

# 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

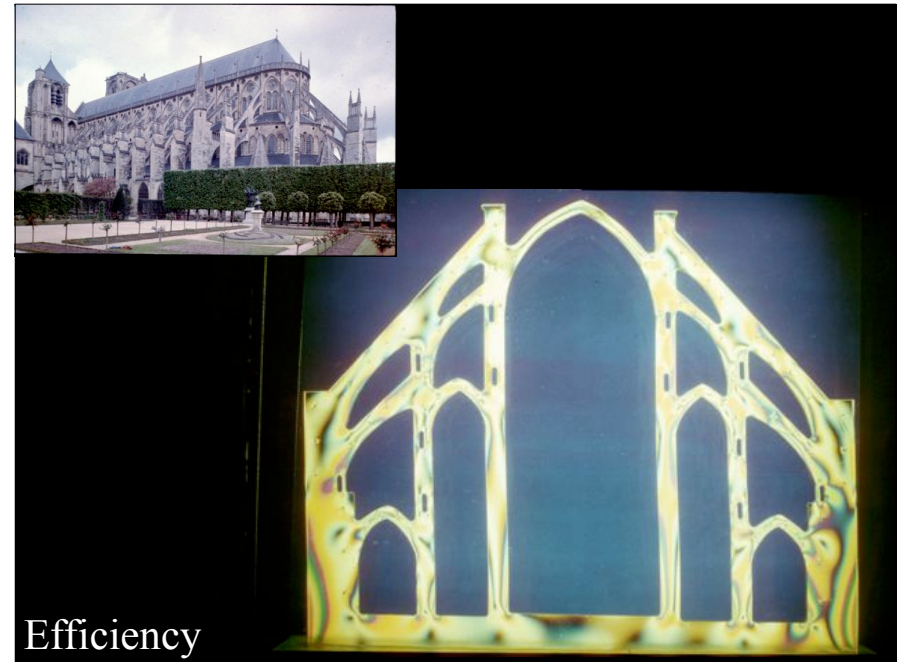


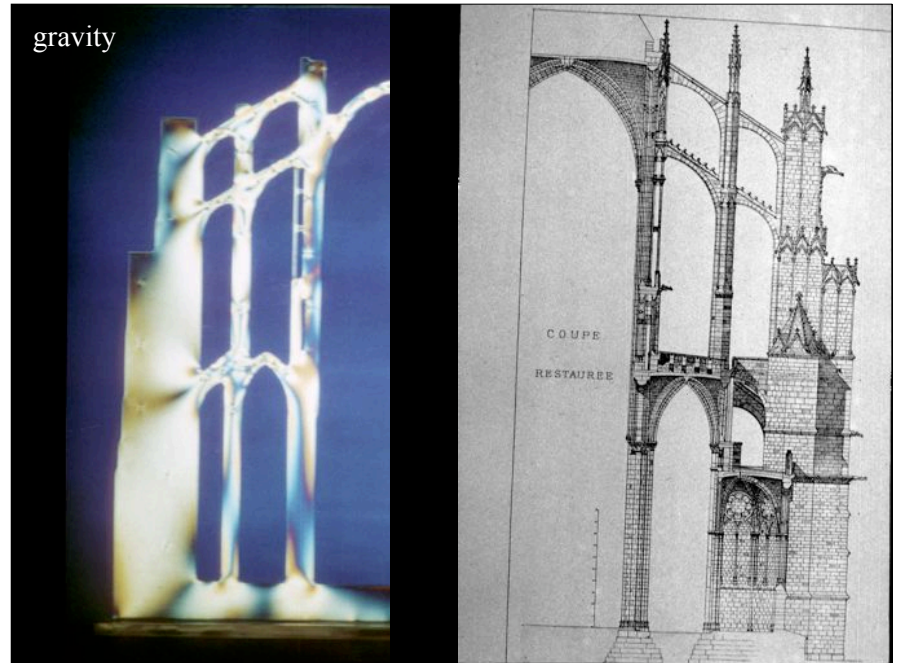
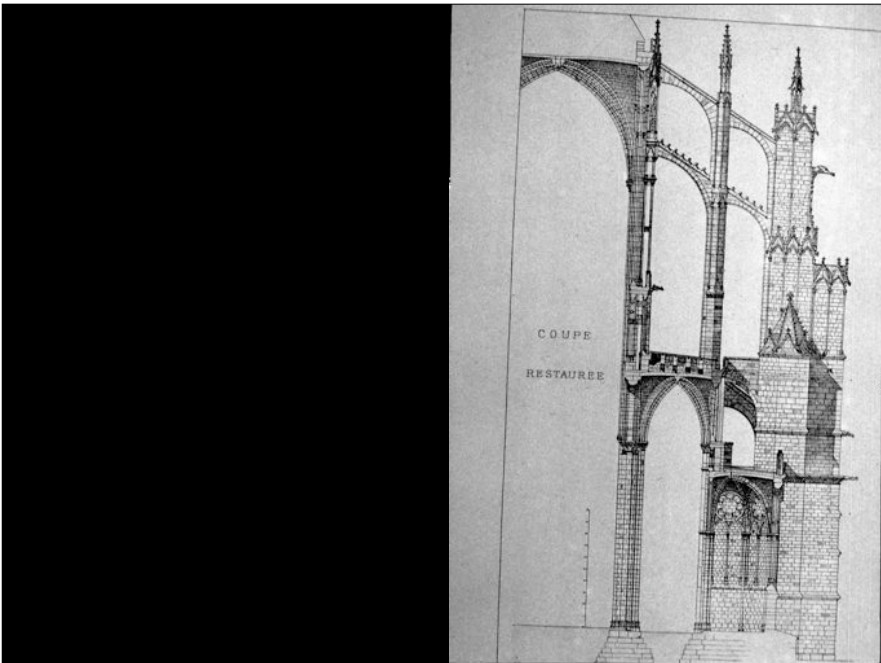
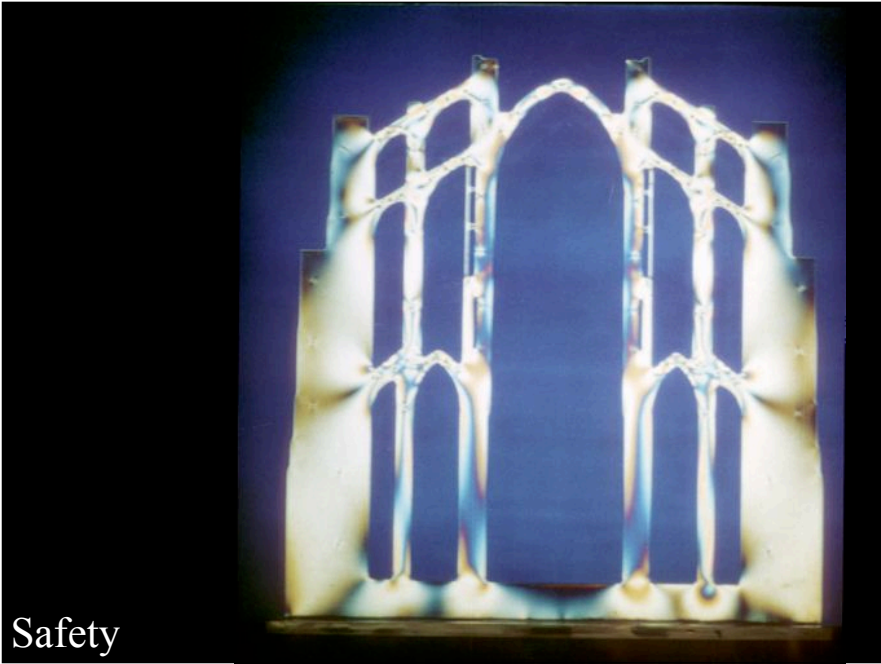


