

Univerza v Ljubljani



**Oliver Forbes 92331483**

**CE 6014 Computer Mediated Communication**

**Lecturer: Asst. Prof. Dr. Matevž Dolenc, University of  
Ljubljana**

**Date: 04-Dec-2013.**

Project Report:

*Use of an Existing Integrated (GIS) Enabled,  
Pavement Management Information System to  
Digitally Plan and Deliver Real Time Services in the  
Field*



**ITC-Euromaster**

European Master in Construction Information Technology

## Table of Contents:

1.0	Preamble/Executive Summary .....	4
2.0	Introduction and Scope .....	5
2.1	MapRoad PMS .....	5
2.2	Microsoft Dynamics CRM .....	5
3.0	Background to the Use of the (MapRoad) Pavement Management System: .....	7
3.1	Key Reasons .....	8
4.0	Background to the CRM system manage Roads Service Requests.....	11
5.0	MapRoad PMS Functionality.....	16
5.1	MapRoad Pavement Management System .....	16
5.2	Open Source components: .....	17
5.2.1	Map Server.....	17
5.2.2	Open Layers .....	17
5.2.3	Python.....	17
5.3	Proprietary software Components .....	17
5.4	Operation.....	17
6.0	Existing Microsoft Dynamics CRM system Functionality. ....	19
7.0	System User Requirements.....	20
8.0	Functional Requirements.....	20
8.1	Map Road PMS Functionality.....	20
8.2	Microsoft Dynamics CRM System.....	21
9.0	Gap Analysis.....	21
10.0	Solutions .....	22
10.1	Mobile App .....	22
10.2	Workflow management software.....	22
10.3	Online document sharing software tool.....	22
10.4	Software tool to Integrate Maproad PMS and MS Dynamics CRM .....	23
10.5	Reporting Tool .....	23
11.0	Mobile Access to Process Support Documentation.....	25
11.1	Safe System of Work Plans .....	25

11.2	Traffic Management plans.....	26
11.3	Road Opening Licencing.....	27
11.4	Task Management Record Sheet.....	28
11.4.1	Google Drive .....	29
11.4.2	Dropbox: .....	29
11.4.3	SharePoint:.....	29
12.0	Conclusion.....	30
13.0	References .....	31

# 1.0 Preamble/Executive Summary

The proliferation of technology in the digital age has meant that business processes have become much more integrated in line with available technologies and thus have the possibility of migrating to a virtual space.

As a simple example: In the past the process of purchasing an airline ticket and going on a plane journey was initiated by going to a bank to get cash then going to a travel agent to purchase a ticket and finally ending with arrival at an airport where one presented the paper ticket at a check-in desk in order to finalise arrangements and travel onwards on the journey.

Through the use of computer mediated communication this process has now been reduced down into the simple task of accessing the airlines website from a mobile device, Selecting and Booking the required flight, then paying as part of this process and finally ending with the use of the same mobile device to check in and gain access to the flight at the airport. This has now evolved into a seamless and integrated process relative to those times before enhanced Computer mediated communication.

In all industries there now exists a multitude of software packages which assist how we work, in recent years much progress has been made in the technological fields related to construction and engineering disciplines, CAD is evolving into multidimensional BIM modelling which allows for detailed modelling of every aspect of an engineering project.

This BIM software is used to reduce risk, manage costs, and optimize schedules on complex building projects. Virtual Construction, 5D software now allows for an integrated approach to construction coordination, materials and quantity takeoff, costs estimation and project scheduling.

The same is true in the field with which I am most familiar with, that being Road Network Maintenance within the Local Government sector. In this report I shall propose how enhanced computer mediated communication will allow for further integration of existing software packages and how this can be used to enhance and improve all necessary outcomes in terms of roads maintenance operations.

## 2.0 Introduction and Scope

This report proposes to investigate how improvements could be made to two existing software systems:

- Map Road PMS
- Microsoft Dynamics CRM

These systems are being used independently to manage the delivery of road maintenance services in the area of Cork City Council.

The ability of the two systems to relate and share information will mean enhanced usability and help further satisfy the requirements of the users.

### 2.1 MapRoad PMS

This is an integrated, Geographical Information System (GIS) enabled roads Information system and is used to manage the following:

- Creation of inventory listings for of all road assets in the city, which takes physical parameters of the roads into account and creates a unique identifier for each length of road on a node to node basis.
- Physical Pavement Condition Surveys and condition ratings.
- Recording details of project works undertaken to renew/refurbish roads on a medium to large scale.
- Recording Details of spending and cost allocations to geographical locations.
- Plotting certain thematics such as collision data, traffic patterns public lighting issues and details of bridge assets etc.
- All these records have been collected and collated remotely from the PMS and have been inputted retrospectively at desktop level. This means that the asset management system does not reflect the condition of the assets or any activities associated with them in real time in the field. At present its functionality is simply a means of identifying programmed works in a GIS context with little or no ability to drill down through this information and extract further information relating to those works.

### 2.2 Microsoft Dynamics CRM

- The majority of works carried out by Cork City Road Maintenance is generated by a CSR (Customer Service Record) system which captures all requests and interactions with citizens

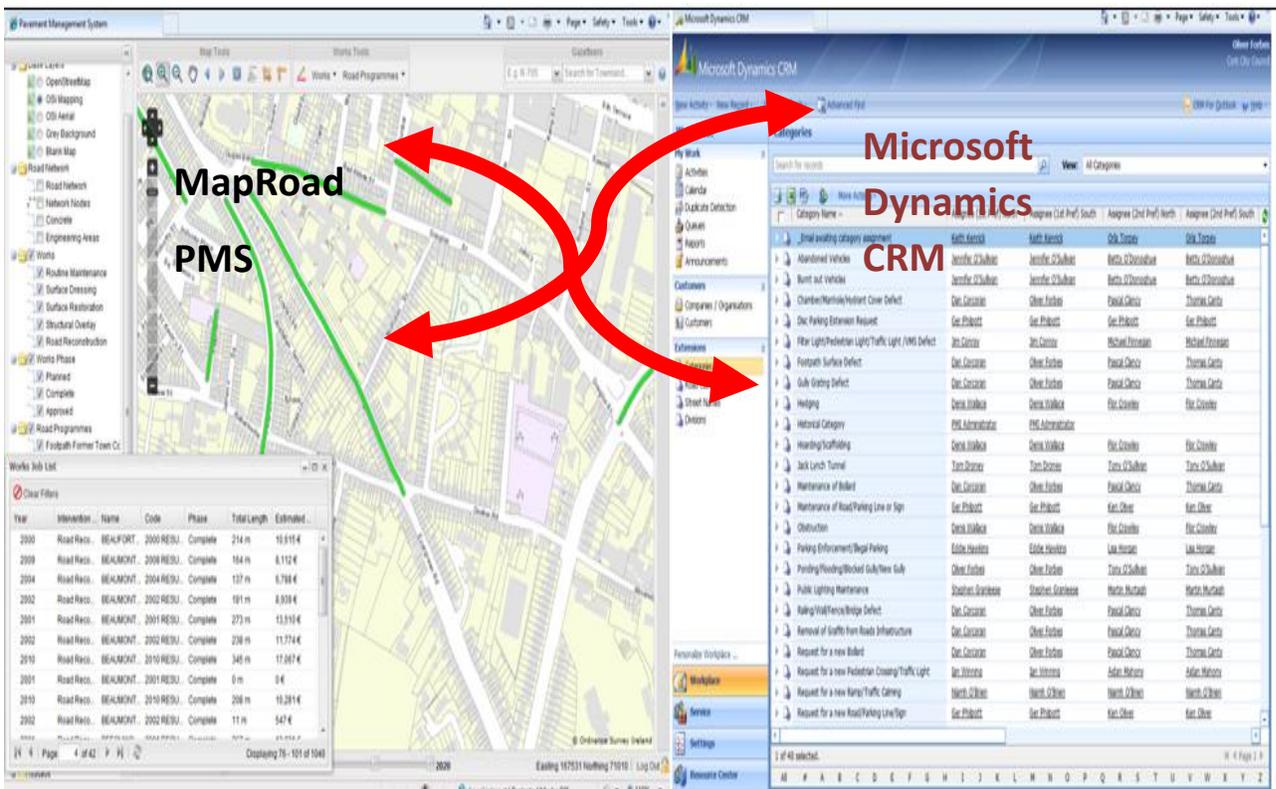
and stakeholders such as businesses and elected representatives. Generally these requests for service identify issues which require immediate attention.

- This day to day routine work is presently managed outside of the PMS system so additional data entry is required to reflect the evolving realities in the field and to update on works carried out to the roads as they occur. Unfortunately at present sufficient resources are not in place for this level of retrospective data entry.

By utilising enhanced computer mediated communication between the systems I would propose to create a holistic higher level PMS system which not only integrates recording and planning of works at a larger renewal scheme level but also allows for low value works to be micro managed remotely allowing for Resources, Traffic management plans, safe system of work plans, road opening licencing to be all and to communicate directly with CSR systems to give real time feedback on works to the citizenry and stakeholders.

This will in turn allow for the following outputs:

- It will allow for a wider audience of local authority users due to expansive nature of its use.
- Make data-entry more efficient.
- Improve outputs from system which will assist in the decision making process.
- Allow for better record keeping in defending Public liability claims.
- Allow for real-time up dates to the public on issues they have raised.



Screen Images of the two Programmes side by side

### 3.0 Background to the Use of the (MapRoad) Pavement Management System:

Here in Ireland Local Authorities are responsible for the administration, construction, and maintenance of approximately 87,000 kilometers of National and Non-National roadways.

In Cork City, The Roads Asset Management & Maintenance Division is responsible for maintaining the City's Road Network which is comprised of approximately 500 km of various class of road varying from 3 lane dual carriage-ways to local and estate roads of varying degrees of importance.

Physical works involve the maintenance, repair and/or renewal of the various road and footpath surfaces throughout the network.

This is in addition to an extensive programme of road resurfacing and footpath renewals. Generally these repairs are required on an ongoing basis as part of planned renewals as well as dealing with requests from the public concerning the rectification of defects.

The extent of works possible in any year depends on funds made available from Government grants, revenue raised from rates and payments received from outside agencies. Inadequate funding over recent years has led to large sections of roads and footpaths being under maintained with consequential effect on current condition. Cork City and its surroundings have seen millions of pounds invested over previous decades designing, constructing and maintaining a modern road network. This road network is a valuable asset, which enables safe, efficient and convenient access to homes, businesses, industry etc. and impacts positively on the economic, social and cultural life of the city. It is vital that this asset is managed to secure maximum benefit for the community.

