



Smarter Suffolk Project

Street Lighting Central Management System User Interfaces

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1 Executive Summary

A comparative usability review has been undertaken on the five different street lighting CMS user interfaces trialled by Suffolk County Council (SCC) in the Smarter Suffolk Live Labs project. The review process was designed as a comparative review following a set protocol applied to each user interface. The purpose of the tests was to assess the process of using the street lighting central management system user interface supplied by different suppliers to the Smarter Suffolk Live Labs project.

Tasks and scenarios were created and agreed with SCC technical users. Tasks and scenarios selected were considered to be basic or fundamental processes that all or most modern CMS user interfaces would be expected to include, enabling comparison between the interfaces. Eight tasks were selected, and scenarios developed to present each of the tasks. The tasks selected covered:

- logging on;
- Out of hours override switching;
- Event file and control log inspection;
- Extract of power data;
- Extract of daily faults list;
- Communications check;
- Application of part-night lighting profile;
- Creation of new asset.

The user interfaces reviewed were:

- Telensa: Planet interface
- Lucy Zodium: Ki Platform
- Liveable Cities: SmartLinx
- SSE: Mayflower CMS
- CIMCON: LightingGale

SCC and University of Suffolk (UoS) thank these suppliers for their support with this review.

The usability tests were undertaken online during February 2022, each with a representative of the supplier undertaking the scenarios, facilitated by Dr Hannah Steventon of UoS and observed by Andy Allberry and Richard Webster of SCC, who rated the tasks on ease of undertaking and discussed their views based on their experience.

Screenshots, ratings and discussion of each scenario are included. Time taken for the scenarios and number of steps were noted, though neither the time taken nor the number of steps were found to be significant differentiators in the user experience.

Differences observed were:

- Ease of log on process;
- Duration of available lighting override;
- Use of graphical visualisations across the interface;
- Integration with asset management system and with smart city interface

It is recommended that user interface design is a criterion when considering street lighting CMS selection; whilst all user interfaces enabled the set of basic tasks, some were more easily achieved, and ease of out-of-hours, emergency support was considered a high priority for user experience.

2 Introduction

2.1 Introduction

This report discusses a comparative usability review of several street lighting central management (CMS) systems which have been operated as part of the Smarter Suffolk Live Labs trial, run by Suffolk County Council. It is based on a structured usability protocol agreed with the participants, and testing each CMS system separately. The input from the test participants is acknowledged and thanked.

The first section of this report presents an Executive Summary of the report.

The second section of this report describes the purpose of street lighting CMS systems, and how a structured usability test has been applied to review them comparatively.

The third section describes the design of the test: the tasks that were selected and the results of the testing. The tasks were selected by Suffolk County Council (SCC) street lighting manager and systems manager to represent frequent and important actions. The tests were facilitated and reported by the University of Suffolk (UoS) researcher.

The fourth section presents and discusses the usability tests undertaken, and feedback provided by the test participant and observer.

The fifth section presents conclusions and recommendations from this set of usability tests.

Screenshots presented throughout the report have been edited to remove specific identifying details for security and privacy purposes.

2.2 Street Lighting Central Management Systems

A street lighting central management system (CMS) is a system of components that enable the remote management of street lighting. The components include:

- a node mounted on the street light lantern which controls the street light, and receives and transmits data via a wireless protocol signal,
- collectors that receive and retransmit data signals from nodes within a geographical area;
- and a central service with a data server, software and a user interface.

Further details of the architecture and components are presented in The Institute of Lighting Professional's guidance PLG01, Central Management Systems (The Institute of Lighting Professionals, 2017). This report assesses only the user interfaces within the systems.

Benefits of CMS are detailed in PLG01, Central Management Systems (The Institute of Lighting Professionals, 2017) and summarised here:

- Supporting reduction in energy and operational costs, by enabling variable lighting levels and timings, by monitoring performance, and by accurately measuring consumption;
- Supporting reduction in carbon by enabling variable lighting levels and timings;
- Enabling a targeted lighting design, with variable lighting levels and timings, and enabling changes remotely;
- Enabling dynamic dimming with traffic counting or other inputs;
- Monitoring and reporting lamp failures for maintenance planning;
- Profiling lamp performance for lamp life management;

- Management of unmetered energy payments via the ELEXON process (which manages the energy charges for unmetered electricity supplies) using the CMS event log;
- Future-proofing with ability to adapt to changing standards, requirements and targets;
- Enabling dynamic dimming on National Highways' strategic road network via their motorway road lighting control system.
- Potentially supporting evolving lighting-based smart city developments.

The user interfaces assessed in this report are all hosted servers, with web-based browser interfaces to access the data and controls. This report does not assess the security of the system.

A development in CMS management has been the TALQ consortium, which describes a standardised software interface between the central database and the user interface, to enable multiple vendors' devices to be controlled from one interface (The Institute of Lighting Professionals, 2017; TALQ Consortium, 2021). This is mentioned here for completeness, and is not a focus for the work described in this report.

This report does not provide complete comparison of the different components of CMS systems: an approach to CMS selection is described in PLG01 (The Institute of Lighting Professionals, 2017). During informal use of the different user interfaces, the Suffolk County Council street lighting team noted different approaches within the user interfaces from different suppliers, and requested this structured comparative usability review.

PLG01 describes the main active functions of the CMS as switching and dimming, and that profiling street lights into groups (such as residential, industrial or other uses) is important for these functions. It could also enable remote fault diagnosis. Other important functions are report generation, data export and access to the event log.

Uptake and use of CMS control of street lighting has increased as more street lights are moved to LED lighting (Orchard, 2021), addressing the fact that street lighting is the largest part of local authority electricity bills.

2.3 Comparative usability review

A comparative usability review has been undertaken using an approach based on “*simple, informal, small-sample, do-it-yourself usability testing*” (Krug and Matcho, 2010; Krug *et al.*, 2014). This is not a formal usability test of any of the systems, and should not be applied as such. As a comparative test, it has been designed to be structured and quantitative, and follows a set test protocol. Usability tests are “*watching one person at a time try to use something ... to do typical tasks*” in this case to enable comparison of competing CMS dashboards. The test was undertaken on the computer on which the participant would most commonly undertake these tasks.

The test participants were:

- Andy Allberry, SCC Street Lighting Systems Manager, usability participant and technical expert
- Representatives of CMS software suppliers, usability participant and product expert
- Richard Webster, SCC Street Lighting Manager, technical expert observer
- Dr Hannah Steventon, UoS Research Associate, facilitator and researcher

Usability testing is “*the process of learning about users from users by observing them using a product to accomplish specific goals of interest to them.*” (Barnum, 2011) In usability testing, a small participant sample (typically three) is used. For this assessment, the software and tasks are so specialised, that the usability of the interface were assessed by the key SCC user only, due to the high level of domain knowledge required, with guidance provided by the supplier for each interface. Testing with one person is not a statistically valid sample, but provides structured user experience in a comparative methodology. “*Testing one user is 100 percent better than testing none.*” (Krug *et al.*, 2014).

To create the test, a set of tasks was agreed with Allberry and Webster. These tasks represent frequent and important actions that Allberry undertakes using the CMS. These tasks were written up into a structured test protocol, which was followed for each CMS assessed. The tasks with the reason to select them are listed in Section 3.4.

Each usability review was undertaken separately, with no more than two reviews in one day. The usability review was undertaken on MS Teams videoconferencing platform with screensharing, and recorded for transcript production and analysis. Video was not recorded.

In accordance with agreed academic ethics review procedures, these recordings have been retained until the completion of the project (April 2022) and are only available to the researcher and her Principal Investigator. Consent was given by participants prior to each review.

During the test, the time taken for each task to be completed has been recorded.

3 CMS user interface comparative usability review

3.1 Introduction

The usability review was designed to compare the processes required to achieve a set of tasks on each of the selected user interfaces. User interfaces were selected (Section 3.2) and a set of tasks chosen by discussion, with scenarios created (Section 3.3). The planned process for each user interface review was detailed (Section 3.4).

The user interface review was not a ‘blind’ review of an unknown site, but a comparative review with a structured approach to a selection of processes undertaken by SCC as a typical local authority CMS customer, and was undertaken by users familiar with the site operation.

3.2 Supplier user interfaces selected for review

Five supplier central management system user interfaces were selected for review, based on the systems used within the Smarter Suffolk trial. The instances of the CMS and user interfaces reviewed were those from Suffolk County Council’s Smarter Suffolk Trial, which may differ from other versions or instances of user interfaces from these suppliers to other clients. These suppliers include many but not all of the significant street lighting CMS providers, and the selection of these companies is based on their inclusion in the wider Smarter Suffolk project.

These suppliers of the CMS user interfaces selected for review were:

- Telensa: Planet interface
- Lucy Zodion: Ki Platform

- Liveable Cities: SmartLinx
- SSE: Mayflower CMS
- CIMCON: LightingGale

These companies were invited to participate by email, and the Smarter Suffolk project is grateful to these organisations for their support of this review.

3.3 Planning the review

The tasks and scenarios were designed in discussion with Richard Webster and Andy Allberry of Suffolk County Council, and Hannah Steventon of University of Suffolk. Tasks and scenarios selected were those undertaken frequently or as a matter of urgency. Andy Allberry's specific input into scenario design enabled the construction of the scenarios and preparation of required supporting material.

Tasks and scenarios selected were considered to be basic or fundamental processes that all or most modern CMS user interfaces would be expected to include, enabling comparison between the interfaces. Some user interfaces also include additional or more advanced functionality that could be of value or importance to users. As this review was designed to compare standard functions, supplier-specific options are not addressed in the review, or discussed here in a structured way. When encountered either during the review or during Suffolk County Council user interface use, they have been mentioned later in this report. This will not capture all the advanced functionality of each of the interfaces included in this review.

The scenarios were created as a script, and amended and agreed with Richard Webster and Andy Allberry, key users of the user interfaces for Suffolk County Council.

Additional questions were added to the script, based on details that were of interest to the users in the basic operation of the system, but which could not be addressed by user action or included in the test. These additional questions were provided to suppliers in advance.

3.4 Tasks and test protocol

Tasks selected, and the reason to select them, were identified in the initial planning meeting. These are detailed in Table 1, together with the reason for selecting them. Some have been selected due to frequency in which they are undertaken, and some due to importance of success. These were detailed as scenarios during the planning session, and the script for these scenarios is included in Appendix A.

	Task description	Reason for selection
1	Log onto the site	Essential prior to any use. Identify ease to logon, and supplementary processes
2	Out of Hours switching	Infrequent task, essential that undertaking it is rapid when requested. Required for emergency services actions.
3	Event file and control log	Automated process essential for billing of electricity used
4	Extract of data	As-needed task used to confirm remotely whether lights are working or if lanterns have been replaced
5	Extract of daily faults list	Approximately monthly task to review contractor KPI compliance Automated process also desired
6	Check communications	As-needed task to confirm if and which assets are not communicating.
7	Apply part-night lighting profile	Occasional task to apply or update lighting profile, essential for lighting management and electricity savings
8	Creation of a new asset in the system	Occasional task, essential to do accurately, useful to be able to do remotely

Table 1: Tasks selected during initial planning meeting

3.5 Process

Due to the complexities of the different user interfaces, each review was undertaken by a representative of the supplier familiar with their product alongside Andy Allberry as the Suffolk County Council user.

During each site review, the user was asked to describe and discuss what they were thinking throughout the test. They were presented with the series of pre-agreed scenarios to undertake the tasks by Steventon. Webster and Allberry observed and made comments after each scenario. The test session was recorded on MS Teams, and the automated transcript made available to participants following the test.

The script for test introduction and scenario is included in Section 10.

Initial assessment for each task is based on the time taken to complete the task from the Home page; the request was for the process to be undertaken at a professional pace, not as a tutorial or as a race. Time-taken is considered a better assessment of user ease than number of clicks, as *“it’s not the number of clicks it takes me to get what I want ... but rather how hard each click is, the amount of thought required and amount of uncertainty about whether I’m making the right choice”* (Krug *et al.*, 2014). Number of clicks, navigation and other processes are also recorded.

Some supplier representatives took more time on explanations than others. The reviewer has attempted to minimise the effect of this in the timing process, by stopping and starting the stopwatch, on a ‘best efforts’ approach. This does not necessarily represent complete consistency between interfaces, and so the time recorded is not the fastest time in which the

scenario could have been completed, and is indicative rather than completely comparable between interfaces, due to the different users involved in the test.

A trial review was undertaken with the SCC user and observer using the SCC incumbent interface, without supplier representatives, to test the processes and script. Further adaptations to the script were applied following this trial review.

