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Irish Pavement Asset Group

Pavement Asset Management Guidance

Section 3:

Inventory and Data Management

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3 Inventory and Data Management

This section recommends the inventory data that road authorities should hold. It provides guidance on data collection methods and states how the data should be updated and validated.

3.1 Asset Register and Inventory Data

The list of assets that an organisation owns is usually referred to as its asset register. *Section 1: Road Asset Register* of this guidance sets out how a road asset register should be categorised. The asset register is broken down into asset types to enable an understanding of an asset's value and the funding needs that it generates. Appropriate inventory data is required, to enable estimation of costs and other forward planning activities. Inventory data is the record of specific attributes of an asset that is held, in order to enable reporting and management of the asset. This relationship is illustrated in the table below. The asset register should identify the road assets held in charge, or not, by the road authority.

Table 3.1: Asset Register and Inventory Data

Asset Register					Inventory Data
Asset Group	**Asset Type**	**Asset**	**Component**	**Sub-component**	**Inventory (to be held for each segment or sub-component)**
Roadway	Regional Roads	Road Name and Number	Road Segment	XSP (Cross-sectional position) / lane	Length
					Width
					Traffic Impact Number
					Surface type
					Surface material specification
					Material source
					Date of last resurfacing
					Environment (urban, rural, etc.)
					Construction type
					Surface treatment type *
					Date of last surface treatment *

** Optional data.*

These tiers of detail enable a road authority to report on their assets in a number of different ways, as shown in the example here for National Primary Roads:

- 5,230 km on National Primary Roads;
- 9,287,250 m^2 of HRA surfacing on National Primary Roads;
- 5% of the National Primary Roads resurfaced last year, equivalent to a 20-year return period;
- €24m per annum is required on average to maintain the current condition.

3.2 Inventory Data

A robust inventory is essential for good pavement asset management. It should be sufficiently reliable to enable it to be used to support the development of maintenance programmes and the prediction of the funding needed to achieve stated condition targets / standards.

Recommendation: Road authorities should maintain the following inventory data as a minimum for each road segment (or sub-component / XSP *).

** Where desired, road authorities should hold their inventory data for each sub-component.*

Table 3.2: Minimum Roadway Inventory Data

Road Name and Number	e.g. N1, R101
Length	Segment length
Roadway width	The average width (to calculate area of the segment)
Road Classification	National, Regional, Local, etc.
Road Impact Number	Impact Number for Roadworks Control
Surface type	HRA / DBM / Concrete / SMA / Surface Dressing / Other
Surface material specification	Material specification
Material source	Supplier details including quarry
Date of last resurfacing	Date (year) when last resurfaced
Environment	Urban, rural, etc.
Construction type	Flexible / rigid / composite
Surface treatment type *	Slurry seal / High-friction surfacing
Date of last surface treatment *	Date surface treatment laid
Contractor *	Name and contact details of contractor that laid the last resurfacing
Cost *	The total cost of the resurfacing scheme
GIS *	Co-ordinates of a polygon of the area

** Optional data*

Network Reference: All data collected should be referenced to a common location reference, i.e. a base network comprising of the roads schedule broken into segments, as described in *Section 2: Network Referencing* of this guidance.

XSP: the cross-sectional position.

Road Name and Number: Road name from Street Gazetteer (English and Irish), road number from road schedule.

Length: The length (in km) of road in each class is available from the roads schedule. It should be updated annually as a minimum. Further updates are appropriate, if significant additions have been made to the network, e.g. the taking in charge of large new estates. Care should be taken to check that lengths held in the road schedule are correct and that segments do not, for example, extend into the middle of a junction.

Roadway width: The average width (in metres) of each segment should be recorded. Where widths are not known, estimated default values should be used. The PMS should be capable of recording an average width for each road segment from which a surface area can be computed. Roadway width is defined as between kerbs on urban roads and to the edge of wearing course on rural roads.

Road Classification: the class of the road – national, regional, local, etc.

Road Impact Number: A number given to each road according to its importance as a strategic traffic route.

Surface type: The surface type for each road segment should be recorded. Where a segment comprises more than one surface type, the type covering the majority of the segment should be recorded. If the road segment is long (>500m) consideration should be given to creating two new segments. This should only be undertaken where the different surface type is likely to be retained into the future, i.e. future maintenance works are not likely to treat the whole of the existing segment with the same material. The surface type should be recorded using a standardised code, for example:

- HRA: Hot rolled asphalt
- SD: Surface dressing
- Conc: Concrete
- Mod: Modular paving

Surface material specification: For each length of surfacing the details of the material specification should be recorded (e.g. Dense Asphalt Concrete Surface Course (to Clause 909 & 912).

