Thematic Network

LIFETIME

Lifetime Engineering of Buildings and Civil Infrastructures

Deliverable 5.1:

Support for Demonstration, Dissemination and Exploitation of lifetime principles

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Danish Technological Institute, Concrete Centre	DK	68	DTI
National Technical University of Athens, Department of Chemical Engineering	EL	17	NTUAC
CARSA	E	70	CARSA
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Members: Totally 89 Members
Observers: Totally 4 Observers

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Jean Luc Chevalier, September 2005

Table of Contents

Summary

Lifetime Engineering is an innovative approach that shall enable incorporation of a long-term perspective in decision making related to building and civil engineering. It thus addresses all types of buildings and civil engineering works. With the methodology and the content of lifetime principles established, work package 5 of the EU thematic network on lifetime engineering aimed at illustrating and communicating the benefits and potentials of applying these principles to building-related project planning.

The state of the art of applying lifetime principles was determined by issuing a questionnaire to the participants of the network. Due to the organizational structure with national dissemination groups and their national contact networks, the information gathered on this basis is considered as a very good and up-to-date basis for determining the state throughout Europe. This state of the art concerned application in real projects, not only the availability and awareness of concepts and methodologies. From these application examples, a number of projects have been chosen for display on the final WP5 workshop as well as for display on international conferences. These so-called demonstration projects were chosen to illustrate the state of the art throughout the regions of Europe as well as to communicate the possibility and the experiences made with application of lifetime principles. The projects have usually not been conducted with "lifetime engineering" clearly present in the mind of the involved decision makers, consequently the applied principles varies largely between projects; partly due to the nature of the project, partly due to the mind-set and the priorities of the actors.

Lifetime engineering can now present projects and indicate the fields of concern that have been addressed, also meaning that decision makers are enabled to put the singular aspects into a broad and coherent context, and to complement, where practicable, their concerns with aspects of relevance not initially considered. Communicating and disseminating the content of lifetime engineering consequently means that decision makers and stakeholders here can find material that helps them in their striving to contribute to a more sustainable built environment.

Introduction

Lifetime Engineering is an innovative idea aimed at solving the dilemma that currently exists between infrastructures as a very long-term product and short-term approach to design, management and maintenance planning.

Lifetime engineering includes:

- Lifetime investment planning and decision making,
- Integrated lifetime design,
- Integrated lifetime construction,
- Integrated lifetime management and maintenance planning,
- Modernisation, reuse, recycling and disposal, and
- Integrated lifetime environmental impact assessment and minimisation,

Integrated lifetime design includes a framework, a description of the design process and its phases, special lifetime design methods with regard to different aspects: human conditions, economy, cultural compatibility and ecology. These aspects will be treated with parameters of

technical performance and economy, in harmony with cultural and social requirements, and with relevant calculation models and methods.

Integrated lifetime management and maintenance planning includes continuous condition assessment, predictive modelling of performance, durability and reliability of the facility, maintenance and repair planning and the decision-making procedure regarding alternative maintenance and repair actions

Moving into **lifetime technology** means that the design process must be renewed. Furthermore, new methodologies and calculation methods must be adopted, e.g., from mathematics, physics, systems engineering, environmental science/ engineering and other natural and engineering sciences. However, we have to keep in mind the need for strong systematic, transparency and simplicity of the design process and its methods in order to keep the multiple issues under control and to avoid excessive design work. The adoption of the new methods and processes will raise needs for renewal of education and training of all stakeholders.

The scope of Lifetime Engineering as addressed by the LIFETIME network includes buildings, civil and industrial infrastructures, with the following distribution.

Buildings	Office buildings
	Housing
	Industrial buildings
	Trade and commerce buildings
	Hospitals
	Hotels
	Others
Civil infrastructures	Transport facilities and areas(roads, streets, railways, waterways, parking etc.)
	Bridges
	Tunnels
	Harbours
	Airports
	Transport terminals
	Pipelines
	Landfill sites
	Underground spaces
	Energy and telecommunication networks
	Others
Industrial infrastructures	Industrial production facilities and structures
	Mining facilities and structures
	Others

Table 1 Types of buildings included in the scope of the LIFETIME network

Concern related to sustainable development is progressing in the mind-set and in the practices of the construction sector actors. Addressing sustainable development requires innovative

changes in terms of integration of different steps and actions within the design and construction process. It also means to better take account of long-term aspects already in the design phase. The future behaviour and performance of the building, as well as use aspects and performance requirements are decisive elements to be integrated into the design phase. This approach is called Lifetime Engineering, the main concern of the European Thematic network LIFETIME, and the purpose of this report is to present work package 5 on demonstration, dissemination and exploitation of the lifetime engineering principles.

The LIFETIME project was conducted in 6 work packages, whereof work package 5 focussed on demonstration and dissemination, itself originally addressing 4 tasks:

- Analysis and benchmarking of demonstration programs and projects
- Present demonstration projects in a Workshop
- Prepare and support exploitation plans
- Organize and support training courses
  (treated in WP1, based on inputs given by NDG's)

The main objective of this work package is to disseminate the results of the network activity, developed by WP1 to 4, via a series of reports and publications, as well as through workshops aimed at user groups and stakeholders in the field of life time engineering. By this, the work package aims to contribute to European and worldwide development towards a more sustainable built environment.

