



LIFECON DELIVERABLE D 1.3

IT-BASED DECISION SUPPORT TOOL FOR LIFECON LMS

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Interconsult Norgit AS**

Shared-cost RTD project

Project acronym: **LIFECON**

Project full title: **Life Cycle Management of Concrete Infrastructures for Improved Sustainability**

Project Duration: 01.01.2001 - 31.12.2003

Co-ordinator: Technical Research Centre of Finland (VTT)
VTT Building Technology
Professor, Dr. Asko Sarja

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PROJECT CO-ORDINATOR: Technical Research Centre of Finland (VTT),
VTT Building Technology
Professor, Dr. Asko Sarja

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Nature:

PR - prototype (demonstrator), RE - report, SP - specification, TO - tool, WR - working report
OT - other

Dissemination level:

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Approved for release WP Leader / Co-ordinator	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Sign.: _____</td> <td style="width: 50%;">Sign.: _____</td> </tr> <tr> <td>Date: _____</td> <td>Date: _____</td> </tr> </table>	Sign.: _____	Sign.: _____	Date: _____	Date: _____				
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Date: _____	Date: _____								

Lifecon Deliverables

Deliverable No	Title of the Deliverable
D1.1	Generic technical handbook for a predictive life cycle management system of concrete structures (Lifecon LMS)
D1.2	Generic instructions on requirements, framework and methodology for IT-based decision support tool for Lifecon LMS
D1.3	IT-based decision support tool for Lifecon LMS
D2.1	Reliability based methodology for lifetime management of structures
D2.2	Statistical condition management and financial optimisation in lifetime management of structures <ul style="list-style-type: none"> • Part 1: Markov chain based LCC analysis • Part 2: Reference structure models for prediction of degradation
D2.3	Methods for optimisation and decision making in lifetime management of structures <ul style="list-style-type: none"> • Part I: Multi attribute decision aid methodologies (MADA) • Part II: Quality function deployment (QFD) • Part III: Risk assessment and control
D3.1	Prototype of condition assessment protocol
D3.2	Probabilistic service life models for reinforced concrete structures
D4.1	Definition of decisive environmental parameters and loads
D4.2	Instructions for quantitative classification of environmental degradation loads onto structures
D4.3	GIS-based national exposure modules and national reports on quantitative environmental degradation loads for chosen objects and locations
D5.1	Qualitative and quantitative description and classification of RAMS (Reliability, Availability, Maintainability, Safety) characteristics for different categories of repair materials and systems
D5.2	Methodology and data for calculation of life cycle costs (LCC) of maintenance and repair methods and works
D5.3	Methodology and data for calculation of LCE (Life Cycle Ecology) in repair planning
D6.1	Validation of Lifecon LMS and recommendations for further development

Abstract

This document contains the user documentation of the Lifecon LMS IT prototype.

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1 Introduction

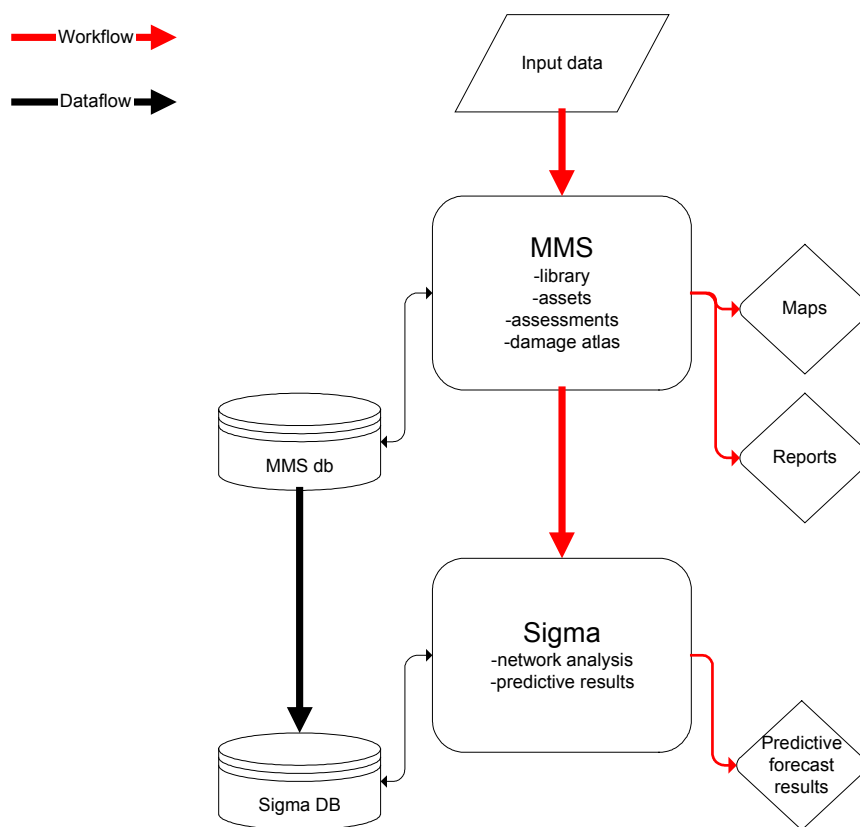
The purpose of the Lifecon LMS is to add information to an experience database over time that enables the user to do continuously better maintenance planning. As the database grows, the accuracy and control increases. Hopefully the system users will experience that planned proactive maintenance gives financial, safety and environmental benefits compared to traditional reactive maintenance schemes.