Material sources: Details of where the stone came from for the surfacing material, i.e. the quarry. This data is useful if early life failures are experienced and a road authority wants to understand the risk of further failures from materials from the same source.

Date of last resurfacing (year): The year in which the last resurfacing was undertaken should be recorded for each segment. It is accepted that this data will only be readily available for recent years. As a minimum, road authorities should record this data from now on. An effort to populate historical data, such as from work contracts from the last number of years' worth of contract records, would assist greatly to make this data useful in assisting the planning of works.

Environment: Each road segment should be identified as being in either an urban or rural environment. The definition of urban is a road with a speed limit of 50 km/h or less.

Construction Type: The form of construction of the road, flexible, rigid or composite.

Surface treatment type: Some road authorities may have significant areas that have been treated with a surface treatment, typically either a slurry seal or high-friction coating (for example on approaches to a traffic signal). Some of these treatments have significant lower expected lives than the wearing course surfaces that surround them. Where significant quantities exist, the road authority may wish to store a record of these areas to aid maintenance programme development. Note: this data items is considered optional in terms of this guidance.

Date of last surface treatment: Where road authorities choose to record surface treatments the date (year) when it was laid should be recorded.

Contractor: Where works have been carried out by contractor, the name and contact details of the contractor who laid the last resurfacing or treatment on each segment can be recorded.

Cost: The total cost of the resurfacing scheme can be recorded. The cost should be spread over the relevant road segments pro rata, based upon the length of each segment.

Table 3.3: Minimum Footway Inventory Data

Network Reference	Road number, segment number, cross-sectional position
Footway Hierarchy	Hierarchy, i.e. 1, 2, 3, 4 (see below)
Length	Segment length
Width or area	Width (sufficient to calculate area) or area from GIS
Surface Type	DBM, HRA, concrete, modular paving
Surface material specification	Material specification
Date of last resurfacing	Date (year) when last resurfaced
Environment	Urban, rural, etc.
Surface treatment type *	Slurry seal
Date of last surface treatment *	Date surface treatment laid
Contractor *	Name and contact details of contractor that laid the last resurfacing
Cost *	The total cost of the resurfacing scheme
GIS *	Co-ordinates of a polygon of the area

** Optional data*

Footways Functional Hierarchy

Most road authorities manage their footways recognising that those in particular locations warrant a higher level of attention. It is appropriate to maintain footways in high use areas such as shopping centres) and areas where they are used by more vulnerable users, e.g. hospitals, schools and care homes, to a higher standard than other footways on the network. The below provides a recommended hierarchy for footways.

Table 3.4: Footway Hierarchy

1	Primary Walking Routes	Urban shopping areas, business areas and main pedestrian routes.
2	Secondary Walking Routes	Linking access footways between primary walking routes and local footways.
3	Local Footways	Footways associated with low use roads, residential streets.

Recommendation: Road authorities should establish a functional hierarchy for their footways by allocating each footway to a category, such as in Table 3.4.

Storing Inventory Data

Inventory data should be stored using an appropriate computer software system. It is anticipated that most road authorities will store their inventory data in the *MapRoad* system. The base network comprises a series of interconnecting road segments. These are stored in the road asset management software system used by the council.

Recommendation: Road authorities should store their inventory data in an appropriate software system capable of storing (as a minimum) the data shown in Table 3.2.

Absence of an appropriate software system should not prevent a road authority from collecting data. It should however be noted that difficulties may be encountered in subsequently transferring the data to a software system. However, much can be learned from the data that is collected and the experience of using it with management of the asset. Any Geographic Information System (GIS) software could be used to store asset and inventory data in the absence of a PMS system.

The key to being able to interrogate pavement asset data effectively is to be able to relate all the data stored to a common location reference. The most common way of doing this is to relate all items to the base network as described above. Some road authorities may choose to store some of their data in the form of polygons. For example, a major city may choose to polygonise their footway network for the purposes of matching condition surveys to differing material types. Authorities may also decide to use polygons in data collection to get an accurate area of the asset type.

For the majority of road authorities, data stored as a line with attributes attached to them will be acceptable. For urban networks there may be a desire to hold a more detailed map-based representation and therefore polygons may be favoured. Urban authorities will have to balance the benefits of having accurate maps of the areas of pavement against the cost of maintaining data in this format.