## three ideals of structural engineering

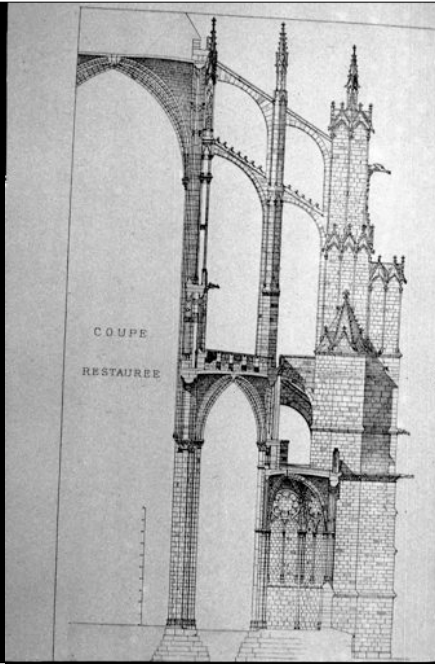
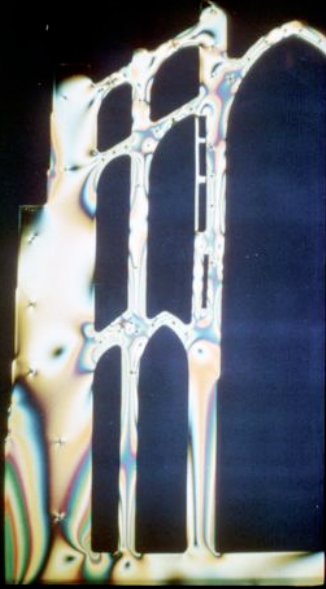
- efficiency
- safety
- permanence

(good structural engineering does not necessarily create structural art)

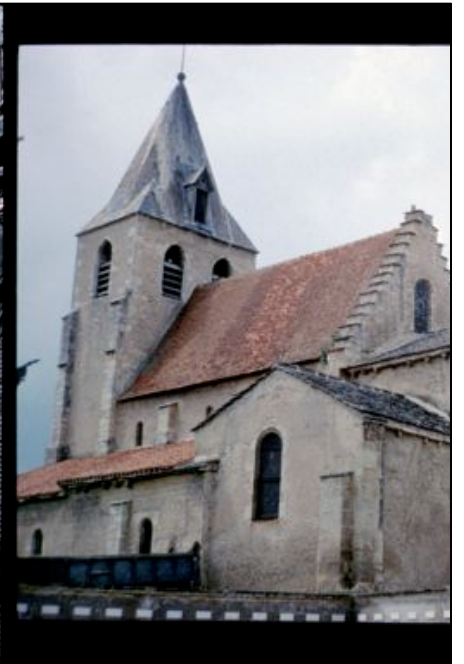
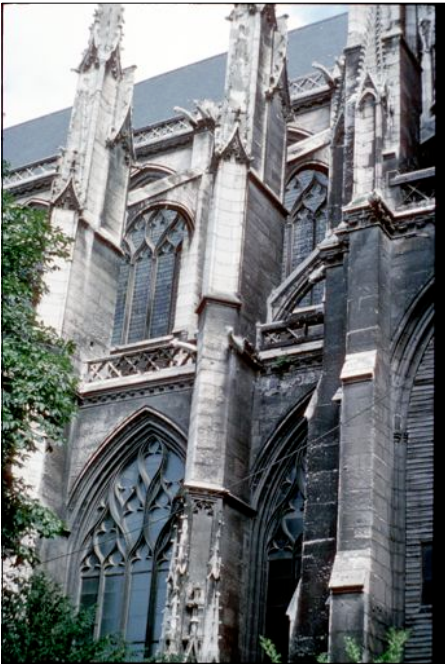