Considering the size of the road network and the limited funds available for its upkeep, Local Authorities' such as Cork City therefore need to optimize the use of their funds in their road maintenance management. This is where a Pavement Management System is advantageous, by providing an organized and coordinated approach to handling the pavement management process.

Research has shown that the use of properly formulated and constructed asset management planning provides real and immediate benefits in terms of maintaining assets, getting maximum value from available budgets, adopting appropriate service levels, ensuring political accountability for decisions affecting the assets and provision of levels of serviceability to the end user.

### 3.1 Key Reasons

The Key reasons for implementing a road asset management system are:

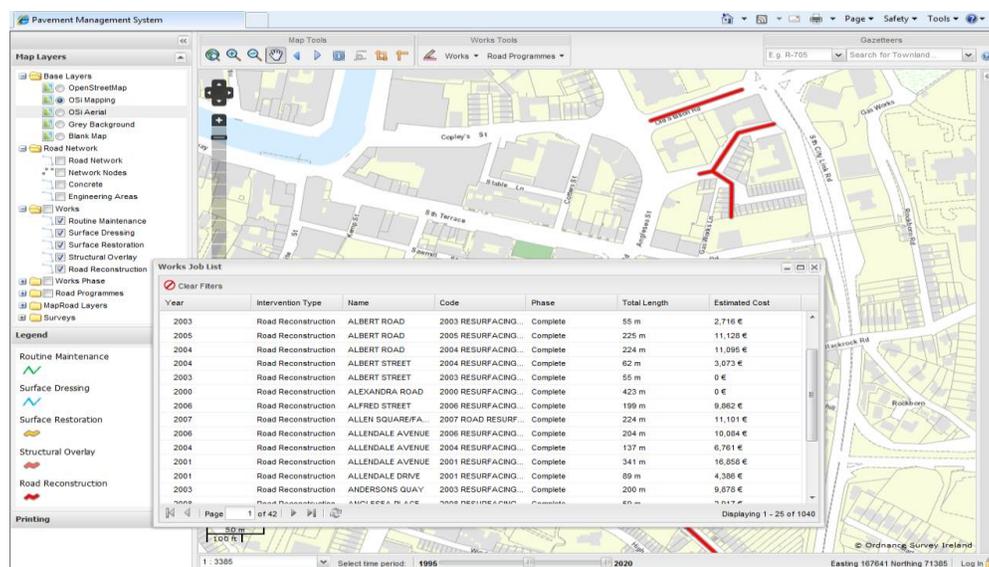
- The Importance of appropriate maintenance as road networks provide the platform for economic and social development
- Good quality infrastructure is the cornerstone of public safety
- Infrastructure and property assets increasingly meet recreational and other community needs
- Benchmarking condition and performance promotes innovation and efficiencies”.

The nature of the works captured and managed as part of this package are medium to large capital schemes, these are generally designed in house within the roads design-construction division and range from large scale street refurbishments, cycle routes and pedestrian mobility schemes to road overlays.

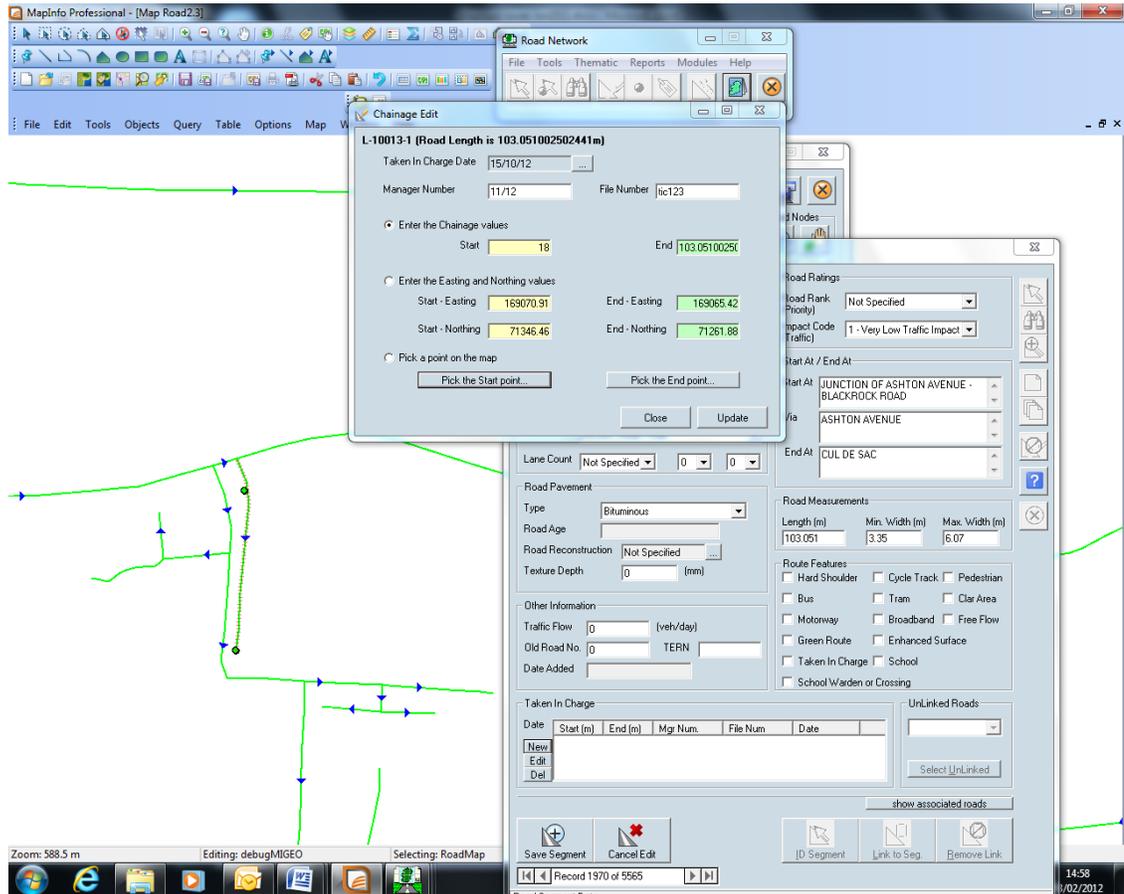
The value of such capital works in the most recent calendar year would amount to:

- Road Resurfacing Contract traffic routes and Estate Routes € 3,525,000
  - Barrack Street Area renewal Scheme € 850,000
  - Parnell Place Refurbishment € 2,542,000
  - UCC and Western Suburbs Green Route and mobility Corridor € 2,480,000
  - Knocknaheeny Apple Computers access road €2,400,000
- Total €11.8 million

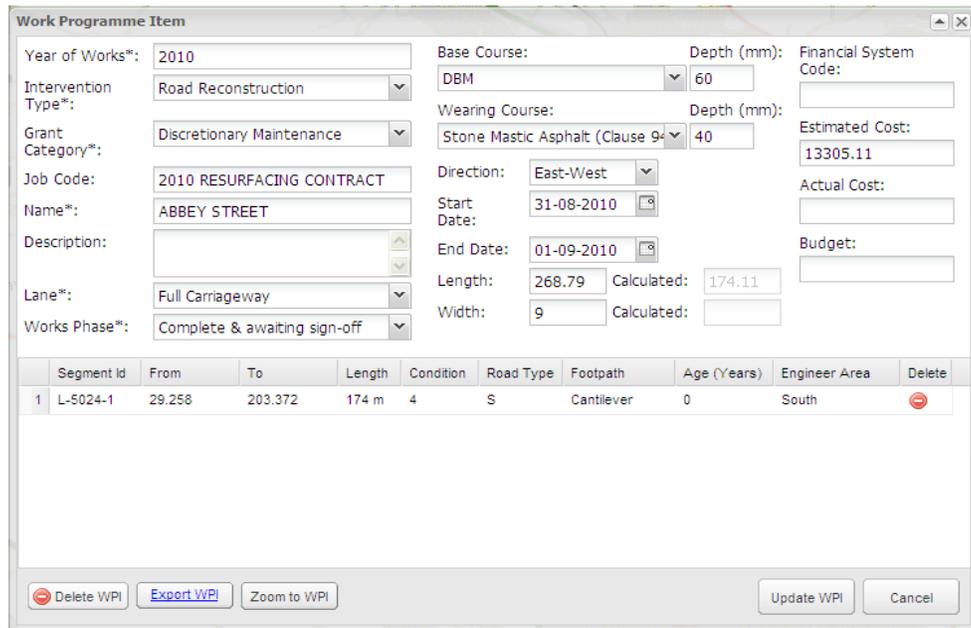
Funding is raised through a combination of City Council Revenue from Parking and other road related services, Block Grants from The NRA as well as direct funding from the DTTAS (Department of transport, tourism. Arts and Sport).



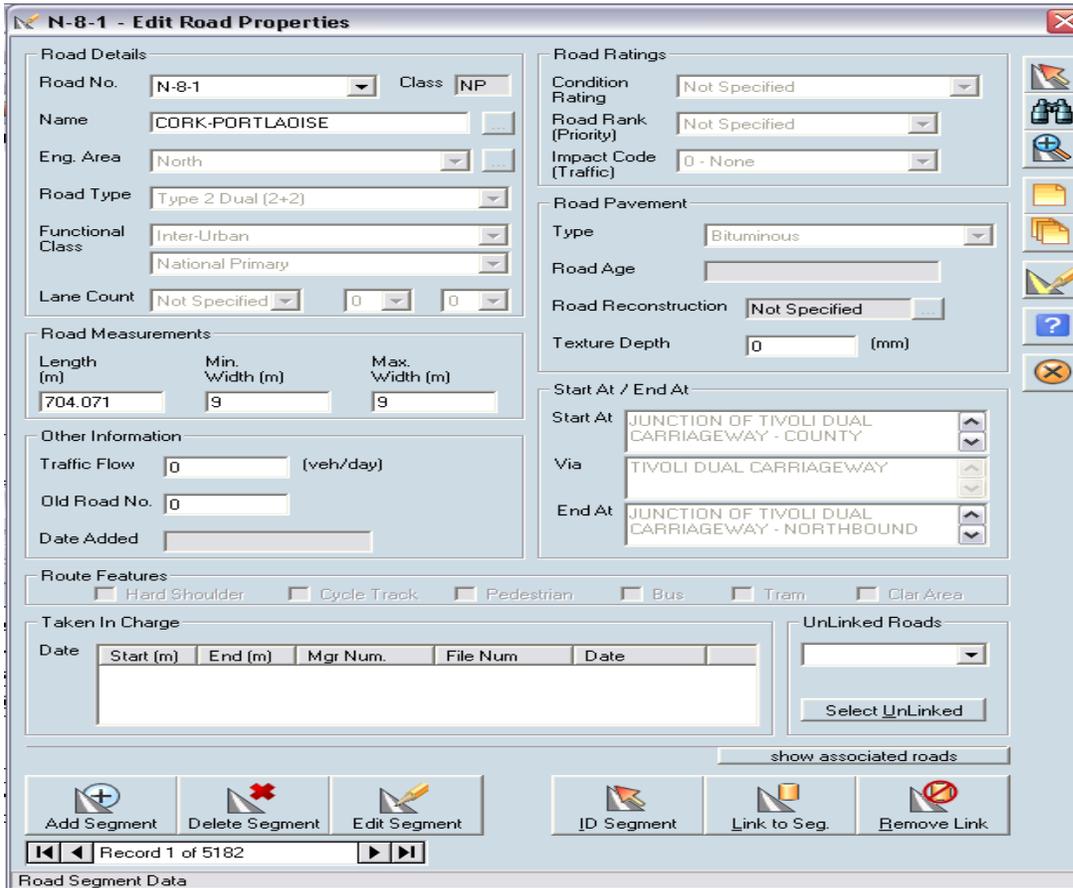
Maproad PMS showing the GIS Map with extracted data for works programme



