

Model Public Lighting Inventory & Audit Guidelines

STREET LIGHTING AND
SMART CONTROLS PROGRAMME

Version 1.0

1 | Introduction

The need for robust model public lighting documentation was first recognised in 2016 stakeholder consultations during the establishment of IPWEA's Street Lighting and Smart Controls Program (SLSC) and is described on IPWEA's website www.slsc.org.au and www.slsc.org.nz.

After decades of relatively static public lighting technology, many people with oversight of public lighting are unfamiliar with how to best procure and manage new LEDs and smart controls. Compounding their knowledge gaps, they are being asked to oversee lighting retrofits and new lighting projects at a growing pace in the midst of a continuing evolution of lighting technologies and changing standards, suppliers and electricity distributor requirements.

A basic but robust model public lighting inventory structure and audit regime can help address many issues and raise overall confidence levels about the appropriate management of public lighting for any organisation.

The model public lighting inventory structure suggested in this document is based on council and utility benchmarks as well as consideration of the parameters that need to be tracked with new technology. Of particular note is alignment with IEC 62386 (DALI) Part 251: Memory Bank 1 Extension, Part 252: Energy Reporting and Part 253: Diagnostics and Maintenance. These documents are designed to standardise how luminaires store information about the product that can then be later uploaded by customers as well as establish a standard way of reporting energy and operational data.

1.1 Purpose and Target Audience

This model inventory structure and audit guidance is targeted at technical staff with responsibility for managing portfolios of public lighting assets within their organisation.

The purpose of this model public lighting inventory and audit guidance is to help an organisation develop a robust public lighting inventory structure by detailing what information to record, in what format and how to audit this information.

The resulting inventory, once customised for the organisation, will offer guidance to internal staff, consultants, designers, contractors, suppliers, developers and other stakeholders about the organisation's requirements in recording detailed public lighting asset information, basic maintenance cycles and asset history.

1.2 Aim of the Model Public Lighting Inventory Structure

The aim of the Model Public Lighting Inventory & Audit Guidelines is to be:

- Technically robust and current;
- Compatible with AS/NZS standards and specifications and addressing gaps where AS/NZS guidance does not exist or is not suitably current;
- Written concisely in easy to understand language;
- Applicable to large and small lighting portfolios in urban and rural settings;
- A living document, subject to ongoing review as technology and standards change over time; and
- Widely and freely available to assist in the effective management of public lighting.

Suggestions for improvements are welcomed. Please forward suggestions to the IPWEA head office using the contact details provided at www.ipwea.org.

1.3 User Customised Strategy - Source Acknowledgement

This IPWEA model guidance is free-issued publicly. Updated versions will be issued in future by IPWEA, as and when required on the [SLSC Website](#).

When compiling a customised inventory IPWEA requests that:

- Users should acknowledge the source of their Customised Inventory e.g. “Based on IPWEA Model Public Lighting Inventory & Audit Guidelines Version 1.0 (or later if available)”;
- If the Model Inventory structure is materially altered, Users must not state or imply that the document is based wholly on the IPWEA Model Public Lighting Inventory & Audit Guidelines. ***Users must clearly indicate which part of the Model Inventory structure has been materially altered.*** Ideally IPWEA should be notified so that, if the material change is one which would benefit the industry, it could be included in the next version of the Model Inventory & Audit Guidelines; and
- Any excerpts of sections of the Model Inventory & Audit Guidelines should acknowledge IPWEA as the source.

1.4 Disclaimer

Although the information in this publication is believed to be correct at the time of printing, the Institute of Public Works Engineering Australasia (IPWEA), and its agents, contractors, directors, employees, subcontractors and officers, do not accept any contractual, tortious or other form of liability (including in negligence) arising from the information contained herein, to the extent permitted by law. The information included in this publication is intended as a general guide only and is not tailored to your needs and circumstances. People using the information contained herein should apply, and rely upon, their own skills and judgement to the particular lighting installation they are considering and seek appropriate professional lighting design and engineering advice as needed.

This document is not a substitute for specialist, professional advice.

1.5 Document Information

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2 | Lighting Inventory Structure & Audit Guidance

2.1 Scope

This Model Public Lighting Inventory & Audit Guidelines is intended to provide organisations with a basic inventory structure, details of what information to record (and why), what format to record it in, how to audit existing information and how to gather new information.

