Switzerland

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ABSTRACT: In Switzerland construction waste management is dealt with under regulations and guidelines based on the Environmental Protection Law. The legislation requires that waste is avoided or - if that is not possible - reused. Authorities can prescribe the reuse of waste if this is ecologically and economically reasonable. Standards regulate the waste management on building sites and the use of recycled material in construction. Approximately 11.1 million tons of construction waste is generated per year – excluding excavated earth. 84% is reused – either directly on construction site or after an appropriate treatment. The rest is disposed of on dumps or burned. Different tools are available for waste owners, waste disposition companies and waste-law executing authorities. One of them is the Disposition Guide. It consists of a central database listing all waste disposition systems and a web page that offers information about waste treatment.

1. LEGAL STATUS AND STRUCTURE

1.1 *Legal status*

Environmental protection in Switzerland is based on the Federal Constitution (Bundesverfassung [BV] 1999). In Article 73 and 74 the Constitution requires a sustainable handling of the environment. Harmful effects should be avoided and where this is not possible, the causer is responsible for resulting costs. Based on this article the government has issued numerous laws, regulations and guidelines. In addition private organizations issued standards, which also have an obligatory character.

1.1.1 Laws

In 1983 the Swiss parliament issued the Law for Environmental Protection (Umweltschutzgesetz [USG] 1983). The law contains the basic principles of waste management, without treating construction waste specifically. The law requires that waste should be avoided or reused as far as possible. The government can prescribe the reuse of waste if this is ecologically and economically reasonable. The cantons are responsible for the execution of the law.

1.1.2 Regulations

Numerous regulations relate to the Law for Environmental Protection. The major regulation in the field of waste management is the Technical Waste Regulation (Technische Verordnung über Abfälle [TVA] 1990). It requires the separation of construction waste on building sites. Waste has to be separated into the following categories: Unspoiled excavated earth, waste that can be disposed of in dumps without further treatment, inflammable waste and remaining waste. Excavated earth should be used for re-cultivation projects as far as possible, inflammable waste should be burned. Authorities can require waste owners to recycle their waste if this is ecologically reasonable, technically feasible and economically bearable. The federal states have to write a waste plan, which describes the state's waste management system.

1.1.3 Guidelines

The Federal Office for Environment FOEN has issued numerous guidelines aimed at standardising the way in which the federal states apply the regulations. The guidelines specify the national regulations and define quality requirements of waste to recycle. There is, for

example the Excavation Guideline (Aushubrichtlinie, BUWAL, 1999) and the Directive for Utilization of Mineral Waste Material (Richtlinie für die Verwertung mineralischer Bauabfälle, BAFU 3106, 2006).

1.1.4 Standards

The Swiss Engineer and Architect Association SIA and the Swiss Association of Road Building Experts VSS, regulate the waste management on building sites in their standards. These standards are mandatory. The associations require the creation of waste management plans in order to oblige the planners to implement waste management in the earliest planning and design phase (SIA 1993; VSS 1998). These standards also determine quality requirements for recycled construction materials. (SIA 1994)

1.2 *Structure and responsibilities*

Switzerland consists of 26 federal states all of which have their own constitution and federal laws. In the field of waste management, the national government is responsible for issuing laws while their execution is the responsibility of the states. Additionally the states and municipalities have their own more specific laws and regulations on waste management. The Federal Office for Environment FOEN tries to standardise the application by issuing numerous guidelines.

1.3 *Classification*

According to the SIA 430 (SIA 1993) construction and demolition waste is grouped into four different types:

1. Excavated Earth (“Aushub”)
2. Construction and demolition debris (“Bauschutt”) which is further differentiated into road construction waste (“Strassenaufbruch”), asphalt debris (“Ausbauasphalt”), concrete debris (“Betonabbruch”) and mixed debris (“Mischabbruch”)
3. Bulky construction waste (“Bausperrgut”)
4. Special waste (“Sonderabfälle”)

2 STATISTICAL OVERVIEW

2.1 *Introduction*

In the field of construction waste, no statistics have been made in the recent past. In 1998, the FOEN and the federal states assigned an engineering company to execute a calculation model on resulting construction waste between 1997 and 2010. The results have been published in 2001 by the FOEN (BUWAL 2001). In 2004 those results have been checked critically within the framework of a more general annual waste statistic (BAFU 2004). The examination showed that the construction waste amounts have not change much since 1997.

