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ECOLOGICAL BUILDINGS – BUILDINGS FOR PROCESSING AND LIQUIDATION OF WASTE.

Introduction to waste treatment

The topic of my dissertation work are ecological buildings, e. i. buildings for processing and liquidation of waste. My attention is focused to incineration plants for waste. It's impossible to comprehend all the aspects of incineration of waste as an independent part without knowing all the possibilities of processing and liquidation of waste that modern technology provides. That's the reason for my study of different technologies and I'll mention them in my work.

- The architect designing an incineration plant, should to include all the aspect of waste treatment already in the preparation analysis, in order to find the best suitable variants of solution of problems with removal (transportation), processing and liquidation of refuse as well as decide about a suitable localisation of such structure. When deciding on the best possible location of an ecological construction, the following views should be taken into account:

- ecology – protective zones, the major direction of winds...,
- landscape design – correct placement of the structure into landscape (or settlement) from aesthetical point of view,
- hygiene – the protection of human health,
- traffic – communication routs leading to object that processed the waste, should not be highly frequented and potentionally dangerous,
- economy – determination of expensies for processing and liquidation of waste, it's minimalisation, searching for new possible forms of ecologically acceptable way of liquidation of refuse in relation to potential of the settlement (possibility of recycling).

Naturally this approach demands co-operation of more specialists in professions

such as, for example, city planning, ecology, hydrology, geology, economy...

In Slovakia, the situation in the field of treating the waste is very difficult and it is still strongly influenced by the previous political system. We can say we fail away the member countries of the European Union.

Disposal of municipal waste on land is still the major disposal way in the Slovak Republik (SR). In 1997, 540 landfills were operated in Slovakia, out of which 124 fully complied with set technical standards. From the total amount of special and hazardous waste, 2.3 mil tonnes were deposited at landfills. This number represents 25.6% of total volume of special and hazardous waste being generated. Five new landfills (Zlaté Moravce, Michalovce, Spišská Belá, Slavošovce and the Žilina region landfill) were under construction in 1997. Landfills at Brezová pod Bradlom, Dolný Bar, Žilkovce, Cerová and Pezinok were open in 1997 for the first time. The process of closing down and reclamation of landfills further continued.

Compared to 1996, the amount of waste being incinerated in 1997 decreased by 110 thousand tonnes. This decrease resulted from unsatisfactory technical conditions of incineration plants and from introduction of tighten emission limits. In Slovakia, 38 out of 78 existing incineration plants are used for hospital waste disposal. The main disposal centres for municipal waste are Bratislava and Košice incineration plants. In 1997, 188 818 tonnes of special and hazardous waste were incinerated. This number represents 2.02% of total waste volume. In 1997, preparation for reconstruction of the municipal waste incineration plant in Bratislava, started. Reconstruction of hazardous waste incineration plants at Slovnaft a.s. Bratislava and Duslo a.s. Šaľa is under ongoing discussion.

My contribution is dedicated to description of situation of waste management in Great Britain. Great Britain, as well as Slovakia, will soon have to agree with recycling and incineration of waste in a higher degree as it's evident and common in other EU countries. I believe that new law on waste which is undergoing the improvement will contribute to improvement of this situation in Slovakia.

The source of information for this presentation has been the publication by Cliff Tandy: Landscape of Industry, Internet web-pages: Biffa – waste services, EPA – Environmental protection Agency, ECO – web, and information relised by Ministry of Environment of Slovakia.

WHAT DO WE MEAN BY WASTE?

What is Waste?

As an outcome of every production process, waste is an inescapable consequence of a consumer society. As such, waste is a 'product' like any other.

An average British family:

- generates 0.59 tonnes per annum from its dustbin;
- has a further 3.6 tonnes produced on its behalf by industry and commerce;
- a further 15 tonnes by agriculture, mining, quarrying and construction works;

Waste is also a paradoxical product. It demands contrary thinking. Companies need to minimise its production and pay "buyers" to take it away. However, waste is not an homogenous commodity. Waste streams are complex, presenting several different disposal challenges. Companies need to buy a package of services to handle all aspects in an efficient and responsible fashion. Yet because waste is unwanted, otherwise well-run firms tend to ignore a fundamental management principle that governs all other areas of their businesses.