To meet this main purpose, a set of objectives for WP5 have been identified, as to:

- Deliver the results of past and current national and international demonstration programs and projects on fields of lifetime engineering to potential users.
- Facilitate and encourage collaboration, co-operation and exchange among EC-supported research projects and researchers
- Raise awareness of all stakeholders in the fields of *building and civil infrastructures,* informing of best practices and R&D works and results, and development potential
- Form links with relevant targeted research and demonstration actions and other Thematic Networks within the European Commission's programmes
- Minimise overlap and facilitate communications between national, international and EC-funded activities
- Encourage the formation of new RTD partnerships between stakeholders in construction including industry, designers, developers and researchers.

The innovative aspect of the Lifetime Engineering approach is to be seen in the proper integrated consideration of numerous issues of relevance, rather than taking these separately. To demonstrate the potential benefits of the lifetime engineering approach and to illustrate developments at hand in the participating countries, a cross-European survey of demonstration projects was started already in the early stage of the network. The presented demonstration projects illustrate the principles of lifetime engineering.

Resources and work programme

For the conduction of the lifetime thematic network, a EU-wide thematic network has been established. The establishment of national dissemination groups complements this international network.

The lead partner in charge of WP5 was CSTB. Nine network members have expressed their interest to participate in the working group, but moreover the “national dissemination group leaders” (NDGL) are the key members for the WP5 purpose. The resources allocated to WP5 cover partly the leader activity, but members and NDGL’s have been poorly funded. Due to the funding situation, the actual work performed by work package members and national dissemination groups strongly relied on the motivation of the involved members for finding additional funding at the national level.

EU thematic network – description of WP5 tasks

The work plan of WP 5 includes the following tasks:

1. Analysis and benchmarking of national and international demonstration programs and projects on fields of lifetime engineering : including a state of the art of existing and ongoing national and demonstration programs and projects on life cycle costing, life cycle performance, service life planning and design, energy efficiency of buildings, reuse and recycling, followed by a selection of the most relevant ones, spread over all types of works: housing, office, commercial and industrial buildings, transport structures (bridges, tunnels, harbours, roads, railways), and energy production structures (power plants, pipelines).
2. Presentation of the case studies in an international workshop, and publication of these results through dissemination material: The selected case studies will be presented in a workshop to be held in April 2005 in conjunction with the 10 DBMC Conference in Lyon (France). This meeting will involve project members, and representatives of all sides of the construction sector, hopefully from many countries, together with the European Commission.
3. Preparation of supporting exploitation plans and training courses. WP 5 leader, The WP5 working group as well as the national dissemination groups will cooperate to prepare exploitation plans of the results of the LIFETIME network in the EU, and even globally. These plans should suggest actions for development of international and national regulations and standards on lifetime investment planning, design, facility management and maintenance planning, and of education and training for all stakeholders on lifetime principles and methods, to be finally integrated into the daily practice.
4. Initially, a forth task on “organisation and support of training courses” was among the tasks of WP5. During the conduction of the project, this task has been moved to WP1.

Task 1. Analysis and benchmarking of national and international demonstration programs and project on fields of lifetime engineering

The analysis and benchmarking of national and international demonstration programs and projects is based on an overview over the international state of the art. To enable a comparative review, the relevant thematic fields in lifetime engineering needed to be identified and established within the network. The national dissemination groups were addressed with an inquiry in order to identify and present projects where these issues of relevance, including elements such as life cycle costing, life cycle performance, service life planning and design, energy efficiency of buildings, reuse and recycling had been addressed in the project work. 85 project questionnaires were returned and analysed in order to identify the current state of the art.

From these projects, a selection was made in order to gather additional more detailed information in order to prepare an evaluation and presentation of case studies with

demonstration project character. The selection was performed under involvement of the networks Steering Committees and includes projects of all types of construction works: housing, offices, commercial and industrial buildings, transport structures (bridges, tunnels, harbours, roads, railways), and energy production structures (power plants, pipelines).

Case studies that were chosen as demonstration projects were documented and presented on the basis of data and information provided the members and their national networks. For the presentation of the demonstration projects, a common format for poster presentation has been developed, and the posters were invited for a presentation at the 10dbmc conference in Lyon. Additionally to that conference, the posters are being made available in the final documentation of WP5.

Task 2 Presentation of demonstration results

The material and information collected in task 1 was aimed to be presented and discussed at an international workshop held in conjunction with the 10th international conference on durability of construction materials and components (10dbmc) in Lyon in April 2005. The workshop involved project members, cluster co-ordinators and representatives of all sides of industry together with the European Commission.

Additional to presentation of the material at the workshop, the case studies and demonstration projects, as well as the analysis and evaluation of the state of the art, are included in the WP5 documentation.

The task developed the workshop, including determination of the date, venue, content and speakers in consultation with the Commission and the Steering Committee, preparation and issuing the invitations and programme, liaising with the participants and local organisers, publishing the workshop, organization of the meeting and preparation and dissemination of proceedings. The steering committee reviewed the preparation of the workshop, mainly in order to maximize the usefulness of what is an expensive undertaking. The feasibility of linking to another appropriate conference was appreciated, and hence the workshop was held in conjunction with 10dbmc.