2.2 *Swiss building stock*

The following model calculation, is based on data from the Federal Statistical Office (Bundesamt für Statistik BFS, 2005) and displays material flow calculations for Switzerland. The Swiss building stock consists of 2.46 billion tons of embodied construction material, of which about two-thirds are stored in structural engineering stocks and one-third is stored in civil engineering stocks and other infrastructure buildings. The major material groups are concrete with approximately 1060 million tons and gravel/sand with 760 million tons.

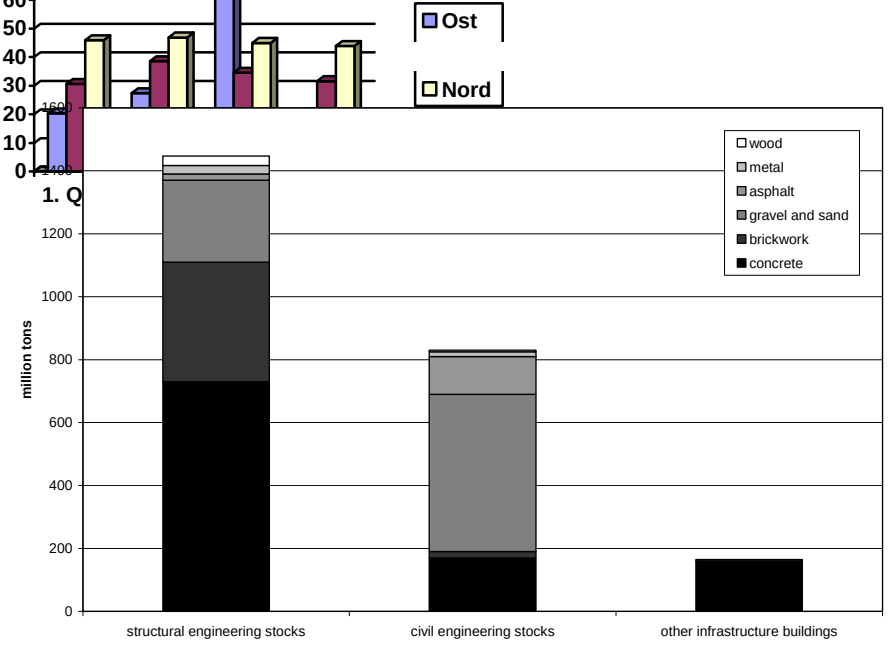

Figure 1: Estimated construction material stocks in structural and civil engineering and other infrastructure buildings (BFS 2005)

2.3 *Construction waste and types of disposition*

The embodied materials are the source of future construction waste. In 1997, 11.1 million tons of construction waste were produced by demolition, renewal and building of structures. Excavated earth is not included in those amounts.

Approximately 42% of construction waste is reused directly on the construction site. This amount consists exclusively of road construction debris and bitumen waste. Another 39% - mostly concrete, bitumen and mixed debris and gravel/sand - is reused after an appropriate treatment. This makes a total of 81% of reused waste. The remaining waste is either disposed of in landfills (approx. 1 million tons) or burned. Wood waste contributes two-thirds of the burnt s.

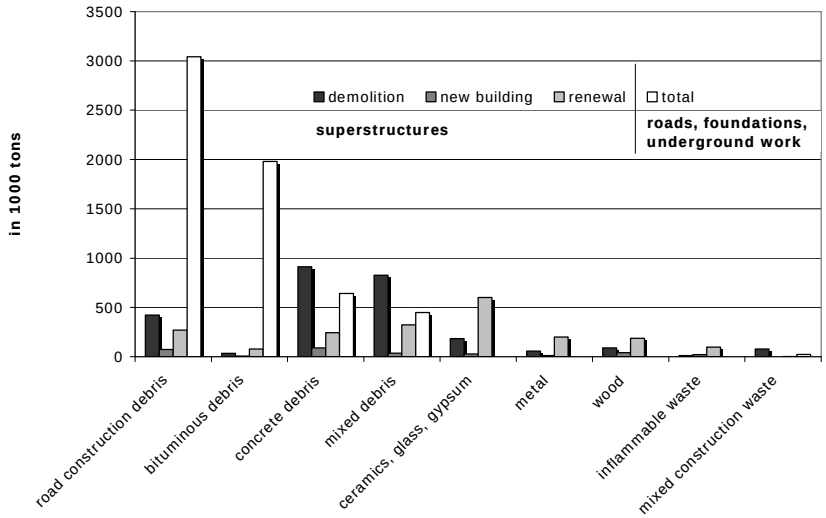

Figure 2: Construction waste in Switzerland 1997 (BUWAL 2001)