The user documentation will give a brief overview on how to use the system. It will not go into detail on the Lifecon LMS methods or how to apply them in the Lifecon LMS IT system.

2 Lifecon LMS Workflow

The following figure shows the workflow and dataflow for the IT prototype and the interactions between the main components.

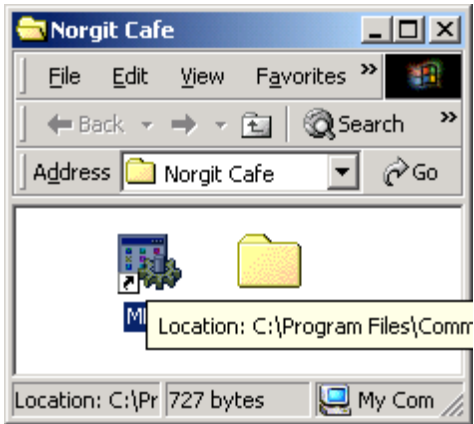
LMS prototype: Simplified workflow and dataflow structure



Lifecon LMS: Simplified workflow and dataflow structure

3 The Maintenance Management System (MMS)

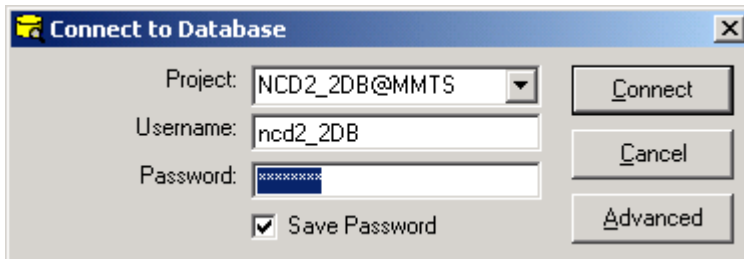
3.1 Start MMS (Maintenance Management System)



Double-click your desktop icon for starting MMS, or start it from a Citrix Server connection.

3.2 Connect to the database

Select "File->Connect..." to log on to the database.

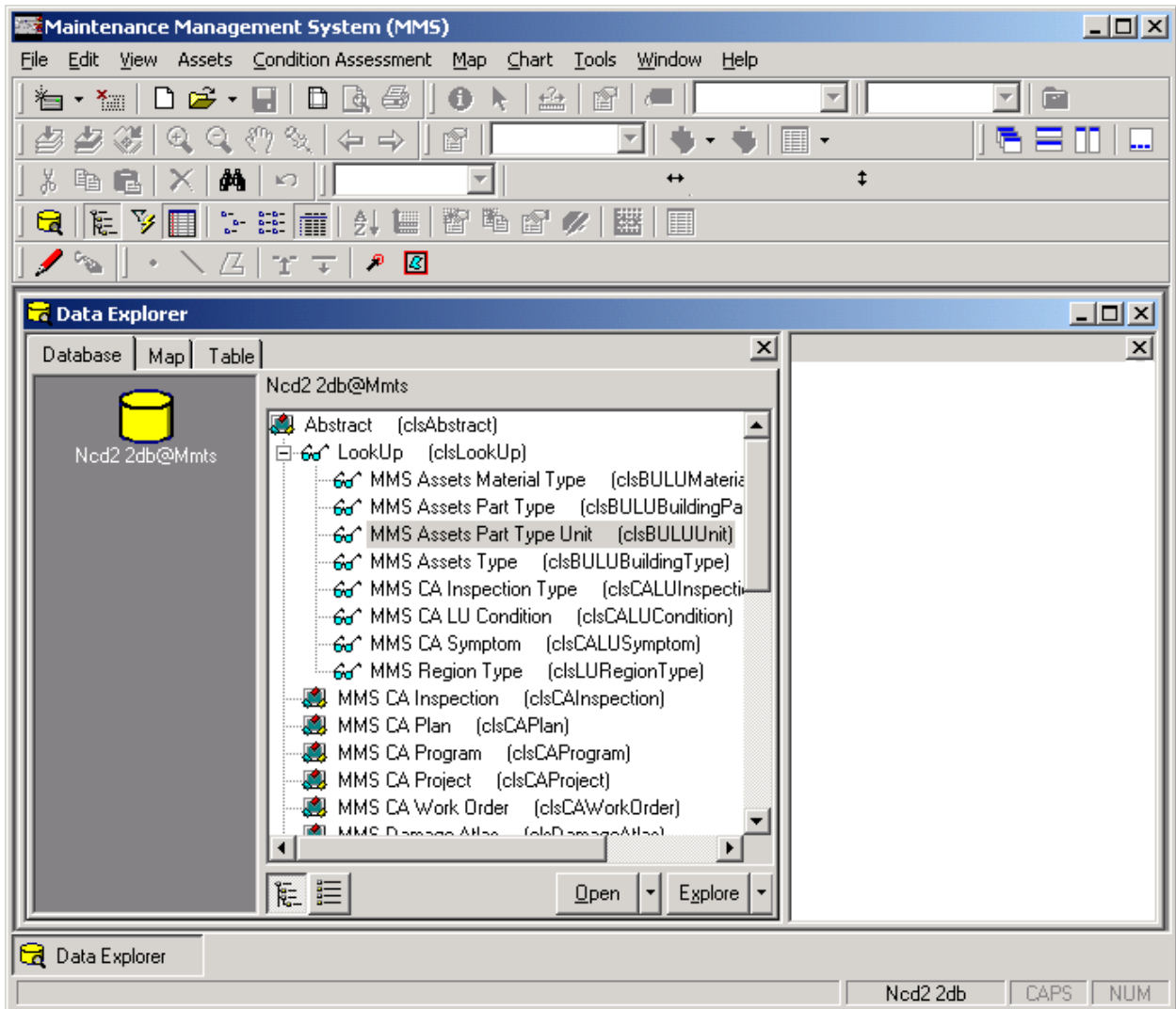


Contact your database administrator to get your logon information and press connect.