Task 3 Preparation of supporting exploitation plans and IPR issues

Exploitation and commercialisation of the network results is a prerequisite for having an impact on the state of infrastructures on the European level. The project members of WP5, including the project leader, participants and the national dissemination group leaders, were to assist and coordinate the establishment of national groups. These all cooperated in the preparation of exploitation plans of the results in the EU, and even globally. User Groups were established through the national dissemination groups, initially in participating countries, and later during the work in other European countries thus having a wide European dimension covering also Southern Europe and the Eastern Central European EU Candidate countries, who became EU members during the project period.

Every member of the Network will use the results of the Network in their own national activities. The results will be used to:

- Propose actions for development of international and national regulations and standards on lifetime investment planning, design, facility management and maintenance planning.

- Propose actions for development of education and training for all stakeholders on lifetime principles and methods.
- Promote dissemination and exploitation of systematic lifetime principles and its methodology and methods into investment planning and decisions, design, as well as into management and maintenance planning of buildings and civil infrastructures.

Such promotion of the network results and life time engineering principles may include workshops, seminars, courses and training efforts directed to various actors and stakeholders related to the construction sector. However, the detailed content is to be decided and prepared by the NDGs, the material provided by WP5 can be applied for such purposes.

National Dissemination Groups

National Dissemination Groups were established, with designated Group leaders to function as link between the EU thematic network and the activities present and the organizations involved in a participating country. Further, the NDGL coordinates the participation of the members from his country. His role in the communication related to the LIFETIME network is bi-directional. Concerning the WP5 case studies, he is a key in identifying and gathering information and to make experience available to the network, in the other direction he is to disseminate the experiences gained through the network available in his country. This task relied heavily on individual commitment, as there was no funding available for these tasks, meaning that the NDGs had to identify sources for funding for their efforts.

WP5 assumed the task of coordinating among the NDGLs, while their participation in the LIFETIME network gave an international reason to the establishment and funding of the national groups, as well as an impetus for networking with already existing groups, such as standardisation mirror groups, national thematic groups (possibly linked to other European research projects and thematic networks).

Objectives of the national demonstration and dissemination actions

The objectives established for the national demonstration and dissemination actions are to:

- **disseminate** results from WP1, 2, 3 and 4 via publication and workshops, through NDG's and associated members, to user groups and all stakeholders
- **survey and report** on national and international demonstration programs/works details required through inventory, selection, presentation format, and workshop organisation
- **facilitate** links and collaboration all over EU, starting from the existing groups and networks, and encouraging new ones, supporting exploitation plans

The demonstration projects

The study of demonstration projects related to the first task and to two of the objectives outlined for WP5. Further, the gathering, analysis and communication of demonstration project experiences additionally provides an excellent basis for discussions concerning the life time engineering concept, both regarding content, state of the art, success factors, constraints, experiences and development potentials.

A first survey was conducted by using the international contact network related to the LIFETIME network, and examples from each participating country were sought, where issues

of lifetime engineering have been applied to buildings or other construction works. Hence, the task included a study of the state of the art of existing and ongoing national demonstration programs and projects on life cycle costing, life cycle performance, service life planning and design, energy efficiency of buildings, reuse and recycling. The initial survey was followed by a selection of the most proposing projects, spreading over all types of works: housing, office, commercial and industrial buildings, transport structures (bridges, tunnels, harbours, roads, railways), and energy production structures (power plants, pipelines).

These selected demonstration projects were invited for a presentation at an international workshop, and were presented in conjunction with the in conjunction with the 10th international conference on durability of building materials and components (10dbmc) held in April 2005 in Lyon (France). The workshop was conducted as a LIFETIME project activity, involving project members, and representatives of all sides of the construction sector, as well as other stakeholders. Additionally, the posters were available for the scrutiny of the participants of 10dbmc during the entire conference duration and were displayed again at the 11th joint CIB international symposium "combining forces – advancing facilities management and construction through innovation" in Helsinki, June 2005.

The Survey and Questionnaires

The main purpose of the survey is to perform, among the existing projects reported by the National representatives, a selection of case studies intended to be used as a wide spread illustration of how the lifetimes principles are actually implemented. The selection is planned in order to cover as far as possible the different categories of works (from housing to civil engineering works, including offices, factories and power plants), the different sizes, the different steps of elaboration, from the paper project to the existing work, and finally also representing a geographical spread throughout the different participating countries. The initial step has been to elaborate a questionnaire for a large survey. The questionnaire was designed to identify to what extent life time engineering principles were applied in project planning. The national dissemination groups, who also gathered and provided the information, chose these projects. A second survey was performed after an analysis of the first round, with the intention to gather additional information on selected projects, which were perceived as interesting examples, consequently called "demonstration projects".

The first questionnaire was intended to collect essential information on each project submitted by the NDGL. A separate answer was required for each project, and it contained the coordinates of the responsible, the state of progress of the project ("paper" project according to a brief, project planned and ready to be built, project in the construction phase, project already built). The type of building is documented (building, civil infrastructure, industrial infrastructure, with several sub-classification for each category), and finally the fields of Lifetime engineering covered by the project are indicated. The list of these fields is extracted from the main introductive document on LIFETIME, already used in the WP1 questionnaire.