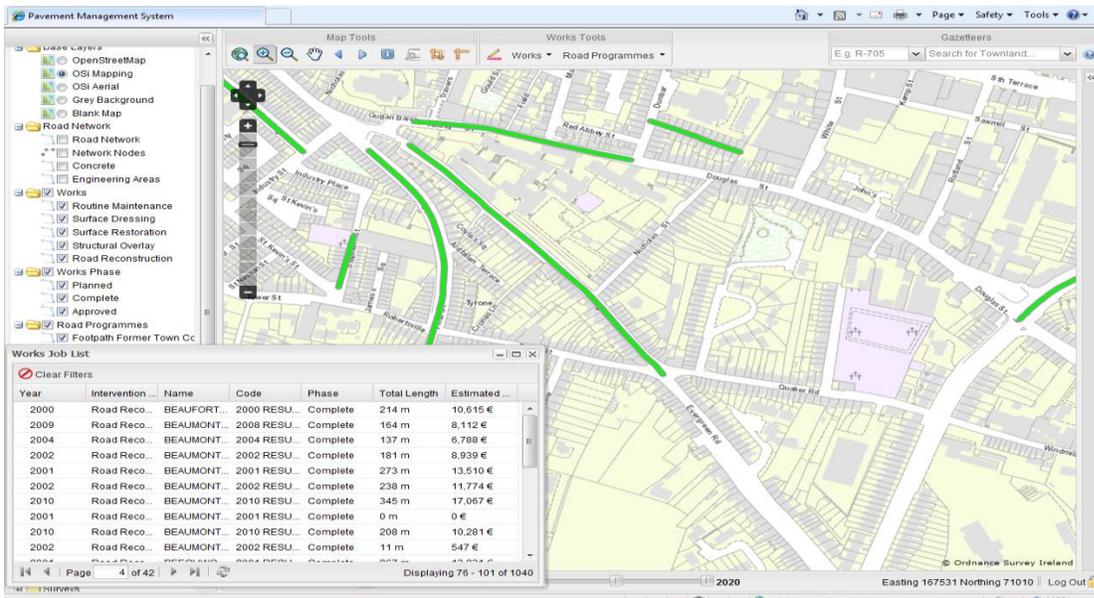
Maproad PMS showing the data entry phase to populate the GIS with information on each road asset



Maproad PMS showing data entry of capital works programme on a section of roadway



Maproad PMS showing editing portal to input data concerning physical properties of the roadway and other thematics such as numbering, Status and traffic flows.



Maproad PMS showing Selected features on GIS, and programme data for works on selected roads

Year	Intervention Type	Name	Code	Phase	Total Length	Estimated Cost
2007	Road Reconstructi...	ALLEN SQUARE/F...	2007 ROAD RESU...	Complete	224 m	11,101 €
2006	Road Reconstructi...	ALLENDALE AVEN...	2006 RESURFACI...	Complete	204 m	10,084 €
2004	Road Reconstructi...	ALLENDALE AVEN...	2004 RESURFACI...	Complete	137 m	6,761 €
2001	Road Reconstructi...	ALLENDALE AVEN...	2001 RESURFACI...	Complete	341 m	16,858 €
2001	Road Reconstructi...	ALLENDALE DRIVE	2001 RESURFACI...	Complete	89 m	4,386 €
2003	Road Reconstructi...	ANDERSONS QUAY	2003 RESURFACI...	Complete	200 m	9,878 €
2008	Road Reconstructi...	ANGLESEA PLACE	2008 RESURFACI...	Complete	59 m	2,917 €
2007	Road Reconstructi...	ANGLESEA STREET	2007 RESURFACI...	Complete	370 m	0 €
2000	Road Reconstructi...	ANGLESEA STREET	2000 RESURFACI...	Complete	365 m	0 €
1999	Road Reconstructi...	ANGLESEA TERRA...	1999 RESURFACI...	Complete	62 m	3,064 €
1999	Road Reconstructi...	ANGLESEA TERRA...	1999 RESURFACI...	Complete	62 m	3,068 €
1999	Road Reconstructi...	ANGLESEA TERRA...	1999 REURFACIN...	Complete	59 m	2,940 €
1999	Road Reconstructi...	ANGLESEA TERRA...	1999 RESURFACI...	Complete	61 m	3,024 €
2008	Road Reconstructi...	ANGLESEA TERRA...	2008 RESURFACI...	Complete	94 m	4,666 €

*Maproad PMS output to show details retained on current system relating to large scale capital (over-laying works)*

## 4.0 Background to the CRM system manage Roads Service Requests

Like most large organizations which need to manage interaction with external parties, Cork City Council uses a digital management system. However at a corporate level it uses a number of different CRM systems, these vary Sage to Salesforce and more recently SugarCRM depending on the relevant Department within the City Council. This is indicative of the lack of joined up thinking and use of cohesive policy implementation in Irish public administration over the last 20 years as technologies became available.

In the absence of an agreed corporate policy, different divisions within the organization were able to specify and customize bespoke CRM systems relative to their own particular needs. This is now a legacy issue and will take some time to unpick and homogenize at a corporate level.

The Roads and Transportation Directorate uses a CRM system to manage all customer requests concerning roads issues, these vary from public lighting, and parking issues all the way up to major road faults and defects which would have the potential for serious accidents and fatalities.

So with this in mind, it is extremely important that the main conduit of information from the public and external stakeholders to the relevant asset managers and works supervisors functions efficiently. The System used is Microsoft Dynamics CRM which has been customized by a 3rd party engineering software vendor to capture the particular requirements of Cork City Councils Roads and Transportation Directorate. At present there is a wide spectrum of users from Engineers, Foremen, Traffic managers, Traffic wardens and administrative staff, these would all be staff who

would have responsibility for specific Assets. Of the 99 overall staff within the Roads Maintenance Function 23 would have responsibilities assigned through the system.

01 Ref No.	02 Assignee	03 Customer	04 Category	05 Street Name	06 Description	07 Priority	14 Logged On	09 Closure Due	08
018096	Oliver Forbes	Mary O'Brien	Ponding/Flooding	SAINT FINBARR'S	Blocked gully o...	Routine	26/11/2013 15...	10/12/2013	In
018093	Oliver Forbes	Anon Anon	Road Surface Defe	WESTSIDE ESTA	Caller reports a ...	Routine	26/11/2013 12...	21/01/2014	In
018087	Oliver Forbes	Citizen	Road Surface Defe	WOODHALL ESTA	Potholes at abo...	Routine	26/11/2013 09...	21/01/2014	In
018086	Oliver Forbes	Moir Fordie	Footpath Surface	ANGLESEA STREE	lip on footpath ...	Routine	26/11/2013 09...	21/01/2014	In
018083	Oliver Forbes	Ted Powell	Road Surface Defe	DEERPARK ROAD	There is a hole i...	High	25/11/2013 15...	20/01/2014	In
018082	Oliver Forbes	Tom O'Sullivan	Road Surface Defe	KENLEY ROAD	Caller reported ...	Routine	25/11/2013 14...	20/01/2014	In
018076	Oliver Forbes	Citizen	Footpath Surface	SAINT FINBARR'S	Gentleman cam...	Routine	22/11/2013 15...	17/01/2014	In
018046	Oliver Forbes	Carán Lynch TD	Hedging	EDWARD WALSH	Please see atta...	Routine	20/11/2013 09...	15/01/2014	Re
018020	Oliver Forbes	Paul McDaid	Footpath Surface	THE CRESCENT -	When it rains h...	Routine	14/11/2013 14...	09/01/2014	In
017982	Oliver Forbes	Mary O'Keefe	Footpath Surface	CURRAHEEN DRIV	...regarding bro...	Routine	12/11/2013 09...	07/01/2014	In
017977	Oliver Forbes	FYS Incident User	Road Surface Defe	SOUTH DOUGLAS	Large Potholes ...	Routine	11/11/2013 15...	06/01/2014	In
017971	Oliver Forbes	Cass Fitzpatrick	Railing/Wal/Fence	CORVALLEY COU	Caller reported ...	Routine	11/11/2013 14...	06/01/2014	In
017964	Oliver Forbes	Ether O'Donovan	Road resurfacing	TIFFANY DOWNS	The entire esta...	Routine	08/11/2013 16...	07/11/2014	In
017938	Oliver Forbes	Michael McCarthy	Road Surface Defe	BALLINLOUGH RO	Mr. McCarthy ca...	Routine	06/11/2013 12...	20/11/2013	In
017934	Oliver Forbes	Derry O'Sullivan	Road Surface Defe	MCGRATH PARK	Caller reported ...	Routine	06/11/2013 11...	01/01/2014	In
017917	Oliver Forbes	Brian Gabriel	Waste Material (M	CARRIGROHANE R		Routine	05/11/2013 14...	19/11/2013	Re
017886	Oliver Forbes	Mary Hayes-Walsh	Weed Spraying/C	WELLESLEY TERR	Caller requests ...	Routine	04/11/2013 09...	30/12/2013	In
017854	Oliver Forbes	Mary Shields (cl)	Chamber/Manhole	THE RISE	At first entranc...	Routine	30/10/2013 12...	25/12/2013	In
017848	Oliver Forbes	Mary Reidy	Footpath Surface	BROWNINGSTOW	Caller reported ...	Routine	30/10/2013 09...	25/12/2013	In
017815	Oliver Forbes	Geralkine Lumley	Road Surface Defe	BEECHWOOD PAR	Huge craters of...	Routine	24/10/2013 15...	19/12/2013	In
017797	Oliver Forbes	Jerry Buttner TD	Road Surface Defe	SAINT FINBARR'S		Routine	23/10/2013 15...	18/12/2013	In
017777	Oliver Forbes	Kav Murphy	Road Surface Defe	SOUTH DOUGLAS	Caller has repor...	Routine	22/10/2013 16...	17/12/2013	In
017770	Oliver Forbes	Barry Keane	Chamber/Manhole	CROAGHTA PARK	Caller reported ...	Routine	22/10/2013 11...	17/12/2013	In
017769	Oliver Forbes	Sharon Long	Road Surface Defe	KILBRACK LAWN	There was a w...	Routine	22/10/2013 11...	17/12/2013	In