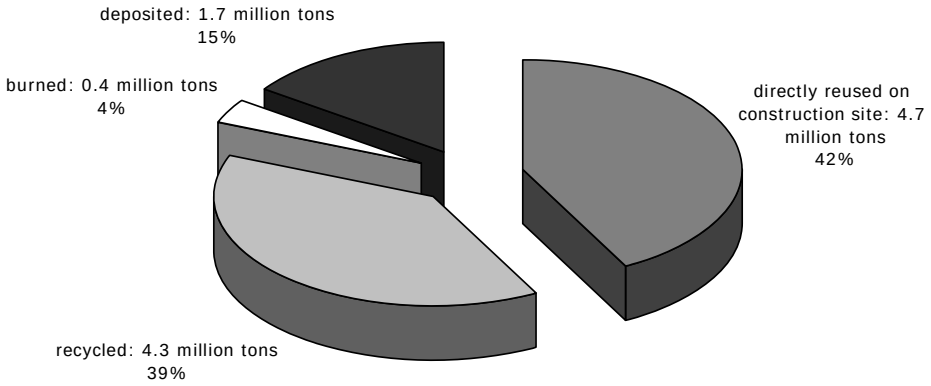

Figure 3: Disposition of construction waste in Switzerland 1997 (BUWAL 2001)

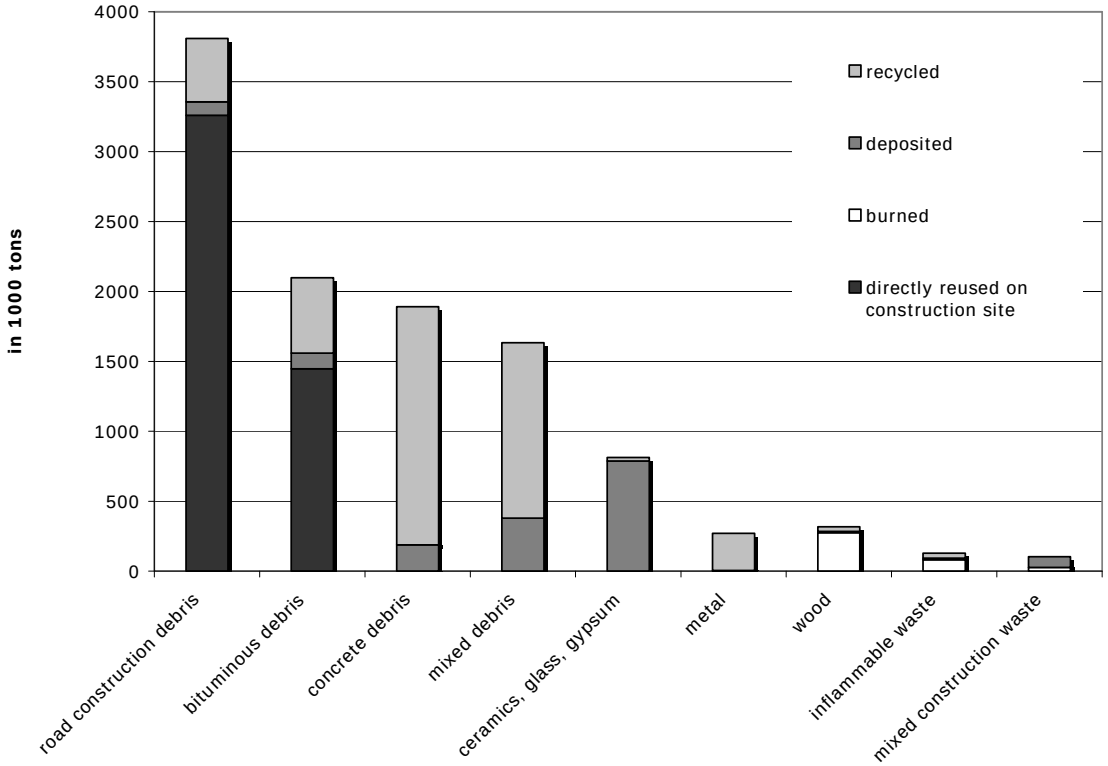

Figure 4: Disposition of construction waste types in Switzerland 1997 (BUWAL 2001)

