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# Sustainability and Civil Engineering

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2009 Ohio Valley Student Conference  
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**“Sustainability and Civil Engineering”**

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## Introduction

In today's society the idea of sustainability is possibly more prevalent than at any other point and time. Across our everyday lives we encounter the practice of sustainability from renewable energy resources to curbside recycling programs. As our demand for products, infrastructure and lifestyle amenities grow, so should our awareness that we live in a fragile balance between meeting these needs and meeting these needs in a way that has minimal impact to the environment and does not jeopardize our own public health and safety.

We as Civil Engineers and future Civil Engineers play a vital role in the Sustainable Development in meeting the needs of the public. We are those designing and building the infrastructures that support us as a society. A Civil Engineers utmost responsibility is sustainability.

## Sustainable Development

When you decide to follow a certain career path and make the decision to become a professional in that field, whether it be medical, law or in this case a Professional Engineer, you have a code of ethics that you are bound to. The American Society of Civil Engineers (ASCE) Code of Ethics was designed so that a standard could be put in place as to how engineers should practice professionally. This Code of Ethics lays out seven Fundamental Canons that an engineer shall always govern their actions by. The first of these Canons introduces us to the concept of Sustainable Development.

*"Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties." (ASCE Code of Ethics, 1996)*

This concept of Sustainable Development could in many ways be considered the "Golden Rule" of engineering. If as engineers we follow this one Canon the other Canons immediately fall into place.

Sustainability by definition is the method of using a resource in a way that the resource is not depleted or permanently damaged. (Merriam-Webster Online Dictionary). Traditionally the concept of sustainability has been applied to relating biological systems (the Earth) and human systems (society). Although, very complex when looking at the direct relationships of human needs and biological impacts, the concept is really one that is as old as time itself that has been taught through the concept of not over harvesting from the Bible.

For this discussion the concept of sustainability will deal primarily with Sustainable Development as defined by the ASCE in 1996: "Sustainable Development is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development."(ASCE Code of Ethics, 1996)

### **Practice of Sustainable Development**

As civil engineers we play a vital role in Sustainable Development. When a client approaches a Civil Engineer to design a new project this immediately incorporates a multi-discipline process that may involve biologists, geologists, community interests groups, regulatory enforcement agencies and the business community. All of these groups have an interest in the project and seeing that the project is completed in a way not to put their interests at risk. It is the Civil Engineers responsibility to ethically combine all the disciplines interests and produce a design that meets the client's goals.

For an example of this in practice we can take a look at a new manufacturing facility being built. The area that this new facility is being built was once used as cropland and will continue to have active cropland around it once completed. There is also a major body of water close to the facility that is used for shipping and recreation.

A civil engineer will be responsible to determine: if the land used will be adequate to support the characteristics of the facility (i.e., soil characteristics, layout of facilities, site drainage, past land usage); if the transportation system to the new facility will be adequate; provide a design that will take into account the needs of the aquatic habitat and flora and fauna; design a facility that will minimally impact residents that may surround the facility; design a facility that meets EPA and OSHA requirements; and a design that is in conjunction with other businesses in the area.

In order to successfully combine these needs as an engineer one must have a knowledge and understanding of multiple disciplines. The combination of this knowledge is projected out through the concept of Sustainable Development. As civil engineers ethically you cannot discount other disciplines and must always be aware of how they may affect your work.

The concept of Sustainable Development is one that an engineer should never feel that they must violate in order to ethically complete a project. For an engineer to violate the concept of Sustainable Development in a project the size of a manufacturing facility, or any project they are jeopardizing the safety, health and well being of the public and potentially damaging the environment. Knowingly doing this not only is unethical but in severe cases may even be considered criminal. At no time should violation of

sustainable development be a solution to issues encountered in the practice of engineering.

An engineer that practices sustainable development should never feel that they are acting unethically. During the design stages of the manufacturing facility if an engineer has taken all appropriate steps to gather the information needed from all involved parties to provide a client with a sound design, that engineer has acted ethically. Sustainable development should always take into account what is best for society and best for the environment in providing a client with a design that meets their goals.