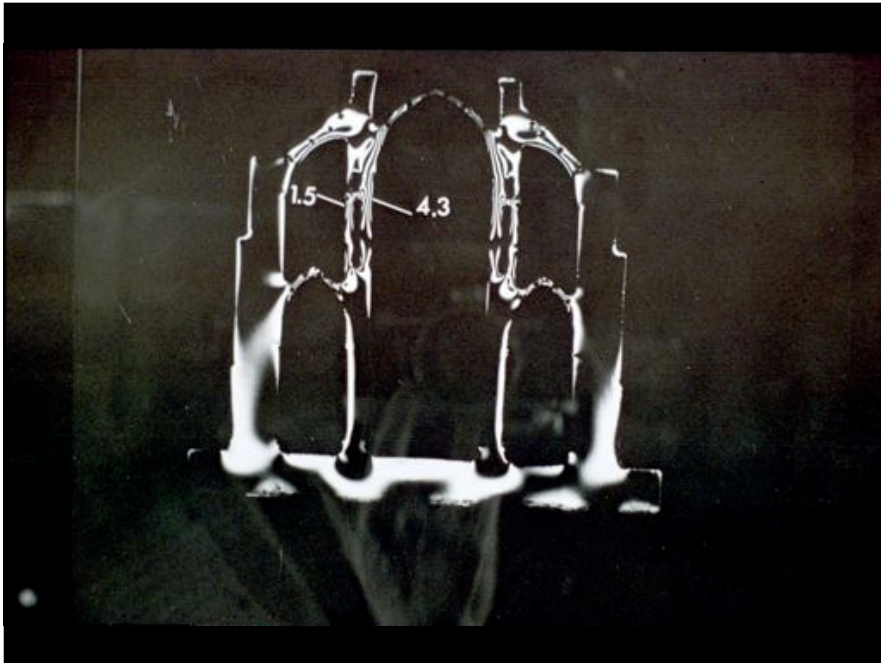


wind



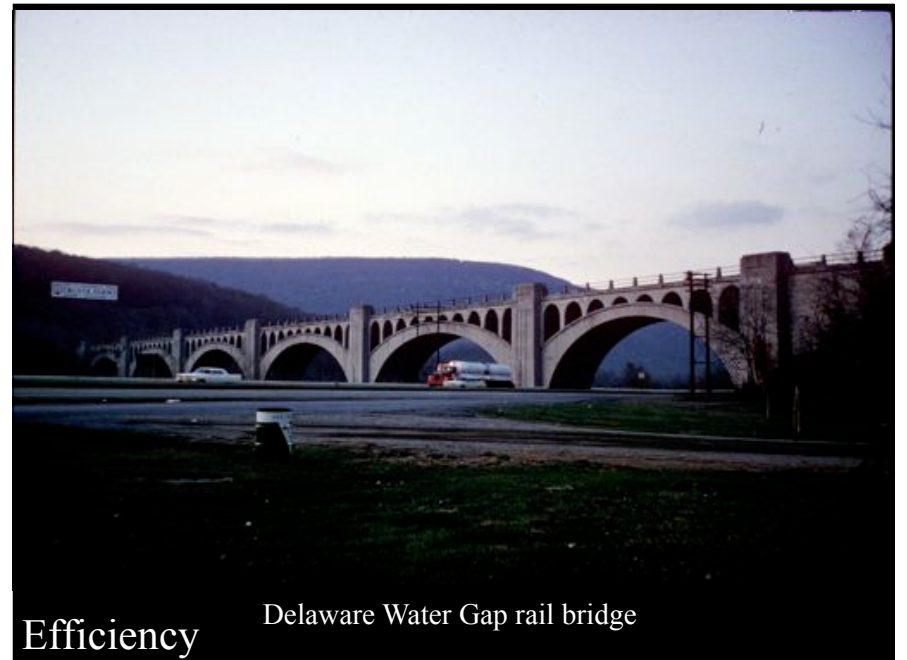
Permanence



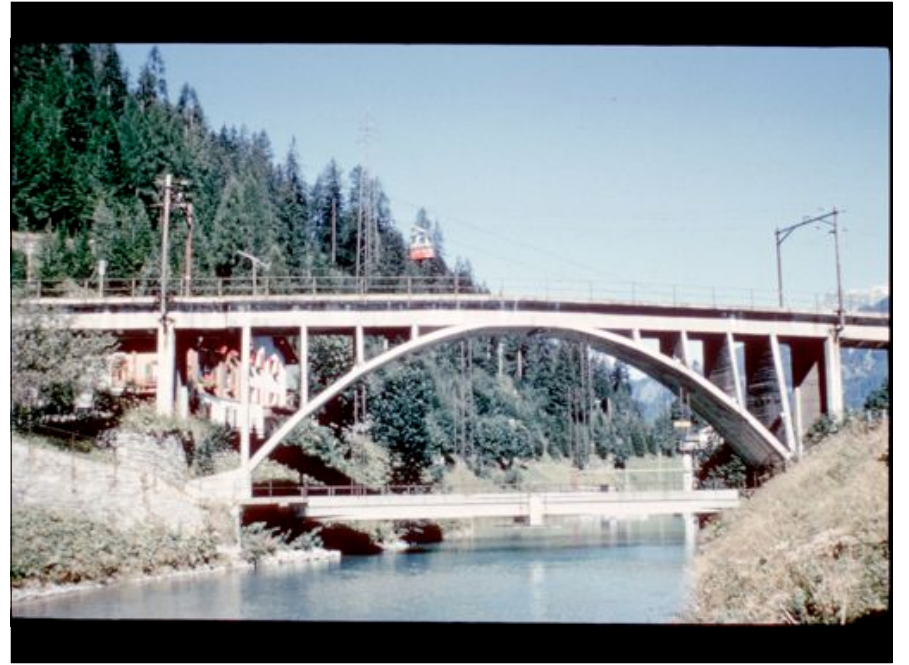