4 Trial results

4.1 Trial set-up

For each user interface, the usability review took place online on a Teams call. The supplier's representative user shared their screen showing an instance of their user interface, as if they were a local authority user. UoS read the scenarios and recorded the screen and audio, with consent by email and repeated verbally. SCC supplied required specific details such as dates, times and locations. The tests took place online on 9, 16 and 21 February 2022.

The recordings were used to collate the results and discussion in this report. In accordance with the university ethics approval, these recordings will be deleted at the end of this project.

4.2 Completion of tasks

The initial review was whether the task was completed, or whether it was not. The following results have been randomised and anonymised.

Task	Supplier A	Supplier B	Supplier C	Supplier D	Supplier E
1	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	No	Yes	n/a
4	Yes	Yes	Yes	No ¹	Yes
5	Yes	Yes	Yes	Yes	Yes
6	Yes	Yes	Yes	Yes ²	Yes
7	Yes	Yes	Yes	Yes	Yes
8	Yes	Yes	Yes	Yes	Yes

Table 2: Completion of tasks

1: Achieved for an individual lantern, but not for a set of lanterns

2: Current day only; historic date not achieved see Section 5.6.4

4.3 Ease of tasks

SCC's user was asked to rate whether it was easy to undertake the tasks, scored on a five-level Likert Scale from 1 (strongly disagree) to 5 (strongly agree) on five aspects of the system:

- A. Ease of Overall Use
- B. Ease of Navigation
- C. Organisation of Information
- D. Functionality with respect to that task

These are subjective ratings, based on the SCC main user's opinion on observing the scenario demonstrated. Footnotes to the table add other comments made when scoring, including to explain where the task experience has scored lower, with cross-reference to the Section in which this is discussed.

Task	Supplier A				Supplier B				Supplier C				Supplier D				Supplier E			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1	5	5	5	5	5	5	5	5	5	5	5	5	3 ⁴	5	4	4	5	5	5	5
2	4	4	4	2 ¹	5	5	5	5	4	5	5	5 ²	3 ⁵	4	5	3 ⁵	5	4	3 ¹⁰	5
3	n/a				n/a				n/a				5	5	5	5	n/a			
4	4	4	5	4	5	5	5	5	5	5	5	5	4	4	2 ⁶	2 ⁶	4	5	5	5
5	4	5	4	4	5	5	5	5	4 ³	4	4	5	4	4	4	3 ⁷	4	5	5	4
6	4	4	5	4	5	5	5	5	5	5	5	5	5	5	5	4 ⁸	5	5	5	5
7	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5
8	5	5	4	5	5	5	5	5	5	5	5	5	5	4 ⁹	5	5	4	5	5	5

Table 3: Assessment of ease of completion of tasks

- 1: Currently the override only lasts for one hour, see Section 5.2.2
- 2: Currently the override only lasts for one hour, see Section 5.2.3
- 3: "Lots of information, but lots of different places to see it"
- 4: The user did not like the 7-day security code, which can be hard to find in an emergency, see Section 5.1.4
- 5: The user found the multi-step process to retain the lights-on and revert to default "long-winded", see Section 5.2.4
- 6: Achieved for an individual lantern, but not for a set of lanterns, see Section 5.4.4
- 7: "It is a manual process to do the export to the AMS"
- 8: Current day only; historic date not achieved see Section 5.6.4
- 9: "You had to go to two or three places."
- 10: "Not as searchable or filterable as other systems." See Section 5.2.5

4.4 Time for completion

The time taken for completion was noted: this excludes time during the process when explanations were being given, and is therefore a best estimate rather than a specific or minimum time to complete the task.

Task	Supplier A	Supplier B	Supplier C	Supplier D	Supplier E
1	0:25	0:08	1:02	0:35	0:11
2	2:01	1:10	2:44	2:10	1:44
3	n/a	0:11	n/a ¹	0:05	n/a ⁶
4	1:12	1:05	2:10	0:36 ²	1:55
5	0:43	0:36 & 0:24	0:56 & 0:15	0:25	0:09 & 1:23
6	0:30 & 1:40	1:12 & 0:23	0:24	1:06 ³	0:05 & 0:26
7	2:33	1:40 ⁷	1:50	3:38 ⁴ & 0:40	4:27
8	1:30	1:17	1:30	2:00 & 1:10 ⁵	1:09

Table 4: Time taken for task (times in min:sec)

- 1: No current customers in UK therefore do not yet integrate with a billing administrator, see Section 5.4.3
- 2: Achieved for an individual lantern, but not for a set of lanterns, see Section 5.4.4
- 3: Current day only; historic date not achieved see Section 5.6.4
- 4: First time is to create a new part-night lighting regime, the second is to apply it to selected lights
- 5: First time is for creation of the asset, the second is to assign the node to a submaster
- 6: This is not viewable from within the interface
- 7: For this CMS interface, the scenario did not require the creation of a new profile, as one had previously been created.

The time taken for each of these tasks has been plotted as a cumulative histogram; for task 3 an average of the other times has been applied where there was no time. For tasks with more than one part, the 'past 24 hours' option was used, not the historical date. Note that Telensa, with the shortest cumulative time, had advantage of incumbent system with familiarity and some preset details that were not available to other systems. Whilst best efforts were made to

measure time taken for each process, discussion and explanation was not identical between user interface reviews.

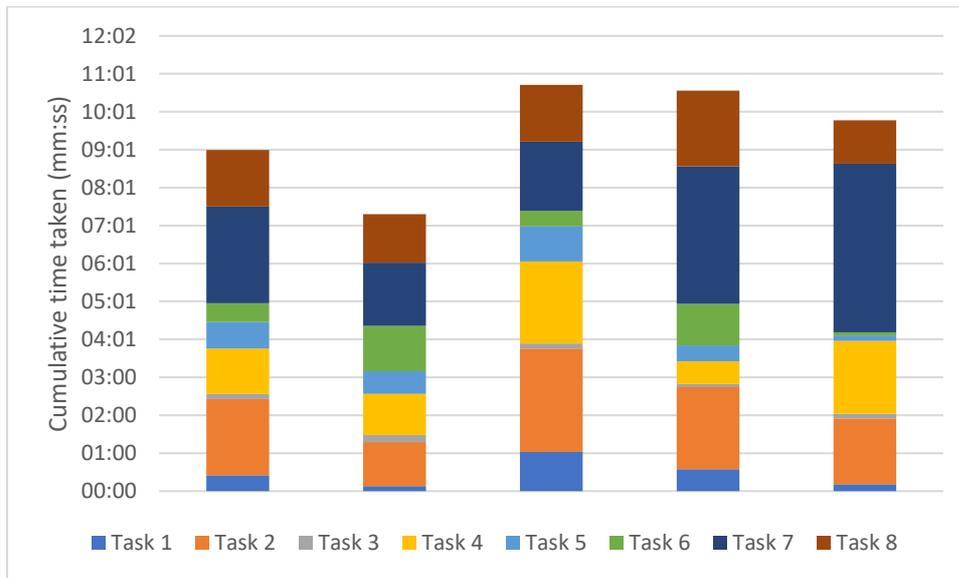


Figure 1: Cumulative time taken for the eight tasks

It can be seen that whilst there is some difference in overall time taken for the scenarios, this variation is considered likely not to be significant, and may result from the test processes. Excluding one interface, total time taken varied between 9:01 minutes and 10:44 minutes.

4.5 Steps for each task

The number of processes involved with completion of each task has been counted. These processes include:

- Mouse clicks to open a menu or dialogue box
- Entering text in a dialogue box
- Selecting from a drop-down menu
- Closing dialogue box

These are observed processes for one approach to achieving the task. For many tasks and interfaces, there were more than one approach to complete the task, and these may not represent the approach with the least processes. As a general view, they indicate the complexity of achieving the task in the interface. A step-by-step process list has not been documented.

	Supplier A	Supplier B	Supplier C	Supplier D	Supplier E
Task 1	4	4	4 ¹	8	4
Task 2	13	18	27	26 ³	18
Task 3	3	2	n/a	3	n/a ⁸
Task 4	12	12	25 ²	11 ⁴	24
Task 5	9	8 & 6	6 & 5	5	3 & 21
Task 6	5 and 14	18 & 11	5 or 3	11 ⁵	2 & 6
Task 7	12	25 ⁹	16	55 ⁶ + 12	55
Task 8	10	15	18	34 + 18 ⁷	15

Table 5: Number of steps for test (in red indicates not completed)

- 1: The user had some login difficulties to his account during the review. 4 steps represents the typical login process.
- 2: This took more stages in part due to the case-sensitivity of the text search field (Section 5.4.3)
- 3: Including programme change during the night and to revert to default the following day
- 4: Achieved for an individual lantern, but not for a set of lanterns, see Section 5.4.4
- 5: Current day only; historic date not achieved see Section 5.6.4
- 6: 55 steps to create a new multi-stage part-night lighting regime, then 12 to apply it to the lights
- 7: 34 steps for creation of the asset, then 18 to assign the node to a submaster
- 8: This is not viewable from within the interface
- 9: For this CMS interface, the scenario did not require the creation of a new profile, as one had previously been created.

The processes for each of these tasks has been plotted as a cumulative histogram; for task 3 an average has been applied where there was not possible to undertake. For tasks with more than one part, the ‘past 24 hours’ option was used, not the historical date. Note that one supplier had advantage of incumbent system with familiarity and some preset details that were not available to other systems. Whilst best efforts were made to measure time taken for each process, discussion and explanation was not identical between user interface reviews.

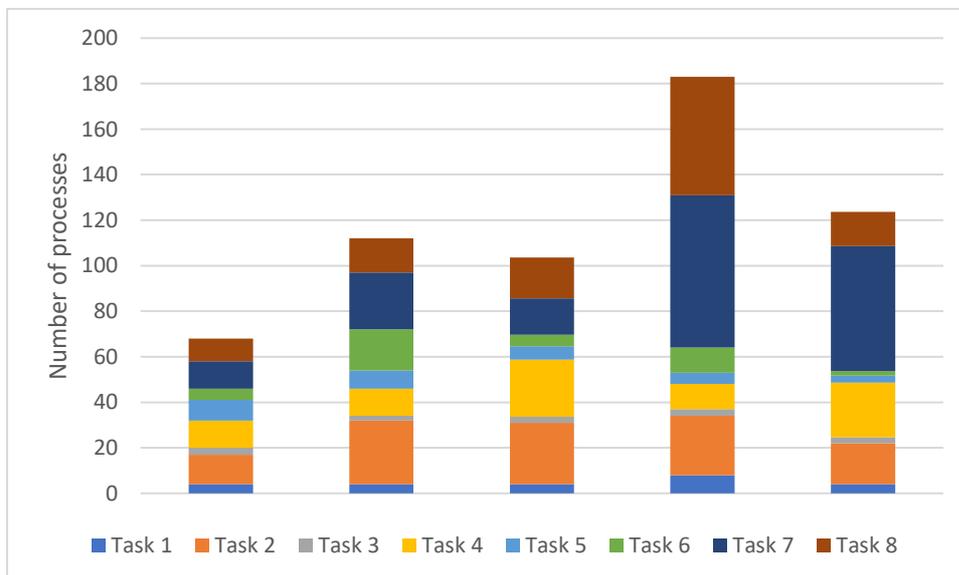


Figure 2: Cumulative processes for the eight tasks

A greater range in numbers of processes compared with time taken is observed, indicating that where there are more individual steps, they did not directly lead to additional time. In some cases, additional steps could reduce cognitive load and time. The largest number of steps, for one suppliers part night lighting programme creation, was not required for another supplier at all as it was already a programme in the system. The supplier that had the largest number of steps was due to their processes to create a part-night lighting profile, and create a new asset in the system. These processes may be undertaken rarely if at all.

4.6 Overall view of system and user feedback

Users and observers were asked for their overall view, using the Likert Scale, and what they liked most, least, what they would consider as improvements, and other feedback. These are included in Section 5, both in the discussions of specific scenarios, and in Section 5.9.

5 Discussion of scenarios with subsidiary questions

Wider comments and observations for each scenario are included in this section, together with responses to the subsidiary questions raised by the SCC technical user teams.

5.1 Task 1: Log onto the site

Scenario 1: logon

Scenario: At the start of a work day, please logon to the Suffolk County Council instance of the user interface as if you were a Suffolk County Council user.

Note: please explain any passwords, password change requirements, two-factor authentication, codes, emails, or other logon or security steps.