3.3 Assessment of Data Quality

To enable assessment of the quality of road inventory data, a simple method of assessment is provided below. It is recommended that data quality be reviewed, at least annually. More frequent data quality checks may be appropriate, where a road authority discovers that its data is unreliable, to the extent that it is not considered appropriate to use it for planning maintenance works and / or estimating costs.

Recommendation: Road authorities should assess their inventory data annually using the method described in *Section 3.3*.

Data confidence should be recorded for each of the following items:

Roadway inventory:

- Width
- Surface type
- Date of last resurfacing
- Construction type

Footway inventory:

- Length
- Width
- Surface type

The source of the data held for each of the items above for each road segment shall be entered into the PMS using the following table. The PMS will then ascribe the confidence level shown to each individual data item for each segment.

Table 3.5:

Basis of data	**Confidence Factor**
Actual / field measurement, e.g. tape measurement recorded width	1.00
Desktop measurement, e.g. from Ordnance Survey mapping	0.75
Estimate / default, e.g. local engineers estimate or default value for road class	0.50
Nil, no data held	0.00

For each road class, the quantity by length of data recorded on each basis shall be calculated by the PMS, as shown in the example below based on a 100 km of road.

Table 3.6:

Source of Data	**Example (width of roadway)**	**Length (km)**
Actual / Field Measurement	Field measurements of 250 segments total length 50 km.	50 km
Desktop Measurement	Width for area not measured on site, where reasonable quality mapping exists. Widths taken-off for 30 km worth.	30 km
Estimate / Default	Average estimated width for the road class entered for remaining segments totalling 20 km.	20 km
Nil	No Data	0 km

This method can then be used to create an assessment of data confidence for each item and overall assessment for the class of road, by multiplying the length of road from each source with the relevant confidence factor. Using the example above, the overall confidence level for width is calculated as:

$$Confidence\ level\ for\ width\ = \frac{[(50\ x\ 1.0) + (30\ x\ 0.75) + (20\ x\ 0.5)]}{100} = 83\%$$

An overall confidence level for each class of road can then be computed, by calculating the average confidence level for the items of data required, as shown in the example below:

Table 3.7

Road Class	**Data Item**	**Confidence Level**
Regional roads	Width	83%
	Surface Type	30%
	Date of Resurfacing	30%
	Construction Type	30%
Data confidence for regional roads		43%

3.4 Data Collection

Many road authorities will have a need to collect additional data. A number of methods are available for the collection of inventory data. The most common methods are described below together with an assessment of the advantages and disadvantages of each method.

Walked Inspector Data Collection

Inventory data can be collected using existing resources, who are trained to capture relevant details during their normal inspection activities.

Advantages: Using existing resources to collect data means that the data collection exercise can be integrated into other inspections. Whilst this will slow inspections down, it takes far less time than undertaking a separate, dedicated walked data collection exercise. A significant advantage of collecting missing data with inspectors is the fact that the inspectors will be trained to record asset data. The subsequent upkeep of the data, when changes are made to the asset as a result of maintenance works, etc. can then be similarly undertaken, avoiding the need to repeatedly undertake or procure data collecting surveys.

Disadvantages: Initial data collection using this method can be time consuming and can slow the inspections down. If a regime of inspections is not currently in place, the collection of the data will be sporadic and would require some additional inspections to be undertaken, to ensure that the asset is fully surveyed.

Relative Cost: This method of data collection for inventory is the cheapest and most viable method available in the long run. Once inspectors are trained-in and capable of using suitable data collection devices, the additional cost is low. Some investment may be required in computer hardware (hand-held data-capture devices) and associated software. This investment can usually be justified by staff time savings of handling hard-copy data from inspections, although an appropriate software system to store and analyse the resulting data is required, in order to make this exercise fully justified.

Walked Data Collection

Inventory data can be collected using existing resources, who are trained to capture relevant details as a separate surveying exercise.

Advantages: Collection of data using a walked additional survey, by existing resources, has the advantage of the data being captured by people who may subsequently use it. A walked survey allows all data to be captured. Using existing resources to collect the data means that they are trained in the process of data capture and can then subsequently assist with the upkeep of data.

Disadvantages: Depending upon the amount of data that is missing, collecting data by additional survey can be time consuming and costly. If the data required is only pavement data, then the survey can require a lot of walking to collect a relatively modest amount of data.

Relative Cost: The cost of a survey of this nature is highly dependent upon the items of data being captured and the capability of the staff chosen to undertake it. This can be a comparatively expensive method of data capture.