This document is intended to apply to all public lighting within streets and public areas that are under the direct control of any organisation as the asset owner or ones for which they pay a 3rd party for but which they are ultimately responsible for providing as the road authority or public authority.

This document does not directly deal with the sometimes unique requirements of lighting for wayfinding, traffic signals, sports field lighting, street furniture lighting, security lighting, advertising, illuminated signs, decorative, façade, tree, creative or dynamic type lighting that may also be present in the public domain. It is, however, expected that these types of lighting assets will have many of the same characteristics and much of the contents of this document may therefore be of relevance.

2.2 Existing Lighting Inventories

Existing lighting inventory information may be available from multiple sources including:

- Existing inventories of lighting owned by the organisation and those it pays 3rd parties for; and
- Internal organisational supporting information – additional spatial datasets which help locate assets and context (eg street addresses, street names, suburbs, road reserve boundaries, bridges, tunnels, parks, pathways).

2.3 Objectives in Maintaining a Robust Public Lighting Inventory

Many organisations which own, operate and maintain, or pay a third party for public lighting services, have little confidence in existing public lighting inventories, whether their own the assets in those inventories or pay a third party to provide the public lighting service based on their inventory.

The core objectives of establishing and maintaining a comprehensive and robust public lighting inventory are to identify the physical location, age, performance and to monitor the condition of public lighting assets that an organisation owns, operates and maintains, or that it pays a third party to provide. This document aims to provide organisations with a clear and simple to use format to record such asset information.

An accurate public lighting inventory will allow any organisation to:

1. Understand what lighting assets they have or pay for and their characteristics
2. Provide the foundation for good asset management and financial planning (eg developing estimates of costs, values, maintenance expenditure, budgetary provisions for asset renewal, estimate costs of large-scale upgrades)
3. Track ownership and maintenance responsibility
4. Calculate energy and greenhouse gas emissions

5. Validate billing
6. Enforce supplier warranty claims
7. Assist in remotely investigating fault reports and obtrusive lighting complaints
8. Estimate lighting compliance outcomes (and prioritise upgrades)
9. Identify the location of problematic technologies (eg when a type fault is identified)
10. Assist in planning of roadway, streetscape and park upgrades

Importantly, the collection of inventory information at the time of installation is much simpler than collecting it retrospectively. Therefore, requirements to provide complete inventory entries at the time of asset construction and handover should be included in the organisation's specifications and technical documents and be required for all new and updated public lighting projects.

2.4 Public Lighting Inventory Structure

A suggested public lighting inventory structure is attached as Appendix A.

The suggested inventory structure is based on benchmarking against inventories used by Australian local governments, inventories of Australian electricity distributors, DALI requirements, the needs of GIS systems and consideration of the new information that needs to be tracked with emerging technology (such as LEDs, smart controls and smart sensors). It is suggested as an approach that can be adopted as shown or customised to remove or add any fields that an organisation deems required.

Of particular note are recent developments with an internationally standardized protocol for digital communication between lighting-control devices called DALI. DALI 2.0 (now recognised under IEC 62386) is managed by an industry consortium called the DALI Alliance that encompasses most major global manufacturers. A relatively recent DALI development is IEC 62386 Part 251: Memory Bank 1 Extension. Part 251 is designed to standardise how luminaires store information that can then be automatically uploaded to public lighting inventories by end customers via smart controls systems.

The pioneering work of US utility Georgia Power to demonstrate how this could work in practice and the business benefits it brings in terms of faster installation times, much greater inventory accuracy and subsequent maintenance efficiencies is both acknowledged and commended.

Wherever possible, the inventory structure in Appendix A identifies fields that align with DALI Part 251 and might be automatically populated in this manner.

2.5 Audit Objectives

Audits of many hundreds, thousands or tens of thousands of public lighting assets can be costly so organisations need to ensure that they have a clear purpose that justifies the audit cost and a well-defined scope that focuses on the issues to be audited.