## three ideals of structural engineering

- efficiency
- safety
- permanence

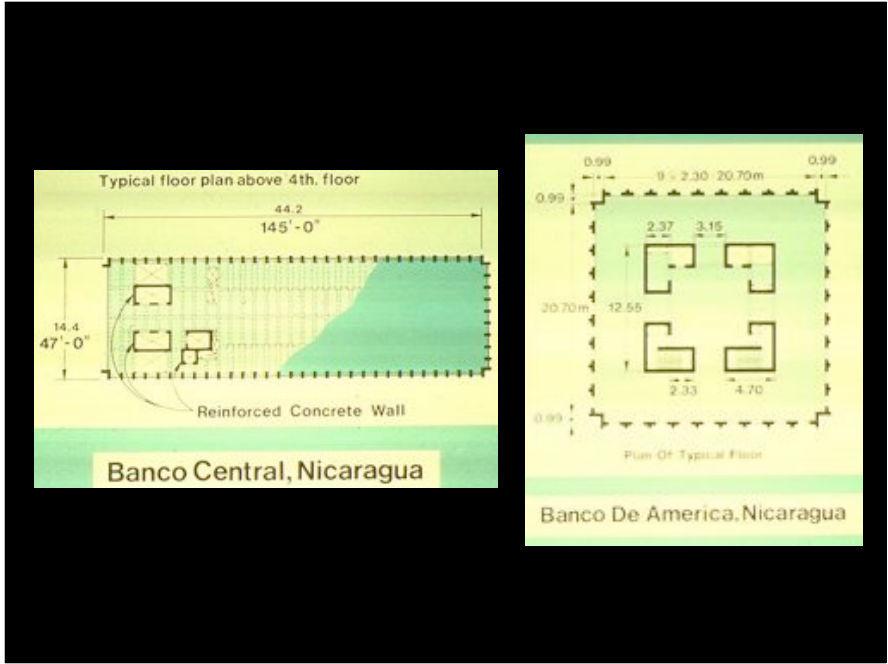


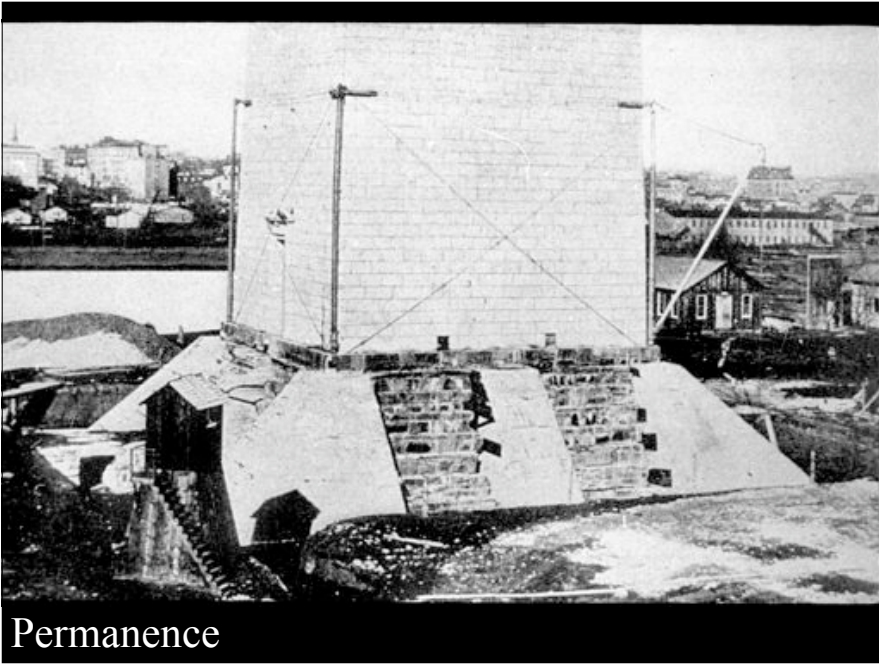
Delaware Water Gap rail bridge