If no inventory data is held, it may be appropriate to undertake a full inventory survey and get a complete base inventory and follow this up with maintenance of the data by 'walked inspector data collection'.

Topographical Surveys

This method involves the use of topographic survey methods to accurately locate inventory data. This would typically comprise the collection of point items, lines and polygons for each of the asset types collected.

Advantages: This method provides a high level of accuracy for location. Where detailed records of areas are required, it provides polygon data which can be presented in graphical format that better reflects reality than line data.

Disadvantages: The level of accuracy that topographical surveys provide is not required for many road asset items. The data, once collected, has then to be managed by others and collection via this method does not assist in creating a resource capable of keeping the data up to date.

Relative Cost: The relative cost of a topographical survey can be high, but may be warranted if there is a specific need for collecting of accurate area information.

Digital Video Capture

This method involves using specialist vehicle-mounted digital video equipment to capture data. The survey is undertaken, by driving the vehicle around the survey route. Data is then taken-off, either automatically for some items using sophisticated software or by an operator subsequently viewing the videos and digitising the data required.

Advantages: This method provides a record that can be replayed and reviewed. It is comparatively safe, as it is undertaken from a vehicle. Large amounts of data can be relatively rapidly collected.

Disadvantages: In some instances, the video capture may miss items that are obscured by parked vehicles and other obstructions.

Vehicle-based Condition Surveys

This method involves using data, usually a video, collected during vehicle-based condition surveys, as a source of inventory data. Surveys such as the UK “SCANNER” condition surveys will typically collect video data. It is similar to the method above, but would generally not apply such sophisticated video technology.

Advantages: This method takes advantage of data that is already available, from a survey that has been paid for.

Disadvantages: Taking data from a video relies on the image being good enough, to discern things like changes in surface and where the edge of pavement is. A vehicle-based condition survey will only be available for some roads, typically national and regional roads. This survey might not provide geo-referenced co-ordinates or measurements and if that were the case, it would be of limited use for inventory capture.

Relative Cost: The relative cost is low. The additional survey cost should be nil. The cost lies in the activity in taking-off data from the videos.

Aerial Photography

This method uses aerial photographs as a means of identifying areas and location of assets. This method is rarely used for road asset management data collection.

Using Existing Mapping

This method uses existing mapping to determine areas of road.

Advantage: This can be a cheap source of some basic area data.

Disadvantages: The accuracy of the mapping may not be suitable to enable its use for many areas. The method cannot be used to capture material type and is likely to only be used in combination with other surveys.

Relative Cost: The relative cost is low.

LiDAR

Light Detection and Ranging is a method of survey that is capable of measuring the height of the ground surface, in large areas, to a high degree of accuracy. The technology is not new, but the relatively recent technology improvements have provided a step change in accuracy, over the last few years. The high resolution and accuracy of the LiDAR datasets can be used to identify and geo-reference road assets.

Advantages and Disadvantages: Dublin City Council has recently carried out a pilot data collection exercise using this method. A case study outlining their experience is included in *Appendix 3.a.*

Relative Cost: The cost of this form of survey is difficult to state. Very few have been undertaken for the purposes envisaged by this guidance. Prices are likely to change if a market emerges for its use.

Pavement or Road Asset Data Collection

It should be noted that many inventory data collection exercises involve collecting a range of inventory items on a range of assets, i.e. it is typical for a road authority to want to collect information on signs and road markings, safety fences, etc. in addition to pavement data. The extent of the data being collected, in terms of the range of items, can significantly affect the method chosen for collection of data.

By far, the most cost effective method of maintaining an inventory of pavement assets is to integrate the collection of the relevant data into normal operating practices, i.e. to make collection of the data part of what happens normally, when works are undertaken on the asset. However, this method does rely upon staff accepting the need to collect data and to do so accurately and diligently. As noted previously, this method may not be immediately available to some road authorities.

As an example, where no data currently exists, road authorities should populate their systems with estimated widths, based upon local knowledge of the network. It is expected that in doing so, local "standard" default widths will be used for groups of roads. The systems should record that these are default widths and be capable of reporting the percentage of road by length, for which a default width is currently used. Over time, road authorities should plan to progressively update this data, until such time a full record of measured road widths exists. The most practical way of doing this is to measure the road width, whenever a road is inspected and then update the data in the system with the result.