Screen View showing Current CRM's assigned to Oliver Forbes –currently 96 open issues

Category Name	Assignee (1st Pref) North	Assignee (1st Pref) South	Assignee (2nd Pref) North	Assignee (2nd Pref) South
_Email awaiting category assignment	Keith Kenrick	Keith Kenrick	Oria Torpey	Oria Torpey
Abandoned Vehicles	Jennifer O'Sullivan	Jennifer O'Sullivan	Betty O'Donoghue	Betty O'Donoghue
Burnt out Vehicles	Jennifer O'Sullivan	Jennifer O'Sullivan	Betty O'Donoghue	Betty O'Donoghue
Chamber/Manhole/Hydrant Cover Defect	Dan Corcoran	Oliver Forbes	Pascal Clancy	Thomas Canty
Disc Parking Extension Request	Ger Philpott	Ger Philpott	Ger Philpott	Ger Philpott
Filter Light/Pedestrian Light/Traffic Light /VMS Defect	Jim Conroy	Jim Conroy	Michael Finneagan	Michael Finneagan
Footpath Surface Defect	Dan Corcoran	Oliver Forbes	Pascal Clancy	Thomas Canty
Gully Grating Defect	Dan Corcoran	Oliver Forbes	Pascal Clancy	Thomas Canty
Hedging	Denis Wallace	Denis Wallace	Flor Crowley	Flor Crowley
Historical Category	PMT Administrator	PMT Administrator		
Hoarding/Scaffolding	Denis Wallace	Denis Wallace	Flor Crowley	Flor Crowley
Jack Lynch Tunnel	Tom Droney	Tom Droney	Tony O'Sullivan	Tony O'Sullivan
Maintenance of Bollard	Dan Corcoran	Oliver Forbes	Pascal Clancy	Thomas Canty
Maintenance of Road/Parking Line or Sign	Ger Philpott	Ger Philpott	Ken Oliver	Ken Oliver
Obstruction	Denis Wallace	Denis Wallace	Flor Crowley	Flor Crowley
Parking Enforcement/Illegal Parking	Eddie Hawkins	Eddie Hawkins	Lisa Horgan	Lisa Horgan
Ponding/Flooding/Blocked Gully/New Gully	Oliver Forbes	Oliver Forbes	Tony O'Sullivan	Tony O'Sullivan
Public Lighting Maintenance	Stephen Granleese	Stephen Granleese	Martin Murtagh	Martin Murtagh
Railing/Wal/Fence/Bridge Defect	Dan Corcoran	Oliver Forbes	Pascal Clancy	Thomas Canty
Removal of Graffiti from Roads Infrastructure	Dan Corcoran	Oliver Forbes	Pascal Clancy	Thomas Canty
Request for a new Bollard	Dan Corcoran	Oliver Forbes	Pascal Clancy	Thomas Canty
Request for a new Pedestrian Crossing/Traffic Light	Jan Winning	Jan Winning	Aidan Mahony	Aidan Mahony
Request for a new Ramp/Traffic Calming	Namh O'Brien	Namh O'Brien	Namh O'Brien	Namh O'Brien
Request for a new Road/Parking Line/Sign	Ger Philpott	Ger Philpott	Ken Oliver	Ken Oliver

Screen view showing the various categories of issues which are captured as part of the system and details of the relevant assignees who have responsibility for these issues.

Street Name	Location	Maintenance Zone	Area	Locality	Min X
ABBEY STREET	JUNCT DOUGLAS STREET	South			167,3
ABBOTS LANE	NORTH MALL	North			166,8
ACADEMY STREET	OFF PATRICKS ST	North			167,4
ADARE MEWS	NEAR ADARE VILLAS, COLLEGE RD	South			170,0
ADARE VILLAS	HIGHFIELD AVE	South			166,0
ADELAIDE PLACE	OFF GARDINERS HILL	North			168,6
ADELAIDE STREET	OFF NORTH MAIN ST	North			166,9
ADELAIDE TERRACE	SUMMERHILL	North			167,8
AHERLOW FLATS	OFF THOMAS DAVIS ST	North			167,5
ALACOQUE PLACE	WESTERN RD	North			165,2
ALBERT PLACE	SUMMERHILL	North			168,0
ALBERT QUAY	PARNELL BRIDGE	South			168,0
ALBERT ROAD	JUNCT VICTORIA RD	South			168,2
ALBERT STREET	JUNCT ALBERT RD	South			168,1
ALDERGROVE	HIGHFIELD WEST	South			165,9
ALDERWOOD	OFF SOUTH DOUGLAS RD	South			168,9
ALEXANDRA PLACE	OFF WELLINGTON RD	North			168,4
ALEXANDRA ROAD	JUNCT WELLINGTON RD	North			168,3
ALEXANDRA TERRACE	OFF ALEXANDRA RD	North			168,2
ALEXANDRA VILLAS	OFF MILITARY RD	North			168,3
ALFRED STREET	JUNCT LR GLANMIRE RD	North			168,1
ALLEN SQUARE	OFF BR RICE AVE/OFF GLENRYAN RD	North			166,9
ALLENDALE AVENUE	OFF ALLENDALE DRIVE	South			163,6
ALLENDALE DRIVE	OFF MELBOURN RD	South			163,6
ALLEVARD	LHS AFTER ASHTON AVE, BALLINTEMPLE	South			168,8
ALLINETT'S LANE	OPP BURKES AVE	North			167,2

Screen view showing the various street listings in alphabetical order

The following is a breakdown of the number of requests received over a 26 month period this amounts to over 6000 separate representations which required action and follow up.

It is quite apparent here that the majority of requests received comes from the roads maintenance function (nearly 3400) this clearly illustrates the significant body of works involved.

The amounts to an average of just over 12 requests received per working day over that time.

## CSR's Logged since October 2008 - November 2010

<b>Roads Maintenance:</b>	
Footpath Surface Defect	618
Gully Grating Defect	25
Chamber/Manhole/Hydrant Cover Defect	214
Maintenance of Bollard	95
Ponding/Flooding/Blocked Gully/New Gully	679
Railing/Wall/Fence/Bridge Defect	108
Removal of Graffiti from Roads Infrastructure	10
Road Surface Defect – Pothole/Ramp/Sinking/cracking	966
Road Surface Defect – Trench/Cutting	101
Waste Material (Mud/Soil/Debris etc on Public Road)	49
Weed Spraying/Clearing	15
Road resurfacing or footpath renewal request	169
Spillage – Oil or Chemical or Ice	324
<b>Total</b>	<b>3373</b>

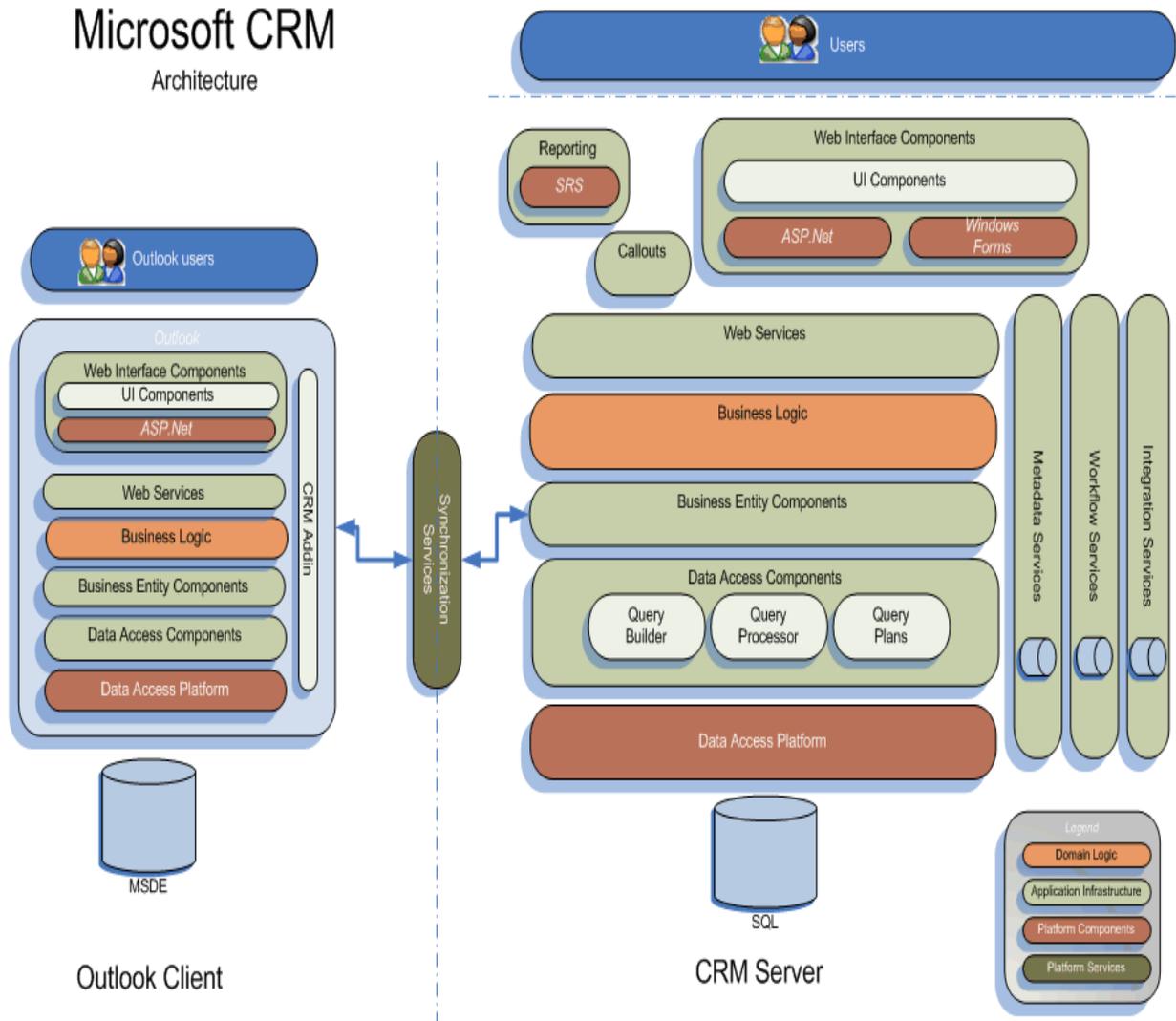
<b>Roads Traffic Infrastructure Maintenance:</b>	
Filter Light/Pedestrian Light/Traffic Light /VMS Defect	259
Maintenance of Road/Parking Line or Sign	394
Public Lighting Maintenance	673
<b>Total</b>	<b>1326</b>

