


University at Buffalo The State University of New York
 

THE DEPARTMENT OF CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING

BRIDGE ENGINEERING PROGRAM

Distinguished Speaker Series

CIE 579: Bridge and Highway Infrastructure Management and Public Policy

Social, Economic and Environmental Challenges: Meeting Peoples Needs in the 21st Century

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 Hatch Mott MacDonald

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Introduction of Presenter

- ♦ **Ronald J. Klinczar, P.E.**
 - ♦ Principal Project Manager/Senior Associate
 - ♦ B.S., Civil Engineering, SUNY Buffalo
 - ♦ 33 Years Consulting Design Experience
 - ♦ Preaches balance in design between infrastructure and environment








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Presentation Topics:

- ♦ **Topic 1:** The Historical relationship between Society and its Environment
- ♦ **Topic 2:** The Engineer's Role in Society and the Environment
- ♦ **Topic 3:** The Environmental Review Process
- ♦ **Topic 4:** Detailed Environmental Considerations
- ♦ **Topic 5:** Paying for Damages
- ♦ **Topic 6:** Sustainability: Its about Society

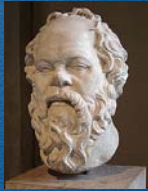



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Topic 1: The Historical Relationship...

...between Society and its Environment

- ♦ A Quick overview of significant changes in societal thinking, leading to the modern Environmental Review Process.



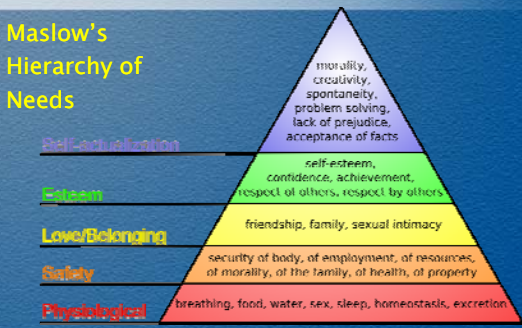
Socrates

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The makeup of man...

Maslow's Hierarchy of Needs



The diagram shows a pyramid with five levels. From top to bottom:


- Self-actualization** (purple): morality, creativity, spontaneity, problem solving, lack of prejudice, acceptance of facts.
- Esteem** (green): self-esteem, confidence, achievement, respect of others, respect by others.
- Love/Belonging** (yellow): friendship, family, sexual intimacy.
- Safety** (orange): security of body, of employment, of resources, of morality, of the family, of health, of property.
- Physiological** (red): breathing, food, water, sex, sleep, homeostasis, excretion.






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Prehistoric Society

Basic Survival... Needs of Man met first and foremost by use of earth's resources



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Gehenna




Valley of Hinnom, Reported site of burning "City Garbage Dump"






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Roman Empire: Aqueducts



Pont Du Gard, France, built circa 19 B.C.

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Roman Sewers



The Romans "recycled" public bath waste water by using it as part of the flow that flushed under the latrines.





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The New Dawn

The Development of America (1492-1950)






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The Industrial Revolution




The new "factory" was viewed as a good place where a living could be earned, by native born and immigrants alike...




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1960's Environmental Disasters

1969 Santa Barbara oil spill -200,000 gallons of crude oil from natural gas explosion






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1960's Environmental Challenges


1969 Ohio River burning



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1960's Societal Response



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1960's - 1970's Legislative Response

- 1965 - Wilderness Act
- 1967 - Clean Air Act (set NAAQS)
- 1968 - Wild and Scenic Rivers Act
- 1970 - National Environmental Protection Act
- 1972 - Clean Water Act (NPDES)
- Various State Acts

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The Past Generation...

- 1980's - Industrial Call for Balanced response
- 1990's - Renewed Environmental Action
- 2000's - A Sophisticated Public
- 2010's - Being Green, and a Political Football




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Topic 2: The Engineer's Role...

... in Society and the Environment

- We have a large role and responsibility in maintaining the balance between what we develop and what we should protect.



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Traditional Engineer Role

- Empirical Design, Live Test






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The Engineer in Today's World

NSPE Code of Ethics for Engineers

- As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. The good of the public must be held in high esteem.







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Code of Ethics: Fundamental Canons

Engineers, in the fulfillment of their duties, shall:




1. Hold paramount the safety, **health**, and welfare of the public.
2. Perform services in areas of their competence.
3. Issue objective and truthful public statements
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully.