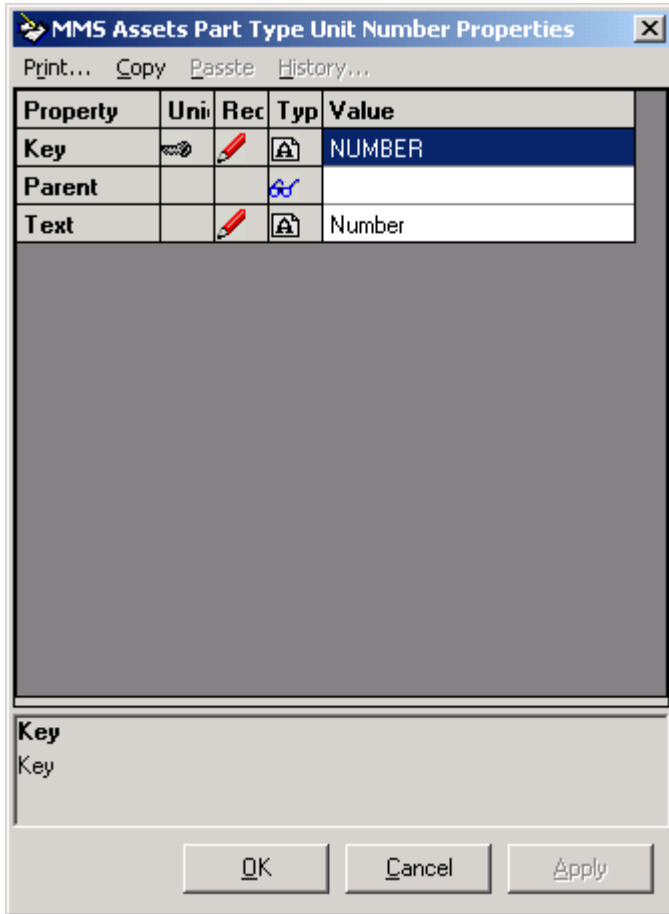
3.3 Configuration

The object part types must initially be configured with the general Data Explorer in Norgit Cafè.

Select "Tools -> Data Explorer..."



Add units to MMS Assets part type unit list:



Add Assets Part types to the MMS Assets Part Type list.

Fill in:

- Value per unit and condition index
- Upgrade cost per unit and condition index
- Degrade/upgrade transition matrix

Property	Uni	Rec	Typ	Value
Unit				Number
Upgrade Cost Per Unit 0				10
Upgrade Cost Per Unit 1				20
Upgrade Cost Per Unit 2				30
Upgrade Cost Per Unit 3				40
Value Per Unit 0				30
Value Per Unit 1				20
Value Per Unit 2				10
Value Per Unit 3				0
Upgrade 0				1
Upgrade 1				0
Upgrade 2				0
Upgrade 3				0
Upgrade 4				1
Upgrade 5				0
Upgrade 6				0
Upgrade 7				0
Upgrade 8				1
Upgrade 9				0
Upgrade 10				0
Upgrade 11				0
Upgrade 12				1
Upgrade 13				0
Upgrade 14				0
Upgrade 15				0
Degrade 0				0
Degrade 1				0
Degrade 2				0
Degrade 3				1
Degrade 4				0