<b>Request for new Infrastructure:</b>	
Request for a new Bollard	45
Request for a new Pedestrian Crossing/Traffic Light	20
Request for a new Ramp/Traffic Calming	131
Request for a new Road/Parking Line/Sign	60
Request for new Public Lighting	19
Request to Close a Laneway	23
Request to convert Green Areas to Parking	37
Street Nameplate	53
<b>Total</b>	<b>388</b>

<b>Operational CSR's:</b>	
Abandoned Vehicles	433
Burnt out Vehicles	86
Disc Parking Extension Request	19
Hedging	162
Hoarding/Scaffolding	12
Jack Lynch Tunnel	2
Obstruction	115
Parking Enforcement/Illegal Parking	25
Resurfacing Contract Works Complaints	92
South Ring Road	9
Stop Cock Cover Missing	27
Street Furniture	4
Unlawful Sale of Vehicle on a Public Road	6
<b>Total</b>	<b>992</b>

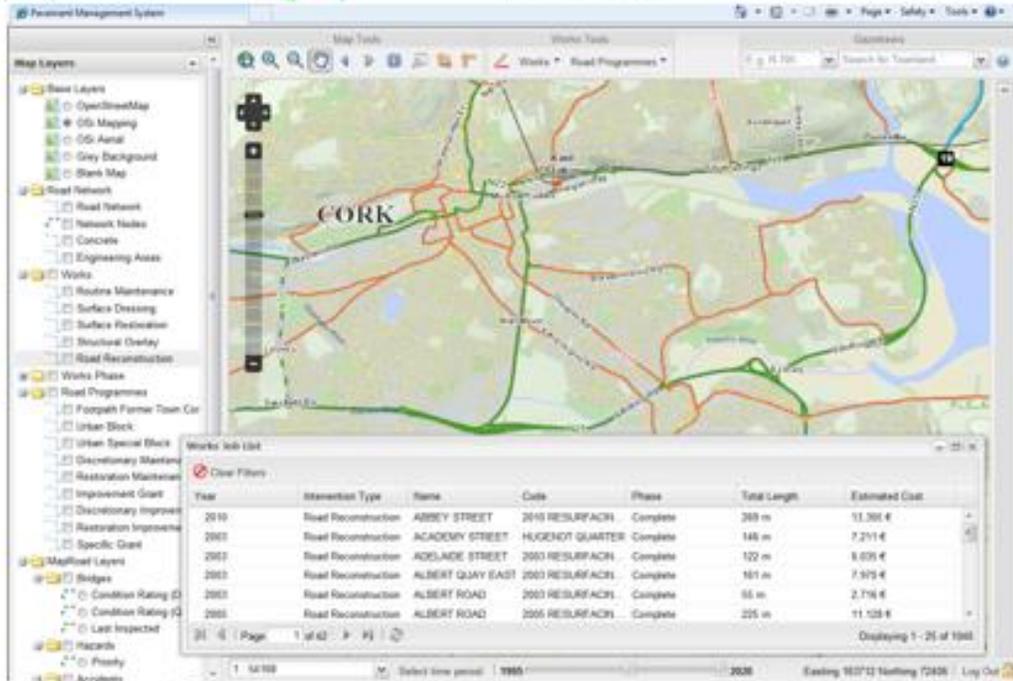
<b>Grand Total</b>	<b>6079</b>
--------------------	-------------

# Microsoft CRM Architecture



*Typical System Architecture of Microsoft CRM*

# 5.0 MapRoad PMS Functionality



## 5.1 MapRoad Pavement Management System

MapRoad Pavement Management System – is a cross Platform GIS Roads Management Toolkit. The web solution is open source, with proprietary elements, and allows assessments including routing, feature editing and attribution with time period based visualization. As a hybrid system it utilises both open source and proprietary software components, this allows for a great deal of flexibility in terms of customisation and development. The main components are summarised as follows:

## 5.2 Open Source components:

### 5.2.1 Map Server

Mapserver – is an open source development environment for building spatially-enabled web mapping applications and services. Which is fast, flexible, reliable and can be integrated into many GIS environments. It was originally developed at the University of Minnesota. MapServer is now maintained by developers around the world and runs on all major operating systems and will work with almost any web server.

MapServer features MapScript, a powerful scripting environment that supports many popular languages including PHP, Python, Perl, C# and Java. Using MapScript makes it fast and easy to build complex geospatial web applications.

### 5.2.2 Open Layers

Open Layers is an open source JavaScript library for displaying map data in web browsers. It provides an API (Application Programme interface) for building rich web-based geographic applications somewhat akin to those we are familiar with such as Google Maps or Bing Maps.

### 5.2.3 Python

**Python** is a widely used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in other languages. While providing constructs intended to enable clear programs on both a small and large scale supporting multiple paradigms. Its greatest advantage is probably its large standard library which provides many prepared tools for various tasks.

## 5.3 Proprietary software Components

All components run on the Windows Server 2008 operating system

**Microsoft SQL Server** is a relational database management system developed by Microsoft.

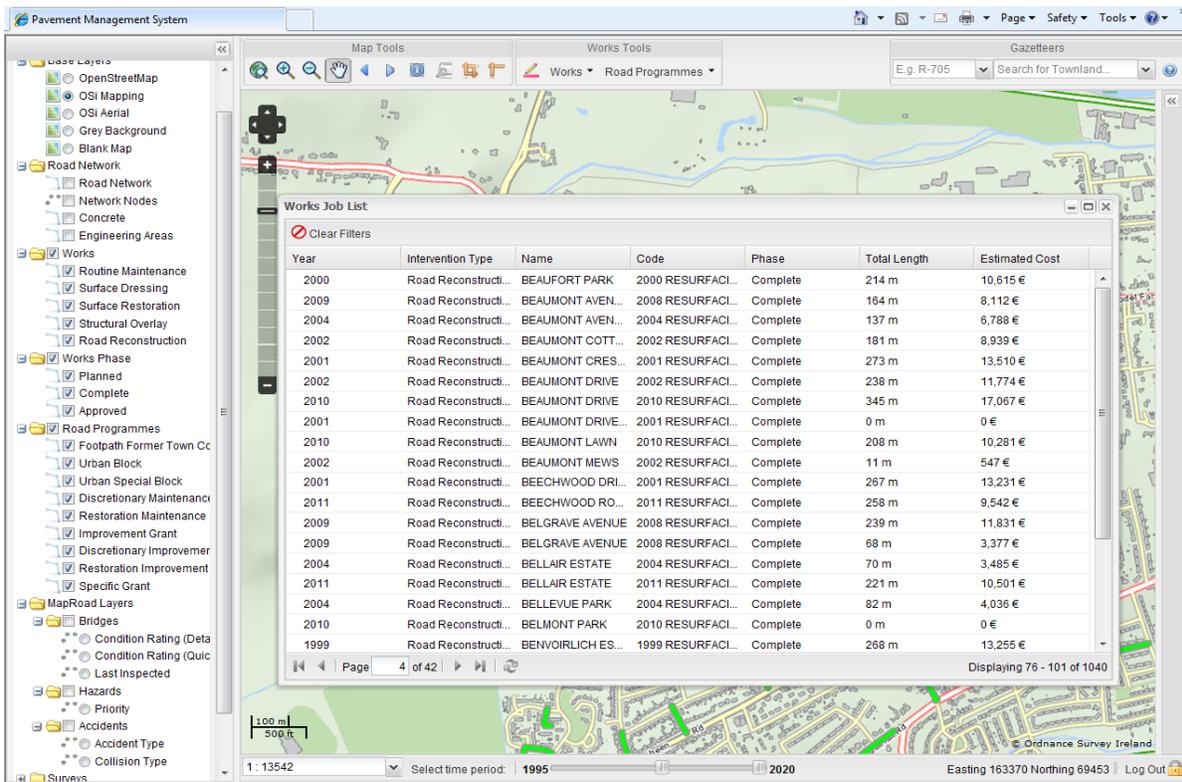
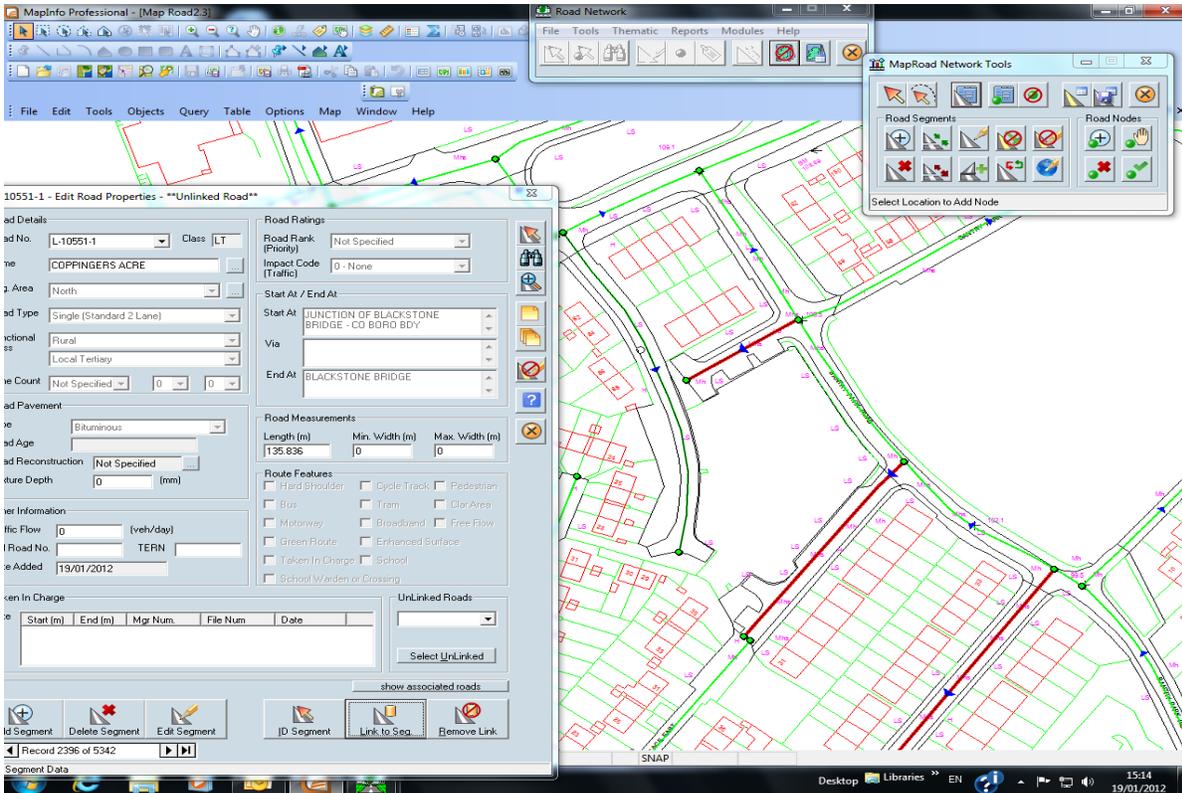
Its primary function is to store and retrieve data as requested by other software applications, be it those on the same computer or those running on another computer across a network (including the Internet).