5.1.1 Telensa: Planet

As the incumbent user of the system commented this login page is frequently used, and therefore was “*already bookmarked*”. It had a two-step login, with a network login and then a personal login for the specific account. “*The two-step process does make it difficult if you’re restricted on screen size*”. “*Other than that, it is pretty straightforward.*”

The PLANet interface offers a range of password management configurations and user levels that can be set by the customer system admin. Telensa can also adjust password change frequency and strength requirements on request.

5.1.2 Lucy Zodion: Ki Platform

The Lucy Zodion Ki Platform has a single stage login, with email address and password. A password reset function is authenticated with a user email address, sending a link by email to that address.

Logging in lands on the general city apps landing page, from which the street lighting interface can be accessed by a single easy button click.

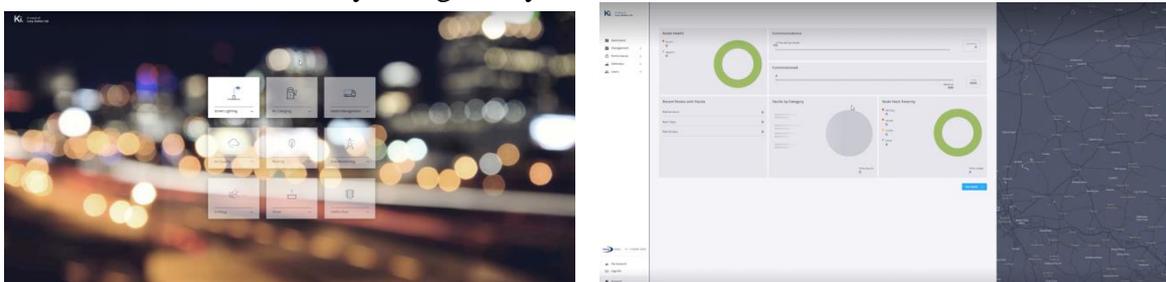


Figure 3: Lucy Zodion’s Ki Platform city apps landing page and Ki landing page

5.1.3 Liveable Cities: SmartLinX

SmartLinX offers user configurable login options, including 2FA, SSO and configurable password strengths and requirements, within the user account admin function.

Their landing page includes visualisations, and a menu bar along the base of the page (Figure 4). This menu bar was observed to be inconsistent with the menu bar in subsequent pages

which is vertically on the left hand side. This landing page is customisable depending on the user’s preference.

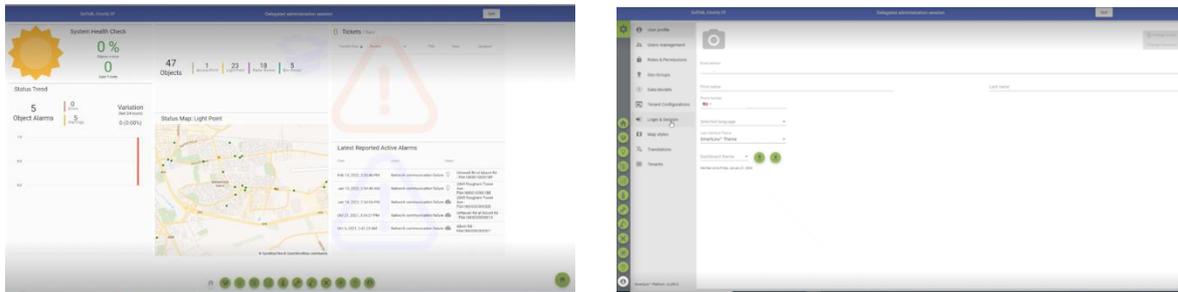


Figure 4: Liveable Cities SmartLinX landing page and login management page

5.1.4 SSE Mayflower

Login to the SSE Mayflower CMS requires a Security Code, renewed by email every 7-days, in addition to a username and password. Security code can be regenerated if required, or password reset, with a link in an email within a few minutes. The SCC users felt that the additional step of a security code provided a potential challenge, especially during night-time or emergency calls, if not already pre-populated for that week.

The landing page was visually different to the internal pages, with menu horizontally along the base, with ‘Nodes’ and ‘Sub Masters’ pre-set as favourites. As the users said *“It’s good to see this.”*

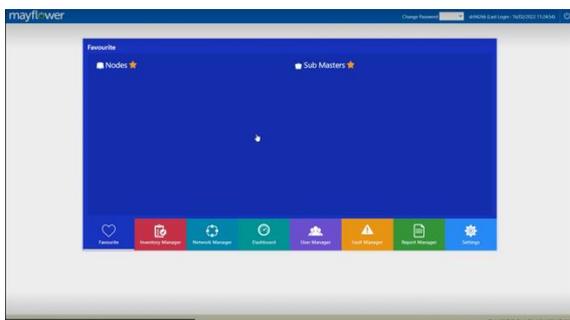


Figure 5: SSE Mayflower landing page

5.1.5 CIMCON LightingGale

Login to the platform requires a username and password. Further password and 2FA configuration is available to customer requirements and can be configured by the customer admin. The main dashboard has selected visualisations with a summary of the system status (Figure 6). This was described as *“quite straightforward”*, *“As all logins should be”*.

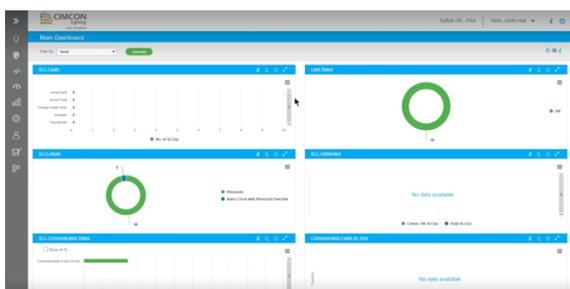


Figure 6: CIMCON LightingGale main dashboard

5.2 Task 2: Out of Hours switching

Scenario 2: Out of hours switching

It is ten past two in the morning, and you're woken by a phone call from the police. They would like lighting on a road within your lighting area to be switched on immediately in order to facilitate their investigation. Lights should remain on during the rest of the night. SCC wants the lighting to revert to normal profile the following night.

Note: if switch on/off are identical processes, for this test during the daytime, switching on lights that are currently off would be considered the same process).

5.2.1 Telensa Planet

Default settings already include the input of the previous selection, which could be useful if a set of lights need repeated resetting. Within the out-of-hours over-ride switch, the lights could be turned on for any length of time. The time selected in this scenario was until they were due to next turn on within SCC's part-night lighting programme.

The asset setting via this process is limited to fewer than one hundred lights, with a different approach based on groups if more than one hundred lights are required to be switched at one time. *"There is an issue if you want to switch more than 100 lights on: it doesn't like doing more than one hundred lights in one go."* *"Are there many occasions where that needs to happen?"* *"No, that is where we would go over to a group and switch as a group rather than assets."*

Assets can be overridden as groups of assets, or also as groups of assets, such as all lights under management.

Lights can be switched on for a period of up to 45 days, or on an unlimited period. Alternatively, an alternative control programme would be set up rather than an override. Lights are anticipated to be turned on in about 24-48 seconds for a group override or a 1-2 minutes for about 15 assets: override assets are sent as unicasts, so group override for a large number of assets. Lights can also be selected from a map view, individually or with a lasso.

5.2.2 Lucy Zodion: Ki Platform

The process was to create a group for the required lights, and set a brightness (to 100% to turn them on). *"Currently that override command only lasts for one hour, that's a default on the platform, but we do have a development package in process that will allow you to set a configurable time of up to twelve hours."* *"The nodes will go back to their preset dimming profile."*

The issues relating to limits on the time-constrained override are considered to have the potential to be safety-critical, and are discussed further in Section 6.3.

5.2.3 Liveable Cities: SmartLinx

Applying out-of-hours switching in the SmartLinx platform was observed to be a two step process, creating a group then applying the override switching to that group.

There is currently a two-hour maximum time period for override switching, although this is presented on the user interface as 1-hour. A "rest of night" option could be available with further development if required. The issues relating to limits on the time-constrained override are considered to have the potential to be safety-critical, and are discussed further in Section 6.3.

The visual interface of grey and orange bars indicating lights switched on was considered positively by the users (Figure 7). The “Auto” button to trigger a return to default programming was also considered positively.



Figure 7: Liveable Cities SmartLinx showing lights on or off with grey and orange bars

5.2.4 SSE Mayflower

The out-of-hours switching scenario was observed to be a multistep process: the lights could be switched on quickly, but their profile needed to be adjusted and that configuration updated to prevent the ‘heartbeat’ identifying their status ‘on’ as an error during the rest of the night. They then needed to be manually reverted to the default profile the following day. *“It’s usually about two minutes till they turn on ...” “We changed them to an all-night regime to make sure they stay on for the rest of the night ...”*

By resetting the lights, then requiring a manual reversion the following day, the time-limits of some other systems are avoided. However, this does require an additional manual action the following day, to revert to the default program.

5.2.5 CIMCON: LightingGale

For this task, the lights were selected via a lasso geofencing in the map view (Figure 8). This was a straightforward process.

The length of time for the over-ride switch was input in units of minutes, and could be set for up to 24 hours. This could be verified in the “track network” “sent commands” information table. Lights reverted to their default programme automatically.

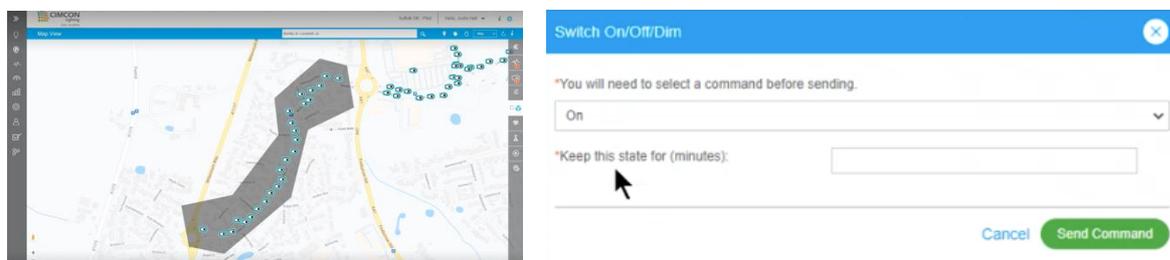


Figure 8: CIMCON LightingGale, selection of units by lasso geofencing, and Switch On / Off override dialog box

5.3 Task 3: Event file and control log

Scenario 3: Event file and control log

Automated process so not a task scenario, just the question.

Question: Can you show us that the energy event file and control log are automatically generated and provided to 3rd party administrator for billing?

5.3.1 Telensa Planet

“The system does this automatically within the firmware / software of the system.”
“The energy accounts are here ... some relate to Suffolk county council, some relate to parishes. ... click on download and that shows you the energy file that goes to the meter administrator ... set of numbers in a specific format.... This is an important thing ... is the CMS system approved on the ELEXON website. If it’s not approved it won’t be able to generate these logs and use them for energy metering.”

These are created daily at 09:00, with the switching for the previous night. They are updated over thirty days with any data that had not been reported on previous nights due to telecall operation.

5.3.2 Lucy Zodian: Ki Platform

“Currently we have an integration set up with one billing administrator. We generate these logs within the platform ... I have prepared some earlier ... with logs from another customer. These are the day logs which include these events for that day. ... Those are automatically pushed through to the billing administrator every day.” The logs are available to view on the platform under the menu item “UMSUG Reports” (Figure 9).



Figure 9: Billing reports available to view on Ki Platform

5.3.3 Liveable Cities: SmartLinx

Liveable Cities are a North American based supplier, with limited experience of the UK market. They explained that they have a number of luminaires and a stand-alone pre-set dimming controller certified with ELEXON, but do not yet have experience of integration with UK-based billing administrators. In North America, they work closely with utility providers to access information, through their API; information accessible via the user interface was demonstrated.

5.3.4 SSE Mayflower

Event files and control logs are viewable under the “Consumption Utility” option in the settings menu (Figure 10). An admin or ‘superuser’ in each organisation would be expected to have visibility of these files. *“It’s good to actually see this.”*

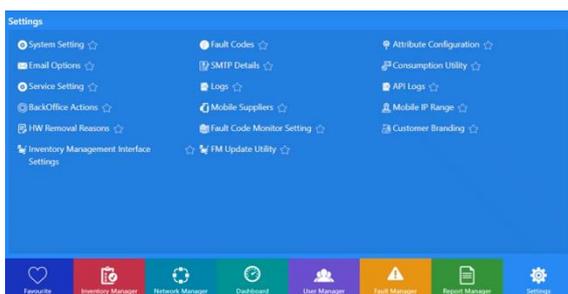


Figure 10: Mayflower Settings Menu including ‘Consumption Utility’

5.3.5 CIMCON LightingGale

This can be done with the required information, but the generated event files are not viewable from within the interface. *“This would send out the csv file sent out.”*

5.4 Task 4: Extract of data

Scenario 4: Extract of data

Scenario: You wish to confirm power drawn by a range of lanterns, to provide confidence that the lanterns are working (or that the lanterns have been changed to lower power ones). Extract the power readings for previous 24 hours for a set of assets stated at time of scenario

Question: What data can be extracted and how?