Unit

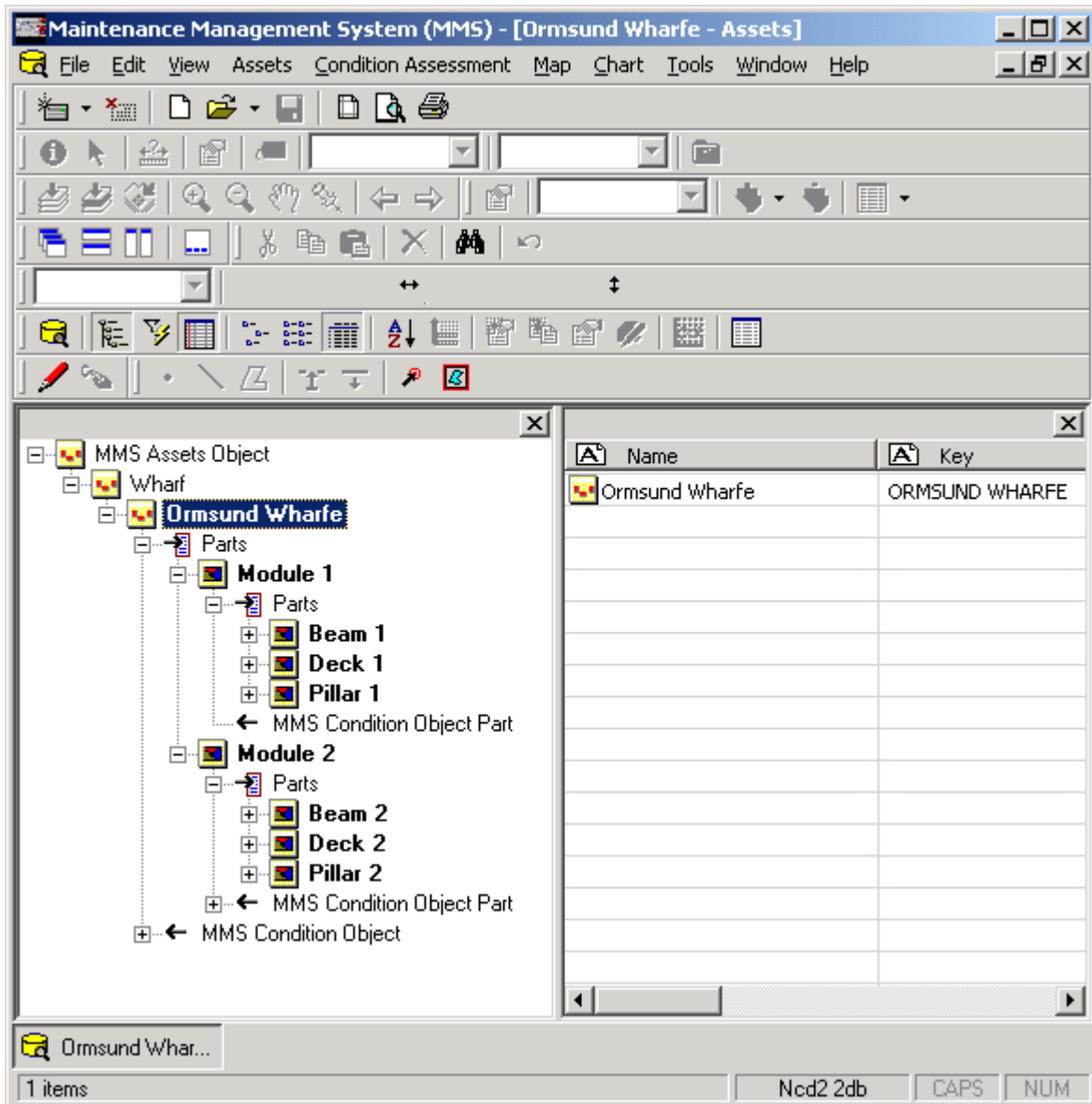
OK Cancel Apply

The calculation of the data to insert must preliminary be done by for example by corrosion experts on the selected object part types.

Close the Data Explorer when you are finished.

3.4 Register your assets

Select “Assets -> Open...”



Here your assets can be added, both the objects and their object parts.

The assets modules contain a tree-view to the left and a list to the right. The list to the right shows the content of what is selected in the tree view.

3.4.1 Connect objects to Maps

After registering the objects it is possible to position them on maps as object points.

Right click your object in the tree view and select “Show Map”.

3.4.2 Connect object parts to drawings

After registering the object parts it is possible to position them on different drawings appended to the objects.

Right click your object part in the list view and select “Edit Geometry...”

3.4.3 Connect any database object to photos and/or documents

It is possible to connect each object and object part to multiple photos and documents added to the database.

Right click your object in the tree view and select “Show photos” or “Show documents”.