Cost-effective data collection is almost always facilitated by the use of hand-held data collection devices (DCDs), or in some instances, the use of tablet computers. Further information on types of data collection devices and the basic requirements of the data collection device is included in *Appendix 3.b*.

Currently, most road authorities do not have a full inventory of their pavement assets. Resource constraints mean that for most road authorities, contracted-in data collection exercises are unlikely to be feasible.

The most major consideration when selecting a method of data capture should be one of sustainability, i.e. will this method assist the road authority to get into a position whereby it is able to sustain an up-to-date set of data.

3.5 Data Management

It is essential that road authorities maintain their inventory, to ensure that it is accurate and up to date. Authorities should record the data about its road assets, as described in *Section 3.4* and document the methods used to maintain and improve this data as below. Plans for improving the standard of data held should be based on the following principles:

1. Creation of an asset register and inventory database.
2. Collection of inventory data will be a priority.
3. Updating asset data shall be carried out by road authority staff, as part of their normal duties.
4. Data will be collected electronically, wherever possible.
5. Data collected by third parties* will be validated by the road authority, prior to acceptance.
6. All data will be stored against a common location reference.

* *A third party may, for example, be data collection contractor, a contractor supplying "as-constructed" data records or a utility operator applying for a licence.*

It is preferential for the engineers / inspectors supervising the works to have access to and the ability to update the inventory database directly, in the field. The use of hand-held data collection devices for the engineers / inspectors is recommended. This would only be possible with an asset management system.

Responsibility

It is recommended that an individual is identified to be responsible for ensuring the reliability of the inventory data, an Information Manager. It may be appropriate for this person to be responsible for all road asset data, including other data types, e.g. condition data, inspection records, etc.

The Information Manager should be responsible for ensuring that data held is current, to acceptable levels of accuracy and that progress is made on data improvement actions. He / she should report on the quality of the data held, to an appropriate manager, on at least an annual basis. Where other data types are involved, a more frequent reporting regime may be appropriate.

It may be appropriate to also appoint specific GIS technicians who are responsible for collating all data on their allocated asset group or data type. The GIS technicians should ensure that the data management procedures are adhered to, check that the targeted standards of data are met in terms of completeness of the data sets and their accuracy. Where standards are not being met or data procedures are not being adhered to, the GIS technicians are required to report the deficiencies to the Information Manager. These responsibilities will usually be executed via undertaking or arranging sample checking of the data.

3.6 Data Management Procedures

Road authorities should document specific data management procedures, to ensure that the inventory is updated. Specific procedures will need to be created to reflect the resource levels, organisation structure and management methods of each road authority. It is however expected that the following procedures will be required, as a minimum.

New Assets – Contractor- or Council-built

This section refers to assets that are commissioned by the council itself and built by a contractor or by the council's own construction resources. A specific procedure should be developed. It is likely to include reference to:

- Confirm scheme list for the year.
- Confirm completion of each project / scheme and hand-over into maintenance.
- Advise maintenance department to commence inspections and routine maintenance.
- Delivery of as-constructed drawings.
- Creation of data from as-built drawings and input into asset register / inventory databases. [1]
- Validate a sample of the data on site to check for accuracy.
- Update roads schedule / asset register and data inventory.

The contractor should deliver the as-constructed drawings, in a format specified in the road authority's tender documents.

New Assets – Taking In Charge

For assets that are built by private developers and subsequently put up for taking in charge by the council, a specific procedure should be developed. It is likely to include reference to:

- Confirmation of taking in charge from the appropriate department.
- Advise maintenance department to commence inspections and routine maintenance.
- Delivery of as-constructed drawings from the developer.
- Creation of data from as-constructed drawings and input into the asset register and inventory databases.
- Validate a sample of the data on-site, to check for accuracy.
- Delivery of as-constructed drawings from the work section responsible for confirming completion of works.
- Input of data into the database (PMS or other road asset management software system).

[1] *Most as-built drawings will be delivered in a drawing file format, e.g. a CAD drawing. This cannot be easily converted into data for uploading into a pavement management or road asset software system. The data usually has to be extracted from the drawing manually, by a technician taking-off relevant details, then manually entering them into the inventory database. Alternatively, the council may be able to specify delivery of asset data in an appropriate format, for uploading into the council's systems. This applies to contractor- or council-built assets and taking in charge.*

Major Maintenance and Resurfacing

A specific procedure should be developed. It is likely to include reference to:

- Confirmation of the completion of individual schemes.
- Delivery of as-constructed drawings from the work section responsible for confirming completion of works.
- Creation of data from as-constructed drawings and input into the asset register and inventory databases.
- Creation of data from as-constructed drawings and input into the database (PMS).
- Validation of a sample of the data on-site, to check accuracy of the records supplied.
- Creation of data from as-constructed drawings and input into the database.