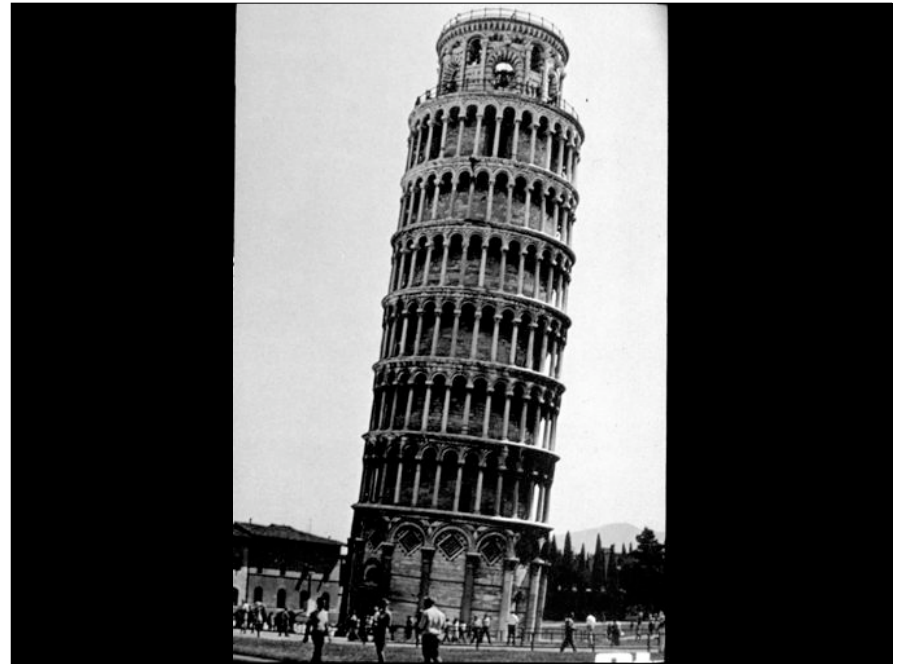
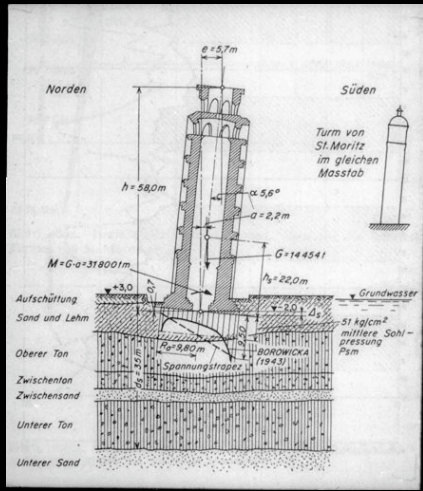
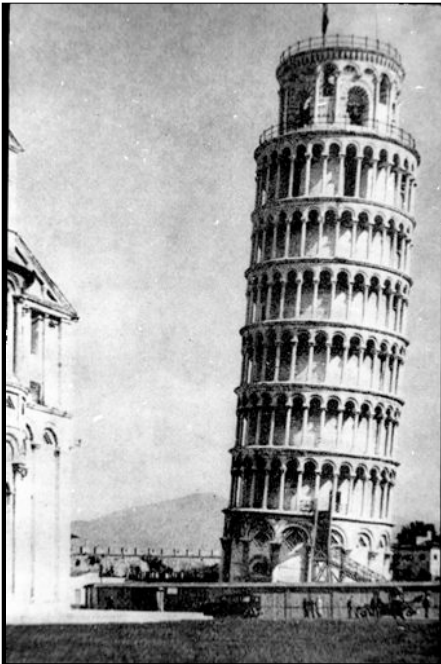
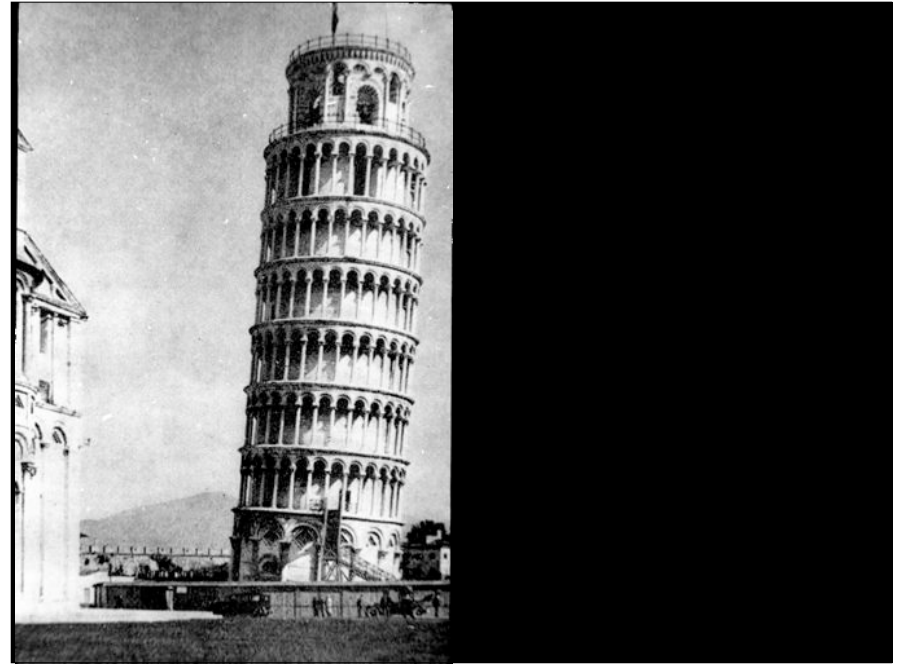