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Public and Agency Involvement



- It is the engineer's responsibility to foster public comment on projects
- Agencies have an obligation to do so
- The public and agencies provide input...for evaluation by the engineering team

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The future of Project Development




- Responsibility:** As the environment becomes more critical and regulated, public agencies and the public expect to have greater say in project development.
- The engineer must be vigilant and persuasive with critical arguments to assist in the selection of the right alternative!

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Topic 3: The Environmental Review Process

...A brief overview of the National Environmental Protection Act (NEPA) and its Review Process...

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National Environmental Protection Act (NEPA)

- Policy for Federally Funded Projects.
- Environmental Protection Agency (EPA): Leads the nation's environmental science efforts since 1970.
- EPA's mission is *to protect human health and the environment.*





The Enforcer!




The Environmental Process

- Acceptance of **Lead Agency Status**– Federally funded projects must be advanced by a federal agency such as the Federal Highway Administration (FHWA) or Their Designee
- Similar Lead Agency Status for State Projects
- Project Owner Agency can be lead agent for public projects
- Agency must accept lead agency status for private projects







Project Classification

NEPA CLASS	DEFINITION	EXAMPLE
CLASS I	NEW OR HIGH IMPACT ACTION	NEW EXPRESSWAY
CLASS II	LIMITED ACTION	BRIDGE REPLACEMENT, EXISTING ALIGNMENT
CLASS III	POSSIBLE ENVIRONMENTAL IMPACTS, UNKNOWN	BRIDGE REPLACEMENT, RELOCATED ALIGNMENT

The Environmental Process

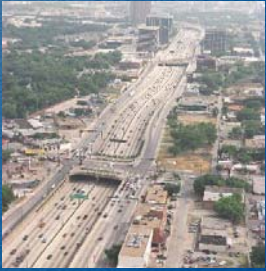


- **Scoping**– The act of defining a project and ensuring full development of alternatives considered
- Purpose and Need Statement
- NEPA Class I Projects: Public must be given opportunity to comment on the range of alternatives developed

What can be the Public's Reaction??

Example: New Expressway with several bridge overpasses


- NIMBY
- Too much noise
- Too much traffic
- Poor route
- Too much impact on undisturbed land

Agency Reviews


- Federal, e.g. USACOE
- State, e.g. Departments of Environmental Protection
- Municipalities and Local Planning Commissions







Preliminary Design and EIS or EA

- **Preliminary Design/ Report:** Concept design to a level necessary to identify environmental impacts
- **Environmental Impact Statement (EIS):** Class I Action
- **Environmental Assessment (EA):** Class III Action





Your Project

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What does an EIS or EA Address??

- **Social Impacts:** Will action create a disproportionate impact on a disadvantaged social group?
- **Economic Impacts:** Will any alternative disrupt businesses or employment?
- **Environmental Impacts:** Our ecosystem

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Selecting the "Preferred" Alternative

Document Agency and Public Comments-

- Prepare responses
- Address Appropriate Comments
- Modify Design
- Public Comment is **NOT** one person, one vote!!
- Be prepared for legal challenges

Record of Decision:




- Publish notice

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Detailed Design

- "Hard Engineering"
- Develop Construction Bid Documents
- **Incorporate Environmental Restrictions in the documents**

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Finally, Construction!

- Your contractor must follow the permit requirements of the jurisdictional agencies!



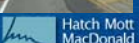




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In Summary

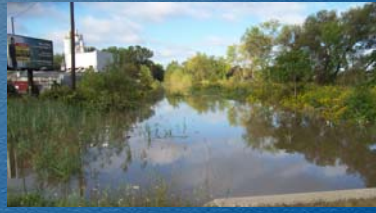


- Establish the **scope** of the project
- Allow **public and agency comment** on alternatives to be studied
- Study the **impacts** of each alternative
- Allow **public and agency comment** on developed alternatives
- **Select** a preferred alternative based on careful consideration of all factors
- **Design** and **Build** the Project

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Topic 4: Detailed Environmental Considerations

...A look at Social, Economic, Environmental, and other factors that you the engineer must consider...

Some Social Considerations

- Does project discriminate against **race, color, sex, or national origin**?
- Are particular **social groups** harmed?
- Are **neighborhoods segregated** such that community interaction is destroyed?