5.4.1 Telensa Planet

“We will just check that they are all in Bury.” “Export ... comes out in .csv format.” User then showed how the downloaded file could be opened in Excel.

The additional question, what data can be extracted and how, was answered with demonstrating the potential data field, shown in Figure 11. Export is as a .csv file.

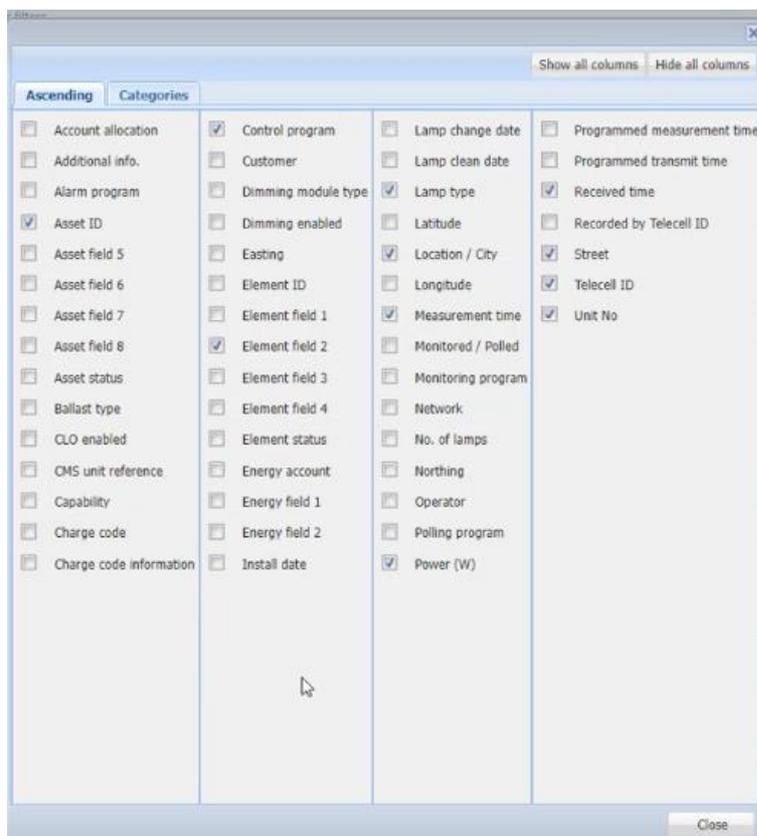


Figure 11: Telensa Planet, available power data

5.4.2 Lucy Zodion: Ki Platform

Power consumption for the selected assets is presented as a minimum, maximum and average for the selected assets (Figure 12). This is presented in the interface and can be exported as a csv file if required.

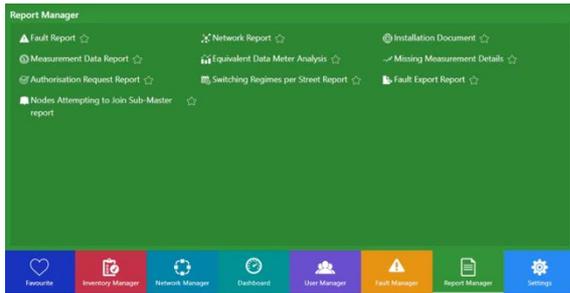


Figure 15: Mayflower Report Manager options and report

5.4.5 CIMCON LightingGale

A range of parameters are available for selection in the interface (Figure 16) with logical operators offering filtering to identify specific parameter criteria.

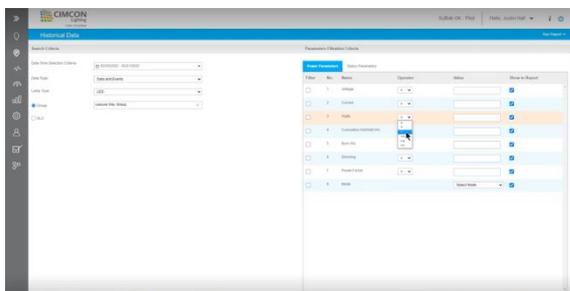


Figure 16: CIMCON LightingGale Historical Data offers a range of Power Parameters

5.5 Task 5: Extract of daily faults list

Scenario 5: Extract of daily faults

Scenario: We need to check our contractor is meeting KPI, please extract the daily faults list. Show the current faults as a list on the day of the scenario, and another historic date given on the day of the review.

Question: can this also be automated?

5.5.1 Telensa Planet

The user indicated that this page was customisable with the required settings:

For the historic date, the process was similar, when set with the historic date.

This is automated under the existing system

The PLANet system is integrated with a number of asset management systems, including Mayrise, Confirm, Synology, Alloy and WDM.

5.5.2 Lucy Zodion: Ki Platform

Lucy Zodion's Ki platform offers a fault dashboard with visual and map-based indication of fault numbers and locations (Figure 22), with further information available when drilling down. A report can be extracted as a csv file.

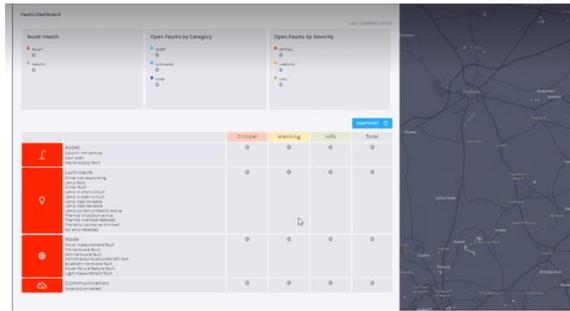


Figure 17: Lucy Zodion Ki, active faults dashboard

An automated daily email can be activated with a number of new faults.

5.5.3 Liveable Cities: SmartLinX

“As with everything, there are several ways to do this. You can have the list emailed to you every day...”

Navigation to the Alarms History page provided tables and a heat map (Figure 18).

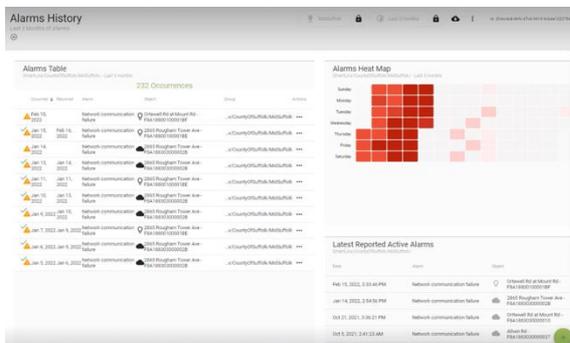


Figure 18: Liveable Cities Alarms History

Discussed within this and other questions, was the integration of the CMS with asset management systems (AMS). Liveable Cities as a North American based company do not currently integrate with AMS but are expecting to do so as their UK based business develops; this is discussed further in Section 5.3.3. Liveable Cities do offer a Swagger interface for developer integration with their system.

5.5.4 SSE Mayflower

Again, this is achieved through the Report Manager, presenting a report format of faults for the selected date (Figure 19).

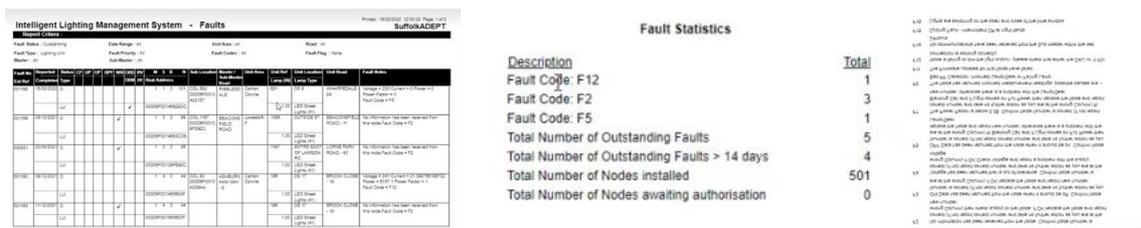


Figure 19: Mayflower Report Manager with summary statistics and fault codes

An alternative approach, with export to an asset management system (AMS) is via fault manager (Figure 20), which can be integrated with an asset management or inventory system. Mayflower is integrated with a number of AMS including Mayrise, Confirm, FM (used by

many PFIs) and others on request. A regular run can be set up with export following a supervisor review of the faults. SCC users would prefer the option of a fully automated export process to the AMS

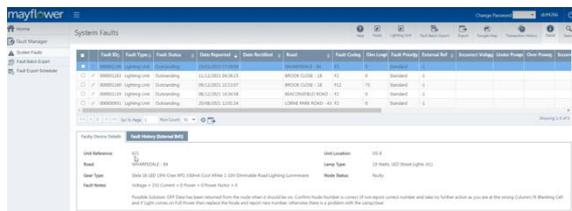


Figure 20: Mayflower faults via the Fault Manager

5.5.5 CIMCON LightingGale

The faults panel within the main dashboard has a clickable link to a listing of faults (Figure 21), which is extractable as a csv file. *“It’s all where it should be.”* This can be automated to email the csv file each day. SCC identified that *“day burners”* were identified as faults, even though they were on due to a requested switch (previously in the user interface review) rather than a fault.

Identifying historic faults was found to be more complex, with a query to identify locations prior to running the report. *“you could go into the status and filter down by faulty lamp”, “Pretty straightforward.”*



Figure 21: CIMCON LightingGale faults panel within Main Dashboard

An API with push and pull capabilities is available to integrate with AMS if required for fault extraction or inventory management. As a North American-based organisation, there is limited existing experience of integration with UK AMSs, and details were not available at the time of the review.

5.6 Task 6: Check communications

Scenario 6: Communications

Scenario: Please look which assets are communicating or not communicating. Extract a list of non-communicating assets at the time of the scenario, and also those on a historic date given at the time of the scenario.

Question: Is there further information on reason for not communicating that can be accessed remotely?

5.6.1 Telensa Planet

Asset communication is easily available visually on a map and as a list, as shown example screenshot of this process is shown in Figure 22.

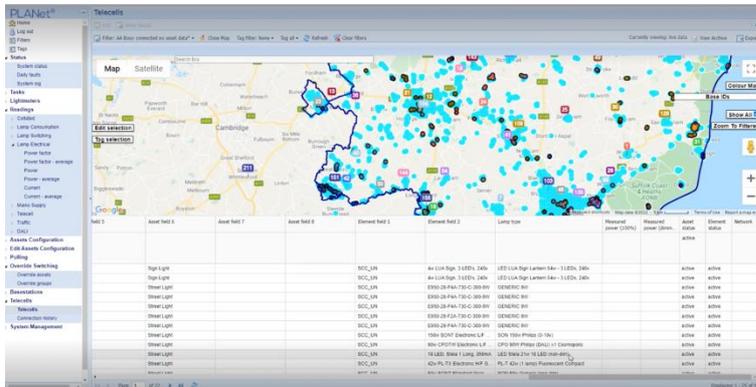


Figure 22: Example of screen showing non-communicating Telecells

In response to the question as to whether there is further information on the reason that they are not communicating successfully: *“yes, there is ... communication strength and communication quality. .. [they are useful] as they give us an idea as to why the asset isn’t communicating.”*

5.6.2 Lucy Zodion: Ki Platform

Communications faults within the Ki Platform are extracted by selecting “comms” within the Faults Report Generator (Figure 23). Export to asset management system is via integration. Integration of selected asset management systems is already developed, and further asset management systems can be integrated if required.

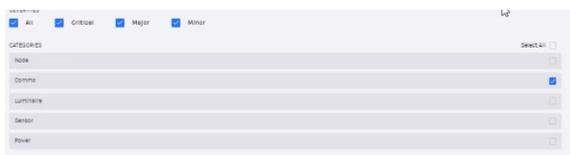


Figure 23: Ki Platform: Selecting Comms faults

More information on signal strength impact on communications is in development.

5.6.3 Liveable Cities: SmartLinx

Similarly to faults listing, communications alarms is available as tables and a heat map (Figure 24). An eighteen-month fault history is available.