Safety





Permanence

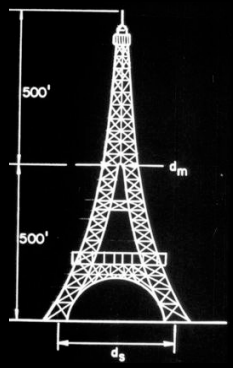




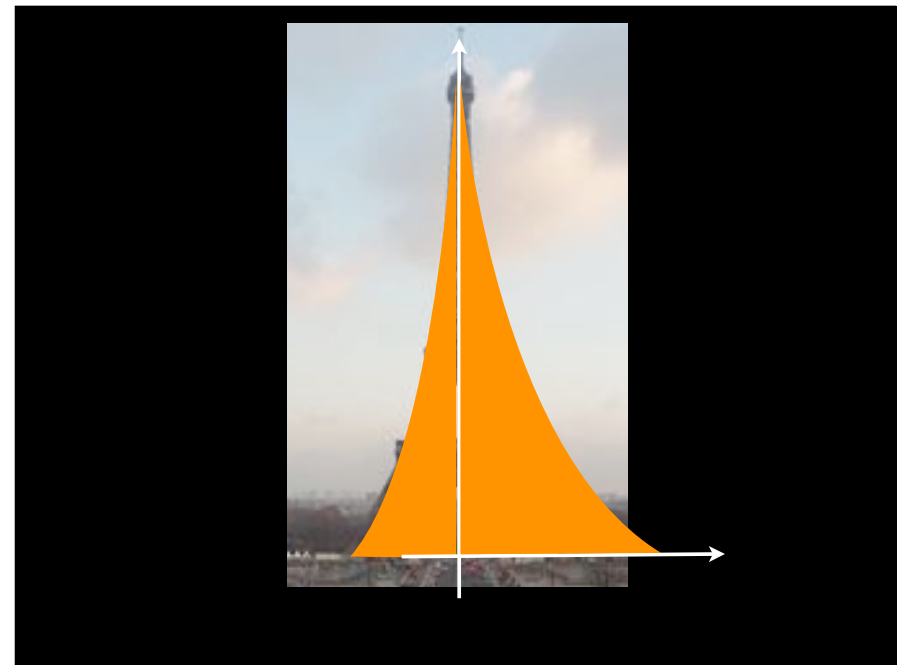
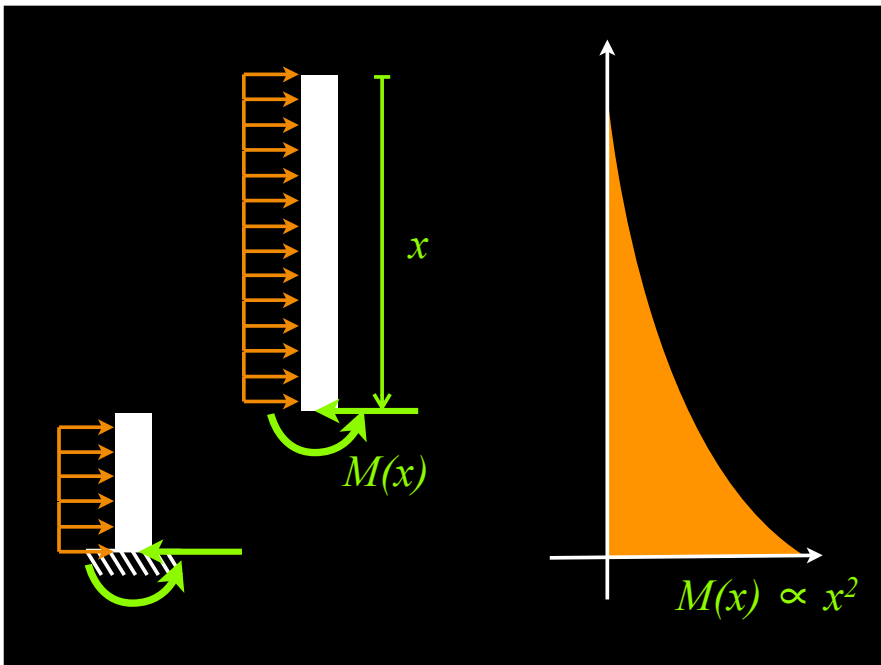
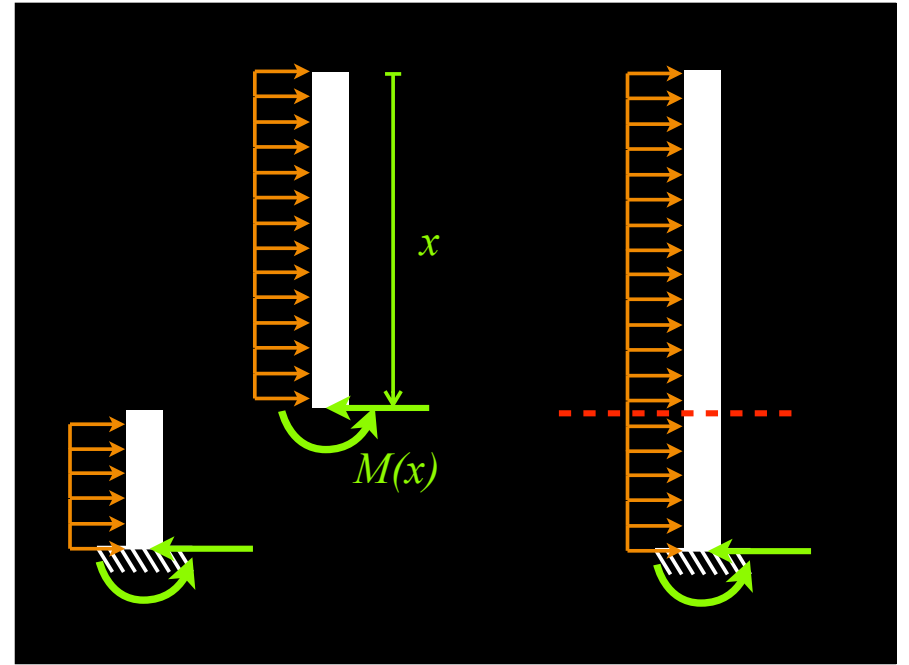
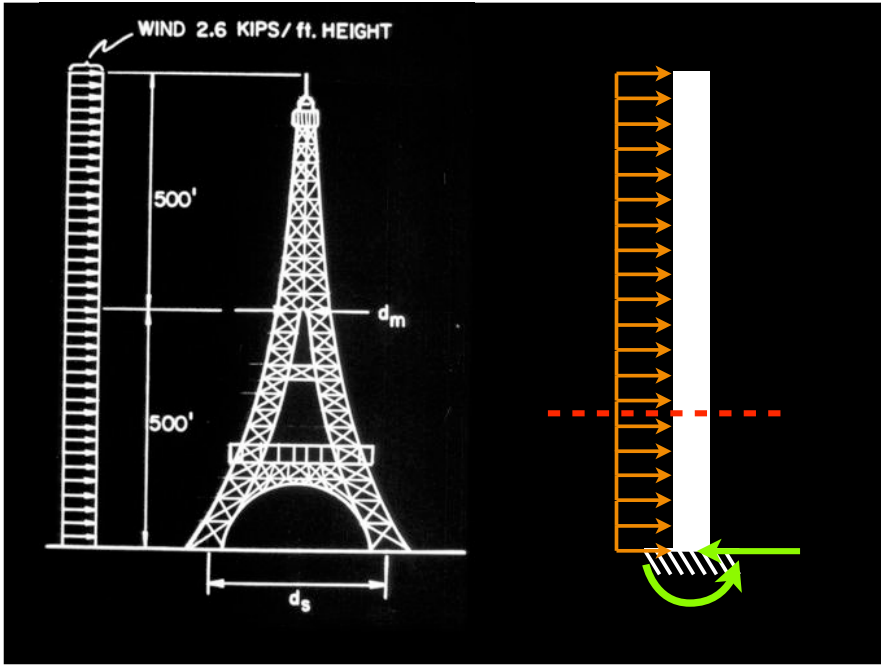
What should be the order of importance efficiency, safety, and permanence in structural design and construction?