The first analysis of the questionnaires was conducted when roughly 60 projects from 12 countries had been reported. 40% of thee projects were already built (mainly younger than 5 years) and an additionally roughly 30% were in the construction phase. Among the not yet built projects, less than a third are only paper projects. The estimated total cost of the projects is essentially in the range, of 1 to 10 M€, except 5 projects above 50 M€. But this information is missing in a quarter of the answers.

This advancement of the first questionnaire and the possibilities to extract information of relevance for the LIFETIME project was understood as encouraging, with some main fields for improvement before selecting demonstration projects for a more detailed analysis. The improvements concerned to encourage the involvement of more countries and to receive more than one example from each country. This also to enable recognition of the regional differences in spread and content of lifetime principles. The goal to receive a total of 100 projects could finally not be reached, but a total of 86 answers was a good basis for the analysis.

Some core results of the analysis are displayed in the below figures, the complete evaluation presentation is enclosed as appendix 4.

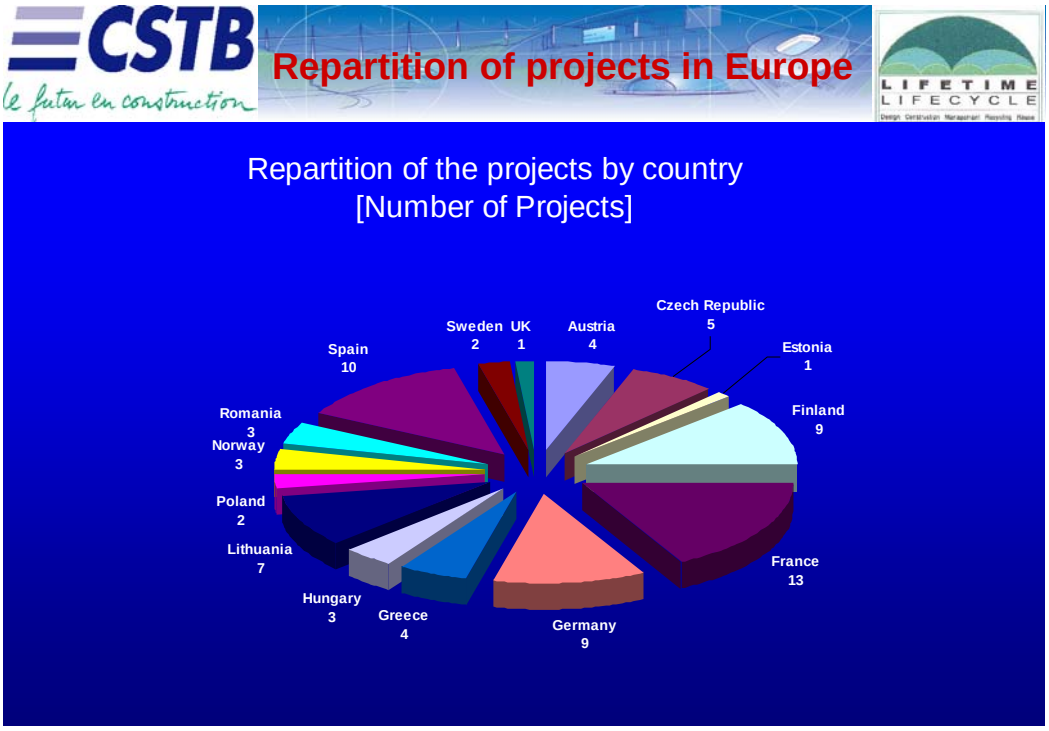

Fig 1 Case studies provided per country

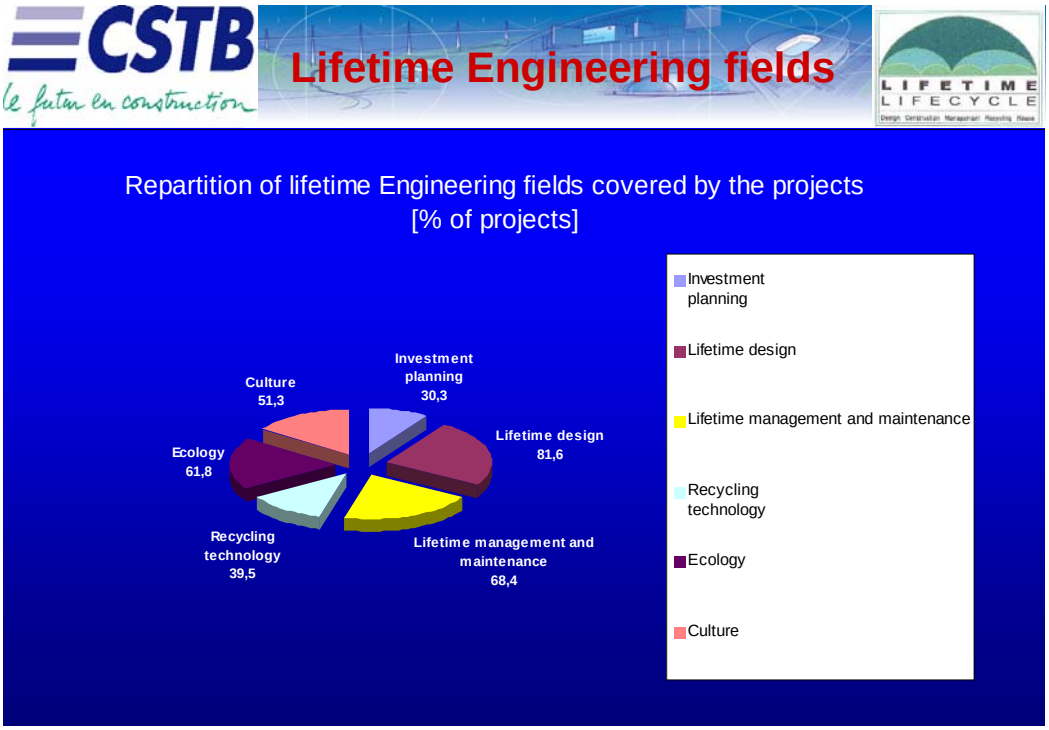

Fig 2 Life Time Engineering fields covered by the case studies

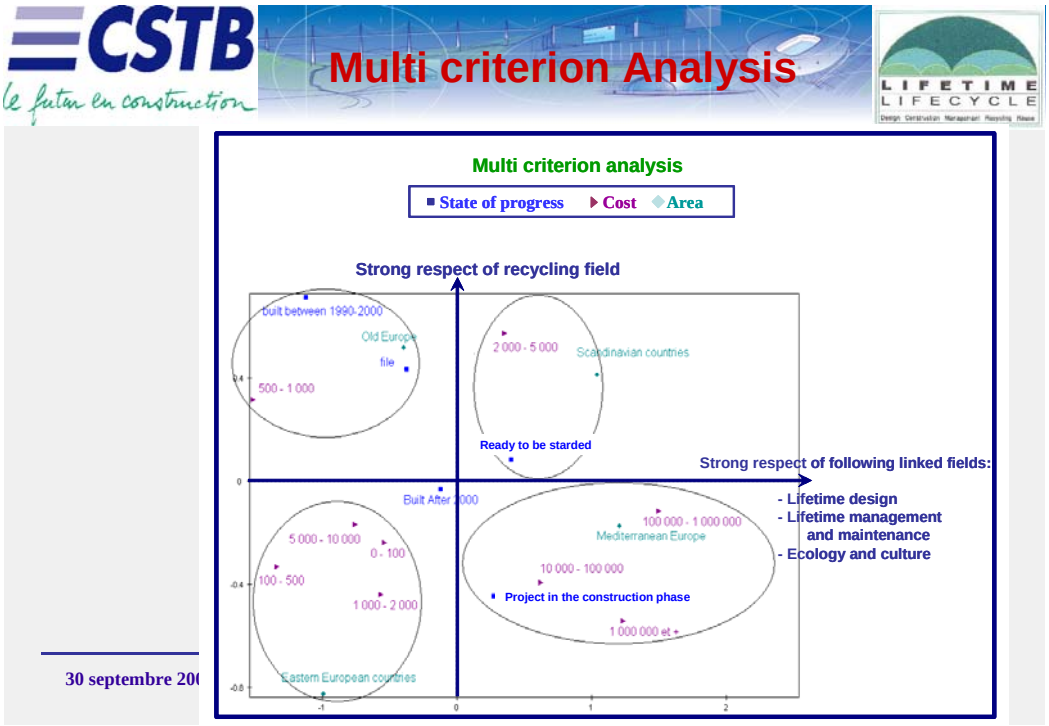

Fig 3 Tracing the connection between lifetime fields addressed, region and cost of project

The following step was the selection of representative projects, for which further documentation was gather through an additional questionnaire. This second round was conducted in order to prepare comprehensive and illustrative presentation of the demonstration projects during the 3rd Lifetime workshop to be held in April 2005 in Lyon.

Demonstration Projects

This section presents the project description from the case studies that have been selected to perform as demonstration projects and that were presented at the final WP5 workshop in Lyon. For a more detailed description including the answered questionnaires, please view the Appendices.