3 STRATEGIES AND CURRENT ACTIONS

In Switzerland, there are several guidelines, recommendations, labelling systems and other tools that tackle the problem of construction waste management by way of building strategies, disposition strategies and reuse and recycling strategies.

3.1 *Building strategies*

3.1.1 SIA 112/1: Recommendations for sustainable building

The SIA 112/1 (SIA 2004) provides guidance that enables principal and planner to communicate possible tasks and objectives in sustainable building. It covers social, economic and ecological aspects of sustainability in building through defined criteria and objectives. Propositions and recommendations for the choice of appropriate construction materials are made:

- Use of available primary resources and a maximum use of secondary (reused or recycled) resources
- Use of materials with low embodied energy and low environmental impacts
- Avoiding materials which emit harmful substances
- Use of assemblies, techniques and devices that facilitate easy separation for reuse or recycling

3.1.2 SNARC: System for an environmental sustainability assessment of architecture projects

SNARC (SIA 2004) is a tool for assessing a project during an architecture competition. It is a systematic approach aimed at facilitating an impartial assessment of a project's fulfilment of environmental objectives. The evaluation criteria cover important aspects like resource demand and embodied energy in construction and flexibility for later refurbishment.

3.1.3 MINERGIE-EC

MINERGIE is a label for sustainable buildings in the Swiss cantons Bern and Zurich. It has been initiated in 1994 by the Association MINERGIE and is the most important energy-standard for low-energy buildings in Switzerland. In 2006, the MINERGIE-ECO standard has been added in cooperation with the Swiss association eco-bau. This Standard does not only cover aspects of energy-efficiency and thermal comfort, but also ecological aspects concerning the choice of construction materials and indoor environmental quality. In order to get a MINERGIE-ECO certificate, a building needs to fulfil a catalogue of criteria on the basis of the MINERGIE-standard and the SIA 112/1. The use of recycling concrete is mandatory.

3.1.4 Instruments for sustainability assessments: Survey and orientation aid (Instrumente zur Nachhaltigkeitsbeurteilung: Bestandsaufnahme und Orientierungshilfe)

This handbook has been published by the Swiss Federal Office for Spatial Development (Bundesamt für Raumentwicklung ARE) in 2004. It is a descriptive compendium of the multitude of instruments used for an assessment of sustainability in Switzerland, Austria and France. Its aim is to give designers guidance and orientation in their choice of an adequate evaluation-tool for sustainability and to help them to understand why this instrument will help themwithin a particular context.

3.1.5 'Eco-bau' requirements sustainable building ('Eco-bau' Vorgaben ökologisch Bauen)

'Eco-bau' is a common platform of the public building departments from federal, state, and city governments with recommendations for sustainable planning, building and maintaining of buildings and systems. Eco-bau offers checklists for sustainable material decisions. This information is also integrated in cost planning software as additional components. The aim of those additional components is to graphically represent ecologically advantageous performances. This helps planners to integrate considerations about sustainability in building projects and material decisions. The information given primarily directed towards designers assigned by the public building departments. (Eco-bau 2007) The requirements are already being used at many building departments, for example in the cantons of Zurich and Bern as well as in the City of Zurich (Amt für Hochbauten).

3.1.6 SIA 493: Declaration of ecological features of building products

The SIA 493 (SIA 1997) is not a standard but a recommendation issued by the SIA. It defines the ecologically relevant features that have to be declared for fourteen building product groups. It standardizes the terminology and the form of the declaration. The declaration grid implements the most important features on the production, the processing, the use and the disposal of a

building product. The recommendation aims at listing and standardizing valuation criteria. It is aimed at designers in building companies.