3.4.4 Final procedure

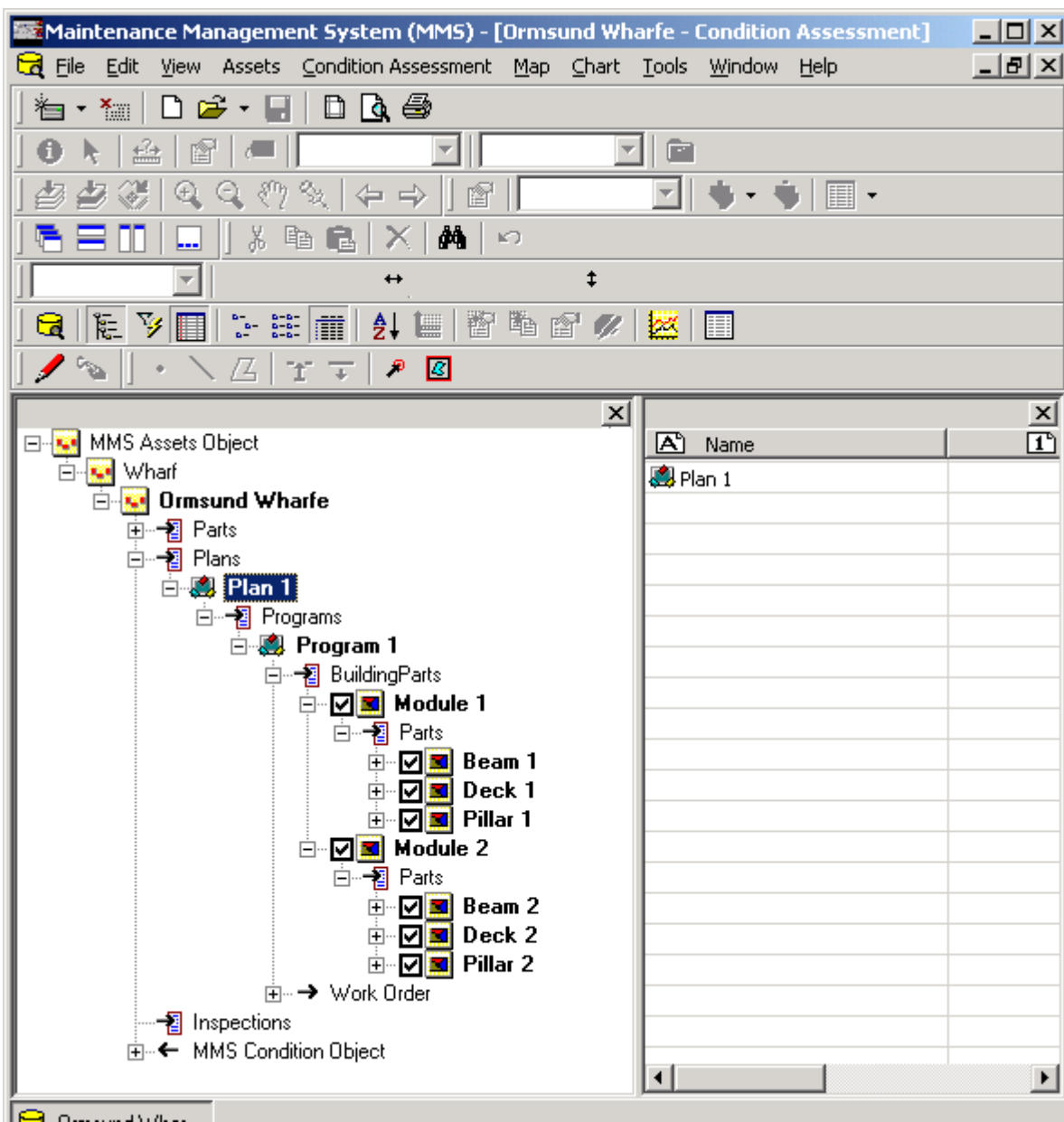
Now you are finished with your Assets registration. Close all windows before you continue with Condition Assessment. (But don't close the main application)

3.5 Do Condition Assessment

Select “Condition Assessment -> Open...”

3.5.1 Make a plan and program for your inspection

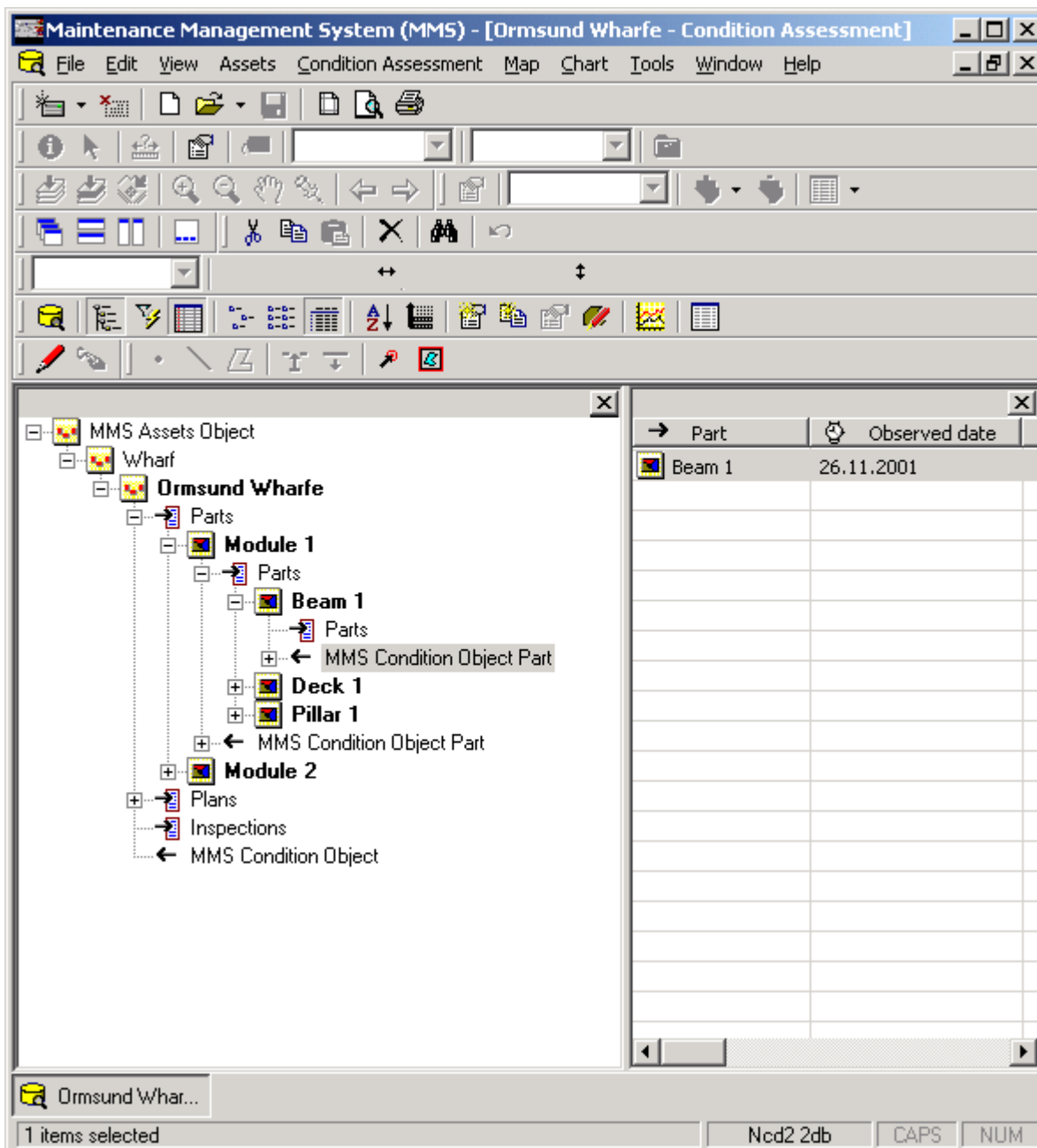
An LMS plan and program is to select what object and object parts to inspect.