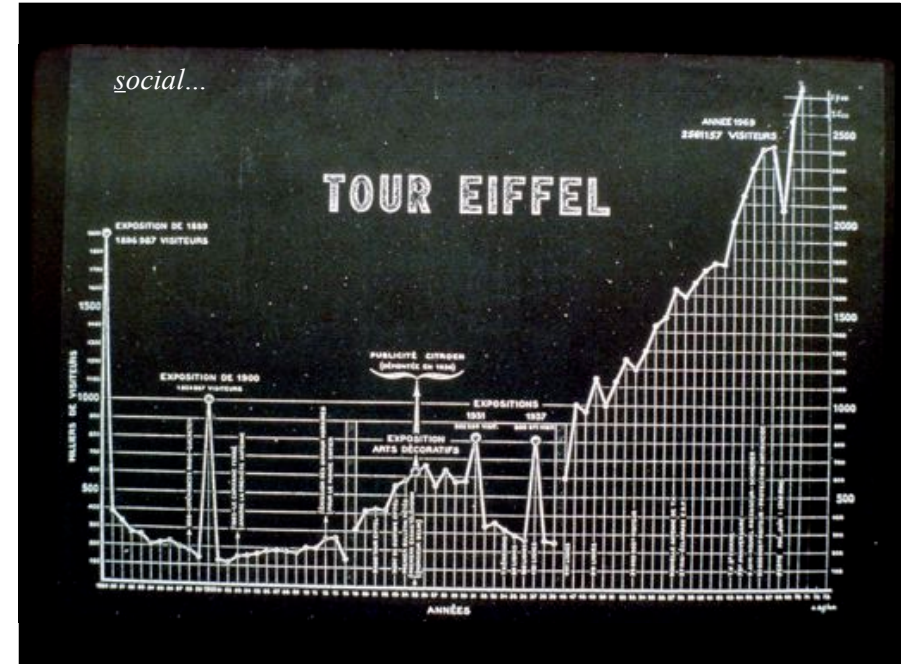
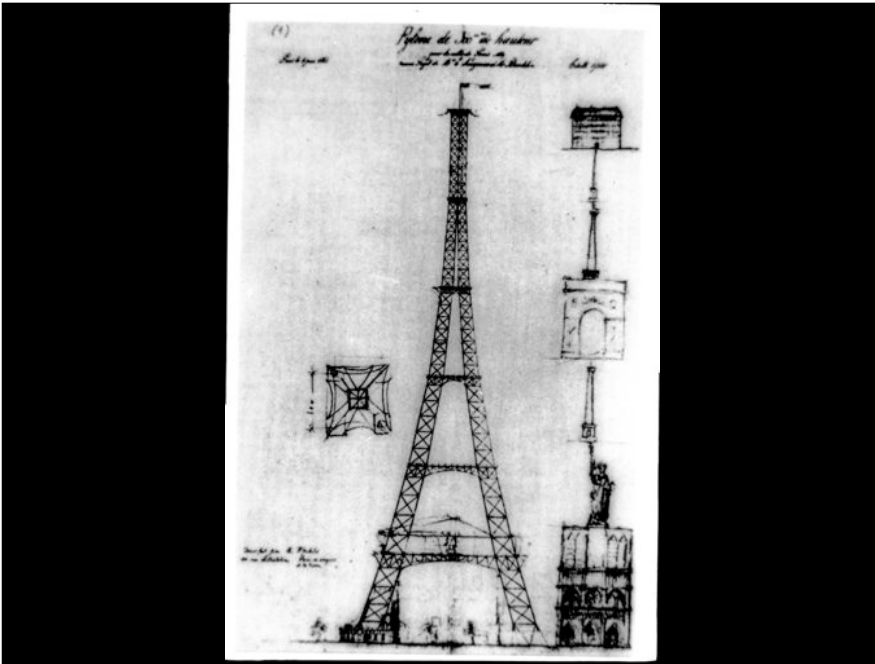
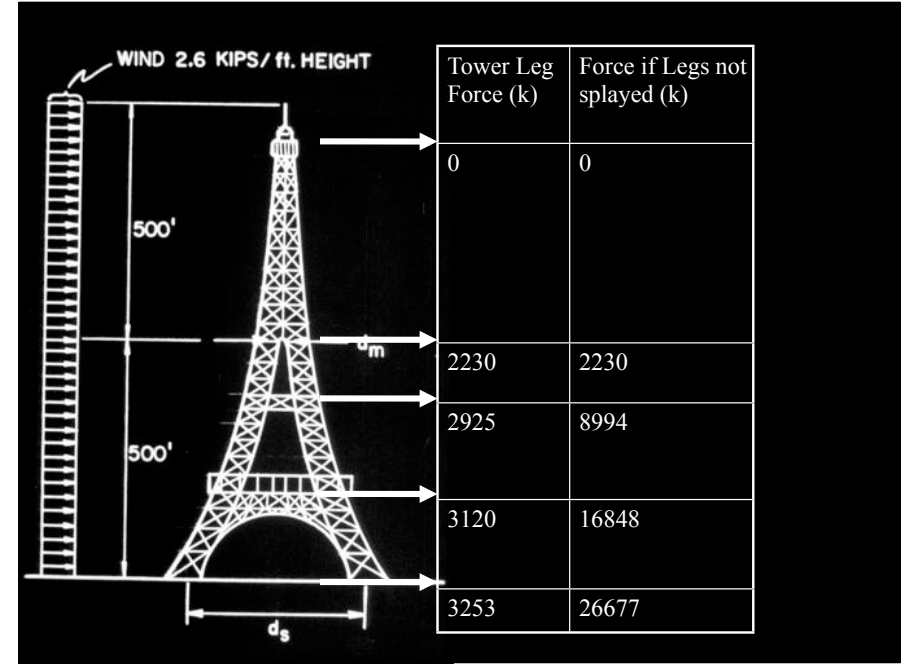
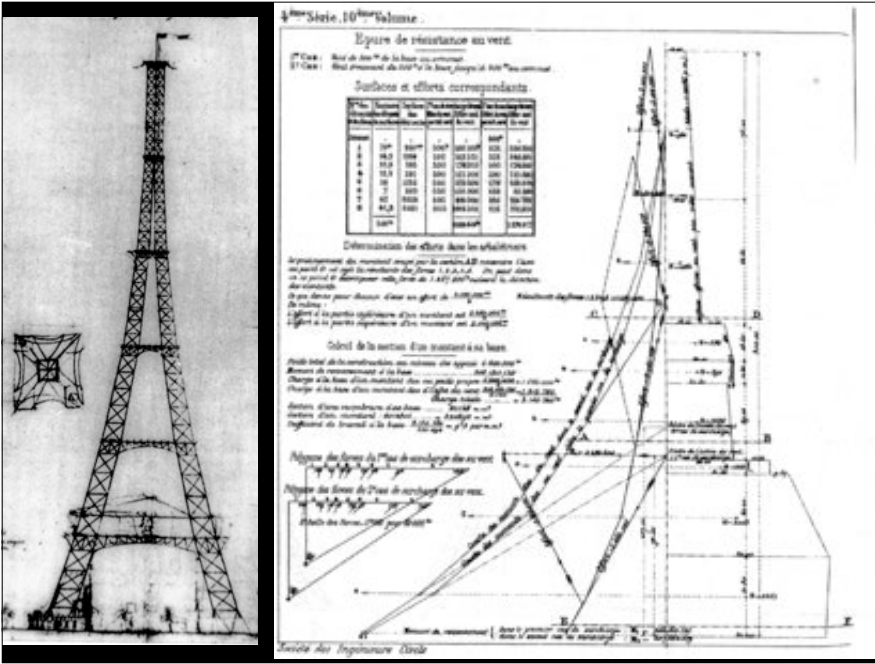
What should be the order of importance efficiency, safety, and permanence in structural design and construction?