Austria - Checkpoints

Due to the increasing centralization of train operation and decrease in visual train inspection by station personnel there is an increasing demand for automated train inspection systems. One approach is to combine the abilities of multiple sensors to an integrated modular system for evaluation of the train condition, called ”Checkpoint”. Further improvement of train monitoring can be achieved by using networks to exchange train information. The data-exchange enables the system to do trendanalysis for characteristics that evolve slowly over time the train is in operation. Another advantage of this data-exchange mechanism is that expensive detection equipment must not be installed at all, monitoring stations and even equipment outages can be compensated by acquiring information from previously passed Checkpoints.

Functionality of Checkpoints
At the moment, several failure scenarios in the railway system have been identified:

- Derailed wagons, broken axles or bearings,
- Flat spot, reweldings and cracks on wheels
- Hot bearings, hot and stuck brakes
- Displaced cargo, open doors, silhouette violations
- Fire, overweight, broken pantographs

Numerous sensors are available. Combining sensor data provides better and more information about the status of the train. Data can be used for rail-pricing or for positioning data of cargo, too.

Apart from an increase in safety and quality, the introduction of the new OeBB management operation system has to result in a reduction of operational costs. This goal can only be achieved, if the personnel is concentrated on a few locations and the traditional train supervision is replaced by a technical solution, the so-called Checkpoints. Checkpoints can be defined as track-side locations where the trains are examined to detect any deviation from normal condition. This check is executed by sensor components which are passed by passenger and/or freight trains with the locally authorized speed. The data collected is considered as an important source for subsequent activities.