Routine and Minor Maintenance and Reactive Repair

It is not expected that the asset inventory will include records of routine minor maintenance and reactive repairs. These records should be collected and stored in accordance with the guidance given in *Section 4: Routine Maintenance Management* of this guidance.

Removal

Removal of assets is relatively rare, however a procedure should be outlined, if it is considered that this may happen and asset records will require updating, to remove assets.

Updating Timing

The timing of the updating of inventory should be specified, for example:

Table 3.8: Inventory Updating Timing

Type	Timing
New Assets – Council-built	Within 3 months of completion
New Assets – Taking in Charge	Within 3 months of taking in charge
Major maintenance and resurfacing	Annually updated in November
Removals	Within 3 months of confirmation of order

3.6 Data Improvement

Road authorities should record their data improvement actions for roadways. This should refer to the assessment of existing inventory data, as detailed in *Section 3.3* above. Improvement actions should focus on a small number of achievable targeted improvements, as illustrated in the example below.

Table 3.9: Data Improvement Actions

Inventory Data Deficiency	Action	Target Completion Date
Roadways		
Accurate road widths are only held for 25% of the network	Estimated widths to be measured from Ordnance Survey digital maps	e.g. December 2014
Surface types are held for less than 10% of the network	Last 3 years resurfacing records to be entered onto the *MapRoad* system	e.g. December 2014

3.7 Audit, Validation and Reporting

Road authorities should record the methods used to audit and validate data.

Desktop Audits

It is recommended that road authorities programme an appropriate regime of desktop audits of the data held in their systems and databases. The timing of these audits should be dictated by either time (a set frequency) and / or the level of activity, i.e. an additional check may be warranted if there have been a lot of changes to the assets, over a period of time. A minimum frequency of quarterly audits is recommended. Desktop audits should be able to test the full database for logic. If the audit is to check that new records have been added, it is recommended that a check is undertaken on 10% of the records. If this check fails to meet the specified standard of, say 98%, the sample should be extended by 10%. If the standard is then met, then the audit is considered to comply. If the data does not meet the standard, appropriate corrective actions should be programmed. The actions may include collection of data, in areas where records are suspect, staff re-training, or amending data management procedures, to ensure the procedures are adhered to.

Desktop audits should examine items including, but not limited to:

- Checking if data from known changes (e.g. specific schemes) has been loaded.
- Checking if superseded assets have been removed.
- Checking if there are duplicate items in the databases for locations and / or asset types.

A specified level of accuracy and completeness should be documented in this plan and corrective actions instigated, when data quality does not meet the required standard.

Validation of Third Party Data

It is recommended that where any data is collected by a third party, for the council, that the method of validating this data prior to acceptance is recorded separately.

Field Validation

In order to validate data held within the database, a regime of sample field survey checks shall be carried out. These will take a randomly selected sample of data and check it against the physical assets. It is recommended that this exercise is carried out every two years, on a minimum sample of 5% of the network by length. Appropriate corrective actions should be documented, for where the data does not fall within the required accuracy (95%).

Reporting on Data Quality

It is recommended that a reporting regime is included, that reports the result of audits and progresses completing data improvements to an appropriate management forum.

3.8 Other Asset Data

A wide range of data is required, in order to effectively manage pavement assets. The careful management of all of these data sets is required. Asset data is required to enable:

- Monitoring and reporting on the condition of the road network.
- Assessment of the expected lives of individual assets or asset components.
- The assessment of current and the development of future levels of service.
- The measurement and reporting of asset performance, using appropriate indicators.
- The modelling of future maintenance options and investment strategies.
- The development schemes and forward works programmes.
- The identification of future budget requirements.
- Asset valuation and financial reporting.

This section of the guidance deals solely with inventory data, i.e. the number, location, size, type, age and components that make up each asset. Data management principles, described above, should be applied equally to maintaining the quality of other asset data that may typically include:

- **Condition:** comprising measurement and observational rating of the condition of elements of the asset, derived from either physical testing or visual inspection.
- **Inspection:** comprising details of the safety inspection regime and records of inspection results and actions initiated.
- **Use:** comprising details of the use of assets, in the form of data such as traffic counts, heavy vehicle routes, etc. and third party use such as utility openings that affect the operation and maintenance needs of the network.
- **Cost:** enabling the comparison of unit costs, price benchmarking and effective estimating.
- **Safety:** collision statistics and location of collision-prone locations, etc.
- **Customer:** comprising of data on complaints, queries and requests for service, data relating to customer satisfaction surveys.