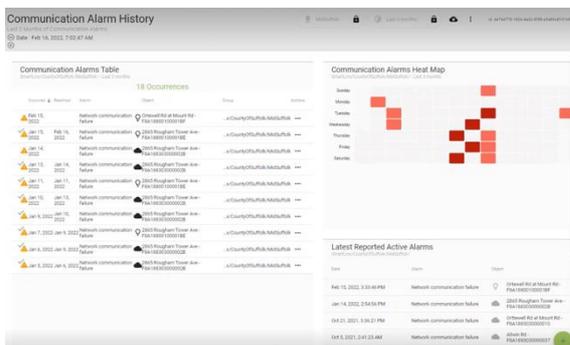


Figure 24: Liveable Cities Communication Alarms History

It might be possible to see a ‘last gasp’ message if a controller lost power, but in most cases for a cellular device, further information on the reason for communications failure is not available on the SmartLinx platform. More tools are available for mesh networked devices. Liveable Cities also have access to their carrier platform for cellular devices on the SIM management portal, and can often access additional information directly from that from the individual carriers.

5.6.4 SSE Mayflower

This was undertaken by selecting F2 category faults, which is the code for units that are not communicating, from within the Nodes Faults tab (Figure 25). A “Fault Notes” can provide some additional information on why the node is not communicating, if any information has been provided. *“Straightforward ... it’s good ...”*

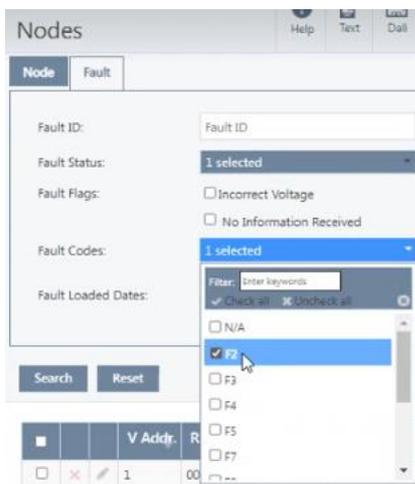


Figure 25: Mayflower, selecting communications faults

5.6.5 CIMCON LightingGale

The main dashboard includes a communications status panel (Figure 26), with a clickable link to tabulated and downloadable communications status data. For communications fault data for a specific past date, non-communication can be identified within the historical data panels. This was described as *“nice and straightforward.”*

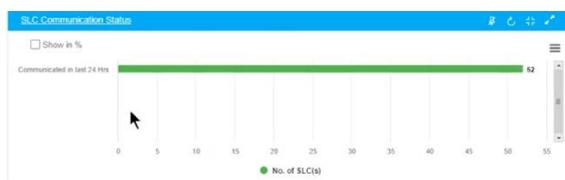


Figure 26: CIMCON LightingGale Communications status panel within Main Dashboard

For a ZigBee based system no further data on reason for communications failure is available, although may be in development *“in the works”*. In cellular or NB-IoT connected systems, a last gasp report can indicate lost power.

5.7 Task 7: Apply part-night lighting profile

Scenario 7: Part-night lighting profile

Scenario: A change has occurred in the management of a group of lights. Please amend a list (given at the time of the scenario) of lights and apply a part-night lighting profile.

5.7.1 Telensa Planet, SCC user

To change a group to part-night lighting profile, the following dialogue box was used.

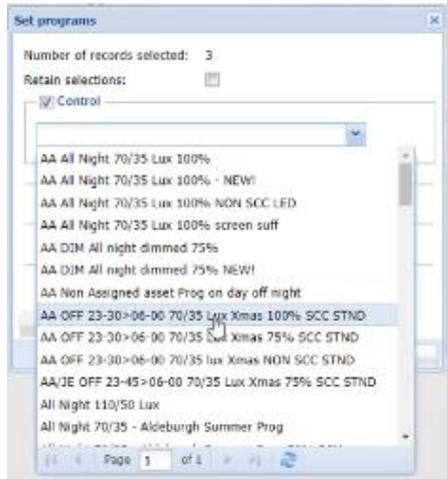


Figure 27: Telensa Planet dialogue box for part-night lighting profile in use

5.7.2 Lucy Zodion: Ki Platform

As with each interface, a profile was created (Figure 28), and a group of lights selected to which to apply the profile. Updates are automatically pushed at 18:00 each evening, or can be forced out as a calendar update.

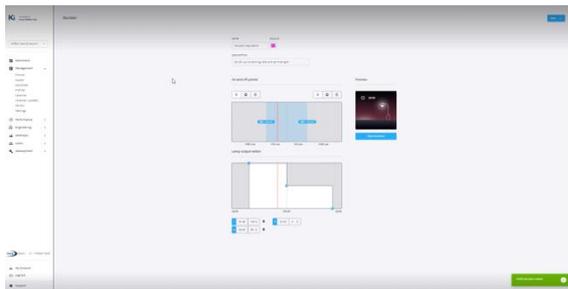


Figure 28: Lucy Zodion Ki Lighting profile editor

It was noted that the platform provided a complete calendar, and profiles can be preset for any future period on specific days of the year, for example for a pre-planned event, which was considered very positively.

Comments included: *“we like that” ... “that was good”*.

5.7.3 Liveable Cities: SmartLinx

The SmartLinx platform offered both visual and tabular format to enter the part-night lighting profile (Figure 29).

There are multiple approaches to apply the created lighting profile to selected lights. Finally, the configuration needs to be pushed to the devices, which can happen automatically, be scheduled for a period when the lights are powered, or pushed at time of creation.

SCC user commented *“I like the way that all sets up ... I like that.”*

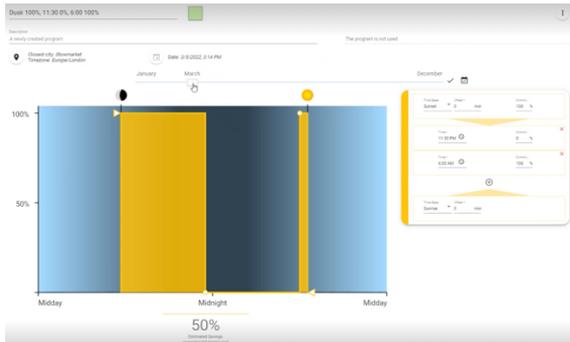


Figure 29: Liveable Cities Scheduler interface

5.7.4 SSE Mayflower

SSE Mayflower demonstrated creation of a new switching regime using the switching regime interface (Figure 30), which can accept up to ten commands in a 24-hour period. This can be different for different days of the week; the SSE representative included ‘confirmation’ steps which check and repeat the command during a period without changes to the lighting.

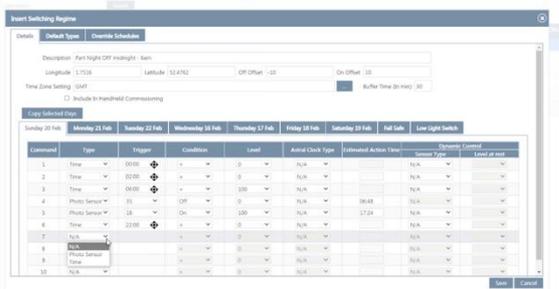


Figure 30: SSE Mayflower Switching Regime interface

SCC user comments were “nice and easy that, I like that.” And “all good, thank you.”

5.7.5 CIMCON LightingGale

Again, a light group was selected, programme designed and applied to the selected group. The light programme options were input from drop-down boxes, and once input offered a visual confirmation of the programme applied (Figure 31), which was very popular with SCC users “I like the functionality of the programming.” “Yes, like the visual confirmation.” “Graphic explanation of what you’ve just done.” This included dimming details, and showed current sunset and sunrise.

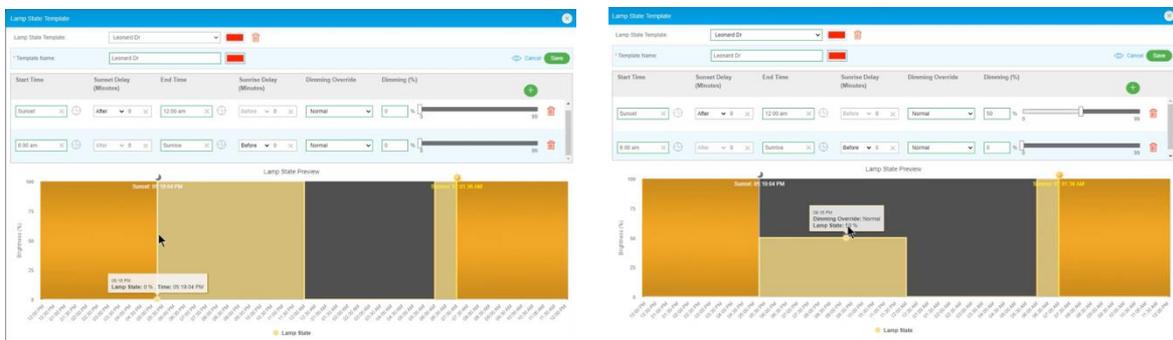


Figure 31: CIMCON LightingGale Lamp State Template box, showing with and without dimming applied

5.8 Task 8: Creation of a new asset in the system

Scenario 8: Creation of a new asset in the system

Scenario: A new asset has been installed. Please create it as an asset on the system. New asset details provided at the time of the scenario.

5.8.1 Telensa Planet, SCC user

This could be done by completing a form for asset details; typically assets are imported from the asset management system.

Figure 32: Telensa Planet dialog box for creation of a new asset in use

5.8.2 Lucy Zodion: Ki Platform

A node can be created with the create asset form, including optional and compulsory fields, and map. The node measures the lantern wattage: *“when the node is first installed, it powers up the light to 100% and sets a marker, saying ‘this is my wattage’ Intelligence within the system ...”*

5.8.3 Liveable Cities: SmartLinx

All devices are GPS enabled, and when powered up *“they sample the luminaire for its maximum power, locks its GPS location and time, and attempt to announce themselves into the CMS. ... a rare edge use case where this might not happen is tunnel lighting, which may not self-discover. You can add these manually to the platform. There are three, four different ways to add them to the platform.”* A manual addition was created.

SCC user said *“I like the csv [import] version ... and the auto-locate. I like that one, it’s good.”*

5.8.4 SSE Mayflower

In common with most other CMS systems, SSE Mayflower can be integrated with a range of asset management systems that may enable asset addition to be automated via “Lighting Unit Import”. For a manual asset creation, the first step to add a new asset was in Inventory Manager (Figure 33). Matching information was required so that the right gear types and maintenance schedule was associated with the lantern created, and errors created if the asset was attempted to be created using non-matching information.

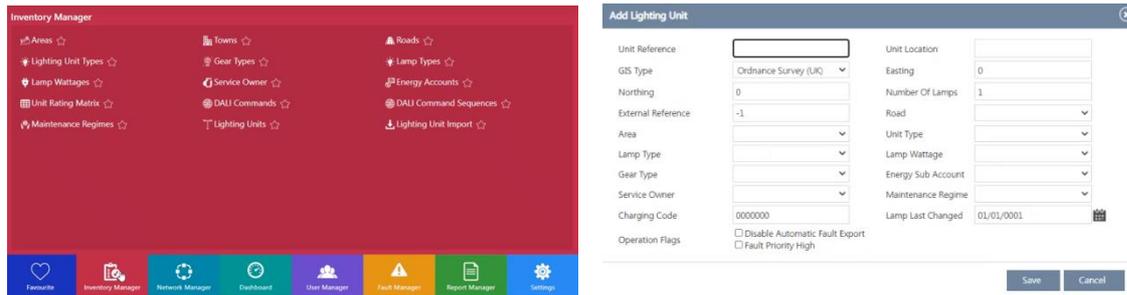


Figure 33: SSE Mayflower Inventory Manager and Add Lighting Unit box

SCC user comments were *“That’s pretty straightforward, I like that. ... It’s all there ... Happy with that”*

5.8.5 CIMCON LightingGale

Creation of a new asset in the system involved identifying a location on the map view, which the availability of a satellite view made very easy, and inputting information into a dialogue box (Figure 34). This requires a Unique Identifier, which in the case of the controllers in this system is a MAC address, and therefore the assets cannot be created in advance of being installed without the MAC addresses *“you do need the controlled details before you can create the asset.”* *“In normal deployment, there are QR codes for our easy-install application.”* Icons on the map view indicates the status of new assets. These can also be uploaded from csv for a larger deployment. *“Pretty straightforward, excellent.”* *“Easy to do and the system works.”*

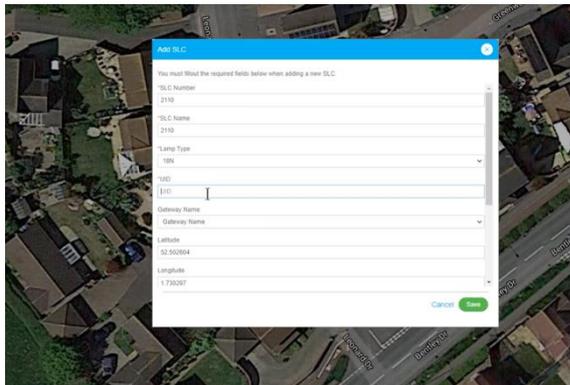


Figure 34: CIMCON LightingGale asset creation dialogue box

5.9 Overall system comments

At the end of the scenarios, an opportunity was provided for SCC experts to comment on each of the interfaces.

