

# A NEW APPROACH TO TRAFFIC SIGNAL AND ITS EQUIPMENT MAINTENANCE IN THE CITY OF YORK

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## 1 Introduction

The typical approach adopted by many local authorities to the maintenance of traffic signals, CCTV and other ITS equipment has changed little in recent years and does not fully support local authorities in the efficient management of the maintenance process or provide information for network managers. City of York Council (CYC), like many authorities, is striving to improve the level of service offered whilst reducing costs so as the ‘traditional’ maintenance contract was nearing its end this provided an opportunity to develop a more innovative and effective maintenance contract for York.

This paper describes why CYC decided to operate its own fault management system (FMS) and the requirements developed by CYC for reporting, managing and clearing faults. Facilities provided to support network managers are also described together with the solution implemented including the available features and facilities of the on line approach adopted,

The new system came into operation 1 November 2011 and the paper highlights the benefits of the approach for the City Council signals staff and network managers as well as the maintenance contractors. The impact to on street operation is also assessed and the paper concludes by considering how the new approach implemented in York could be developed for future maintenance contracts to provide better network operation and reduced operating costs.

## 2 Why CYC Chose to Implement its own Fault Management System

Many local authorities are now realising that fault data, together with other operational information such as periodic inspection reports, bulk lamp change details, cleaning details etc, is important for the effective operation and maintenance of traffic signals and ITS infrastructure. To maintain the control and continuity of this information CYC decided to implement its own FMS.

Many local authorities run multiple ITS maintenance contracts and having a separate user interface for each contract and this can lead to wasted staff time and effort and increased risk of errors. Thus CYC decided to develop its FMS to provide a consistent user interface to manage multiple contracts, initially developing the FMS for two contracts, traffic signals and rising bollards plus CCTV.

Because the FMS is owned by CYC it could be developed by the City Council to provide the most efficient interface to report, clear and manage faults. Key Performance Indicators (KPIs) could be automatically created and the data held within the FMS would be easily interrogatable to provide information necessary to manage the Contractors to ensure the works are being undertaken in line with the Contract requirements or if not that appropriate measures were undertaken. The Contractors would also have access to the same management information and thus could manage the works to maximise performance and ensure the Contract requirements were met and rebates for failure to perform minimised.

Information about faults can also be helpful to manage faults, for example if a site has a higher fault rate than equivalent sites or repeat faults. Automatic creation of routine management reports could also save considerable staff time and effort.

The Local Authority could also use information from the FMS to feed into asset management

planning and determining where and when scarce resources should be invested.

### **3 Operational Requirements**

CYC required the system to provide an effective and easy to use interface with the following features and facilities:

- a) Simplified and efficient fault reporting processes utilising drop down menus to minimise staff time to report faults;
- b) Simplified and efficient fault clearance processes, usually used by the maintenance contractor, from site or office, utilising drop down menus;
- c) Custom displays of live faults, including fault status and clearance information, readily and clearly available including colour coding to highlight when faults have not been cleared within the time specified in the Contract;
- d) Information held on inspections, cleaning etc plus miscellaneous events such as when sites switched off for utility works or when road traffic accidents occurred;
- e) Data presented and analysable using available tools on an area or site basis; and
- f) Key performance indicators to support contract management.

CYC also chose to refine the way faults were reported to the contractor to ensure no faults were missed:

- a) Fault reported to the Contractor and the Contractor is given a defined period (dependant on fault severity) to acknowledge the fault; then
- b) Once acknowledged by the contractor the time by which the fault must be closed (which is dependent on fault severity) is calculated and displayed.

The Contractor also manages the fault clearance process and this has been simplified to allow site staff to directly enter clearances.

In order to increase staff efficiency a simple interface that utilises standard technology maximises the information about the fault at all steps within its life cycle but also allows devices such as internet connected tablets or phones to access the system through the web browser without relying on proprietary technology or the development of dedicated client apps.

### **4. Network management Information**

Network managers need to know:

- a) When there are 'live' faults with significant operational impact, particularly at key sites;
- b) When the fault should be cleared by; and
- c) That the data needed for contract performance management is available and capable of yielding meaningful insights into how contracts are operating.

CYC required the flexibility to share relevant information with network managers in different ways including allowing access to the FMS or automatic creation of emails.

### **5. IMTRAC Fault Management System**

CYC opted to utilise IMTRAC as a base to their FMS as it had a proven track record of operation within York and elsewhere, already utilised intuitive drop down based menus and presented the opportunity to fuse detailed asset data with fault data to support effective maintenance.