Czech Republic – Motorway

The D8 Motorway in Czech Republic is planned to link the German border in Saxony, going further on to Dresden on German A17 and linking to the German highway system. An intergovernmental agreement to open the D8 to the border on the Czech side and similarly the A17 to the border on German side was formalised in year 2000.
On the Czech side, all sections of the D8 except for last section 807 between Trmice and border and section 805 between Lovosice a Rehlovice are finalised and in operation. Both section 807 and 805 have already been designed. For section 805 financing is secured as this section has already been approved by the EIB for co-financing within program A of the

Construction of six new Motorway Schemes in Czech Republic. For section discussion 807 on means of financing are ongoing.
The D8 Motorway is part of TINA Corridor IV. The project of construction of section 807 situated in border region will be mainly aiming at international traffic, and many of the benefits will accrue to transit traffic using TINA Corridor IV

Finland – School

Overall the recent years the suitability and possibility to use private financing for building projects in the public sector has been studied in Finland. As a pilot project the city of Espoo drew up tender documents on a privately financed project in 2000. In summer 2000 Espoo carried out prequalification for the project. Espoo selected three groups for tendering phase.

The bid was submitted in February 2001. The subject was the Kuninkaantie high school, sports hall and swimming hall. The bid included design and build plus services excluding education. The total scope of the project was high school 4.800 sqm2 and swimming hall 2.700 sqm2. The total gross area was 11.000 sqm2.

Concession period is 27 years (2 years construction period and 25 years service provision). The concession expires 30 june 2028.

According to the contract the project company is fully responsible of the maintanance and services for that period. The annual fee paid out by Espoo is fixed and tied to the cost-of-living index.

For the project NCC established an SPV (project company). Two other owners were found (ABB and Sodexho). Each owner owns 1/3 of shares. The responsibilities within SPV are:

NCC:
- design & build & maintenance of the building excluding HEPVAC
- furniture and equipment
- project management

ABB
- design & build & maintenance of HEPVAC
- security
- outdoor services

Sodexho
- cleaning
- janitor
- catering, restaurant and cafeteria operations
- swimming control

France – Office Building

Société Générale
A new office tower for the "Société Générale" Bank with the following key figures:

Land: 2.300 m²
Office: 55.000 m²
184 m high
38 floors in superstructure of 1700 m² each

7 floors in infrastructure (3400 m² each)
with 20.000 m² of parking

Involved Stakeholders:	
Building Owner:	GALYBET (Subsidiary SG)
Building Owner assistant:	ORCADIM (Subsidiary SG + JACOBS FRANCE)
	SOGEPROM (Subsidiary SG) (H.Q.E.)
Property developer:	NEXITY
Project manager (Design):	ATELIER CHRISTIAN DE PORTZAMPARC (Architect)
	COTEBA IMMOBILIER SERVICES (Engineers)
Project manager (construction):	COTEBA
Developer:	EPASA
	(Public establishment of Installation SEINE ARCHE)
Realisation:	Beginning of the studies: July 2000
	Building permit: 28 November 2003
	Completion: April 2008

Germany – Castle Renovation

Tucher castle – repair of a castle, building automation in a pilot project

The building was built as summer residence for the Tucher family. Its present view is dating back to the years 1590-91. During its Lifetime the castle had been changed for several times, once a fire nearly destroyed it completely. In its high and closed way of building the castle is typical for the regional Renaissance architecture. The three main floors and the floor in roof level had always been used for housing. They were further used for housing, as offices and as restaurant.

Since 1999 an ambitious plan has been realized. In the historic ambience an exemplary project combining building automation and high value interior design has been realized. Over a period of about ten years the castle was a “work in progress” that developed constantly. Together with manufacturers new components had been worked out and integrated in a digital building control system. Highly important was not to create singular solutions but to be using serial products, that were modified and developed for modern building automation.
The regional authorities for preservation of monuments and historic buildings supported the project very much with the device to “preserving the old and integrating the new with respect to the existing”.
The repair of the castle followed ecological aspects. As example may serve the roof insulation being performed with sheep wool.

“Intelligent Building” is a very modern term of building industry in the 21st century. We need artificial intelligence – i.e. building automation – for living comfortably and still resource preserving in a building. The future of building will be mostly modernisation or repair. The project tries to compete against prejudices, combining a 400 year old building with advanced modern technique. Building automation should not be preserved for special facility assets while any building, including residences will profit of it. In the Tucher castle today’s available techniques are presented. They are available as serial products.

The project is extending the use of building automation to so far “untypical” elements providing them with sensors and actors. Cupboards and wardrobes can be worked as paternoster elevators. Electronic devices (oven, fridge, sauna,…) can be activated via mobile phone. Of course the traditional elements like ventilation, floor and wall heating are integrated in the automation system. Lighting, window shading and heating are part of the system, that allows to regulate each room separately. A fire protection system is set up, including web cams and automatic warning devices. A permanent contact between building and mobile person can be installed, using SMS, Internet or Fax and providing high building security.