Additional Social Considerations

- Are particular **income groups** more disenfranchised than others?
- Are **relocations** and **disturbances** minimized?
- Is **fair compensation** for loss provided?



Economic Considerations

- Are **businesses** economically harmed?
- Are **employment** barriers created?
- Does the project impact a community economically? Will **jobs be lost**?
- Will the project place undue **financial burdens** on individuals and families?



Environmental Considerations

- Is **water quality** degraded through sedimentation, contamination, disturbance?
- Are **wetlands** disturbed?
- Are designated **coastal zones** compromised?
- Are **navigable waterways** obstructed?
- Are **wild and scenic rivers** disturbed?
- Are **parks or recreation areas** impacted?
- Are **floodplains** changed?



More Environmental Considerations

- Will **groundwater** become contaminated?
- Will **stormwater pollution** be avoided?
- Are **sole source aquifers** uncontacted?
- Are **forest preserves** avoided?
- Are **endangered species** identified and protected throughout construction?
- Are **historic** and **archaeological** sites preserved?



Further Environmental Considerations


- Is **farmland** use minimized?
- Is **air quality** compromised?
- Is **noise quality** compromised?
- Does efficiency in **energy** use result?
- Is **asbestos** identified and abated properly?
- Are **hazardous and contaminated materials** identified and planned for disposal?





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Example: Managing Floodplains

Bridge replacement projects cannot affect upstream or downstream flood plain areas






Maintain Bridge Waterway Opening!!

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Example: Options for Treating Stormwater

- Stormwater can be more toxic than sewage water...
- One Goal is to treat Total Suspended Solids
 - Phosphorus
 - Nitrates
- Answer: Stormwater Management Pond!






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LEED

Leadership in Energy and Environmental Design

- Developed by the Architecture Profession to Address Environmental Efficiency in Buildings
- “Point” System for proactive environmental measures
- Provides certification to facilities that meet requirements



US Green Building Council






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Engineer’s Role in the LEED Process

Develop Design to Obtain LEED Points in following categories:

- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy and Atmosphere (EA)
- Materials and Resources (MR)
- Indoor Environmental Quality (EQ)
- Innovation in Design (ID)




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Topic 5: Paying for Damages

Limit State Perspectives

The “Pollute for free” perspective

- “I can pollute all I want, and as long as it does not affect my bottom line profit, then ok”








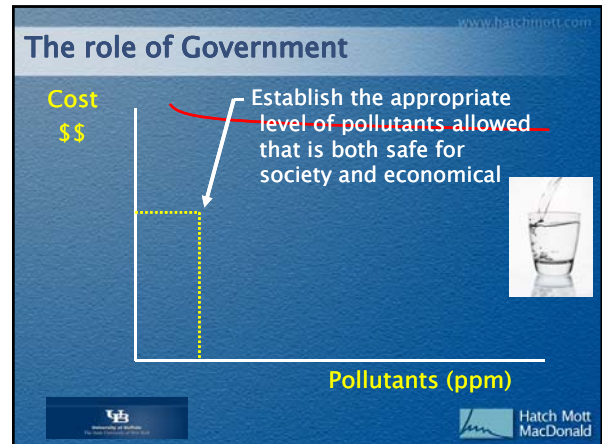
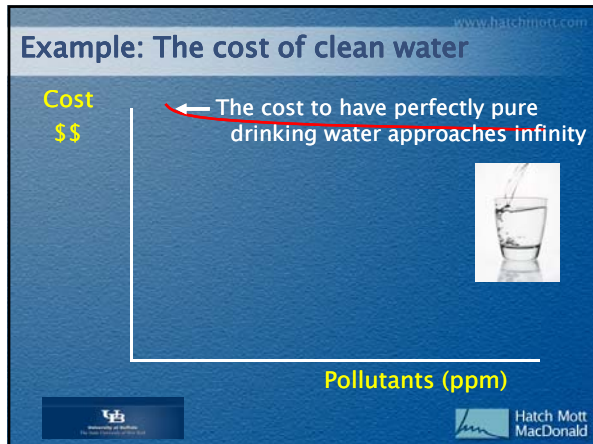
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An alternative limit state perspective...

The “Do not Pollute” perspective

- “No one should be allowed to pollute at all. I want my air perfectly clean and my drinking water pure”



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How does the Govt. manage pollution?