SCC’s user was asked to rate the overall use of the interface, scored on a five-level Likert Scale from 1 (strongly disagree) to 5 (strongly agree) on four aspects of the system:

	Supplier A	Supplier B	Supplier C	Supplier D	Supplier E
Ease of overall use	5	5	5	4	4
Ease of navigation	5	5	5	5	5
Organisation of information	5	5	5	5	4
Overall functionality	4	5	4	4	4

Table 6: Assessment of overall use of the interface

5.9.1 Telensa Planet, SCC user

After each review, some summary questions were asked of the SCC asset manager relating to the overall user interface:

What do you like the most: *“it’s very straightforward, and designed to do the job for streetlighting, it’s very streetlighting biased; it’s good.”*

It was observed that the user in this trial had high familiarity with this user interface, and it is considered that his familiarity may lead to the high ratings he has provided. His familiarity means he will find this system easier to use, as he has had extensive experience with this interface.

Overall remarks for this user interface include:

- Presence of a consistent tree menu, in a stable location at the side of the page
- Autofill of text to enable rapid selection of location names
- Text is all considered to be readable
- Default settings and prefilled boxes were considered sensible
- Export of data to .csv format was consistent between all export actions
- Very few, if any, graphical or visual presentations

Possible improvements could include additional visualisations or graphical presentation. The dashboard screen includes a compilation of graphs proposed by users, and was considered less “modern” than others (Figure 35).

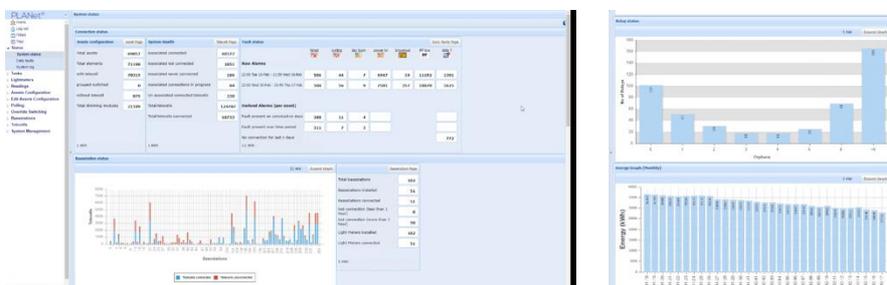


Figure 35: Graphical displays from Telensa PLANet

“It works in a street lighting environment that is well integrated with asset management platforms.”

5.9.2 Lucy Zodion: Ki Platform

After each review, some summary questions were asked of the SCC asset manager relating to the overall user interface:

What do you like the most: *“we can see the logs”, “dimming and creation of programme is very very good, really good.”*

Overall remarks for this user interface include:

- Presence of a consistent tree menu, in a stable location at the side of the page
- Clear boxes and easy visual representations
- Map with colour coded assets
- Text is all considered to be easily readable
- Export of data to .csv format was consistent between all export actions

5.9.3 Liveable Cities: SmartLinx

“Very comprehensive, multiple ways to do things. ... API seemed very good ... work with utilities, so no contractor relationship.” . *“A very good system, one of the best we’ve seen.”*
“It does a lot more than what we’ve tested it on today.” *“I thought the dimming was very good.”* *“You can see the APIs.”* *“easy to look at faults and discrepancies over time.”*
“visualisation on main screen.” *“there are a lot of good things.”*
“It is very in depth compared to others.”

5.9.4 SSE Mayflower

“Overall it’s quite an in depth system. It’s tailored nicely to the contracts they operate.” ... I can see the benefits.”
“I liked the programming for part night lighting ... Scenario seven – that was good.”

5.9.5 CIMCON LightingGale

“I like the use of the mapping and the visuals.” *“I do like the dashboard with the basic information – I can see all our nodes are communicating.”*

The best liked things were *“the graphical parts of the system, the control programme graphics, the dashboard graphics.”*

6 Conclusions and Recommendations

Overall conclusions drawn from the usability review are included in this section. It does not attempt to ‘rank’ interfaces, as user needs will differ between user organisations, based on their requirements and contractual relationships with contractors managing the lighting maintenance.

As stated previously, tasks and scenarios selected were considered to be basic or fundamental processes that all or most modern CMS user interfaces would be expected to include, enabling comparison between the interfaces. Some user interfaces also include additional or more advanced functionality that could be of value or importance to users. As this review was designed to compare standard functions, supplier-specific options are not addressed in the review, or discussed here in a structured way.

The importance of user familiarity with specific interface, and with processes being undertaken was confirmed: in one scenario, the user commented *“I cannot remember how to*

get a specific date”, as this is not a task they do, having been able to do the other tasks with significant familiarity with the interface.

This comparative user review was intended to report on user experience of different user interfaces, and potentially support selection decisions. The review was not intended or designed as a development usability review, and therefore recommendations are not phrased as suggestions for specific product designers; however, we anticipate that product teams may find the observations useful.

Four specific areas were identified by the review process as where the differences between the user interfaces are of greatest significance:

- Logon process
- Out-of-hours switching / lighting override
- Visualisations
- Integration with Asset Management Systems

These are discussed in more detail in terms of specific interfaces in Sections 6.2 to 6.5.

6.1 Overall

All interfaces offered ways to achieve the scenarios, many very straightforward. They are therefore all considered to be appropriately functional. Differences in the approach to their functionality are reflected here to inform other potential users, and, if desired, CMS developers, as to the opinions of the specific local authority users undertaking this review. Some scenarios identified differences in user experience; specific areas for difference are discussed here.

6.2 Log on processes

The first experience of the users is with the CMS logon process. The SCC users have reflected during the Smarter Suffolk project that logging in to the different CMS interfaces for emergency out-of-hours switching can be a specific challenge. Most interfaces had a one or two step log-on process with username and password. Some interfaces had optional additional security features.

6.3 Lighting override

One scenario in which a key difference between CMS functionality was in the lighting override processes, when lights that are off for part-night lighting are switched on during the night at the request of other services. SCC’s scenario was for the street lights to:

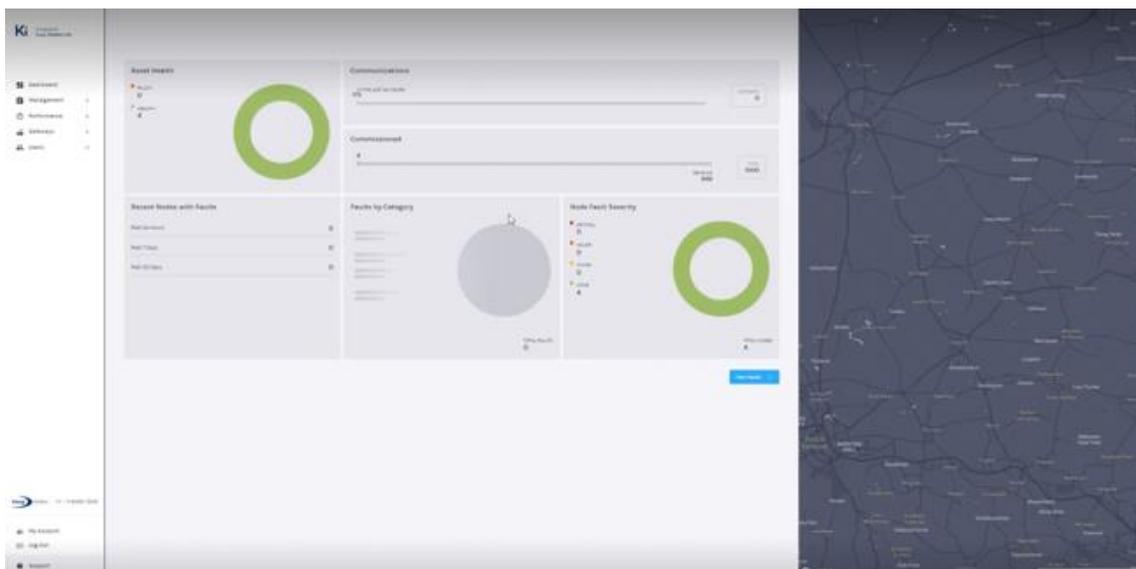
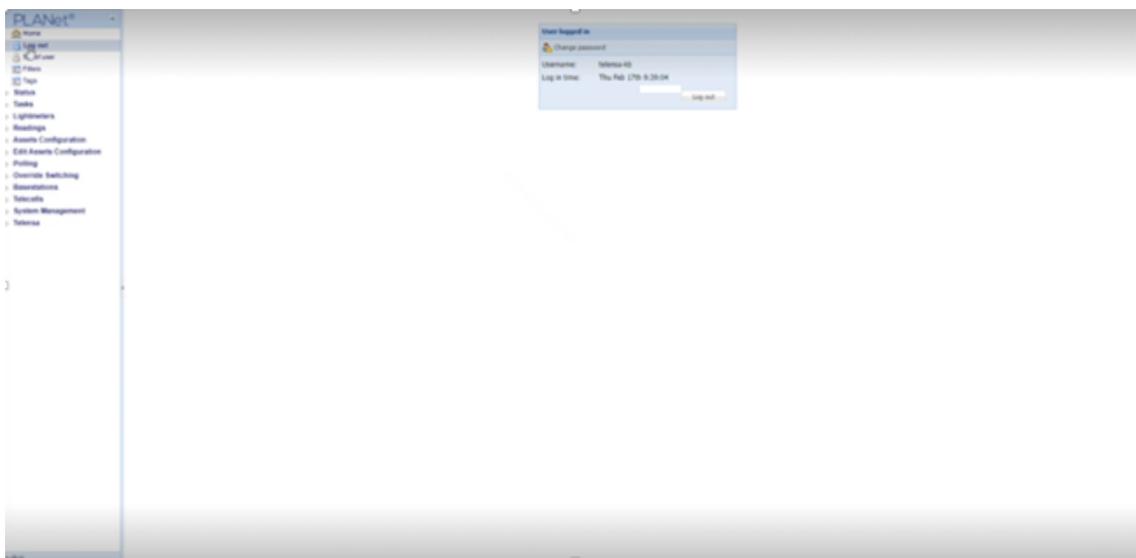
- Be switched on on request;
- Remain on for the rest of the night;
- Revert to their default process for the following night.

This scenario is an important aspect of CMS management, as it enables emergency services to request lighting for their emergency work, which could be policing, health or fire related, and is essential for the safety and well-being of the community. Therefore, the successful operation of the lighting-override scenario is safety-critical, and is an occasion in which the functionality of the digital systems could minimise or exacerbate potentially dangerous situations.

It is suggested that an improvement would be to enable a manual override of a time period that could be until the following usual switch off time, with automatic reversion to default programme for the following night. One further option that was not observed to appear on any of the interfaces, would be for the override switch to remain on until the lights are switched on by their default programme.

6.4 Visualisations

A notable difference between the presentation of the different interfaces was the availability and use of visualisations. For example, the graphical presentation of system status on the landing page of CIMCON’s LightingGale system was appreciated. The five landing pages are included below, and show that three have graphical presentation of system status on the first page (Lucy Zodion Ki; Livable Cities SmartLinx; CIMCON LightingGale).