Waste is not, in itself, a bad thing; rather it is poor waste management that is wasteful and sometimes dangerous. Professionally handled waste presents no threat to people or their environment

A healthy society is not one which produces no waste, but one which recognises its duty to manage, not ignore, its waste.

We all, society and industry together, have a responsibility to manage waste with an eye to the future, to avoid the threats of pollution, disease and environmental blight.

Refuse disposal.

Refuse disposal has only recently become both a serious problem and a subject for scientific study. Before about 1925 it was a simple matter of finding suitable sites for the loos dumping, possibly burning, of domestic and harmless industrial refuse. These early tipping sites are now, frequently, problems in derelict land reclamation.

"Crude" tipping, as it is known, either at sea or on land is now uncommon in urbanized countries. It can be a serious health hazard, from vermin, insects, odours, wind-blow contamination, water-course pollution and fire. This problem may very well be met with in under-developed countries.

However, it is in the affluent societies that the volume of refuse is increasing. In Western countries domestic refuse has doubled in quantity in 20 years. On the other hand, has also the composition of produced refuse changed. The greatest changes are the decline in dust and ash content, due to new forms of heating (domestic refuse in 1968 is composed of 22% of ashes), a great increase in the volume of paper and plastic packaging materials.

The type of material included is gradually changing from compressible, combustible and harmless kinds, to almost indestructable materials requiring great force to compress, and possibly including toxic compounds.

DON'T MAKE IT - MINIMISATION

The most effective way for a company to tackle the escalating cost of waste disposal is to minimise the volume of waste produced. Focusing on ways to reduce waste often brings a further benefit by exposing hidden inefficiencies in manufacturing processes.

But waste minimisation requires shifts in a business culture. As an unattractive and previously disregarded issue, waste must now be made the focus of attention. Personnel at each stage of the design and manufacturing chain must review their processes and consider the implications that those processes have for each other. This

change reflects society's shifting attitudes to waste. But, if fostered within the corporate culture, it is a tremendous potential source of competitive advantage.

The impact on design

Waste stream analysis of products and packages is also an effective way of highlighting subjects for redesign. The greatest steps forward in this area have been in food and beverage containers. The table shows the reduction in weight in packaging materials in recent decades.

Kind of packaging	1950	1960	1970	1980	1990
Milk bottles	538g	397g	340g	245g	245g
Yoghurt pot		12g	9g	7g	5g
Jam jar	180g	180g	180g	180g	160g
Plastic bottles				66g	42
Rinks cans	91g	91g	91g	20g	17g

It is difficult to predict the limits of waste minimisation because it depends on achieving new technology efficiencies and on the incessant quest for new materials. However, it is an inescapable fact that a consumer society with ever-rising demands will continue to generate waste which must be disposed of by recycling, burying or burning, because waste minimisation can only go so far.

Sources of Refuse, 1968, by Cliff Tandy

Household	58%
Commercial	20%
Industrial	18.5%
Miscellaneous	1.5%

Source of Refuse, 2000, by Biffa

Household;	5%
Sewage sludge	8%
Commercial	4%
Industrial	17%
Demolation and construction	8%
Dredged materials	11%
Mining and quarrying	27%
Agricultural	20%

Methods of landfill and reducing of refuse.

Until now, we know few basic methods of tipping and reducing of refuse with various combinations. It is:

- controlled landfill
- controlled incineration
- composting
- re-cycling

RE-CYCLING

It almost goes without saying that recycling is a hugely popular idea. It appeals because it reduces society's impact on the environment. Therefore, the primary benefit of recycling to industry lies in the marketing advantage of a good corporate reputation.

Recycling reduces the amount of waste to be transported to landfill sites and the bill for increasingly costly landfill space. It also offers a means to recover costs by drawing back into the product cycle materials that are otherwise lost.