Hungary – Cement concrete pavement test section

The cement concrete trial section built on road no. 4 near Pilis is a part of the strategy of Hungarian Ministry for Economics and Transport to enhance whole life investment economy in new Hungarian motorways.
The construction of some 1000 km new motorway is planned in Hungary for the next 10-12 years. The asphalt concrete pavements (Hot Rolled Asphalt and Stone-Mastic Asphalt) have not performed sufficiently on highly trafficked sections. Since 1976 only asphalt pavement have been built on new motorway projects. (Before this time-point cement concrete pavement constituted the uppermost layer of motorways). The late 90's and early 00's the asphalt pavement of the highly trafficked motorway M0 (ringroad of Budapest) have been repeatedly rutted in spite of the repair activities, increasing its whole life costs to an economically unbearable value. That is why, a co-ordinated survey and project was initiated in 1999 to revitalize the cement concrete pavements in Hungary. Literature survey, laboratory tests and small-scale site experiments were followed by full-scale experimental sections, among other, the one on the road No. 4 by Pilis.

The location of the 1000 m long section is road No 4. km 58+400-59+400.
The composition (recipe) of the cement concrete pavement mixture is:

370 kg/m3	CEM I 42,5				
1000 kg/m3	aggregate (ONZ 20/35	20 %;	NKZ 12/20	20 %;	
	UKZ 5/12	15 %;	OK 4/8	15 %;	
	OHO/4	30 %)			
155 kg/m3	Water				
0.43	W/C				
0.8 m%	plastificator				
0.1 m%	airved admixer				
0.4 m%	super-plastificator				

The construction of the experimental section has been concluded in November 2003. Since then the condition of the 1000 m long section with a pavement of 260 mm thickness is monitored every year in order to follow its performance.
These values permit to calculate the user costs as a function of time. Besides, the eventual maintenance and rehabilitation costs will also be compiled in order to calculate whole life costs.

Lithuania – Trade Centre and Office Building

At first at this place was 462 m2 commerce premises at the ground floor. The area of this building is near national and bigges hospital in Lithuania, so it was good idea to renovate

premises and equip a shop of medicine implements.Renovation of premises took 5 months-starting from demolition. The end date of project- 2002.

Initially it was only a housing building with a land. The housing building (426m2) was renovated and modified into office building. Also it was possibility to extend the building. An extention to a building is almost twice bigger than initial housing- 959 m2.
Now it is an office building with a leisure center inside. The building and renovation period-13 months. The project was finished at 1998.

Poland – Mining and environmental impacts

The main objective of this project was to develop and validate a holistic methodology to minimise the "full life-cycle" impact of metalliferous mining projects, adopting an integrated approach to production and process design, including waste disposal and remediation, and the costs involved. Despite the attempts of a number of learned societies and some European initiatives towards the development of a comprehensive LCA methodology, there has not yet been the development of holistic life cycle assessment system for the extractive industries, accounting for all stages of the mining activities, from exploration and development of a mineral deposit; to mining, processing of the ore, production of the concentrate; waste disposal, remediation; environmental monitoring, decommissioning and long term control and monitoring of the impacts. The main project emphasis has been on minimising the waste disposal requirements, through the process of "design for decommissioning" concept. The project considered the following themes: - Conceptual LCA modelling of the production and processing unit processes and financial modelling of these options where the main driver is the waste minimisation objective. Research has been be geared by full life cycle and whole industrial system concepts as well as by reduction of the waste to be disposed off and monitored after decommissioning. - The mining and processing alternatives modelled aim at developing methodologies to improve recovery, minimise waste production and ensure safe, low risk disposal with minimum impact monitoring requirements after decommissioning. - The research aimed at using the current state of the art impact monitoring systems installed around the waste disposal sites in mines and has used this to improve our understanding of the environmental processes to reduce risks. The ultimate objective was to develop methodologies to improve the environmental life cycle costs for both the productive and maintained periods of waste disposal sites around metalliferous mines.

Spain – Airport Madrid Barajas

Madrid Barajas Airport is developing as a major hub with worldwide connections and is the foremost European airport with links to Central and South America. Conveniently located 15 kilometres (nine miles) from the centre of Madrid, the airport currently handles more than 25 million passengers a year, a figure set to almost double by 2010. To cope with this increase in traffic a new satellite terminal is planned in addition to two new runways, making four in all. The project was begun in June 1997 by Estudio Lamela and Richard Rogers Partnership, who won an international competition announced by the company AENA.

The project required extension of existing airport facilities to meet the demands of growing traffic. Work began in September 2000 and will be completed in December 2004.
The construction, which will open for service in one year, was inaugurated ahead of time by José María Aznar and represents an important sign for the future of the Spanish capital.

The project is set up in three parallel buildings with inner courtyards permitting natural light to penetrate everywhere and offering views of the vegetation from inside to create a serene, relaxed environment. The parallel design of the buildings makes it possible to minimise the distance to be travelled, with maximum benefit for passengers. With a useable surface area of 820,000 m2 at a cost of 680,000,000 euro, the project includes 9,000 parking spots, direct links with train and metro stations, and of course the terminal itself, with its 37 boarding gates.

The complex consists of a 470,000 square metre terminal area, plus 315,000 square metres of parking space for 9,000 cars. On this scale, the new airport will be right up there with the biggest in Europe. And its modular plan and linear flooring leave room for an expansion due to be completed by the year 2010. A vast range of intermodal transport options will be offered.