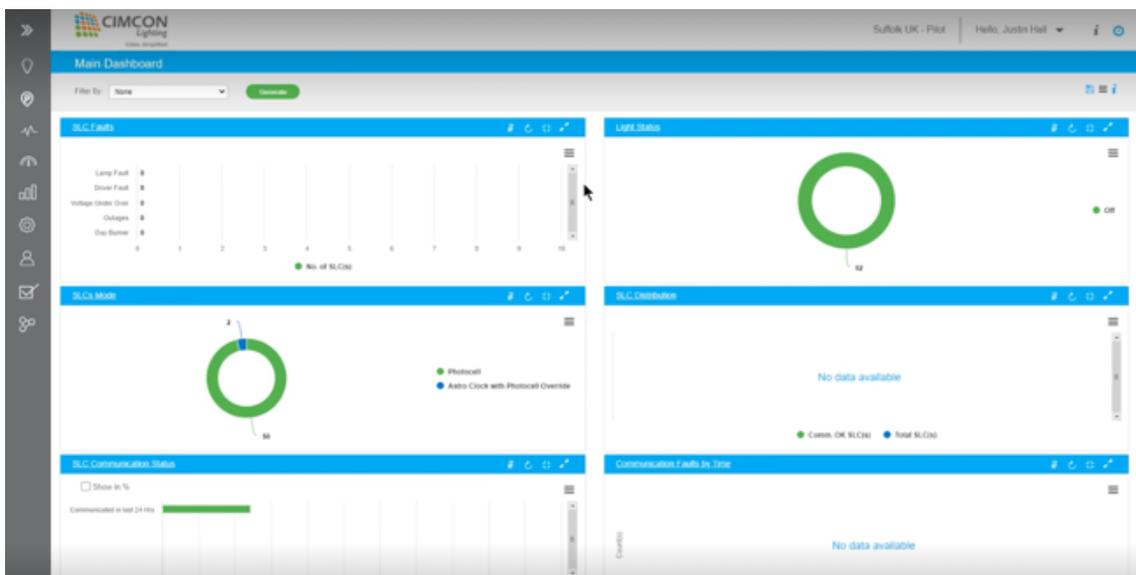
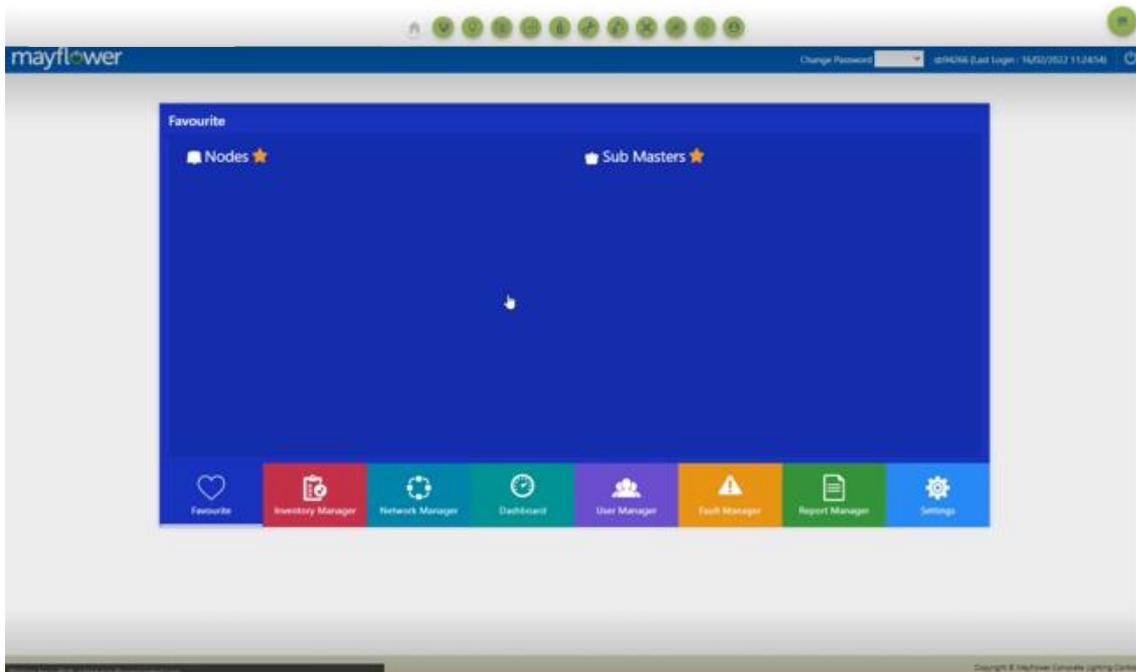
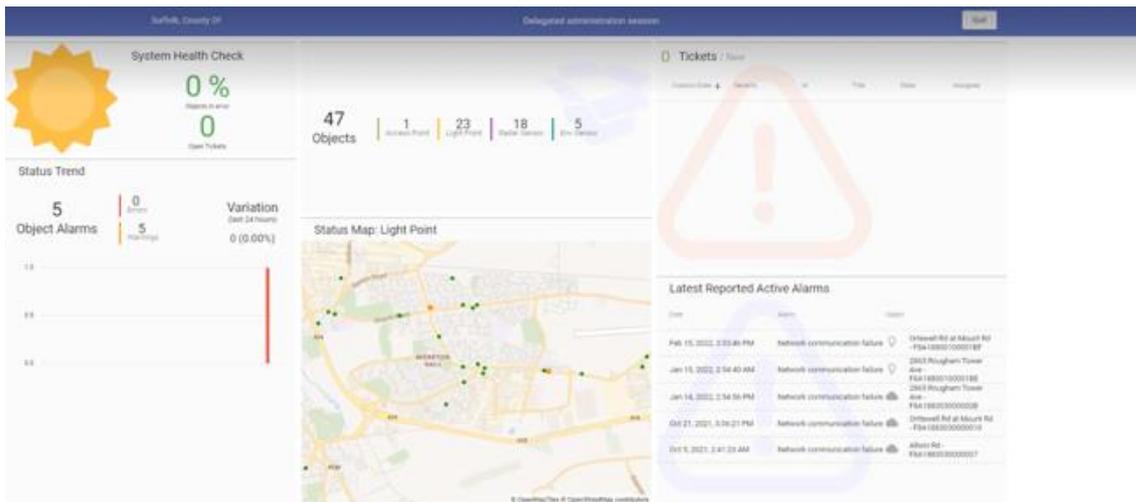
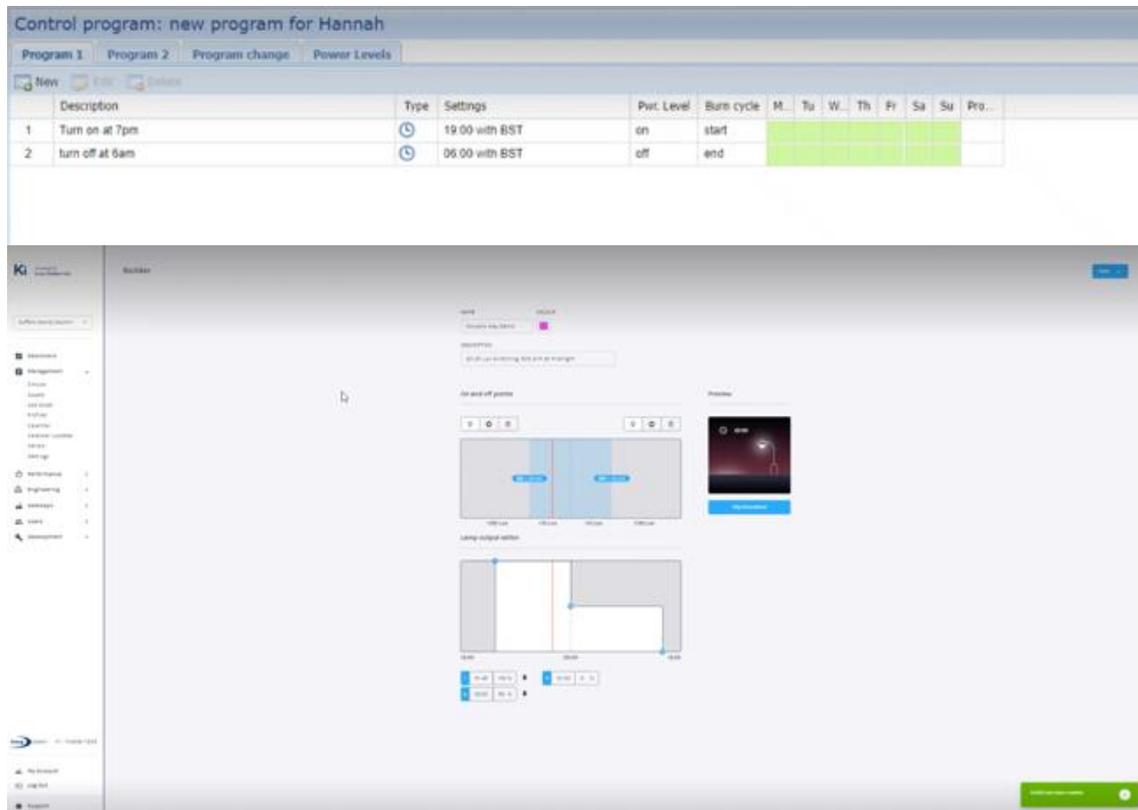
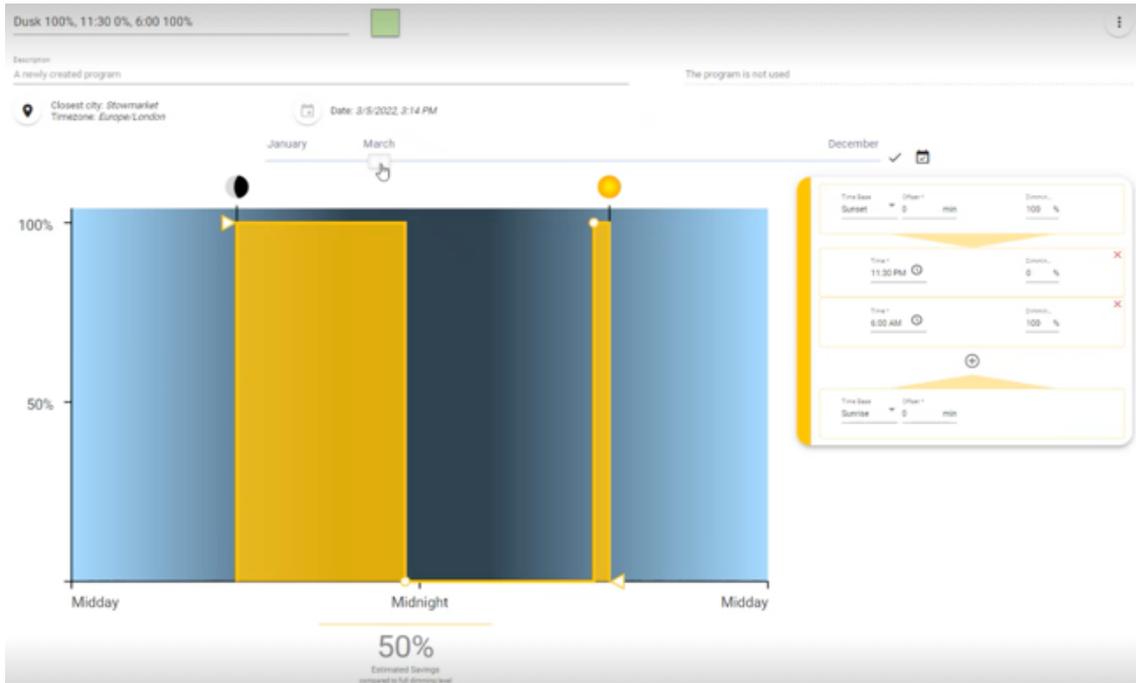


Figure 36: Initial landing pages top to bottom: Telensa PLANet; Lucy Zodion Ki; Liveable Cities SmartLinx; SSE Mayflower; CIMCON LightingGale)

Another area in which visualisations have been noticed was in the creation of a lighting programme or profile, as part of the part-night lighting scenario. All interfaces offered a box-based approach to entering the new profile. Some offered an alternative graphical schedule that could be edited. Others offered a non-editable graphical confirmation of the new schedule. Others did not have a visual presentation of the information. Where the option for graphical or box-based editing was available, box-based editing was preferred as offering greater control of the granularity, using the graphical presentation as visual confirmation. In all cases, having a graphical confirmation was liked. As indicated below (Figure 37), Lucy Zodion had a graphical editor, Liveable Cities offered either graphical or text-based with graphical confirmation, CIMCON offered text-based with graphical confirmation, and CIMCON and Telensa did not present the lighting programme in a graphical way. It was considered that graphical presentation of the information could provide useful immediate feedback and help confirm that the programme had been created correctly.