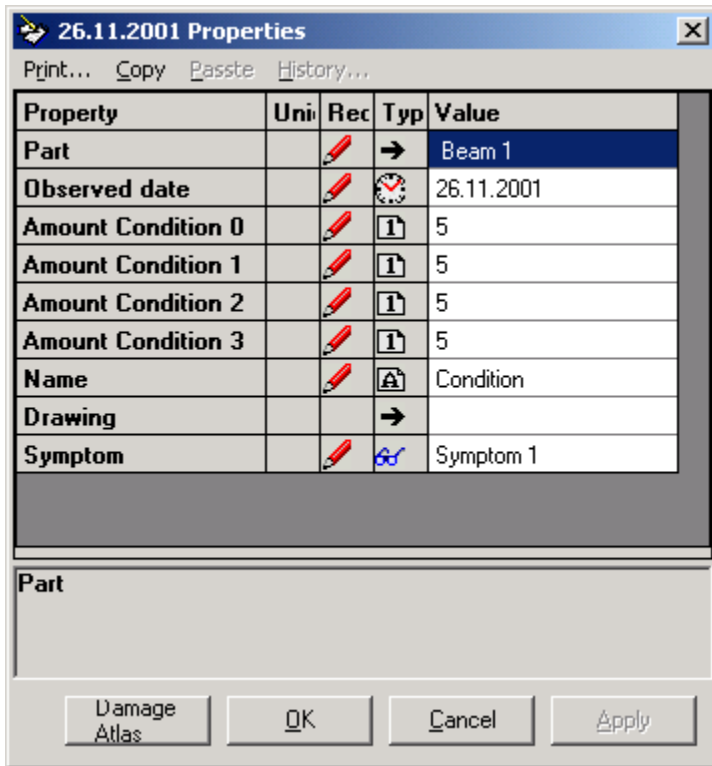


This is an optional task that it is possible to do initially in the condition assessment module.

3.5.2 Do condition assessment

Add the object part conditions after you have done your inspections.





3.6 Final procedure

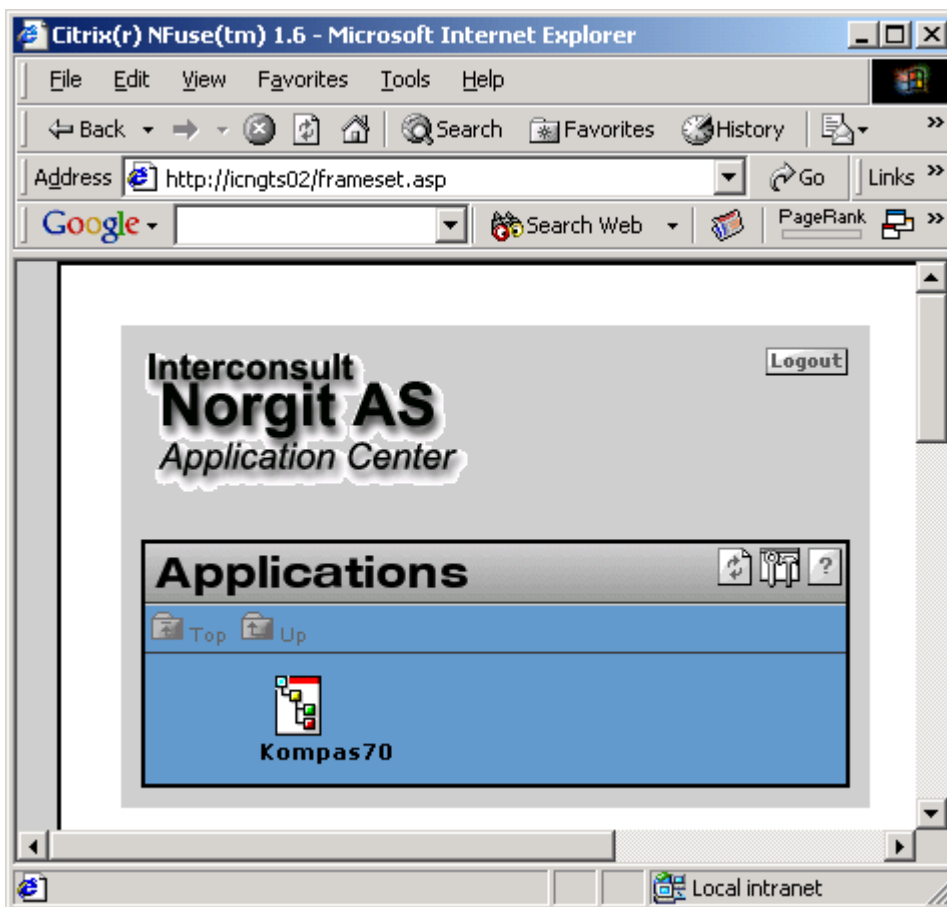
You are now ready to do an integrated network analysis on the registered conditions.

