SUSTAINABLE CONSTRUCTION IN PUBLIC AND PRIVATE WORKS THROUGH IPP APPROACH - THE SUSCON PROJECT

M. LOIZIDOU[1], C. KORONEOS[1], D. CHARDAS[2], A. BOURKA[3], T. PALEKITHRYTIS[4], M. AVRAMIDIS[5] and L. CHRYSOSTOMOU[6]

[1]National Technical University of Athens, [2]Edrasis C. Psallidas S.A., [3]EPTA Ltd, [4]Cybarco Ltd, [5]University of Cyprus, [6]Technical Chamber of Cyprus, **e-mail: mloiz@chemeng.ntua.gr**

ENVIRONMENTALASSESSMENTOFTHECONSTRUCTION ACTIVITIES - THE SUSCON PROJECT

Leading companies in the construction field, universities and technical consultants from Cyprus and Greece have established a consortium to demonstrate life-cycle thinking to the widely-spread construction sector. The main technical and scientific coordinator of the project is the Unit of Environmental Science and Technology (UEST) of the National Technical University of Athens (NTUA). Five more partners are involved in the project: EDRASIS C. PSALLIDAS S.A., a Greek construction company, EPTA that is a technical consultant company, mainly working in the field of environmental protection, the University of Cyprus (UCY), Cybarco Ltd, a contracting and property development company in Cyprus and the Technical Chamber of Cyprus (ETEK).

The main objectives include (a) a review of the construction activity in Greece and Cyprus and assessment of the environmental impacts, (b) an implementation of the Life Cycle Analysis methodology in two construction categories, (c) the assessment of all the ecodesign issues towards the ecodesign of a construction and development of ecodesign criteria, (d) the evaluation of the environmental performance of the participating construction companies, through the use of ecodesign criteria and (e) the creation of an online database regarding sustainable construction for the construction industry.

SUSCON's core outcome is the development of ecodesign criteria, with respect to some major environmental issues :

- Environmentally friendly construction materials
- Energy efficiency in buildings
- Construction and demolition waste.

ECODESIGN CRITERIA OF THE CONSTRUCTION PRODUCTS

Good design is fundamental to sustainable construction. Decisions made at the initial design stage have the greatest effect on the overall sustainability impact of construction projects.

Designing buildings for long life and minimising operational burdens are key aspects of sustainable construction.

Building materials choices are also important in sustainable design because of the extensive network of extraction, processing and transportation steps required to process them. One of the most effective strategies for minimizing the environmental impacts of material use is to reuse the materials from buildings.

Rehabilitation of existing building shells and non-shell components reduces solid waste volumes and diverts these waste volumes from landfills. It also reduces environmental impacts associated with the production and delivery of new building products. Reuse of an existing building minimizes habitat disturbance and typically requires less infrastructure such as utilities and roads.

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

When it is impossible, or undesirable, to extend the life of buildings through adaptation or refurbishment, and therefore demolition becomes unavoidable, it is important that end-of-life impacts are minimised. Principally this involves minimising waste and ensuring that materials are recovered, recycled and reused.

Construction and demolition (C&D) waste consists of the materials generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D waste often contains bulky, heavy materials that include concrete, wood (from buildings), asphalt (from roads and roofing shingles), gypsum (the main component of drywall), metals, bricks, glass, plastics, salvaged building components (doors, windows, and plumbing fixtures), and trees, stumps, earth, and rock from clearing sites.

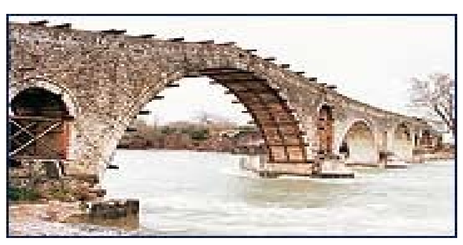
THE EUROPEAN CONSTRUCTION SECTOR

The construction industry is Europe's largest industrial employer, accounting for 7.5% of total employment and 28,1% of industrial employment in the EU. It also accounted for 9,7% of GDP and 47,6% of gross fixed capital formation in 1999. The "cradle to grave" aspects linked to the creation, use and disposal of built facilities taken together constitute major environmental impacts. Construction activities consume more raw materials by weight (as much as 50%) than any other industrial sector. The built environment moreover, accounts for the largest share of greenhouse gas emissions (about 40%) in terms of energy end usage. Measured by weight, construction and demolition activities also produce Europe's largest waste stream, (between 40% and 50%) most of which though, is recyclable.

THE OFFICE BUILDING CASE STUDY

The objective of this LCA case study is the analysis of the environmental impacts of a widely used construction product, as an office building. The life cycle system of the office building comprises of the following stages:

- Raw material extraction: The life cycle of the office building starts with the extraction of the raw materials. This phase includes both the production of raw material and the use of these raw materials to produce other materials and substances. The environmental aspects and impacts from this phase arise from the mining operations, refining of ores, and manufacturing of materials and substances.
- Components manufacture: This phase covers the manufacturing of the components used in the office building such as concrete, paint, bricks, gypsum fibre boards, aluminium windows etc.
- Components transportation: Components are delivered to the construction site by road transport. The environmental impacts in this phase mainly arise from the energy consumption of the carriers.
- Construction of the office building: The main environmental aspect from this phase is the energy consumption and solid waste production of construction processes.
- Use and Maintenance stage: The use phase encompasses all activities related to the use of the building over its life of 80 years. These activities include all energy consumed within the building, including heating, cooling and lighting.
- Demolition - Final Disposal/Recycle/Waste Management stage: It begins after the building has served its intended purpose and includes the demolition process and the solid waste management system (recycling and final disposal of inert materials).



THE ROAD PAVEMENT CASE STUDY

The life cycle of the road is divided into 5 major subsystems:

- Raw material production: The life cycle of the road starts with the extraction of the raw materials. This phase includes both the production of raw material and the use of these raw materials to produce other materials as asphalt. The environmental aspects and impacts from this phase arise from the mining operations and manufacturing of secondary materials.
- Raw material transportation: Materials are delivered to the construction site by road transport. The environmental impacts in this phase mainly arise from energy consumption of the carriers.
- Construction of the road: It includes excavation processes, material placement and road pavement processes. The main environmental aspect from this phase is the energy consumption and solid waste production. The road structure consists of four main layers and two coating layers.
- Use and Maintenance stage: This stage includes the use phase of the road and all maintenance activities during its useful life.
- Demolition - Final Disposal/Recycle/Waste Management stage: It includes the demolition process and the solid waste management system (recycling and final disposal of inert materials). An end-of-life subsystem is not included in the system since the practice in the last decades is not to demolish roads but continuously expand the existing road network or leave the road materials in place even when the road is withdrawn from service.

CONCLUSIONS

The whole topic of "sustainable construction" as well as its scope has already become a major issue for the industry and this tendency are expected to continue. There is a growing need therefore to raise the awareness of sustainability issues both among the actors in the entire construction process, as well as the general public, which is the principal beneficiary of built facilities.

The SUSCON project is the first full-scale application of Integrated Product Policy and Sustainable construction in Greece and Cyprus, where construction industries could evaluate their environmental performance with the use of up-to-date software. It is also the first time that public authorities in these two countries have an instrument to monitor, evaluate and promote environmental criteria in tender specifications.