The conformation of the land the airport terminal is built on played an important role in the design of the new structure: the terminal was built on a low rise, taking advantage of the slight difference in elevation to distribute routes and better define the space between the parking lot and the terminal. This relationship with the surrounding landscape is also evident in the form of the structure and the way it interacts with light and with the surrounding gardens.
The project incorporates several elements characteristic of sustainable architecture, such as a stratified cooling system which saves a considerable amount of energy.

The system is based on a series of ventilation mechanisms installed inside the pillars and employs built-in air conditioning in all high passenger density areas. These are choices closely linked with Richard Rogers' twenty years of work on the study and design of intelligent buildings capable of cutting operating costs throughout their life cycle and solving the problems of sustainability and humans' relationship with the land. The project also aims to make optimal use of natural light, while shades on the façades reduce reflection and the resulting overheating.

Rogers prefers to use zonal lighting rather than diffuse light, because it saves on energy and helps passengers moving from one area to another to find their way around. Another ecologically sustainable system collects rainwater for watering the gardens. The roof on the parking lot is covered with a low-maintenance lawn.

Madrid Barajas airport has embarked on a €2.91 billion expansion programme due to be completed in 2004 The new terminal building will have a yearly capacity of 35 million passengers. The wing-shaped building will have a total floor area of over 470,000m² and is designed with a wide range of environmentally friendly, energy consumption reducing installations. The terminal will host check-in desks, security controls, baggage conveyors, boarding gates, movable ramps, elevators and automatic escalators. The new satellite building will be capable of handling an additional 15 million passengers a year. The new terminal will host an automatic baggage handling system, capable of handling up to 16,500 pieces of luggage an hour. The 840m underground section of the M11 highway linking Barajas to Paracuellos del Jarama is also expanded

The dissemination matter and actions

Within the network, WP1 to 4 have to widely survey the actual level of the spread of the Lifetime engineering principles. This concerns:

- research work
- development projects
- knowledge and best practice within the participants' organisations in WP1
- state of the art from research to standardisation at the international level, especially outside the borders of the Lifetime Network in WP2
- methods and tools, and integration tracks in WP3
- existing and expected information management tools like data-bases in WP4

Such a huge collection and organisation of the available information will be available to be implemented only if a comparable effort is placed in the dissemination of that matter towards the network members, and through them, towards all the potential practical users for an actual change in the daily practice within the construction sector.
Here is the main work to be performed in WP5, and it faces some difficulties that cannot be ignored, related to the construction sector particularities (dispersion, slow diffusion of innovating aspects, language), and to the means available (funding available and availability of the persons).

It is obvious that the construction sector, more than others, is a very dispersed industrial field, with so many categories of professions (manufacturers, designers, contractors, professional owners, demolishers, ..), and in addition often acting in SME's. This means that any dissemination task needs a strong concern related to that particularity.

The construction sector is used to produce and exploit the works it produces for long period, with major responsibilities in terms of performance, safety, health, and covered as such by strong national regulation systems. The obvious way in such a context is of reproducing procedures and know-how which already demonstrated their efficiency. As a consequence, any innovative product or process-procedure needs a careful and necessarily "long" term assessment.

Finally the construction sector process is still very much country specific. The guidance documents (standards, directives, regulation) at the European level are quite recent, and the transposition into the national cores of texts is often a long way. Last but not least, the language barrier is still a major obstacle, as the daily practice of all the construction sector actors is always the national language: probably 20 languages are concerned within the Lifetime network.

Ultimately, it is the task for the national dissemination groups to establish material that is regarded useful for their particular situation. WP5 makes material that has been produced during the conduction of the project available for the NDGs. But from an international perspective, WP5 cannot identify the most reasonable focus for the various involved countries, the context of national or regional regulation and building practices on the one hand and the actual organization and responsibilities between actors on the other hand. The material provided by the LIFETIME network and disseminated by WP5 is intended to be made available nationally by the NDGs.

National dissemination groups can analyse the documented case studies and demonstration projects in the light of other studies from their countries, they can apply the benchmarking assistance and the reports on the international state of the art, all in order to locate their specific potentials, constraints and consequently their specific needs in order to promote the application of lifetime engineering principles in their construction sector.

WP5 creates information flyers promoting the core results of the LIFETIME network and makes the case studies and the demonstration projects available in the context of the general reporting of the network. By the dissemination through different channels, printed information folders, CD-ROM and the LIFETIME internet presence, it is hoped that the international awareness of the project can contribute to a lasting surge for information on the subject of life time engineering applied to the building sector, its products, actors and processes.

Links with other networks

Specific formal contacts have been established outside the Lifetime Cluster with two Thematic Networks of the 5th FP: PRESCO (Practical Recommendations for Sustainable Construction) and PeBBu (Performance Based Buildings).

Acknowledgements

For a Network like LIFETIME TN, dealing with an innovative approach in the construction field intended to integrate the habits, skills and concerns of all the actors, the task dealing with demonstration, dissemination and exploitation is a key issue for the further implementation of the concepts into daily practice. CSTB as leader of the related Work Package expresses its thanks to all participants. Undertaking the selection of demonstration as well as organizing the succeeding steps of organising and conducting the workshop as initial step for dissemination and exploitation relied heavily on the national dissemination groups' motivation, participation and contribution.

APPENDICES

1 List of WP5 members (National Dissemination Group Leaders)
2 Workshop Reports
3 WP5 questionnaire
4 Evaluation of questionnaires
5 Description of poster projects
6 List of Posters