



CRITICAL INFRASTRUCTURE

Keys to a Sustainable Future

Blaine D. Leonard, P.E., D.GE., F.ASCE - ASCE 2009 President-elect
– Utah Dept. of Transportation Research Division

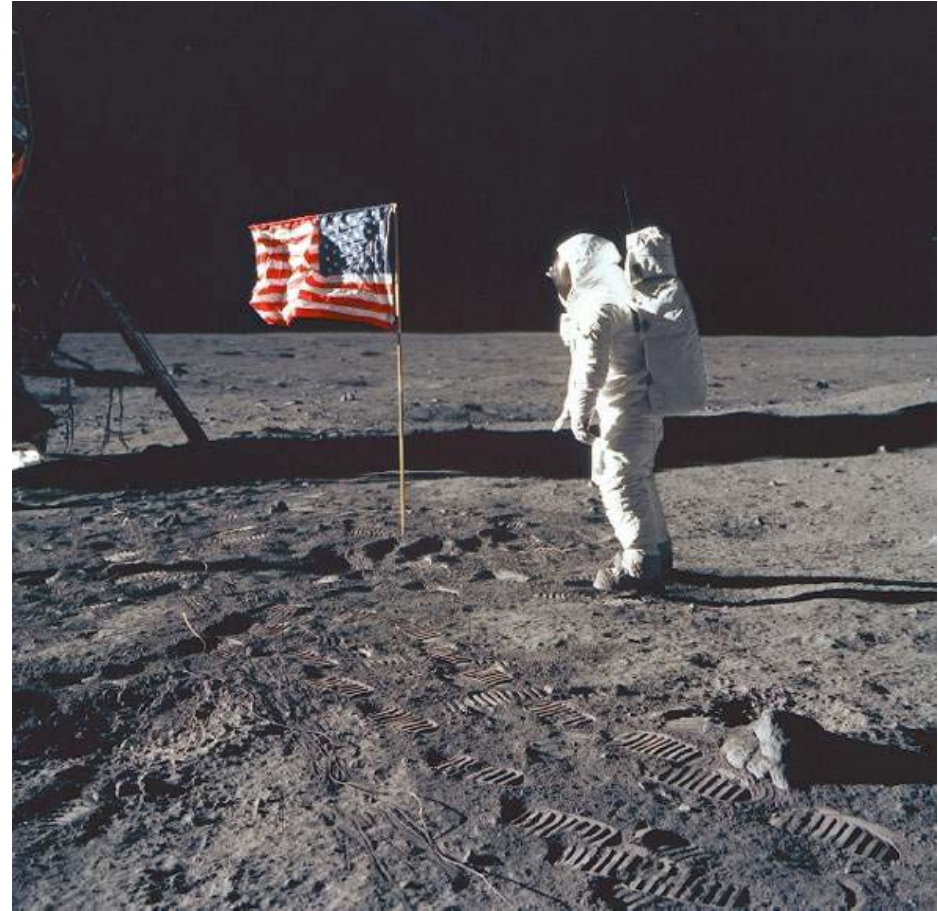
Pipelines 2009 Conference
San Diego, CA

August 17, 2009

July 20, 1969

“One small step for
(a) man,
One giant leap for
mankind”

- Neil Armstrong



Greatest Engineering Achievements

Greatest Engineering Achievements OF THE 20TH CENTURY

◆ About ◆ Timeline ◆ The Book

Welcome!

How many of the 20th century's greatest engineering achievements will you use today? A car? Computer? Telephone? Explore our list of the top 20 achievements and learn how engineering shaped a century and changed the world.