IMTRAC FMS as it is known has helped CYC satisfy their original objectives by providing:

- a) Full alignment with CYC's contract requirements;
- b) Clear, simple and intuitive interfaces for opening and closing faults as well as other elements of the fault life cycle (as Shown in Figure 1);

- c) Providing a filterable overview of all outstanding faults with colour coded displays showing times when faults have to be cleared by;
- d) Service Level monitoring facilities through automated KPI generation facilities; and
- e) Fault monitoring and assessment tools.

**Figure 1: Live Fault Overview (Dummy Data)**

Fault ID	Site ID	Address	Type	Fault Description	Severity	R...	Reported	Acknowledge By	Acknowledged	Close By	Functions
F-000010	YK218	Huntington Rd - Haleys Terrace	Signals	Pedestrian Phase Inhibited	High	P...	21/08/2012 - 11:30	21/08/2012 - 11:40	21/08/2012 - 11:30	21/08/2012 - 15:30	<a href="#">Close</a> <a href="#">Demote</a>
F-000009	YK210	Blossom Street - Queen Street	Signals	Minor Damage	Standard	P...	21/08/2012 - 11:30	21/08/2012 - 15:30	<a href="#">Acknowledge</a>	Not acknowledged	<a href="#">Not acknowledged</a>
F-000008	YK210	Blossom Street - Queen Street	Signals	All Out - Junction	High	P...	15/08/2012 - 16:12	15/08/2012 - 16:22	<a href="#">Acknowledge</a>	Not acknowledged	<a href="#">Not acknowledged</a>
F-000006	YK262	Boroughbridge Road - Beckie...	Signals	Single Lamp Out	Medium	P...	14/08/2012 - 17:26	15/08/2012 - 09:00	14/08/2012 - 17:27	15/08/2012 - 15:00	<a href="#">Close</a> <a href="#">Demote</a>
F-000004	YK201	Heworth Road - Melrosegate ...	Signals	Single Lamp Out	Medium	P...	13/08/2012 - 11:32	13/08/2012 - 13:32	21/08/2012 - 11:23	22/08/2012 - 09:23	<a href="#">Close</a> <a href="#">Demote</a>
F-000003	YK218	Huntington Rd - Haleys Terrace	Signals	Equipment Damaged	High	P...	06/08/2012 - 11:00	Fault opened retr...	Fault opened retr...	06/08/2012 - 15:00	<a href="#">Close</a> <a href="#">Demote</a>
F-000002	YK034	Monk Bar Car Park / Entrance ...	CCTV Camera	Loss of Digital Video Recording	High	P...	13/08/2012 - 11:27	13/08/2012 - 11:37	13/08/2012 - 11:28	13/08/2012 - 15:28	<a href="#">Close</a> <a href="#">Demote</a>
F-000001	YK201	Heworth Road - Melrosegate ...	Signals	Signals stuck on red / not cha...	High	P...	13/08/2012 - 11:20	13/08/2012 - 11:30	15/08/2012 - 16:11	15/08/2012 - 20:11	<a href="#">Close</a> <a href="#">Demote</a>

Fault Data Status: Fault Ref: F-000010 successfully created!

Records 1-8 of 8 displayed. Page 1 of 1 page(s). Live Faults Last Updated: 21/08/2012 - 11:27 Time: 11:31:20

All interfaces within the system utilise components and design styles utilised elsewhere within IMTRAC to ensure that users had a familiar interface which also minimised training requirements and maximised operational efficiency.

IMTRAC FMS automatically provides KPIs as defined in the CYC maintenance contract and this is freely available to both CYC and their contractors (as shown in Figure 2). The KPIs include a mixture of traditional measures such as time taken to attend and fix a fault as well as output driven variants such as controller availability. This flexible approach and the ease at which fault data and KPIs can be accessed maximise the performance of the contractor and thus improves network performance.

**Figure 2: Acknowledge Time KPI (Dummy Data)**

Severity	Target Time	No Faults	In Time	Number	%	Target %	Dif %
Emergency	10 minutes	0	0	N/A	99%	99%	N/A
High	10 minutes	12	10	83.33%	95%	95%	-11.67%
Medium	2 hours	2	1	50%	95%	95%	-45%
Standard	4 hours	2	2	100%	95%	95%	5%
Scheduled	9 hours	1	1	100%	95%	95%	5%
	Total	17	14		-	82.35%	

Notes:  
1. Date fields are inclusive; and  
2. For closed faults the starting date is based on the date the fault was created (not the date it was acknowledged).

Fault Data Status: Fault Ref: F-000020 successfully created!

Live Faults Last Updated: 21/08/2012 - 11:37 Time: 11:39:18

To ensure that IMTRAC FMS correctly implemented the Contract requirements it has been developed designed in a modular fashion that allows different modules to be coupled depending on the functionality required (Fault detail including site log shown in Figure 3).