### **The Future of Sustainable Development**

Recent occurrences like the bridge collapse in Minneapolis, meeting a societies water needs in New York and California, the ever growing demand for transportation infrastructure, a continuing increase in population and concerns of Global Warming has made educating new engineers on the concept of sustainable development never more important. Today's civil engineering student is exposed to the need for sustainable development from many directions.

For a university or professor not to incorporate sustainable development into their curriculum would be unethical. It is the duty of that institution and individual faculty member to ensure that students are being educated on practicing sustainable development.

On the other side, it is that student's ethical responsibility to take the principle of sustainable development and carry it on into their professional careers. They must have a clear understanding of the importance of sustainable development and how it must be applied to their future jobs.

In my educational experience I feel very strongly that I have been taught the concept of sustainable development. From an understanding of how urbanization can effect a natural watershed's ecology to designing structures and seeing through their construction that they are safe for all users. My education has shown me that sustainable development is not just one way of practice, but it is your ethical duty as an engineer to incorporate this practice into all your work.

### **America Today**

As an American culture over the last several decades we are slowly transforming ourselves from a disposable society to one that realizes the importance of more sustainable practices. These sustainability initiatives can be seen from a regulatory stand point such as: the Clean Water Act of 1977 (CWA), which limited releases to

navigable waters; the Resource Conservation and Recovery Act of 1976 (RCRA) that limited the disposal of solid and hazardous waste; the creation of the Occupational Safety and Health Administration created in 1970 (OSHA) and put in place to provide safe working conditions for employees; and the improvement to building codes across the country. All of these have been born out of an American society becoming more aware of sustainable development.

More recently our society has become more aware of further sustainability initiatives through municipally sponsored recycling, vehicles that have been designed more fuel efficient, transportation systems that have been designed to reduce impacts on the environment and safer for their users, and improvements in structures being more energy efficient and increasing safety standards.

The American life style while it has taken great strides in incorporating our society into one that is completely ethical and sustainable will still face many challenges. The major challenge of this is our humanity. We still have needs and those needs do not always align themselves with the practice of sustainability. The use of our natural resources faces the reality of exceeding supply and although we can take every attempt to design in ways that are completely safe the reality is that there are still shortcomings. As a society in the end all we can really do is practice sustainable development, but in my opinion sustainable development is not something that is completely attainable.

As civil engineers we adhere to a code of ethics that states that using our knowledge and skill we are to enhance human welfare and the environment. That being said we are ethically responsible to live our lives and work in our profession in a way that is dedicated to the concept of sustainable development. We are also responsible for setting an example to society as to how this practice can be brought into daily life.

### **U.S. Government**

Within the borders of the United States development projects that are undertaken by government agencies are held under a microscope to the practice of sustainable development. Any time a government agency puts a project out for bid the requirements of that project are in line with the practice of sustainable development.

The U.S Department of State sponsors the Sustainable Development Partnerships ([www.sdp.gov](http://www.sdp.gov)) that not only reaches across this country, but reaches beyond our borders. These partnerships with foreign countries provide them with the information and technology to provide: poverty reduction programs; universal primary education; access to clean water and sanitary systems; access to energy services; reducing the spread of infectious diseases; reducing hunger and promoting agricultural and rural development; conservation and environmental stewardship and protecting marine and

freshwater resources. These partnerships provide developing countries with the information and technology to enhance the health, safety and wellbeing of their citizens in addition to giving them a greater awareness of environmental impacts.

Civil engineers have a very unique duty to society. We have a responsibility to advance the infrastructures of our society in a way that not only meets the demand needs, but also meets those needs in a way that is both environmentally and socially responsible. Professionally, we must push forward to meet the needs of an ever growing and ever changing society. We must find a way to design and practice within our field in a manner that is always ethical and true to the practice of sustainable development.

## References

1. ASCE Code of Ethics, 1996
2. Merriam Webster Online Dictionary