## 5.4 Operation

At Present the PMS system is operated as follows, only 2 staff members of a total of 99 possible users have write/ control privileges and are able to make modifications to the system.

Each year the agreed programme for capital works of medium/long term durations are inputted in at desktop level by these staff members. The information inputted is the location of, and type of planned works as well as the financial cost for carrying out same.

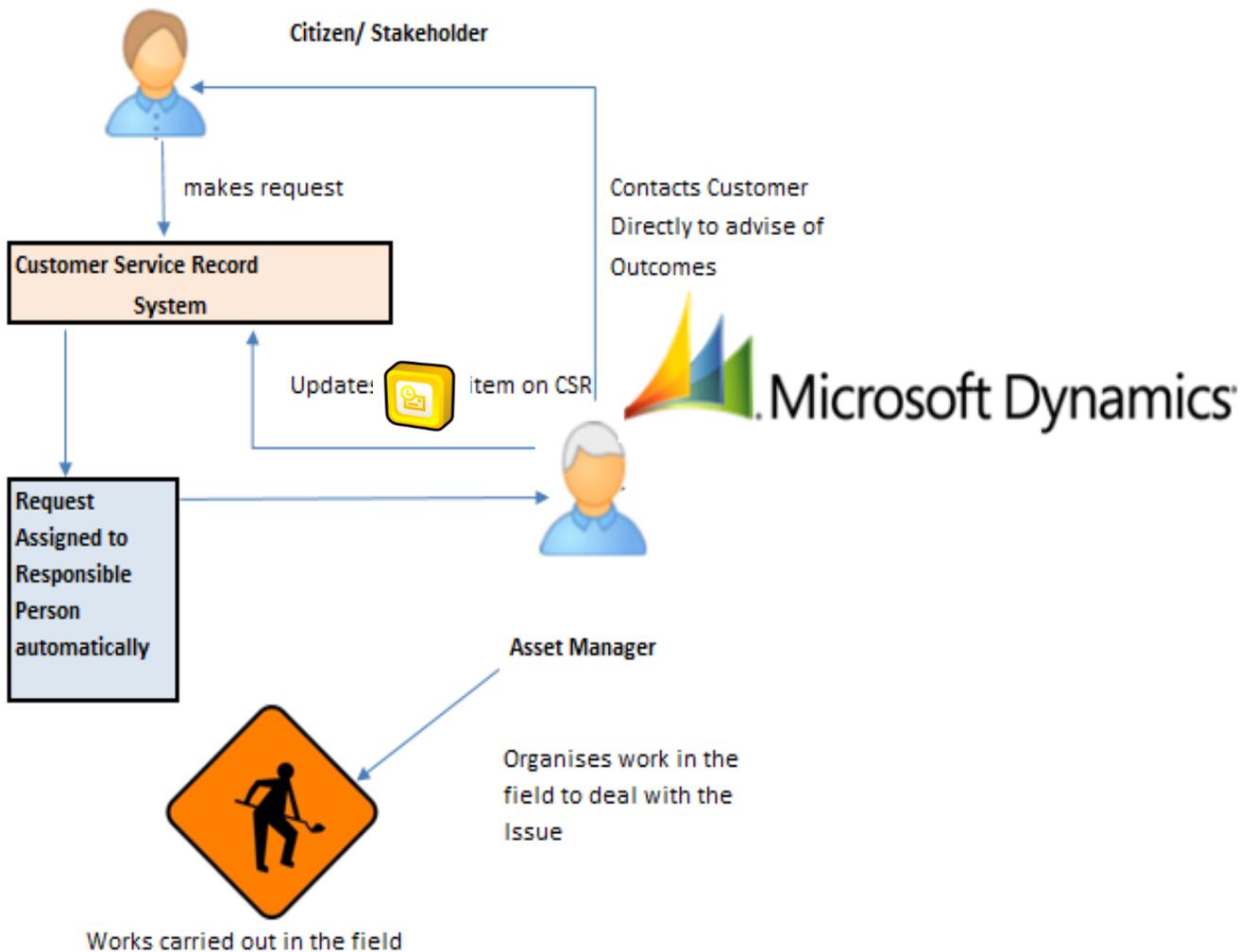
This data relates to resources allocated to particular lengths of roads contained within the system however as mentioned previously in this report it does not reflect demand /issue driven workflows, such as those which arise due to normal day to day CRM requests received.



Typical user interfaces of Mapraad PMS

## 6.0 Existing Microsoft Dynamics CRM system Functionality.

When a request for service is received, it is processed by frontline staff at the public interface, here it is logged on the existing CSR system which is a standalone version of Microsoft Dynamics CRM. It is assigned automatically to the relevant Asset Manager through an automated notification received through Microsoft outlook. The Asset Manager arranges for attention as required and will then close off the Issue on the CSR system. The asset manager then reports back to the customer via telephone/email/letter. This final step is a time sink for already hard pressed managers so some form of improvement would be most welcome here.



*Graphical Schematic of Current Process to deal with work items which are complaint driven as opposed to programmed works*

## 7.0 System User Requirements

The system requirements for both systems can be summarized as follows:

To create a holistic higher level PMS system which integrates recording and planning of works at a larger renewal scheme level and also allows for low value works to be micro managed remotely. The system must allow for Resources, Traffic management plans, safe system of work plans, road opening licences to all communicate directly with CSR systems and in turn give real time feedback on works to the citizenry and stakeholders.

The system should also be compatible with a mobile interface to allow for full access on site/in the field by relevant managers

Software shall allow for communication between the CRM/Works management package and the GIS Based Maproad

The use of a job management tool in conjunction with process works and integrate with management controls to execute the works and integrate with Maproad PMS

- Interoperability between the different packages. ( all proprietary software runs on Microsoft Platforms)
- Specifying a job management software which will meet requirements and will run in conjunction with the CRM and Maproad to incorporate road licensing requirements with Safe System of works plans as well as traffic management plans.

## 8.0 Functional Requirements

### 8.1 Map Road PMS Functionality

**The MapRoad PMS as a GIS Roads Asset Management Toolkit functions as follows**

- Be open source as much as possible to allow for future expansion and ease of modification.
- Allow for ease of use and simple data entry and data retrieval by staff to produce reports and performance metrics.
- Maintain and improve the condition of the road network by comparing overall network condition achieved per euro expended (targeted intervention levels, correct treatment types)
- Improve outputs from system which will assist in the decision-making and thus allow for increased service indicators.
- Improves the business case for investment in road network – increased prioritization for receipt of funding

- Effective & Efficient Maintenance Strategies and Budgeting process of Effectiveness – measure of actual performance compared to planned

## 8.2 Microsoft Dynamics CRM System

### **Microsoft Dynamics CRM System currently delivers the following requirements**

- Provides a platform through which customers can contact Cork City Council concerning roads and transportation issues
- Allows for easy cataloging of the nature and type of request received for saving as part of a database.
- Creates a unique identifier for each request and allows for tracking its progress to completion.
- Assigns and delegates requests to the appropriate asset manager.
- Allows for Automatic notifications to asset managers when key milestones are reached on the process.
- Allow for easy extraction and analysis of data to prepare reports
- Allow for detailed audit trailing of

## 9.0 Gap Analysis

### **In addition to the existing functional requirements I would propose that integration of the two systems would also deliver the following customized requirements which are currently not present**

- The PMS system should be able to integrate with current CRM system Microsoft Dynamics, and introduce a GIS overlap/Geo-tag into each Customer Service Request CSR received.
- CRM system should be able to integrate a workflow management system linked to Each CSR received and show this in a GIS context within the PMS system.
- The system should be able to share files and documents to all users either desktop or mobile which relate directly to the job management system such as Safe System of Work Plans and Traffic Management Plans as well as Road opening licenses.
- The system should be available through a mobile portal, allowing access in the field to look up information relating to a specific road and input information concerning that road in real time to give correct and up to date information on the relevant asset.
- An ability to track Process inputs such as financial resources, labour, mechanical plant and materials should be included
- Component for error checking of data and generation of alarms for overdue issues
- Security and access requirements, which provide an audit trail and take account of different user classes such as asset managers and administrators

- Reporting requirements – ability to produce detailed reports and analysis of performance metrics.

In order to close the gaps out a number of new bespoke software components will need to be developed. I would propose that these would be as follows

1. A mobile App. To allow to access records and manage works in the field through a simple smartphone or tablet.
2. Workflow management system which would create and track the workflows that are produced as a result of tasks created on the PMS/CRM system this would most likely be a customized version of a proprietary product as produced by Oracle, Sage or Microsoft such as MS Navision
3. Document sharing facilities.
4. Software tool to integrate the PMS with CRM using common MS server
5. Reporting tool which collates data from both systems to produce reports for management review,

## 10.0 Solutions

### 10.1 Mobile App

The smart mobile solution should operate on tablets and phones and have facilities for offline data editing but would primarily possess an automated synchronization to back-office systems. Thus giving access to Maproad PMS and the CRM system. These software tools are relatively easy and inexpensive to develop using C# and Xamarin/Mono to allow for use on Android/IOS/Windows depending on the units specified.