Close down the condition assessment windows and also the MMS application.

4 The Sigma network analysis functionality

4.1 Start Sigma

Start Sigma (Kompas70) from your desktop icon or from your Citrix Server connection.



4.2 Create a project

Select "File -> New project" ("Nytt...")

You will then get access to a screen which so far has not been translated into English. A translation and suggestions for actions will follow:

Norwegian	English	Action
Prosjekt navn	Project name	Give a name to the project
Plansone gruppe	Plan zone group	Select any plan zone group

		from a drop-down list
Modell type	Model type	Select "MMS vedlikeholdsanalyse" from a drop-down list
Prosjektperiode	Project period	-
Første stat. år	First year of statistics	Select first year to fetch observation data from the MMS data base
Første ber. år	First year of model calculation	Select the first year from which you want the model to calculate predictive results
Siste ber. år	Last year of model calculation	Select the last future year from which you want the model to calculate predictive results
Standard estimeringsperiode	Standard estimation period	Select the period from which you want the model to estimate necessary parameters for a given model type. For "MMS vedlikeholdsanalyse" the model will degrade data from year to year. For each object, only its last observation will be fetched and degraded from that date.

Nytt prosjekt

Prosjekt navn:

Plansone gruppe:

Modell type:

Prosjekt periode

Første stat. år:

Første ber. år:

Siste ber. år:

Standard estimeringsperiode

Fill in your project settings and press OK.

Alternativ

<Standard>

Prosjekt steg	Datasett
01.01 Upgrade patterns	1
01.02 Degrade patterns	1
02.01 Latest observed condition areas	1
02.02 Aggregated condition areas	1
03.01 Upgrade factors	1
04.01 Upgrade cost per unit	1
05.01 Value per unit and condition	1

Just press OK.

4.3 Adjust and recalculate the model

The model is then loaded and precalculated automatically.

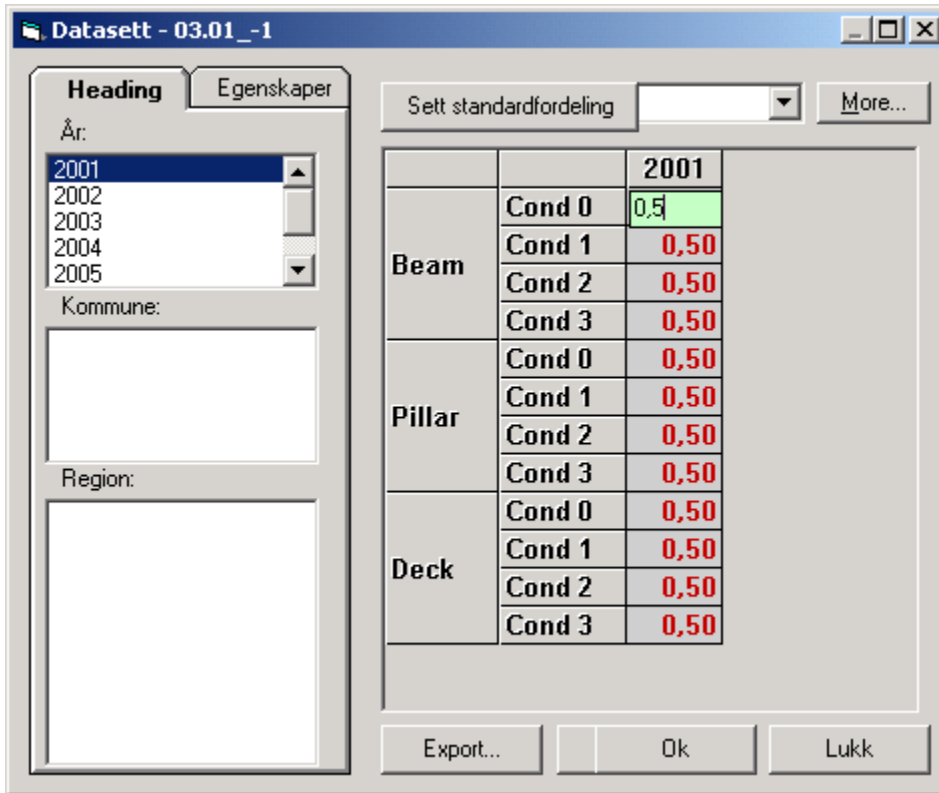
KOMPAS -							
File Rediger Vis Verktøy Hjelp							
	2001	2002	2003	2004	2005	2006	2007
01 Upgrade / Degrade patterns							
01 Upgrade patterns	*	*	*	*	*	*	*
02 Degrade patterns	*	*	*	*	*	*	*
02 Condition							
01 Latest observed condition areas	60	56	28	-	-	-	-
02 Aggregated condition areas	60	116	144	144	144	144	144
03 Upgrade/Degrade condition							
01 Upgrade factors	*	*	*	*	*	*	*
02 Upgrade areas	0	0	0	0	0	0	0
03 Degrade areas	60	116	144	144	144	144	144
04 Upgrade results	0	0	0	0	0	0	0
05 Degrade results	60	116	144	144	144	144	144
06 New condition	60	116	144	144	144	144	144
04 Upgrade costs							
01 Upgrade cost per unit	*	*	*	*	*	*	*
02 Upgrade costs	0	0	0	0	0	0	0
03 Aggr upgrade costs	0	0	0	0	0	0	0
05 Value increase/decrease							
01 Value per unit and condition	*	*	*	*	*	*	*
02 Value after upgrade/degrade	0	0	0	0	0	0	0
03 Value before upgrade/degrade	900	840	420	0	0	0	0
04 Value increase/decrease	-900	-840	-420	0	0	0	0
05 Aggr increase/decrease	-900	-1740	-2160	-2160	-2160	-2160	-2160
06 Totals							
01 Value increase/decrease - cost	-900	-840	-420	0	0	0	0
02 Aggr increase/decrease - cost	-900	-1740	-2160	-2160	-2160	-2160	-2160