- Enforcement of Legislation
- “Permitting” of new actions
- Fines that exceed cost to pollute!!

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Paying for Damages (Allowing Pollution)

Mitigation

- Agency has the option of allowing the project to occur but stipulating paying for damages through mitigation.
- Wetland impacts can be mitigated through a 3:1 or 4:1 replacement ratio

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Other forms of mitigation:

Correcting for negative factors

- Compensating owners for property value loss
- Erecting noise barriers
- Building new parks for torn neighborhoods
- Relocating affected businesses to new areas

It's all part of the Environmental Law!!

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Purchase of Polluting Rights

Environmental protection or tax?

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Non-Mitigatable Impacts

- Many proposals are not accepted by reviewing agencies
- These include actions that would create irreversible damage to the environment

Historic Buildings

Parkland removal



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Watchdogs

Citizens Groups that scrutinize industry or Government Policy

- Environmental Groups
- Public Interest Groups



Many times those who have been "harmed" come back to spearhead grass roots efforts

- Erin Brockovich

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The Role of the Engineer

- Join a Committee
- Become active in Planning Boards
- Use professional influence to properly steer and guide those less knowledgeable
- Advise clients on requirements they may not understand...find a qualified environmental professional if necessary

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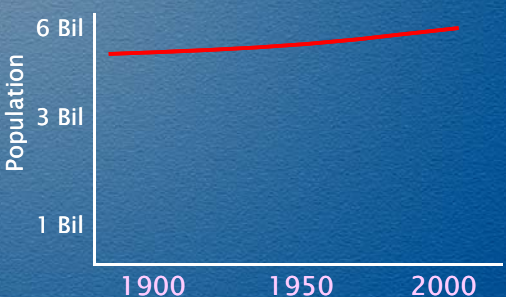
Topic 6: Sustainability: Its About Society

- Society must live. That creates a **demand** for goods and services.
- The earth provides the **supply** of material resources.
- **Sustainability** is about ensuring that the supply of the earth's resources can meet societal demand:
 - across time.
 - Across geographic and economic boundaries

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Earth's Population




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Sustainable Practices

Practices that lend themselves toward either increasing the supply of resources or reducing the demand of resources, while meeting societies needs

- Personal: turn off faucets
- Workplace: automated light switches
- Professional: engineered projects




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Sustainable Practices

- Reforestation: Trees are known as a “renewable resource” (↑ Supply)



- Public transportation: reduce overall fuel consumption (↓ Demand)



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An unsustainable society

Haiti, after 2009 earthquake

- Resources do not meet demand
- Available resources can not be adequately distributed
- Black markets spring up



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Beyond Sustainability

A philosophical and economic look at reaching an equilibrium state in the use of our planet

Let X = demand for resources per person
 P_t = today's population
 P_f = future population

$P_t(X_t)$ = total resource demand rate today
 $P_f(X_f)$ = total resource demand rate future

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Beyond Sustainability

Similarly, Supply of Resources

r = resource renewal rate

T = technology rate (as an increase in resource supply)

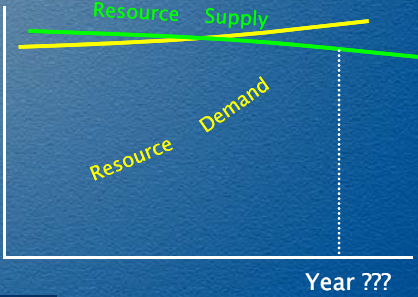
$S = S_0 + r + t - P_t(X) =$ change in resource supply



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Will demand eventually exceed supply?

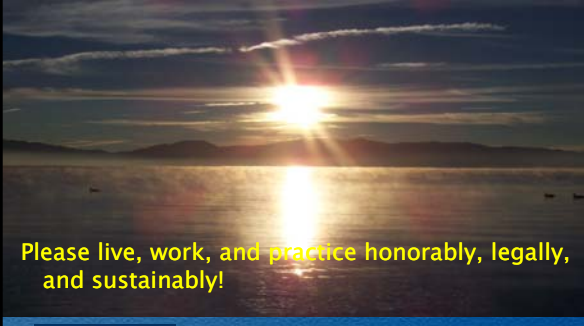


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Thank You for Your Attention!

Please live, work, and practice honorably, legally, and sustainably!



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