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials



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Greatest Engineering Achievements

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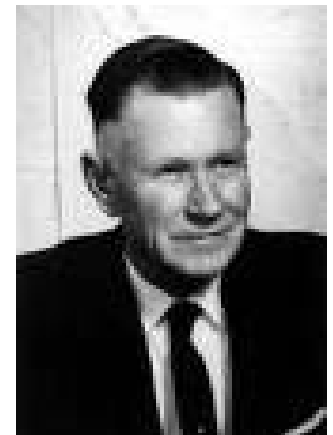
INFRASTRUCTURE

Pervasive, functioning infrastructure
is the key to our
economic well-being and success

INFRASTRUCTURE AS THE KEY

"We do not have great highways because we are a great nation,
we are a great nation because we have great highways"

-- DeWitt C. Greer (1902-1986),
Chair Texas Highway Commission



INFRASTRUCTURE AS THE KEY

Great Bridges

Skyscrapers

Dams and Levees

Pipelines for water, storm water,
sewer, gas, oil, etc.

Water and Wastewater Purification,
Treatment and Reuse



INFRASTRUCTURE AS THE KEY

"... The greatest advances in improving human health were the development of clean drinking water and sewage systems. So, we owe our health as much to civil engineering as we do biology."

- Lewis Thomas, Former head of Yale Medical School & Memorial Sloan-Kettering Cancer Center

INFRASTRUCTURE

Despite having developed one of the best, most pervasive, infrastructure systems in the world, we are in a precarious state

INFRASTRUCTURE CONDITION

Overall Grade: **D**

Aviation	D
Bridges	C
Dams	D
Drinking Water	D-
Energy	D+
Hazardous Waste	D
Inland Waterways	D-
Levees	D-



Public Parks & Recreation	C-
Rail	C-
Roads	D-
Schools	D
Solid Waste	C+
Transit	D
Wastewater	D-

INFRASTRUCTURE CONDITION

27% of the 590,750 bridges nationwide are structurally deficient or obsolete

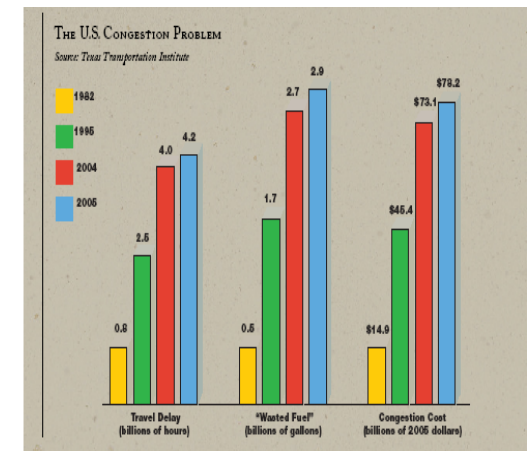
Blocked or broken pipes result in 10 billion gallons of raw sewage flowing into US surface waters annually



INFRASTRUCTURE CONDITION

Severe highway bottlenecks have increased by 40% during the past five years

Americans spend 4.2 billion hours per year stuck in traffic at a cost of \$79.2 billion in wasted time and fuel



INFRASTRUCTURE CONDITION

• A five year investment of \$2.2 trillion is needed to remedy our current infrastructure condition

– Only 45% of that is currently in the federal, state, and local budget now

- 2009 Infrastructure Report Card, ASCE



INFRASTRUCTURE CONDITION

- Note of optimism:
 - public and policy makers starting to pay some attention

PROSPECTS

ARRA (Stimulus Bill)

- \$787 bill - - \$72 bill for infrastructure
- Small, but a significant shift

“A billion here, a couple of billion there, first thing you know it adds up to be real money”

-- late Senator Everett Dirksen

FIVE KEY SOLUTIONS

2009

REPORT
CARD

★★★★ for ★★★★★

america's
INFRASTRUCTURE

1. Increase federal leadership in infrastructure to address the crisis;
2. Promote sustainability and resilience in infrastructure to protect the natural environment and withstand natural and man-made hazards;
3. Develop national, state, and regional infrastructure plans that complement a national vision and focus on system-wide results;
4. Address life-cycle costs and ongoing maintenance to meet the needs of current and future users; and
5. Increase and improve infrastructure investment from all stakeholders.