The practicality of recycling is governed by comparing the costs of using recycled material with the costs of fresh raw material and the cheapest alternative means of disposal. Moreover, in several markets such as paper and glass, the supply of recycled products may exceed demand. If this happens, prices will weaken sharply.

Recycling has both the obstacles and benefits.

Recycling is not cosmetic, even if the obvious benefit of recycling lies in improved corporate reputation. The decision to recycle should be taken as part of a company's manufacturing and financial strategies.

Recycling has a dramatic impact on

operations and internal accounting, where the demand for product redevelopment must be addressed.

The profit benefits can be remarkable. One recent case is of a hotel and restaurant chain which discovered it was paying waste disposal companies £15,000 annually to dispose of 500 tonnes of aluminium cans worth £250,000.

But companies must not forget that recycling cannot eliminate waste. It merely reduces the volume before incineration or landfill.

COMPOSTING

Composting is method which turns putrefying noxious refuse into an innocuous usable humus. It includes:

- pulverization
- digestion
- addition of sewage sludge (or not)
- fermentation

the method is biological, and high temperature is essential.

The high cellulose content of paper, wood and the inorganic components of plastic materials do not break down easily in the composting process.

The reduction of domestic and garden refuse into compost sounds an ideal solution, but has not, been successful. The plant is elaborate and the agricultural value of the product is too low to justify transport costs for such a bulky material.

Furthermore, there is a serious risk of a build-up of toxic metallic salts, if repeated applications of the product are made.

CONTROLLED INCINERATION.

In the UK, around 4 percent of their controlled household waste is burned. It is about 2.5 million tonnes per year. This includes some top-ups from industry and commerce.

There are, however, obstacles. It is the public's belief that incineration is environmentally unacceptable. Waste incineration is seen as dirty, contributing to acid rain, the greenhouse effect and respiratory complaints. This popular view is behind the times. Modern furnace technology,

combined with efficient wet and dry 'scrubbing' systems, produces very clean emissions. Garden bonfires give off more pollutants than a modern waste incineration plant.

However, modern incineration is capital-intensive. Sophisticated plants, capable of burn temperatures of 1300°C and fitted with flue gas filters, are now required to satisfy Environmental Protection Agency controls on atmospheric emissions. More than 50 per cent of municipal waste incinerators constructed since the mid-'60s have now been mothballed for not matching European standards of incineration. All will have to close unless they are upgraded.

Recently, the prospect of rising landfill costs has prompted authorities to reconsider burning waste. Government support means incineration projects are being re-evaluated as combined heat and power plants, although the long term future remains uncertain.

Guaranteeing the return from incineration

It can cost from £70 to £110 m to build a modern incinerator, requiring about 300,000 tonnes of waste per annum to break even. Payback is as much as twenty years, so installers look for certain conditions for the investment to succeed:

- an appreciable saving on landfill costs
- a predictable market for heat and power
- a guaranteed supply of waste to keep the plant burning at maximum capacity

Nearly all waste-to-energy plants (is it kind of re-cycling?) are in local authority hands and these face significant upgrading to meet new standards. Civil engineering and power companies are eyeing this market. Investing in energy-from-waste schemes may make economic sense and appeal companies or regions facing:

- high heat/energy needs
- above average landfill costs/ local landfill shortages
- above average energy transmission costs
- large urban concentrations

How green is modern incineration?

Devotees of incineration insist that it is an environmentally friendly mode of disposal.

Their arguments are:

- modern technology produces minimal emissions
- much ash is recyclable for ferrous metals' recovery, road construction or building materials
- cost estimates (net of electricity revenue) suggest burning is competitive with landfill at gate prices of £30 per tonne
- burning waste eliminates methane, a 'greenhouse' gas, produced by landfill

CONTROLLED LANDFILL

Waste: The Options - Bury it - landfill

Landfill presently accounts for around 90% of controlled waste in the UK. This means that around 90 - 100 million tonnes of waste are sent to landfill in the UK each year at approximately 4000 sites. Consequently, even with a trebling of other means of disposal, landfill will remain the most likely option for British industry for the next decade. But during that decade, its cost is expected to double.