The screenshot shows the 'Fault Details for F-000013' page. At the top, there's a map of a street area with various icons. Below the map, the title 'Fault Details for F-000013' is displayed. The fault details section includes:

- Site:** YK210 - Blossom Street - Queen Street
- Fault Description:** Equipment Damaged - High Priority
- Additional Information:** P12 - Push button fascia vandalised
- Comments:** -
- Reported:** 21/08/2012 - 11:35 by Peter Routledge
- Acknowledged:** 21/08/2012 - 11:35 by Peter Routledge
- Due for Closure:** 21/08/2012 - 15:35

The 'Engineer Demotions' section indicates 'No Engineer demotions'.

The 'Site Log' section contains a table with three rows of data:

Event	Date	User Logged	Comments	Data
Fault	21/08/2012 - 11:35	Peter Routledge	F-000013: High - Equipment Damaged. Status: Open	<a href="#">Detail</a>
Fault	21/08/2012 - 11:30	Peter Routledge	F-000009: Standard - Minor Damage. Status: Open	<a href="#">Detail</a>
Fault	15/08/2012 - 16:12	Peter Routledge	F-000008: High - All Out - Junction. Status: Closed	<a href="#">Detail</a>

At the bottom of the page, there are buttons for 'Fault Data' and 'Status:'.

**Figure 3: Fault Detail Page (Dummy Data)**

## 6 Impact on Street and Benefits Achieved

IMTRAC FMS came into operation on 1 November 2011 has provided significant benefits to the management and operation of the Contract and also improving network performance. Key benefits include:

- Staff time savings for CYC and the contractors because of:
  - The use of a simple and effective user interface;
  - Simplified fault reporting and closure processes, the latter being handled by the contractor and usually by staff on site; and
  - Better access to information;
- Faults are cleared quicker as CYC and the contractor share a common repository of site information and statistical data hence engineers can access up to date drawings, controller specifications etc whilst on site;
- Improved site performance information is available as the site log shows all faults and events occurring on site and this comprehensive site history supports rectification of complex faults;
- Improved contract management by CYC and contractor managers because information is readily available to support the management function, for example:
  - 'Live' fault displays colour coded to show when faults have not been addressed within the contract specified times;
  - Automatic generation of KPIs; and
  - Tools to analyse fault data;
- Sites spend less time classed as 'faulty' as the onus for closing faults is explicitly pushed onto the engineer on site, this ensures that contractors are incentivised to mark a fault as closed as soon as it is closed. This then provides a better feedback loop to CYC and only 'live' faults are present

on the system.

- f) Safer and more efficient site work, as Data stored in the asset management modules of IMTRAC FMS ensure engineers have access to the latest plans and information pertaining to the site, via their mobile device.
- g) The way IMTRAC FMS has been written, using open standards and Web technologies allows Contractors to easily integrate into whatever back office systems they choose to continue to use.

Future robustness is also preserved when changing maintenance contractor as there is no risk of losing historical data if incumbent maintenance contractor does not win new contract.

Perhaps the best indicator of the success of the approach is CYC is now incorporating a third contract (VMS and on street displays) into IMTRAC FMS. IMTRAC FMS is now being used in Doncaster and two other local authorities have indicated their intention to implement their own in house FMS utilising the IMTRAC FMS platform.

## **7 Future Developments**

Taking FMS functionality in house has provided CYC not only with staff time savings and improved operational efficiency but also with a better understanding of where the process can be refined in order to further maximise efficiency, for example the amount of data recorded when a fault is closed tends to centre around the time of closure and the work undertaken, however if the process was broadened to allow for more complex responses dependant on the type of fault then more complex data mining processes could be developed, e.g. recording the phase on which a lamp fault occurred as a distinct field would allow enhanced detection of recurring fault patterns.

If required it would be possible to include additional information requirements to support network managers, for example engineer estimated arrival time on site, engineer on site etc. Current colour coding of faults is based on 'green' (meaning fault clearance time has not been reached) or 'red' (meaning the contract time to clear the fault has expired) but a new class coloured amber could be introduced to indicate the fault is approaching the time it should be cleared by.

As the system is web based it is simple to integrate with other systems (both internal and external to CYC) and emerging technologies. Emerging opportunities are continuing to be reviewed and the potential benefits and pitfalls assessed on a case by case basis.

## **8 Conclusion**

By choosing to operate its own FMS the CYC has achieved a number of significant benefits:

- a) Staff time savings for CYC and the contractors;
- b) Fault clearance times are reducing;
- c) Improved network performance;
- d) Information is available for network managers;
- e) Improved contract management; and
- f) Improved information for asset planning.

As maintenance contractors realise the potential of IMTRAC FMS to provide them with efficiency saving maintenance contract costs potentially could reduce.