Appendix 3.a:

Dublin City Council Inventory Data Collection Case Study

Background

Dublin City Council embarked upon a project to introduce a Transport Asset Management System to support the management of the city's road infrastructure. An assessment of data early in the project identified a need to collect inventory data. Specifically, there was a priority need to collect detailed inventory for the central business area.

Procurement

The council chose to obtain this data using an external surveying contractor, as adequate resources were not available in-house to carry out this survey. A tender was drawn up and advertised. Two suitably-qualified tenders were received. A contractor was subsequently appointed with a tender price of just over €40,000. The tender document comprised of a description of the data to be collected, the accuracy required and the specific items of data to be collected. A separate document, '*Guide Manual for Asset Inventory Survey*' was supplied to the successful contractor upon appointment. This contained photographic examples of the assets and their attributes that were to be collected.

Scope

The survey covered the central business area of Dublin, an area that comprises of 114 km of streets. Data for the following assets was collected:

- Roadway
- Footway
- Kerbs
- Traffic islands
- Anti-skid surfacing
- Cycle tracks
- Road markings
- Pedestrian guardrails
- Traffic signs
- Street-name plates
- Cycle stands
- Bollards
- Public lighting
- Unsignalised pedestrian crossings
- Signalised pedestrian crossings
- Pedestrian-crossing signal poles
- Fibre-optic chamber covers
- Traffic-calming features

For each asset, up to five attributes were collected. A combination of lines, points and polygons were required. All were to be referenced to the road segment.

Specification

The accuracy of the survey was specified as ±500mm. Data was required in a GIS format. It was suggested in the tender that the contractor use hand-held data-capture devices, however, the precise method of survey was left for the tenderers to propose. The winning tender proposed the use of LiDAR technology. Photographs were required of all traffic signs and street-name plates.

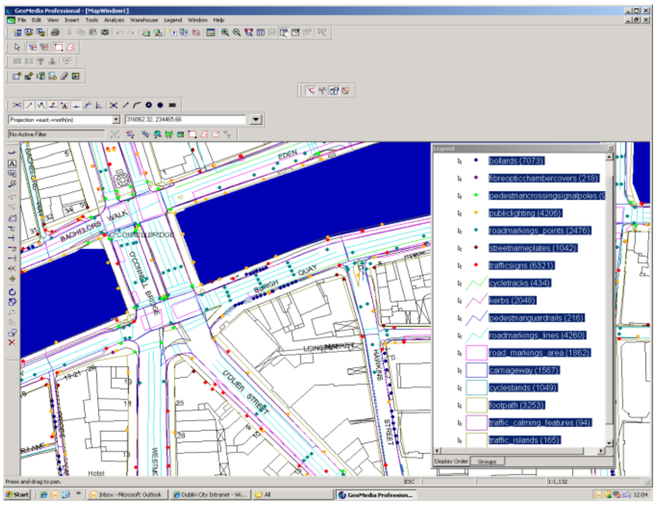
Contract

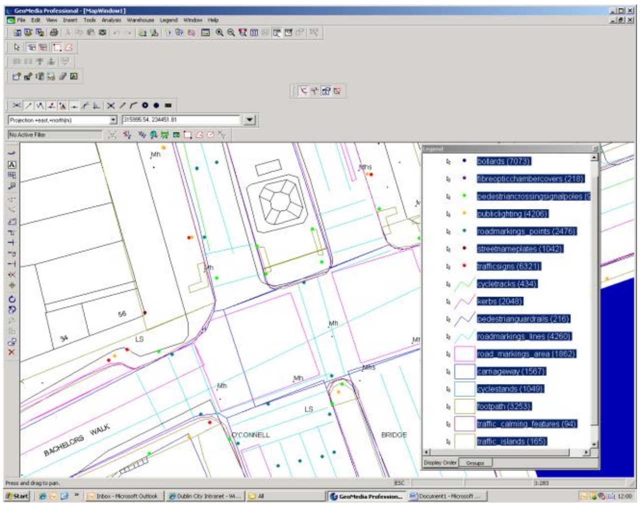
The contract was awarded in February 2011. The successful contractor LandScope Engineering Ltd. proposed the use LiDAR as the survey method. This entailed using mobile mapping technology to gather high accuracy point cloud data and photographic imagery which essentially provided geo-referenced imagery, from which asset data could then be extracted. Survey works commenced in March 2011 and site data collection was completed over two days of site work. The data extraction phase then took place in the office and the data was subsequently supplied on 1st September 2011.