Landfill is a fact of life, but one which is either ignored or sensationalised. Therefore, the facts on landfill must be made clear, and the myths dismissed.

First, disposal by landfill is tightly regulated. Secondly, the industry has high standards of professionalism and landfill is now a scientific process using excellent engineering practice. A landfill site is an expensive, long term development and large UK operators have invested significant sums to ensure safe permanent sites.

Serious contamination crises have occurred under fewer stringent laws in the US, and during the late 80s, the UK suffered from illegal fly-tipping. Allied to this, public understanding of the high safety standards of professional landfill techniques lags behind popular recognition of the link between dirt and disease. Members of the public who wish to reassure themselves that a local landfill operator does not conduct operations which might harm environmental health should check for a best practice policy.

Planning consent

A waste management firm applying for planning consent will provide an environmental impact study, which will include:

- landscaping issues
- containment of litter
- site management, security, drainage, noise containment, operational hours
- traffic impact
- surveys of flora and fauna
- Licensing consent

Licensing is a matter for discussion between the WRA, the NRA and other statutory consultees and the applicant. Items they will discuss include the geology, engineering standards, local need, and the type of waste being placed in the site.

Over the last five years, the average waiting time to obtain both planning and licensing consent has lengthened from a few months to over a year. Applications are often referred to the Secretary of State for final decision. This has created a pond of applications for landfill operator licences awaiting approval and has exacerbated - in certain regions - the growing landfill shortage.

What has to be done to prepare an approved site for use?

Although public opinion, shaped by the NIMBY (Not-In-My-Back-Yard) syndrome, often suggests otherwise, landfilling is not the haphazard business of throwing rubbish into a convenient hole. A suitable site is prepared by qualified engineers to ensure that the surrounding environment will not be affected.

Protecting the water table

Before any waste enters the site, an engineered pit lining system is constructed to seal it from the surrounding rock, soil strata and water table. State-of-the-art landfill sites are designed to ensure that water entering the site is contained within the mass of materials stored. During use capping systems and small working faces limit the ingress of rain water.

In the UK, professional waste companies work in line with the best Continental and US practices in banning the input of liquid material direct from tankers to landfill.

What safety procedures are required during the active life of a landfill site?

Deposit

Rubbish is deposited in consistent even layers according to strict engineering

procedures. These ensure safe decomposition and a stable body of refuse.

Monitoring and control

Decomposing waste can generate landfill gas (LFG) and noxious liquid (leachate). A professionally administered landfill is checked for potentially explosive gas migration. Ground water quality is also regularly monitored.

Methane from landfill

LFG is predominantly methane. Currently about 70% escapes into the atmosphere and the rest is either flared off or used for power generation.

Of the 66,000 MW total produced by the UK electricity industry in the UK, around 32MW is generated from LFC methane. Modern landfill construction and capping systems will improve this figure.

What after-care must be provided for full sites?

Landfill operators not only have to provide reassurance of minimal impact on local communities during a site's productive life, but for many years after it is full.

Restoration

Filled landfills offer opportunities for landscaping and development of public open space in areas of former industrial or mining dereliction. Restoration is now a key part of landfill management, since it returns sites to recreational or agricultural use. Thousands of trees are often planted on the perimeter of a large modern site.

Financial provision

The pollution risks associated with large bodies of waste do not disappear simply because a site is full. Legislation provides for the original operator to be held liable if a closed site develops problems. Responsible waste companies recognise that liabilities extend many decades after site closure.

Large blue chip operators in the waste sector are now making increasing balance sheet reserves for future liability provision over 30 or 40 years.

This may take the form of a long term financial guarantee. In some cases, a utility

company parent for a waste operator provides the necessary surety that the operator is financially secure enough to face its liabilities, and will still be in existence decades after site closure.

