Construction Engineering
Education
History and Challenge

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Ingenium
3rd Lane
Panama Canal

The Latin word *ingenium*
implicitly conveys a
linking of the forces of
nature and the practice
of engineering.

John Stevens –
Panama, work with water.

Nature

For the urbanized populations of
the modern world nature and
environment are abstracted,
romanticized ideals: one political
cause among many, but no longer
an experienced daily reality.
The Issue

Engineering solutions that work with nature in a holistic and integrated manner.

The Issue

Change engineering education from a pure mathematics -physics manipulation of nature.
Encourage engineers to develop solutions that work with nature in a holistic and integrated manner.

The First University

Inka Suspension Bridges

No such bridges in Europe until after the Spaniards saw them.

“In the construction of these crude bridges, I observed their simplicity, and their great instructive value.”

Apurimac Bridge
Squier, 1877
French Theoretical Tradition

École Polytechnique
Emphasis on scientific and mathematical principles laid the foundation for formal theoretical and mathematical based engineering education the world over.

English Apprenticeship

British engineers learned their profession through apprenticeship type training. The British engineer approached problems in a practical and empirical manner.

Their great Civil Engineer Thomas Telford, the son of a shepherd, was apprenticed at age 14 to a stonemason. He would build the Menai Suspension Bridge (1819-1826).

The University & Engineering Education

Engineering education in the United States in all essential aspects is a collegiate education, instituted and directed by educators, rather than practitioners.
U.S. Military Academy at West Point

1802 West Point established.
1817 Sylvanus Thayer superintendent. An engineering program modeled on the French theoretical/mathematical approach.

Norwich University

1819 Norwich University established.
1837 First engineering degree
This was the first civilian technically orientated university.

Rensselaer Polytechnic Institute

1824 Rensselaer School
1835 1-year Civil Engineering course
1849 Rensselaer Polytechnic Institute modeled after the French Écoles
Professional Organization

While engineering schools were coming into existence Civil Engineers struggled to form a professional organization.

1838 initial effort to form an association
1853 James Laurie revived the idea
1867 American Society of Civil Engineers
1877 ASCE finally incorporated
1880 21 engineering colleges in existence

Morrill Act

1862 land-grant colleges and the mechanic arts.
The concept of engineering as a four year college program became deeply rooted.
The practicing profession and ASCE played no part in the formation of these schools.
70 colleges evolved from the Morrill Acts; Ames College (Iowa State University) was the first supported by the Morrill Act.

NAE - Engineer of 2020

• Impact of engineering on sociocultural systems;
• Linkage between professionalism, technical knowledge, and historical awareness;
### NAE - Engineer of 2020

- Need for mathematics and science, but also *humanities*, social sciences and economics;
- Importance of *sustainable* development;
- Be proactive in educating engineers to address technological and *societal challenges* in the future.

### Educating

Phase II study recommendations

- *Interdisciplinary learning*
- *Case studies* and explain
- *Engineering successes & failures*.

### ASCE Policy Statement 465

*Academic Prerequisites for Licensure and Professional Practice*

*New model* for civil engineering education to prepare practitioners for increasing complex work.
Bloom’s Taxonomy

1) **Knowledge**, ability to recall previously learned material
2) **Comprehension**, ability to grasp the meaning of material;
3) **Application**, ability to use material in a new situation;
4) **Analysis**, ability to ascertain the components material;

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Bloom’s Taxonomy

5) **Synthesis**, ability to reorganize material to form something new;
6) **Evaluate**, ability to judge the reorganized material.

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Professor of Practice

Professors with industry experience

- **Assign open-ended problems** and projects.
Such problems cause students to
- **Analyze, Synthesize, & Evaluate**
Professional Licensure

The title Professional Engineer implies that one holds paramount the safety, health and welfare of the public.

A decisive career step - investiture carrying responsibilities that go with the authority to make critical decisions affecting the public.

ASCE - Construction Engineering Education Committee

Advancing Construction Engineering since 1995.

April 2008 - individuals can take the first part of the PE selecting a breadth exam in construction engineering and the second part of the PE a depth exam in construction engineering.

Light
Final Thoughts - Water

Engineering is water. Water can be destruction as with a flood but water is primarily life.

Eads’ South pass jetties completed 1879

Final Thoughts - Air

Final Thoughts - Earth