Avslutt

01 Upgrade / Degrade patterns Totaltid=12 1 1

Double-click on upgrade factors and select first year.

Select all data values in the grid. Input upgrade factors for the different system parts.



Press enter and then press OK.

Select cells after upgrade factors and press F5 to recalculate new conditions.

	2001	2002	2003	2004	2005	2006	2007
01 Upgrade / Degrade patterns							
01 Upgrade patterns	*	*	*	*	*	*	*
02 Degrade patterns	*	*	*	*	*	*	*
02 Condition							
01 Latest observed condition areas	60	56	28	-	-	-	-
02 Aggregated condition areas	60	116	144	144	144	144	144
03 Upgrade/Degrade condition							
01 Upgrade factors	*	*	*	*	*	*	*
02 Upgrade areas	30	0	0	72	0	0	0
03 Degrade areas	30	116	144	72	144	144	144
04 Upgrade results	30	0	0	72	0	0	0
05 Degrade results	30	116	144	72	144	144	144
06 New condition	60	116	144	144	144	144	144
04 Upgrade costs							
01 Upgrade cost per unit	*	*	*	*	*	*	*
02 Upgrade costs	750	0	0	2880	0	0	0
03 Aggr upgrade costs	750	750	750	3630	3630	3630	3630
05 Value increase/decrease							
01 Value per unit and condition	*	*	*	*	*	*	*
02 Value after upgrade/degrade	900	0	0	2160	0	0	0
03 Value before upgrade/degrade	900	1740	420	0	2160	0	0
04 Value increase/decrease	0	-1740	-420	2160	-2160	0	0
05 Aggr increase/decrease	0	-1740	-2160	0	-2160	-2160	-2160
06 Totals							
01 Value increase/decrease - cost	-750	-1740	-420	-720	-2160	0	0
02 Aggr increase/decrease - cost	-750	-2490	-2910	-3630	-5790	-5790	-5790

Avslutt

03.02 Upgrade areas Totaltid=05 11 1

Select cells for the following years and press F5 to recalculate.

	2001	2002	2003	2004	2005	2006	2007
01 Upgrade / Degrade patterns							
01 Upgrade patterns	*	*	*	*	*	*	*
02 Degrade patterns	*	*	*	*	*	*	*
02 Condition							
01 Latest observed condition areas	60	56	28	-	-	-	-
02 Aggregated condition areas	60	116	144	144	144	144	144
03 Upgrade/Degrade condition							
01 Upgrade factors	*	*	*	*	*	*	*
02 Upgrade areas	30	0	0	72	0	0	0
03 Degrade areas	30	116	144	72	144	144	144
04 Upgrade results	30	0	0	72	0	0	0
05 Degrade results	30	116	144	72	144	144	144
06 New condition	60	116	144	144	144	144	144
04 Upgrade costs							
01 Upgrade cost per unit	*	*	*	*	*	*	*
02 Upgrade costs	750	0	0	2880	0	0	0
03 Aggr upgrade costs	750	750	750	3630	3630	3630	3630
05 Value increase/decrease							
01 Value per unit and condition	*	*	*	*	*	*	*
02 Value after upgrade/degrade	900	0	0	2160	0	0	0
03 Value before upgrade/degrade	900	1740	420	0	2160	0	0
04 Value increase/decrease	0	-1740	-420	2160	-2160	0	0
05 Aggr increase/decrease	0	-1740	-2160	0	-2160	-2160	-2160
06 Totals							
01 Value increase/decrease - cost	-750	-1740	-420	-720	-2160	0	0
02 Aggr increase/decrease - cost	-750	-2490	-2910	-3630	-5790	-5790	-5790

Avslutt

01.01 Upgrade patterns Totaltid=10 | 2 | 2

Upgrade factors can be updated for the remaining periods to get a complete upgrade plan with calculated conditions, cost etc.

4.4 Additional functionality

You may cut and paste information from external applications into each dataset. You may also copy information from each dataset or from the model grid into external applications.

4.5 Final procedure

Select “Avslutt” to finish Sigma.