Landfill - value for money

Modern maintenance standards cannot be attained while cutting corners on costs. Economies in landfill, as in all waste management areas, are achieved through scale. A landfill operator - to offer both value for money and legal compliance must have integrated treatment, collection, transport, disposal and in house engineering elements. This offers not only competitive pricing but also a service tailored to the distinct needs of the waste producer.

Landfill - the future cost

At present landfill costs between £7 and £20 per tonne for disposal. This cost was doubled before the end of the century. Five factors will drive up prices:

1. Constriction of supply

Landfill sites are a finite resource. New planning constraints mean that fewer sites can now be classed as suitable for landfill and planning consent is subject to ever lengthening scrutiny.

2. Increasing distances

There is no shortage of available excavated void each year, but the sites will be further and further away from centres of population.

3. Rising infrastructure and start-up costs

The costs incurred in gaining planning and licensing consent make it uneconomic to attempt development of sites below 1.5m cubic metres. A cost of £2m before the gate is opened for the first time is common. Thus, only large voids justify the risks.

4. Rising revenue and maintenance costs

Legislative and public initiatives have triggered growth in essential landfill management practices; installation and maintenance of artificial membrane liners, gas management systems, monitoring systems and sophisticated IT are the result of these statutory obligations

5. Government fiscal policy

Rising public sentiment against landfill and in favour of minimisation and recycling has prompted the Government to consider instruments to encourage industry to consider alternatives before ultimate disposal. The Advisory Committee on Business in the Environment advised the Government in its 1991 report that 'the price of landfill should be increased significantly to levels obtaining elsewhere in the EC'. A recent report from the consultants Coopers & Lybrand examined a levy to be imposed on the operators of all landfill sites according to the weight of the waste landfilled. The Government is presently considering how to assess the likely impact of such a levy on the industrial sector.

Landfill will remain for at least a decade the principal means for UK policy to dispose of its waste.

The cost of landfill is set to double during that period. For a UK company spending 1% of turnover on waste and enjoying profits of 5% on turnover, this could mean a 20% reduction in profit.

As public attention focuses increasingly on where waste comes from, where it goes, and who takes the decisions in that process, only companies that choose waste management firms with the highest standards can expect the double benefits of enjoying the favourable opinions of their own consumers and avoiding legal liability for their waste practices.

Waste disposal costs UK only 0.75% of its GNP. As a result, waste is not generally a high profile management issue. We can see that waste management is very important part of landscape management which has an influence on work of architects.

Waste disposal costs have doubled in the year 2000. Waste disposal have a significant impact on a company's bottom line, driven by landfill scarcity, transport costs and possible taxation policy.

Landscape environmental image among inhabitants is likely to become as important as its economical development. Major players in the sector are emerging to support that need, prepared to invest significant sums in a tightly regulated sector.

There is a clear need for government to develop waste management strategies with

an eye to landscape engineering and design. There is need to make adequate consequence for minimalisation of waste disposal. And above all an accurate nationwide database on the type, amount and disposal methods used for the nation's waste output is needed. This must involve a consensus of opinion at all levels so that any board room discussion on waste is founded on factual evidence - not prejudice.

Waste treatment of Great Britain is on similar level as in Slovakia. Also volume of incinerated wastes is almost the same. The example of Great Britain can show us the supposed development of various technologies dealing with processing and liquidation of waste in accordance with law effective in European Union.

As a matter of fact, according to the waste treatment development in Great Britain, architects will have to assess:

- what kind of structure will be preferred,
- how the floor plan and hygienic and fire security demands to these structures will change,
- possible space and volume composition changes,
- future use of various construction materials and constructions.

My dissertation work is aimed at various strategies of waste management and their impact on architects' work on three levels:

1. landscape planning
2. urban planning
3. structure design

I believe the study of examples that originated in Great Britain can help us to anticipate development and demands of waste treatment in our environment, to make conclusions that have universal value and thus avoid possible ecological collapses and financial losses.

Even today we can suppose, that only landfills that fully comply with set technical standards, regional incineration plants of municipal waste and hospital and hazardous waste incineration plants, will be challenged in our country. Program of Waste Treatment of the Slovak Republic up to 2005 reflects all these facts.