PROSPECTS

“We are continually faced by great opportunities brilliantly disguised as insoluble problems”

- Lee Iacocca

RESILIENT INFRASTRUCTURE

📍 Critical Infrastructure Guidance Task Committee

- Critical Infrastructure Summit
- *Guiding Principles for the Nation's Critical Infrastructure*
 - ASCE Web site (FREE)
 - ASCE Bookstore



CRITICAL INFRASTRUCTURE

“Facilities and assets so vital that their destruction or incapacitation would disrupt the security, economy, safety, health, or welfare of the public.”

CRITICAL INFRASTRUCTURE

✦ Overarching Principle:

- “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 “

- First Fundamental Canon, ASCE Code of Ethics

CRITICAL INFRASTRUCTURE

Four Guiding Principles:

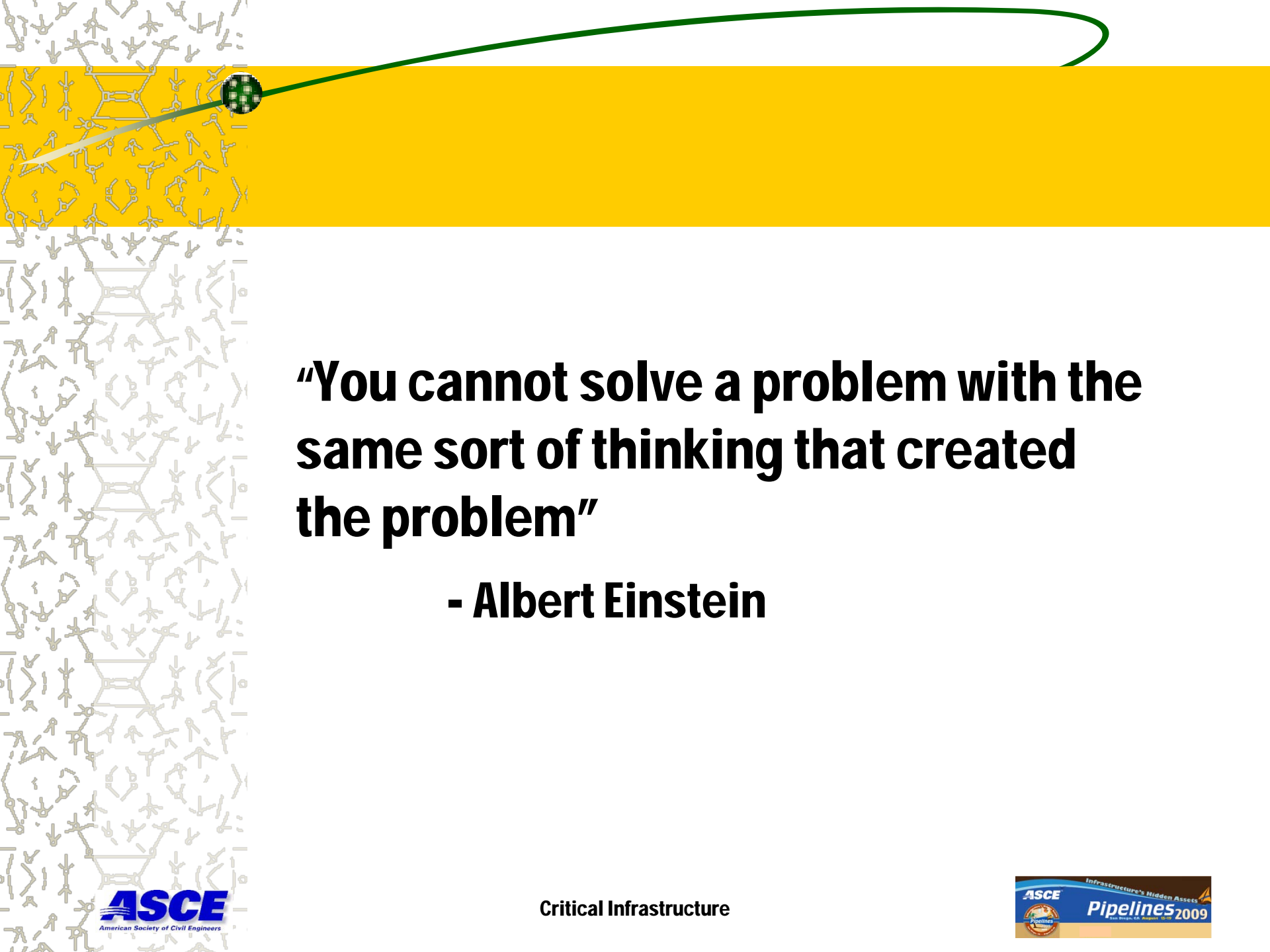
- Quantify, communicate, and manage **risk**;
- Employ an integrated **systems** approach;
- Exercise sound **leadership**, management, and stewardship in decision-making processes;
- Adapt critical infrastructure in response to **dynamic** conditions and practice.