The objectives of carrying out public lighting audits are varied and include at least five broad types of lighting audits:

1. **Inventory Accuracy Verification** - Verifying the accuracy of current inventory information about public lighting assets
2. **Inventory Augmentation** - Gathering asset information that was not previously in an inventory
3. **Lighting Operation Verification** – Night-time inspections of whether lighting is working correctly commonly referred to as night patrols
4. **Lux Level Monitoring** – While AS/NZS 1158 is a calculated and not a measured standard, some specialists offer mobile lighting level monitoring services that can provide an indication of compliance and other issues (eg maintenance deficiencies)

5. **Lighting Asset Condition Assessment** – Condition assessments can be in the form of a visual assessment or detailed structural testing in the case of lighting columns. Both types of assessments can assist in identifying not just works that are needed immediately but can also provide the foundation for the preparation of an asset management plan that then allows budgets to be developed to ensure that assets are properly maintained in a manner that maximises value for money and ensures that there are adequate provisions for end-of-life replacement. Condition assessment data can also be used to develop estimates of the current value of public lighting assets.

Lighting audits may sensibly combine elements of several of the above types of audits but, for purposes of these guidelines, these five basic lighting audit types a suggested common collection approach is discussed in the following section on Audit Methodology.

While beyond the scope of this document, it is also important to recognise that electrical supply infrastructure can and, in some respects, must also be regularly audited. For reference, electrical supply infrastructure audits fall into two broad categories:

- **Electrical Condition Assessment** – Electrical condition assessments can be conducted in conjunction with an above ground lighting asset condition assessment audit discussed above if appropriately qualified personnel are engaged. These assessments are designed to ensure the continued safety of electrical infrastructure and can also provide a vital input into an asset management plan and budgeting process. Electrical conditional assessments can be time consuming and expensive so are often initially undertaken on a sample basis. Where electrical condition assessments are carried out, the general condition scoring rating scale in Section 3 should be used.
- **Electrical Verification** – Regular electrical verification is a mandatory requirement for compliance with Australian Standards and for compliance with jurisdictional wiring codes. The fundamental purpose of an electrical verification is to ensure that equipment remains operational and safe. Electrical verification requirements are provided in AS/NZS 3000 and AS /NZS 3017. Typical verification cycles are every 5 years.

3 | Audit Methodology

Audits can cover a sample of data or an entire inventory. A sample audit can be considerably less costly and may provide sufficient basis to either justify a wider audit or for not proceeding to a wider audit. The decision to proceed to a wider audit may be dependent on the:

- Accuracy of information found in the sample audit
- Amount of missing information found compared to existing inventory information
- Quantity of new assets identified in the field as well as 'missing' or phantom assets present in the inventory by not in the field

While a sampling strategy can help keep costs down, it should be noted that some aspects of audits can be covered as part of a preventive maintenance cycle and this option should also be considered.

Other aspects of the inventory details can be updated and confirmed on an ongoing basis by the utilisation of information available from smart street lighting controls where installed.

3.1 Audit Methodology

The main aspect of gathering inventory information is to ensure consistency of approach and recording methods. This is best achieved by providing those gathering the information with a standard method, scoring approach and terminology. This consistent approach should ensure that each auditor draws similar conclusions.

Auditors should be trained in the following aspects:

- Site safety
- Collection method
- Asset categories
- Installation types
- Information to record
- How to list anomalies
- Condition rating scales as shown in the table below:

CONDITION	RATING	DESCRIPTION	LIFE CONSUMED - TYPICAL
1	Excellent	Excellent presentation and physical condition. No work required (normal maintenance).	0-15%
2	Good	Minor wear and tear, no short-term failure risk. Only minor maintenance work required.	15-40%
3	Fair	Deterioration evident and minor defects. Maintenance work required.	40-65%
4	Poor	Significant defects, failure likely in short term, likely need to renew most or all of asset.	65-90%
5	Very Poor	Failed, asset unserviceable, renewal needed immediately.	90-100%

Each of the five basic audit types above should be completed in a consistent way and a suggested approach is summarised below:

Audit Data Collection & Scoring Approach	
Step 1	Take picture, confirm and input picture number
Step 2	Define category and installation type
Step 3	Collect asset details
Step 4	List anomalies
Step 5	Score condition with reference to table above
Step 6	Add any relevant comments

Australian Standard, 'AS 1199: Sampling procedures for inspection by attributes' provides a robust methodology for developing a detailed audit plan. Indeed, this standard is used in the National Electricity Market for verification of Type 7 electricity consumption data (e.g., unmetered street lighting loads).

The accuracy level required in the National Electricity market for unmetered street lighting electricity consumption data is +/-2%. This may also serve as a reasonable accuracy test for other aspects of a lighting inventory.

