The Eiffel Tower and the Gateway Arch

Lecture Themes (Write these down each class!)

The ideals of structural engineering
The ideals of structural art
Sculptural form vs. structural form: issues of scale
Form as a response to forces
three ideals of structural engineering

- efficiency
- safety
- permanence

(good structural engineering does not necessarily create structural art)
three ideals of structural engineering

- efficiency
- safety
- permanence
Delaware Water Gap rail bridge
What should be the order of importance efficiency, safety, and permanence in structural design and construction?

Can you think of examples where this order of importance was followed? Was not followed?

<table>
<thead>
<tr>
<th>Structural Engineering</th>
<th>Efficiency (Scientific)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Economy (Social)</td>
</tr>
<tr>
<td>Permanence</td>
<td>Elegance (Symbolic)</td>
</tr>
</tbody>
</table>
$M(x) \propto x^2$
<table>
<thead>
<tr>
<th>Tower Leg Force (k)</th>
<th>Force if Legs not splayed (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2230</td>
<td>2230</td>
</tr>
<tr>
<td>2925</td>
<td>8994</td>
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<tr>
<td>3120</td>
<td>16848</td>
</tr>
<tr>
<td>3253</td>
<td>26677</td>
</tr>
</tbody>
</table>
Can you think of another structure that has inspired works of fine art?
Scientific

Social

Symbolic

Efficiency

Economy

Elegance
Eiffel Tower

**Efficiency:** Efficient form of an iron cantilever (9400 tons to go 984 ft - 1/10th Wash Monument, 1/3 StL Arch)

**Economy:** Small cost to the people of Paris (Eiffel built with grant + 20 years of attendance concessions)

**Elegance:** A pure form which is appropriate to its loads and has inspired artists
Pratt Igoe Housing Project

A fascinating topic in its own right, and full of big names of 20th century architecture and politics...
Gateway Arch

**Scientific:** Inefficient catenary for resisting wind, structure must be hidden and complex to provide safety

**Social:** A popular trip which does not let the visitor experience the structure (100 at a time vs. 10,000 at a time in Eiffel’s Tower)

**Symbolic:** A monument (to the Louisiana Purchase and the opening of the West) impressive for its scale, not its novel form
Gateway Arch

**Efficiency:** 20,000 tons for 600 feet (vs. 9400 tons for 984 ft with Eiffel’s Tower)

**Economy:** $11 million to people of St. Louis and the U.S.

**Elegance:** An oversized sculpture to be viewed rather than experienced – it is daring – is it elegant?

structure or sculpture?
In-class exercise

- Break into groups of 4 or less.
- To select a recorder/speaker for your group determine which person has the most musical talent in the group – that’s your recorder for this time.

Structural Engineering
Efficiency
Safety
Permanence

Structural Art
Efficiency (Scientific)
Safety
Economy (Social)
Permanence

Elegance (Symbolic)

Q: How are the ideals of structural engineering reflected, or not reflected, in the ideals of structural art?

(Discuss in your groups, record your names and key thoughts on paper, be prepared to share those thoughts with the class)
Q: What do you think Vitruvius meant by his 3 ideals?
Q: How are Vitruvius’ ideas reflected (or not) in structural art?

A New Tradition Art in Engineering
- A New Art Form
- The Ideals of Structural Art
- The History of Structural Art
- Engineering and Science
- Structures and Machines
- Structures and Architecture
- The Three Dimensions of Structure
- Structural Art and Society

Can a structure be a New Art Form?
- The Ideals of Structural Art are? (hint: E’s)
- The History of Structural Art (shall be taught)
- Engineering and Science what is the difference?
- Structures and Machines what is the difference?
- Structures and Architecture differ how?
- The Three Dimensions of Structure are? (hint: S’s)
- Structural Art and Society relate how?
writing assignment

- writing assignment is posted online
  assignment asks you to select a structure
  and gather information in a style consistent
  with the critiquing of structural art
- full details at
  www.ce.jhu.edu/perspectives
  select assignments, writing 1

UMass only

- Bring laptop computer or ipad/tablet to class
  on Tuesday for in-class exercise