### 10.2 Workflow management software

For this element I would propose the use of a proprietary ERP system module for workflow/task management such as Maximo or more appropriately in this instance I would suggest a solution like Microsoft Dynamics Navision which as an ERP Business Management Solution would allow for seamless integration with Microsoft Dynamics. One would also expect that this could be easily configured to integrate the relevant system controls to deliver works in the field.

### 10.3 Online document sharing software tool

In order to deliver this aspect I would propose the use of simple cloud technologies. Which will be addressed in section 11 of this report, this would allow for a consistent and validated record of the controls put in place for workflows to be executed.

## 10.4 Software tool to Integrate Maproad PMS and MS Dynamics CRM

The obvious solution is to integrate the software which delivers both work streams this would ensure that medium to long term Capital Schemes which are currently administered and tracked using Maproad PMS are accessible to front line operatives in the field while response driven low value/low duration works are administered and tracked using Microsoft Dynamics CRM system

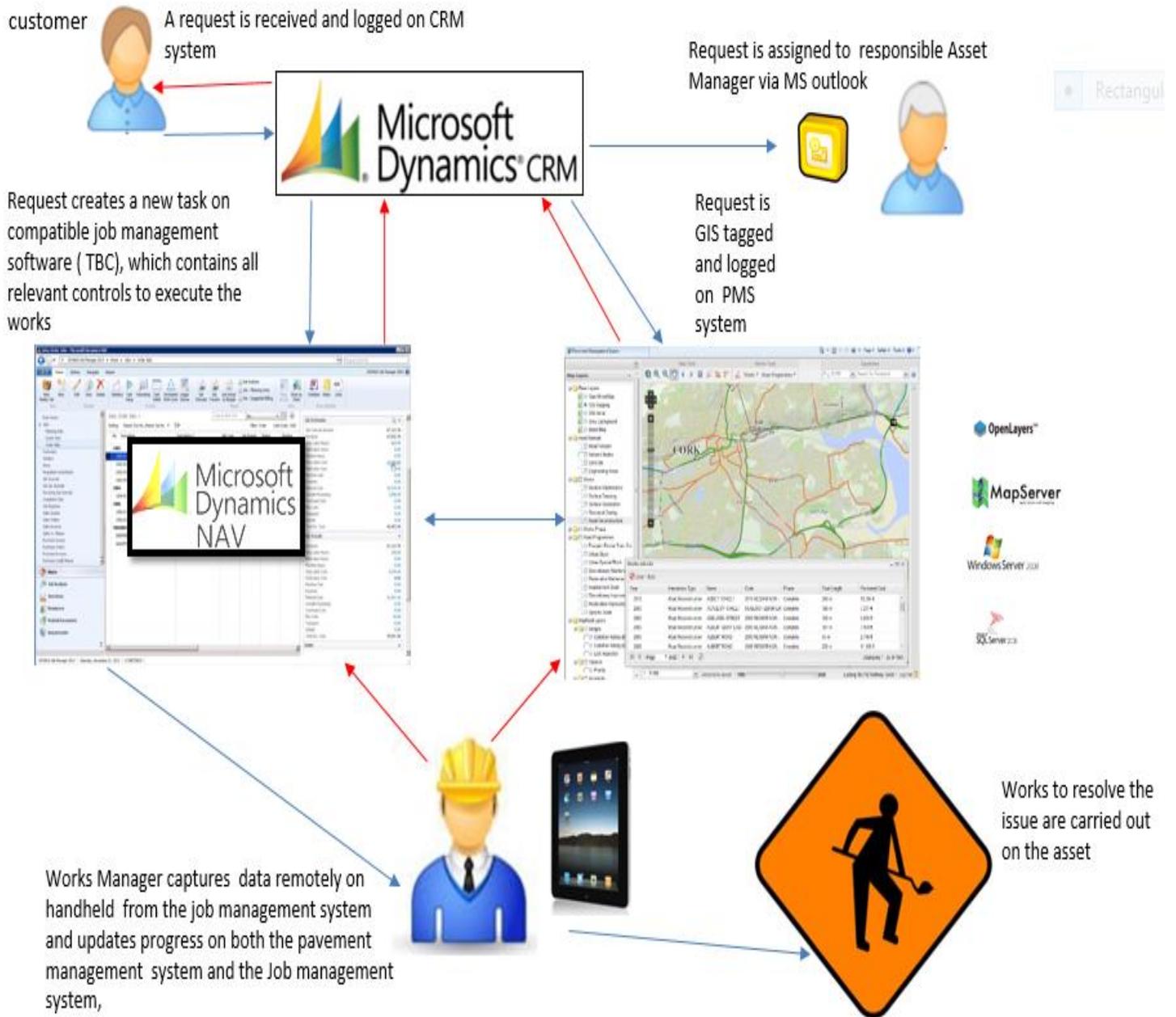
As both programmes run on proprietary Microsoft software, It is possible that the two platforms could be configured relatively easily to communicate with each other, this would involve developing an interface what must be put in place is a tool to read the GIS data relating to Road Segment Information when logging requests concerning a particular road on the CSR system.

This could either be a pop up map where the customer service agent clicks on the relevant roads segment with a record being created on the PMS system, or an intuitive node to node relation which would be highlighted due to the specific locus given when inputting the data on the CRM system.

This element of the works would need to be outsourced to an IT/GIS Specialist who would be able to customise the relevant Interface. This process would be tendered through our national online tendering platform etenders.ie (which by no coincidence is a fine example of how computer mediated communication has led to improvements in business processes

## 10.5 Reporting Tool

The ability to produce detailed reports on all aspects of corporate activities are crucial in order to ensure accountability and transparency, which is most important in the public sector. Producing reports and detailed performance indicators also allows for budgetary and resource planning as well as long term policy formulation and the creation of action plans to deliver the required levels of service. For this I would propose some type of server based report generation tool. There are many such products available in the market such as Cognos from IBM, Tableau, Oracle Reports etc. The product that would appear to be most suitable in this instance is SQL Server Reporting services as this would integrate well due to the platforms in use.



*Schematic showing the workflow of the integrated PMS and CRM Systems*

# 11.0 Mobile Access to Process Support Documentation

As part of the workflow process, the asset managers and works supervisors require access to a number of different standard documents which are essential in final service delivery. These documents provide health and safety controls and roadwork’s licencing in order to manage the works in line with relevant legislation.

These control documents are set as follows

## 11.1 Safe System of Work Plans

These are simple Pictograms which are filled out on site by the staff carrying out the works, this constitutes a real time site based risk assessment and are a crucial tool to manage the Health and Safety of the Work site for both the road workers and the public.

**SAFE SYSTEM OF WORK PLAN (SSWP) WORKING ON ROADS**

Plan No.

**Job Details**  
 Employer Name: \_\_\_\_\_  
 Responsible Person/Supervisor: \_\_\_\_\_  
 Number of Workers: \_\_\_\_\_  
 Specific Location: \_\_\_\_\_  
 Description of Works: \_\_\_\_\_  
 Start Date: \_\_\_\_\_  
 NOTE: A new SSWP must be completed when the task or the environment changes.

**Resources Required**  
 Worker Skills: \_\_\_\_\_  
 Plant/Equipment: \_\_\_\_\_  
 Hazardous Materials: \_\_\_\_\_

**Emergency Details**  
 Contact Names & Tel No.  
 1. \_\_\_\_\_  
 2. \_\_\_\_\_  
 3. \_\_\_\_\_  
 First Aider: \_\_\_\_\_  
 Location of First Aid Box: \_\_\_\_\_

**WORK PERMITS REQUIRED**  
 Hot  Electricity  Excavation   
 Confined Space  Other   
 Method Statement Yes  No

**Before Works Starts the following MUST be in place** Tick the  circle when confirmed

**SELECT HAZARD OR ACTIVITY** Tick the  box to identify controls required; Tick the  circle when control is in place.

**PART 1**

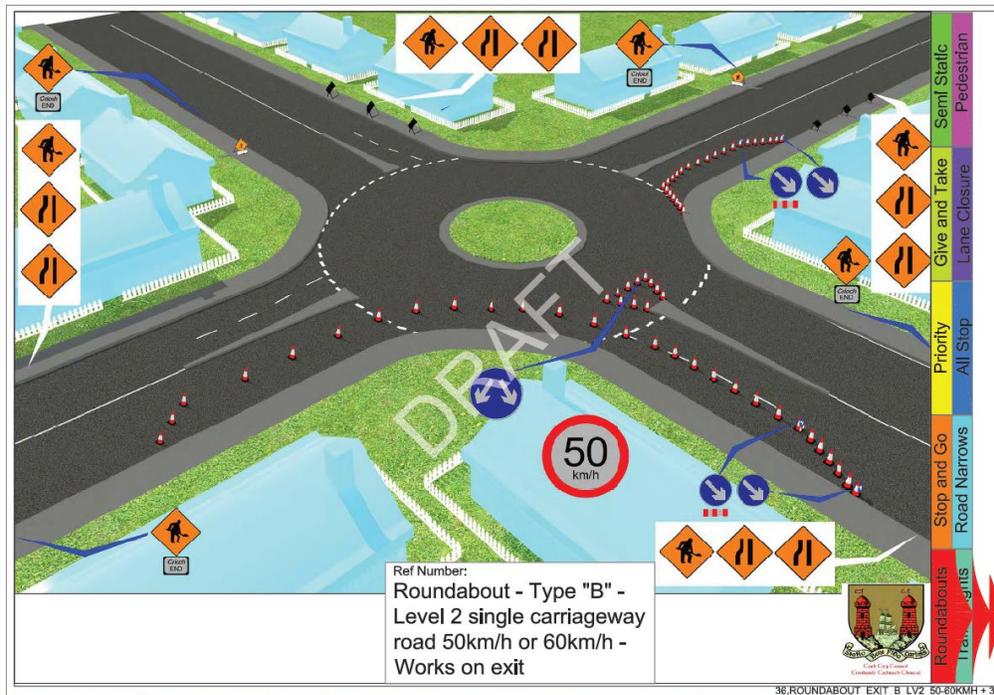
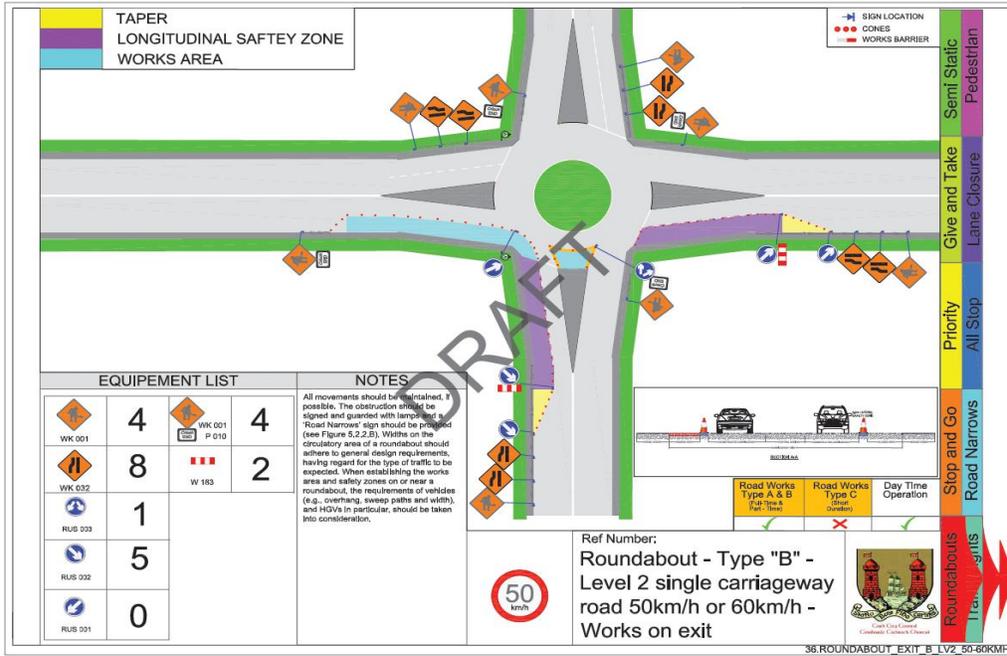
**PART 2**