Under the methodology used in the National Electricity Market, sample testing size is increased in each subsequent audit if the previous audit failed the accuracy test. Similarly, if the previous audit passed, the sample size is reduced. Again, this may be a reasonable approach to take in choosing a general street lighting audit sample size.

Appendix A

Suggested Public Lighting Inventory Structure

Those fields shaded in blue may be automatically downloadable from a smart controls device with a GPS chip or from a luminaire power supply programmed to meet IEC 62386 Part 251 requirements.

FIELD #	FIELD NAME	DESCRIPTION	PURPOSE
Asset IDs & Location Information			
1	OBJECTID	Automatically assigned field in most GIS systems	Unique row identifier in geodatabases
2	GLOBALID	Automatically assigned field in most GIS systems	Unique ID in geodatabases for replication
3	ASSET ID	User-assigned asset ID from their asset management system	Allows alignment with asset management system
4	Street Address	Street address	Allows ready location and sorting
5	Suburb	Suburb name	Allows easy sorting of assets by suburb
6	GDA2020 Lat	Latitude based on GDA 2020	Allows accurate location and sorting of assets
7	GDA2020 Lon	Longitude based on GDA 2020	Allows accurate location and sorting of assets
8	GDA2020 Height	Ellipsoidal height based on GDA 2020	Allows accurate understanding of height at ground level
9	Lot and Plan Number	Nearest Lot and Plan Number	Location information of particular use when there is no unique street address
Column and Outreach Information			
10	Column ID	Column ID number	Primary ID used in field
11	Column Ownership	Which entity owns column	Helps clarify ownership as well as replacement and maintenance responsibility
12	Column Status	Dedicated lighting column or overhead supplied power pole	Allows for sorting of different column/pole types
13	Column Type	Description of column design type	Allows sorting of different column types and facilitates ordering of replacements
14	Luminaire Mounting Height (m)	Luminaire mounting height from road surface in meters	Allows ready assessment of lighting compliance and helps with maintenance
15	Outreach Arm Type	Outreach type	Allows sorting of different arm types and facilitates

			ordering of replacements
16	Outreach Arm Length (m)	Outreach arm horizontal distance from column or pole to luminaire in meters	Allows ready assessment of lighting compliance
17	Column and Outreach Notes	Notes field available for additional details (eg paint colour, footing details)	Allows recording of special features or characteristics
Luminaire Information			
18	Luminaire ID	Luminaire ID number	Allows ready identification of individual luminaires
19	Luminaire Manufacturer	Manufacturer/Brand of luminaire	Allows ready identification of supplier (available from GTIN)
20	Luminaire Model	Model of luminaire	Allows sorting of different luminaire types and facilitates ordering of replacements
21	Luminaire Body Colour	Paint colour or coating name of luminaire body	Allows colour matching and ordering of replacements
22	Light Source Type	Lamp technology type (MV, HPS, MH, LED etc.)	Allows sorting of different light source types and facilitates ordering of replacements
23	Light Source CCT (K)	Correlated colour temperature of the light source	A rough measure of the colour appearance of a light source
24	Initial Luminaire Output (lm)	Initial luminaire output as measured in lumens	Allows a basic understanding of the luminaire's light output
25	Optical Distribution	Optical chip number or name of distribution type	Allows matching of replacement luminaires when single models of luminaire can have many optical variants
26	Shielding	Indicator of additional glare shielding attached to luminaire	Allows tracking of additional glare shields
27	Lamp Make and Model	If applicable (eg if legacy non-LED)	Allows sorting of different lamp types and facilitates ordering of replacements
28	Lamp Energy Rating	Nominal lamp wattage (W) if applicable (eg if legacy non-LED)	Allows sorting of different lamp wattages and facilitates ordering of replacements
29	No. of Lamps	Number of lamps in luminaire if applicable (eg if legacy non-LED)	Allows ready identification of luminaires with multiple lamps
30	Luminaire Energy Rating (W)	Total luminaire maximum energy consumption in Watts including power supply losses (eg as per AEMO NEM Load Table)	Allows calculations of energy consumption and GHG emissions