Output

The results have been loaded in the council's GIS system and can be displayed and interrogated in map form, as illustrated in the screen shots below. The results are displayed as lines, points or polygons.

Images 3.1 and 3.2





Lessons Learnt

The questions (in ***bold italics***) were posed to Dublin City Council following their inventory survey. The answers supplied are given below.

Where you happy with the results?

In general, we were happy with the results for all the assets, except the footway material-type. We had requested footway material-type as an attribute to be surveyed, but found that in a considerable number of cases, concrete paving slabs were labelled as granite paving slabs and vice versa. This was due to the fact that it was difficult to differentiate between these materials by desk-top data extraction from the LiDAR and imagery. We carried out some quality assurance (QA) checks on site and found that the footway material type had an accuracy of 70%. Our in-house surveyors carried out topographical surveys at three random locations within the inventory survey area and on comparison of results we found the accuracy of the locations of the assets was within ±500mm as specified.

Did the data meet the quality you required?

On the whole, yes, but we were disappointed with the footway material type attribute, as outlined above. We are also found that the resolution on some of the street-name plate photographs was not clear enough to read the street name.

Did it load easily into the corporate GIS system?

Yes, we had no problems loading the data as we had specified that the data must be in an Access database viewable in *GeoMedia*.

If you have to procure another survey what might you do differently?

- If possible get a contractor who had experience of using LiDAR imagery for extraction of similar data previously.
- Specify that we receive intermediate results during the survey and organise that we carry out our own QA at these stages to alert us earlier to any problems.
- Specify clearly whether we wish the assets or asset sub-sets to be represented as a point, line or polygon, e.g. for road markings we would specify a polygon for a yellow box and a line for double yellow line.
- Specify photographs of all assets to be recorded and for them to be spatially linked (we only specified photographs for street-name plates and traffic signs).
- Specify that the contractor has to carry out a validation process, to demonstrate the reliability of the data.
- Ensure that we have sufficient in-house resources available to carry out QA audits on the data, as soon as it is received.

We would also need to address in future contracts how we could improve the turnaround, between the survey and delivery of the data, as there was a seven month delay in this contract.

Was the LiDAR approach beneficial?

Yes, in that it is hugely cost effective, in comparison with having to collect all the required asset locations and attributes on site.

Appendix 3.b: Data-capture Devices

The table below describes the items that should be considered, when deciding on the type of data collection device (DCD) that a road authority should procure. A range of DCDs are available and each authority will need to determine what devices best meet their needs.

Table 3.10: Criteria for Evaluating Data-capture Devices

Asset data to be collected	What data is to be collected, i.e. inventory, condition, combination of both and / or maintenance history.
Survey Method	Whether that is by walked survey, using hand-held DCDs or a driven survey using vehicle-mounted GPS units.
Type of Inventory Data	Whether this is point (e.g. gully), point / line (gully and pipework) or point / line / level (gully, pipework and grate level).
Input method	By electronic map (point / line drawn on pre-loaded electronic maps by stylus) or accurate location by GPS and attributes added via "drop-down" menu.
Location Accuracy	Approximate position location only (map) or full X, Y & Z co-ordinates.
GPS accuracy	Standard or DGPS (Differential Global Positioning System) to <1m accuracy, a particular consideration for built-up urban areas.
Physical characteristics	Weight, screen size, screen visibility in bright light, robustness, battery life, additional features, e.g. camera.
Surveyor skills and experience	Degree of road infrastructure understanding and level of computer literacy required.
Compatibility	How the base data will be uploaded onto DCD and survey data subsequently uploaded into a road authority's asset management / GIS systems.
Cost	Purchase and ongoing supplier support and costs.

It is recommended, that road authorities have a documented understanding of data collection needs, prior to evaluating DCDs. In addition, when trialling the use of data-capture devices, it is important to ensure that this is sufficiently detailed and long enough to thoroughly test each unit being evaluated to include the:

- Loading of asset management software (if applicable) onto the DCD.
- Surveying in the field, including use of GPS.
- Uploading of data from the DCD onto an authority's asset management / GIS systems.

Recommendation: It is recommended that road authorities carry out comprehensive trials of DCD equipment are undertaken prior to purchasing.