LA1 © Copyright The Health and Safety Authority - February 2010

SSWP pictogram as used to manage the site risks when carrying roadwork’s.

# 11.2 Traffic Management plans

As all works are generally carried out in the public domain with interaction with live vehicular traffic and pedestrians, a detailed traffic management plan is required in order to manage the works, provide appropriate warning and directional signage and include for the required exclusion zones



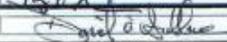
Typical format of Traffic management plans which are used to manage works in the public domain

## 11.3 Road Opening Licencing

When excavations of any type or size are carried out on a public road in Ireland, a road opening licence is required. This procedure has been standardised nationally since 2002 in line with legislation and requires approval from all stakeholders on behalf of the council responsible for the roads asset, it includes provisions for traffic controls, final road reinstatement and financial bonds to ensure works are carried out appropriately.

T2 Application

Page 1 of 1

		<b>Licence to Perform Roadworks - T2</b>		Cork City Council Room 335, City Hall, Cork Phone No. 021 492411 Fax No. 021 492401 e-mail: roadscontrol@corkcity	
<b>Details of Licence to Excavate Street or Footway</b>					
Application:	002/NO(308/1780)		Applicant Ref.:		
Case Number:	T2/050535-02/13				
Date of Issue:	Aug 9 2013				
<b>Permission Granted To</b>					
Applicant:	Roads Maintenance South		Company:		
Address:	Cork City Council, City Hall, Cork.				
<b>To Excavate</b>					
Street/Road Name:	Local Roads, Categories 1, 2 & 3				
Location:	Local Roads (Categories 1,2 & 3)				
<b>Dates and Times</b>					
Start Date of Works:	Jul 1 2013		Date Licence Expires:	Dec 31 2013	
Permitted Start Time:	8:00AM		End Time:	11:00PM	
<b>Garda Division</b>					
Garda Division:	Cork City		Section:	Traffic Section	
Contact Name:	Sgt. John O'Sullivan		Phone Number:	(None Entered)	
Fax Number:	(None Entered)		Email Address:	(None Entered)	
<b>Brief Description of Works to be carried out</b>					
Routine Maintenance Works					
In accordance with Section 101D of the Roads Traffic Act 1961, as inserted by Section 9 of the Dublin Transport Authority (Dissolution) Act 1987, Section 13 of the Roads Act 1993 and Section 53 of the Communications Regulation Act, 2002, Cork City Council direct that the road works detailed above be carried out during the period shown and subject to the conditions under which this Licence is granted.					
<b>Indemnity</b>					
Does the applicant agree to be solely liable for and shall indemnify Cork City Council from and against all claims in respect of injury or damage to persons or property that may be occasioned in connection with or arising out of the roadworks the subject of each roadworks licence and/or the activities associated with or arising thereout and against road-opening or all actions or proceedings that may at any time be brought against Cork City Council in consequence of such injury or damage and against all costs expenses and liability connected therewith?					Yes
<b>Works Designated Contact/Health &amp; Safety Co-ordinator</b>					
Name:	Mossy Carty				
Address:					
Phone (Day):	(086) 3885595		Phone (Night):	(086) 3885595	
<b>Authorisation</b>					
Failure to comply with such conditions constitutes an offence which is subject on summary conviction to a fine not exceeding €1270.00 or, at the discretion of the Court, to imprisonment for a term not exceeding six months or to both such fine and imprisonment.					
<b>Undertaking by Licensee</b>					
Having read the conditions under which this Licence is granted, I do accept and undertake to be bound by same. I shall be solely liable for and shall indemnify Cork City Council from and against all claims in respect of injury or damage to persons or property that may be occasioned in connection with or arising out of the roadworks the subject of this Licence and/or the activities associated with or arising thereout and against road-opening or all actions or proceedings that may at any time be brought against Cork City Council in consequence of such injury or damage and against all costs, expenses and liability connected therewith.					
Signed by Licensee	Date:	12/8/2013	Signature:		
Authorised on behalf of Cork City Council	Date:	09/09/2013	Signature:		
<b>A COPY OF THIS LICENCE AND ASSOCIATED CONDITIONS IS TO BE RETAINED ON SITE FOR INSPECTION BY AN AUTHORISED ROADS AUTHORITY OFFICIAL OR BY A MEMBER OF AN AN GARDA SIOCHANA</b>					

Typical format of existing road opening licence which is required before any works can be carried out on a public roadway

## 11.4 Task Management Record Sheet

This hard copy sheet which is manually filled out on-site is used at present to record details of works carried out any given location, it is a final checklist to make sure all relevant controls are in place. In time as with other support documentation this would migrate over to the works management system.

**Cork City Council Roads Maintenance Division**

**Works Tracking System**

Date(s): 26-11-2013  
Weather: AM 8-30  
PM 5-00

Job Number: 0264

Location of works: MELBOURNE ROAD RSR No017652  
OPP No3

Clos(es) of Road: 3

Description of Works: FOOTPATH WORK

Risk Assessment: LIVE TRAFFIC, PEDESTRIANS, NOISE, MANUAL HANDLING, PLANT AND MACHINERY, OVERHEAD POWER LINES, UNDERGROUND SERVICES, DUST CONCRETE/CEMENT BURNS

Controls in Place: SAFE PASS, PPE, SSWP, FIRST AID, LOCATION OF SERVICES, ABRASIVE WHEELS, SIGN LIGHTING AND GAUDDING, EXCAVATOR OPERATION MANUAL HANDLING

Traffic Management Plan: Generic Ref:  Bespoke Date:

Sketch/ Comments: OVER

Closed out by: \_\_\_\_\_ Signed: CORK CITY COUNCIL Date: 26/11/2013

Typical format of existing Tracking sheet to manage works on public roadways

As all documents are in a relatively simple format. A simple cloud based solution could be advantageous to allow for easy access in the office and on the move. Therefore for this solution I will compare three of the more popular document sharing providers.

### 11.4.1 Google Drive

Google Drive allows for documents to be created, edited and shared online. Google Drive is a free service. Through The Android Google Drive App, documents can be accessed through mobile devices such as a smart phone. Google Drive offers 15 GB free account. Suitable protocols would be required in order to address security issues and access control

### 11.4.2 Dropbox:

Dropbox provides a free service up to a limit of 2GB and offers businesses as much storage as required subject to agreed cost. Documents can be viewed from mobile devices such as smart phones, tablets etc. Dropbox is easy to navigate, as with Drive, files can be drag & dropped into the application and as with Drive Security protocols would be required in order to ensure security and access control to the documents

### 11.4.3 SharePoint:

Microsoft SharePoint is a highly regarded document management system and allows for documentation can be accessed over the internet. It is very suitable for corporate use due to well established partner software and requires that the company to be properly licensed for Microsoft Windows Server.

This would be the most advantageous sharing solution for the proposal in this report as it integrates well with the other software's and would be more secure.

## 12.0 Conclusion

The main aim of this report was investigate the options for, and possible outputs of integrating the two software systems which are currently used to manage the road maintenance activities of Cork City Council. During the course of this investigation it soon became apparent that synergies between computer systems are extremely important and it is imperative that systems be interoperable as much as possible. This would be in line with the main principles of Computer Mediated Communication which are Integration, interoperability, concurrency and collaboration,

This can be generally achieved in a number of ways,

Maintain a strong corporate IT policy to set standards and implement homogenization across the organization.

Careful specification when choosing new proprietary technologies and ensuring that they are easily modified to integrate with existing systems

The use of open source technologies as much as possible means easier and cheaper customizations.

In the case of Maproad PMS and Microsoft Dynamics, a number of additional software tools will be required to deliver enhanced communication and in turn greater functionality which incorporates GIS based real time reporting with integrated workflow management.

As part of the report I have not addressed issues such as the training or procurement required to deliver this new hybridized concept. But it is worth noting that due to the familiarity of existing staff with both core software packages, training and implementation would be relatively easy to roll out.

There is little doubt that improved Computer Mediated Communication means easier delivery of service no matter what activities one is discussing be it building and infrastructure construction, supply chain activates, manufacturing or in this case road maintenance activities.

It allows for sharing of information in real time at all locations to create an integrated system which fosters collaboration ion between all involved in the planning and delivery of road maintenance services.

## 13.0 References

- Proceedings of Local Authority Roads Services Training Group National Conference May 2013  
"Maproad PMS by Peter Burke of Local Government Management Agency"
- Compass 12 Annual Conference 2012  
"Delivering a Cross Local Authority Cross Platform Pavement Management Solution – Paul Fox of LGMA"
- Association for Geospatial Information - Geocommunity Conference 2013  
"Pavement Management System – A Cross Platform GIS Roads Management Toolkit - Gearoid O’Riain Managing Director Compass Informatics"
- FOSS4G Conference 2013 Nottingham  
"Pavement Management System An Irish road map to open source software - Seth Girvin, Geospatial Developer."
- *Computer Mediated Communication: Social Interaction and the Internet* Thurlow, Lengel & Tmoic 2009