section of road carriageway.
- Export some or all the data, for easy use by other applications, including Word, Excel and other database applications. This allows users to easily produce a flexible range of charts, tables, graphs and reports about the road assets surveyed; as well as any further data analysis and manipulation.
- Produce a wide range of maps about the road assets surveyed, using mapping software (e.g. the freely available GQIS).
- Edit (and delete) many data fields (e.g. road names and numbers).
- Provide summary and detailed statistics and reports for each type of asset recorded.
- Provide administrative reports on each of the surveys carried out, such as when they were undertaken, their duration and rate of surveying.

The RoadMark software continues to evolve, with additional features, usability, flexibility and security being continually added. Please contact Penhallow Limited (UK) to find out the latest developments and discuss how this system can best meet your specific requirements.

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[3] RMA requires Microsoft SQL Server version 2016 or later. This software, which is freely available from the Microsoft website, requires one-time installation prior to using RMA for the first time.

[4] Due to the limitations of the GPS system and Smartphone GPS technology, altitude data has a lower accuracy than horizontal longitude and latitude data, (although this data is still captured by RoadMark). This limitation can reduce the accuracy of distances calculated by RMA in very hilly or mountainous areas.