3.2 *Disposal strategies*

3.2.1 Disposal Guide (Entsorgungswegweiser)

The Disposal Guide was developed on behalf of the federal states, the FOEN, the ARV (Association of recycling companies) and the VBSA (Association of waste disposal companies). It has two primary components. The first is a database that lists waste disposal companies that fulfil the requirements set out in legal statutes. The second element consists of a website that offers a collection of leaflets, and guidelines on waste management and defines terms in the field of waste treatment. On the one hand, the Disposal Guide aims at standardising the federal states' execution. On the other hand, it aims to inform waste owners of simple and correct ways of treating their waste. So the Disposal Guide is aimed at the state authorities, waste owners and at managers of waste disposal systems. (Abfallinfo Schweiz GmbH 2006).

3.2.2 *Multi dell concept (Mehrmuldenkonzept MMK)*

The Mehrmuldenkonzept (MMK) (SBV 2001) was developed and published by the Association of Swiss Construction Entrepreneurs (SBV) based on the Technical Waste Regulation. It is an aid for site managers to correctly treat and separate waste on the construction site. The MMK defines different standardised contents of waste containers and ways of disposal. The MMK aims at facilitating quick and rational disposal ways within close proximity to the construction site. The MMK is aimed at managers who have to implement a waste management plan in accordance with the mandatory standards laid down.

3.3 *Reuse and recycling strategies*

3.3.1 AWEL Project: Gravel for generations (Kies für Generationen)

The Office for Waste, Water, Energy and Air (Amt für Abfall, Wasser, Energie und Luft AWEL) recently launched this project with the objective of encouraging the gravel, concrete and deconstruction industry to use mineral deconstruction material for high quality recycling concrete instead rather than sending it to the landfill. The project will be supported by the Association of the Swiss gravel and concrete industry (Fachverband der Schweizerischen Kies- und Betonindustrie FSKB)

3.3.2 Component network Switzerland (Bauteilnetz Schweiz)

Bauteilnetz Schweiz is a private association that promotes the reuse of building components. Founded in 1996, it has now over 60 members, 15 of whom work in component stock exchanges or component shops. The association's website is a platform for the selling and buying of components and for general information about waste management and recycling. Bauteilnetz Schweiz targets architects, construction companies and private buyers. According to the business report (Bauteilnetz Schweiz 2006) the sales of the involved companies amounted to two million Swiss francs in 2006, which corresponds to a volume of about 2600 tons of building components, which represents a ten fold growth from its first operational year, 1997. (Bauteilnetz Schweiz 2007)

3.3.3 KBOB Recommendation: Concrete with recycled aggregate (Beton aus recyclierter Gesteinskörnung 2007/2):

The KBOB (Coordinator of the federal building and real estate agencies) (KBOB 2007) has published a leaflet on the use of recycled aggregate for the production of concrete. It contains information about the advantages of using recycling-concrete in building in order to motivate designers to use recycling-concrete instead of normal concrete

3.3.4 Leaflets of the ARV (Merkblätter des ARV)

The ARV, an association of companies in the field of excavation, demolition and construction material recycling has issued numerous leaflets. They summarise relevant laws, regulations and guidelines. The leaflets are addressed directly at the industry's companies with the intention of giving them an overview of the legal situation and what the associations offers. (ARV 2007)

4 OUTLOOK AND POTENTIAL

4.1 *Status Quo*

Although there are no special incentives of the government, most construction waste is reused – either directly on the construction site or after an appropriate treatment. This proves that reuse is technical possible and economically feasible. The basic conditions for sustainable waste management are favourable. Waste owners can find information about different ways of disposal easily and quickly. Designers who want to build with recycled materials can rely on numerous aids. Building with recycled materials is regulated in the standards. The execution of laws and regulations is relatively consistent from one federal state to another.

4.2 *Recommendations*

Today, there is still about 1 million tons of the total construction-waste being disposed of in landfill dumps. Mixed debris and concrete debris constitute the main part of this disposed waste.

Where possible, waste should be reused directly on the construction site. Where reuse is not possible, construction-waste should be recycled. In some fields, the recycling technology is already available and the recycled products are tested in practical application. Those material cycles should be aiming to become closed loop in order to prevent construction waste disposal entirely.

Basic conditions for considerations on sustainability are favourable. Society is becoming more and more conscious of environmental subjects. Builders should learn more about sustainable building technologies in order to raise pressure on building companies to use those technologies

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