Insert Switching Regime

Details | Default Types | Override Schedules

Description: Part Night OFF midnight - 6am

Longitude: 1.7516 | Latitude: 52.4762 | Off Offset: -10 | On Offset: 10

Time Zone Setting: GMT | Buffer Time (in min): 30

Include In Handheld Commissioning

Copy Selected Days

Sunday 20 Feb | Monday 21 Feb | Tuesday 22 Feb | Wednesday 23 Feb | Thursday 17 Feb | Friday 18 Feb | Saturday 19 Feb | Full Calc | Low Light Switch

Command	Type	Trigger	Condition	Level	Astral Clock Type	Estimated Action Time	Dynamic Control	
							Sensor Type	Level at rest
1	Time	00:00	=	0	N/A		N/A	
2	Time	02:00	=	0	N/A		N/A	
3	Time	06:00	=	100	N/A		N/A	
4	Photo Sensor	35	Off	0	N/A	06:48	N/A	
5	Photo Sensor	18	On	100	N/A	17:24	N/A	
6	Time	22:00	=	0	N/A		N/A	
7	N/A		=	0	N/A		N/A	
8	N/A		=	0	N/A		N/A	
9	Photo Sensor		=	0	N/A		N/A	
10	N/A		=	0	N/A		N/A	

Save | Cancel

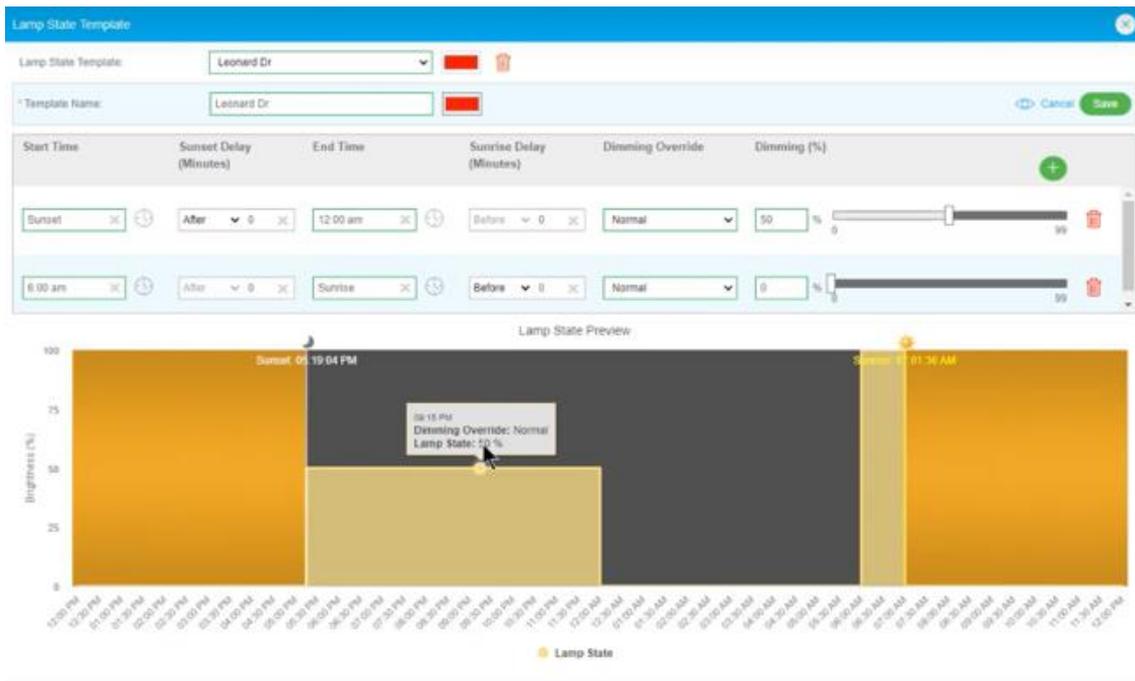


Figure 37: Lighting programme editors (top to bottom: Telensa PLANet; Lucy Zodion Ki; Liveable Cities SmartLinx; SSE Mayflower; CIMCON LightingGale)

In general, the wider use of graphical presentations by some systems was appreciated by both the user who creates the lighting programmes, and by their manager who extracts information for reports and presentations.

6.5 Integration with AMS

Street lighting asset management systems (AMS) are a significant part of managing large street lighting deployments. They may be less common for small lighting deployments such as on individual car parks or industrial sites. There are several main AMS providers in the UK (including Mayrise, Confirm, FM and others). For UK street lighting management, integration of CMS with AMS is important. This is considered the best way to manage deployments and assets, enable automatic fault management and information transfer, and manage inventory. The integration of CMS and AMS avoids the error-prone challenges of having two separate databases. This aspect of the trial was added in informal discussion with each supplier, as of importance to SCC and similar users.

Across the five CMS interfaces reviewed, some currently integrate with all the main UK-based AMSs (discussion in Section 5.5). Some CMS are less well established in the UK, either due to being relatively newer or smaller, or due to being primarily based in North America. These currently interface with fewer or no AMSs. UK-based Lucy Zodion integrates with some AMS at present, and offers the option of development to integrate any further AMS of the customers' choice on request. Canada-based Liveable Cities may be able to discuss integration with UK-based AMS on developing further UK-based customers, and has a well developed Swagger Interface and API for developers integration.

Integration with AMS is an important aspect of CMS use for SCC and similar local authority users. It is recommended that CMS suppliers continue to develop their AMS integration, whether pre-emptively or on an as-needed basis, and organisations selecting CMS include AMS integration availability as an area to consider and discuss.

6.6 Additional functionality

This review covers a set of eight functions within the street lighting central management systems user interface considered essential by the SCC street lighting team. Each of the user interfaces has some additional capability, alternative methods or advanced functions that have not been part of the scenarios covered by this review.

All providers reviewed here have been part of Suffolk County Council’s Smarter Suffolk Live Labs project, providing connected places capability with additional sensors, including air quality, traffic counting, and others. As such, they have all offered a ‘smart city’ interface to present sensor information from sensors in their trials. These interfaces are in varying stages of development and the suppliers may have different intentions regarding their future plans. These smart city / connected places interfaces are not covered by this review. Suppliers currently have different approaches to integration of their smart city interface with their street lighting management platforms:

- Telensa created a separate interface called “Urban IQ”, which is accessed separately from their PLANet street lighting interface.
- Lucy Zodion Ki login front screen offers options to enter interfaces for each of their sensors, with street lighting as one of those options (shown in Figure 3).
- LiveableCities SmartLinx fully integrates their sensor offering into their SmartLinx interface, using the menu items on the left hand side, shown in Figure 4, and with further information accessible as shown below (Figure 38) using as an example the AQI heatmap accessible from the same user interface.
- SSE offer a separate user interface called “Smart Cities Hub”, accessed separately from their Mayflower street lighting interface;
- CIMCON offer a separate user interface called “StreetVibe”, accessed separately from their LightingGale street lighting interface.



Figure 38: Liveable Cities SmartLinx AQI Heat Map

From a street lighting manager’s point of view, integration of the systems is viewed positively. Wider local authority opinion on this has not been available within this review.

6.7 Summary

Whilst all user interfaces offered different user experiences, they all completed most of the tasks set, and offered potential options to complete the others. All have ongoing development, and may have altered processes or added features through time.

Differences were noted in visualisations, ease of login, integration with AMS or with their smart city interfaces, and in times for override switching. Some of these impact on emergency procedures undertaken during the night, often as a wake-up call, and their ease of completion is essential for the user and the emergency services making the request.

Potential customers selecting a CMS provider should consider the operation of their CMS user interface as part of the selection process. Different users may have different priorities amongst the scenarios reviewed. In particular, existing presence or path to development of integration with a AMS provider could be a high priority, depending on contractual relationships and size of deployment.

The approach to this usability review, and scenarios used, are considered to be informative and of value to similar local authority users. SCC and UoS would like to thank the CMS suppliers and their nominated representatives for their support with this work.

7 Discussions and review participants

Thank you to the following people for participation in this comparative usability review, or for useful discussions regarding CMS user interfaces or usability testing. In no particular order:

Richard Webster, Project Director Suffolk LiveLabs, Suffolk County Council
 Andrew Allberry, Lighting Systems Manager, Suffolk County Council
 Ryan Baum, Ki Project Engineer, Lucy Zodium
 Kevin Bridge, Director of Operations, Telensa
 Greg Jacklin, Technical Director of Smart Cities, Liveable Cities
 Shawn Blunt, Field Services Support Engineer, SSE Enterprise Energy Solutions
 Justin Hall, Solution Engineering Technician, Quantela for CIMCON Lighting
 Sian Cook, University of Suffolk
 Professor Nicholas Caldwell, University of Suffolk

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9 Document History

Date	Version	Author	Notes
02/2022	Draft	H Steventon	Reviewed with Prof N Caldwell
02/2022	Issue 1.0	H Steventon	Issued to Suffolk County Council

10 Appendix A: Test script with scenarios

Introduction **Adapted from** (Krug *et al.*, 2014)

CMS user interface usability review script

V1.31 16Feb22

Hi, I'm Hannah and I'm going to be walking you through this session today. Present today are Hannah Steventon from University of Suffolk, Richard Webster of Suffolk County Council and Andy Allberry of Suffolk County Council and <name from company>

Before we begin, I have some information for you, and I'm going to read it to make sure that I cover everything.

You probably have a good idea of why we are meeting today, but let me go over it again briefly. We are asking you, <company representative> to use your street lighting management systems so we can see how easy it is to do a range of functions, and whether it works as intended. We have scheduled several sessions, one to identify the tasks, and one for each of the different street lighting management systems. This is session <session number> assessing the useability of <specific supplier software>. Each session is anticipated to take about an hour.

It is important that I make clear that we are testing the CMS dashboard and not you or other users. You cannot do anything wrong here, as you are not on test.

As you use the software, I'm going to ask you to think out loud as much as possible.

Say what you're looking at, what you're trying to do and what you're thinking. This will be a big help. I may use some of the things you say as quotes in our report.

We are doing this to inform other users of the differences and use experience of these dashboards. The report will be public and suppliers may also use it to inform their development of their dashboard.

This recording will include your name and job title. We do not expect to collect any other personal data, and request that you do not share personal data during the session.

If you have any questions as we go along, please ask. If you need to take a break at any point, do let me know.

With your permission, I am going to record your screen and microphone. Thank you for giving permission before we began the recording. The audio and screen recording will be used by me and Professor Nicholas Caldwell, and won't be used by anyone else. I will use Teams to create an automatic transcript.

Data in the form of recordings and transcripts will be stored electronically until the end of the project (April 2022) and deleted then.

You have already provided consent and permission for this session by email, which had a copy of the text for this introduction. It says we have your permission to audio record and screen record, and that these recordings will only be seen by myself and Nicholas Caldwell working on this project. Thank you.

Do I still have your consent to audio record, screen record and collect an automated transcript?

Do you have any questions so far?

Scenarios have been created with Richard Webster and Andy Allberry, Suffolk County Council

Scenario 1: logon

Scenario: At the start of a work day, please logon to the Suffolk County Council instance of the user interface as if you were a Suffolk County Council user.

Note: please explain any passwords, password change requirements, two-factor authentication, codes, emails, or other logon or security steps.

Scenario 2: out of hours switching

It is ten past two in the morning, and you're woken by a phone call from the police. They would like lighting on a road within your lighting area to be switched on immediately in order to facilitate their investigation. Lights should remain on during the rest of the night. SCC wants the lighting to revert to normal profile the following night.

Note: if switch on/off are identical processes, for this test during the daytime, switching on lights that are currently off would be considered the same process).

Scenario 3: Event file and control log

Automated process so not a task scenario, just the question.

Question: Can you show us that the energy event file and control log are automatically generated and provided to 3rd party administrator for billing?

Scenario 4: Extract of data

Scenario: You wish to confirm power drawn by a range of lanterns, to provide confidence that the lanterns are working (or that the lanterns have been changed to lower power ones). Extract the power readings for previous 24 hours for a set of assets stated by Andy at time of scenario

Question: What data can be extracted and how?

Scenario 5: Extract of daily faults

Scenario: We need to check our contractor is meeting KPI, please extract the daily faults list. Show the current faults as a list on the day of the scenario, and another historic date given by Andy on the day of the review.

Question: can this also be automated?

Scenario 6: Communications

Scenario: Please look which assets are communicating or not communicating. Extract a list of non-communicating assets at the time of the scenario, and also those on a historic date given by Andy at the time of the scenario.

Question: Is there further information on reason for not communicating that can be accessed remotely?

Scenario 7: Part-night lighting profile

Scenario: A change has occurred in the management of a group of lights. Please amend a list (given by Andy at the time of the scenario) of lights and apply part-night lighting profile.

Scenario 8: Creation of a new asset in the system

Scenario: A new asset has been installed. Please create it as an asset on the system. New asset details provided by Andy at the time of the scenario.