CRITICAL INFRASTRUCTURE

Are we ready to:

- manage risk;
- systems approach;
- leadership;
- Adapt to dynamic conditions

???



“You cannot solve a problem with the same sort of thinking that created the problem”

- Albert Einstein

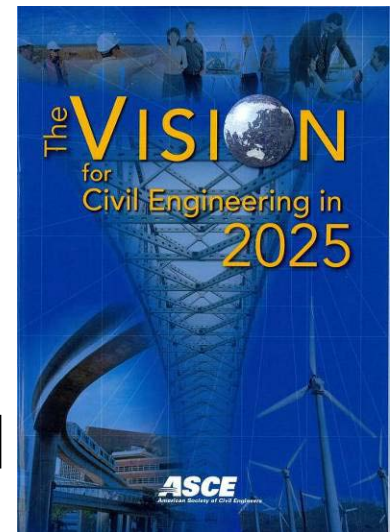
PREPARING FOR THE FUTURE

- ✦ The world is changing
 - ‘not your father’s engineering profession’
- ✦ We need to TRANSFORM to meet the need
- ✦ Summit on the Future of Civil Engineering – 2025 (June 2006)
 - Aspirational vision for civil engineering

VISION 2025

Entrusted by society to create a sustainable world and enhance the global quality of life, civil engineers serve competently, collaboratively, and ethically as:

- Master builders,
- Environmental stewards,
- Innovators and integrators,
- Managers of risk and uncertainty , and
- Leaders in shaping public policy.



VISION 2025

• Components of the Vision that apply directly:

– Sustainability

- includes longer service life, survivability, resilience

– Innovation in all aspects of our practice

- Implement new methods, techniques, and materials

VISION 2025

Components of the Vision that apply directly:

– Risk assessment and management

- Haven't been quantified nor communicated to the project owners or the impacted public - must have a fundamental shift in this approach

– Key decisions are non-technical

- imperative that we get involved in the policy discussions and influence priorities

VISION 2025

“The big questions of what to do next are not technical, or only partly technical, they are primary political”

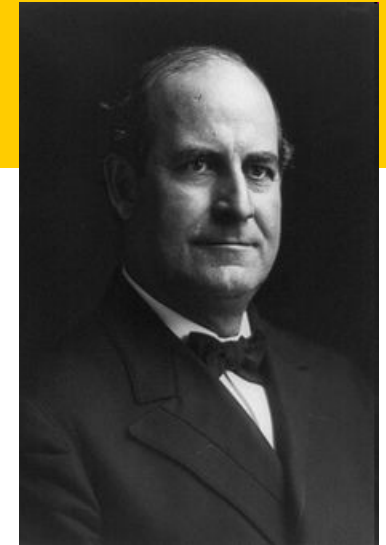
– Samuel Florman, *The Existential Pleasures of Engineering*

WHAT SHOULD WE DO?

- Develop and improve guidelines for design & management of critical infrastructure
 - Risk assessment, management, communication
 - Become familiar with Key Solutions & Guiding Principles
- Think and act “systems”
 - Client / public coordination

WHAT SHOULD WE DO?

- Innovation and dynamic condition assessment
 - Encourage implementation & creativity
 - Academic – Practitioner cooperation
 - Build adaptive management into systems
- Get involved in policy development



"Destiny is not a matter of chance; it is a matter of choice."

-- Statesman William Jennings Bryan