		(Unmetered Loads) or other jurisdictional authority)	
31	Power Supply Type	Non-dimmable, 0-10V, DALI 1.0, DALI 2.0, Zhaga-D4i	Allows ready identification of dimmable power supplies and those that can be interrogated
32	Controls Receptacle Type (s)	Photocell receptacle type (e.g. none, NEMA/ANSI C136.10 3-pin, NEMA/ANSI C136.41 7-pin, Zhaga Book 18)	Allow identification of what types of controls and external sensors can be used on luminaire
33	Warranty (Yrs)	Term of manufacturer's luminaire warranty in years (typically from date of luminaire supply)	Allows initial understanding of whether faults may be covered by warranty
34	Luminaire Notes	Notes field available for additional details (eg further warranty details)	Allows recording of special features or characteristics
Luminaire Controls			
35	Luminaire Controls Type	Timer, photocell or light point controller on CMS system	Clarifies controls approach
36	CMS System	Name of CMS operating software	Clarifies how system is controlled
37	CMS System Comms	Brand and type of communications network	Clarifies supplier and type of controls system communications network
38	Light Point Controller GTIN	Global Trade Item Number	Unique product identifier
39	Controls Profile Program No.	Indicator of programming profile	Records initial dimming profile settings in CMS
40	Controls Notes	Notes field available for additional details (eg further warranty details)	Allows recording of special features or characteristics
Electrical Infrastructure			
41	Electrical Connection Type	Overhead or underground supply	Explains nature of electrical installation
42	Electrical Supply Location	Connection/disconnection point for underground supplied lights	Allows for rapid and safe isolation
43	Electrical Supply Ownership	Council electrical feeder	Clarifies maintenance and replacement responsibility
44	Electrical Control Box Number	User-assigned control box ID	Allows alignment with asset management system
45	Electrical Notes	Notes field available for additional details	Allows recording of special features, characteristics, electrical drawing no. etc
Installation Information			
46	Column Installation	Initial installation date or date of later replacement	Tracks age of asset
47	Outreach Arm Installation	Initial installation date or date of later replacement	Tracks age of asset

48	Luminaire Installation	Initial installation date or date of later replacement (which can be recorded as energised date if installed in conjunction with smart controls)	Tracks age of asset
49	Controls Installation	Date of last photocell / controls replacement	Tracks age of asset
50	Installation Contractor	Contractor who installed column and lighting	Clarifies who installed should there be any later issues
51	Asset Gifted Date	Date of gifting of any gifted assets installed by 3 rd parties	Clarifies date ownership responsibility was assumed if built by 3 rd party
52	Asset Gifted By	Name of 3 rd party gifting asset (eg developer)	Clarifies who transferred it should there be any later issues
53	Installation Notes	Notes field available for additional details	Allows recording of special features, characteristics, design drawing no. etc
Maintenance Information			
54	Maintenance Contractor	Name of responsible contractor	Clarifies maintenance responsibilities
55	Maintenance Interval	Scheduled preventive maintenance interval in years	Allows for programming work schedules
56	Last Preventive Maintenance Date	Date of Last Inspection, Cleaning and Bulk Re-lamp (if applicable)	Ensures maintenance requirements met and confirms when
57	Luminaire Condition Assessment Date	Date of last luminaire condition assessment	Provides evidence of assessment
58	Luminaire Condition Rating	Rating as at last assessment date (Scale 1-5 as indicated in section 3.1)	Allows for programming of future maintenance & replacement
59	Column Condition Assessment Date	Date of last column condition assessment	Provides evidence of assessment
60	Column Condition Rating	Rating as at last assessment date (Scale 1-5 as indicated in section 3.1)	Allows for programming of future maintenance & replacement
61	Electrical Inspection Date	Date of last electrical inspection, testing and condition rating as per organisation's Electrical Asset Management Plan	Allows inclusion of file location of organisation's Electrical Asset Management Plan
62	Date of Last Spot Repair	Date of last spot repair (for any cause)	Helps flag repeat callouts
63	Maintenance Notes	For tracking repeated faults, notes to future service crews, flag vandalism risk etc.	Allows recording of special maintenance requirements
Additional Information			
64	Sensor Type	Type of sensor installed and	Allows recording of any additional sensors added to

		receptacle used (if applicable)	light or column
65	Sensor Date	Date of sensor installation (if applicable)	Allows tracking of sensor age
66	Photo of Installation	Generic photo of luminaire and column type	Assists with identification
67	Additional Notes	General notes field available for additional details	Allows recording of special features, characteristics, original documentation files etc