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

Structural Engineering		Structural Art
Efficiency		Efficiency (Scientific)
Safety		Economy (Social)
Permanence		Elegance (Symbolic)









...symbolic





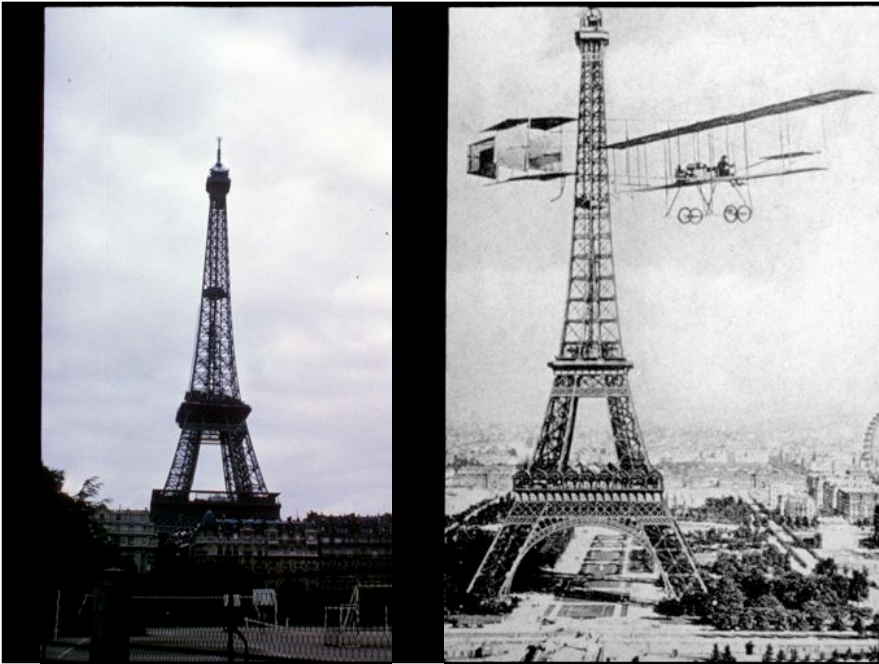


Guillaume Apollinaire  
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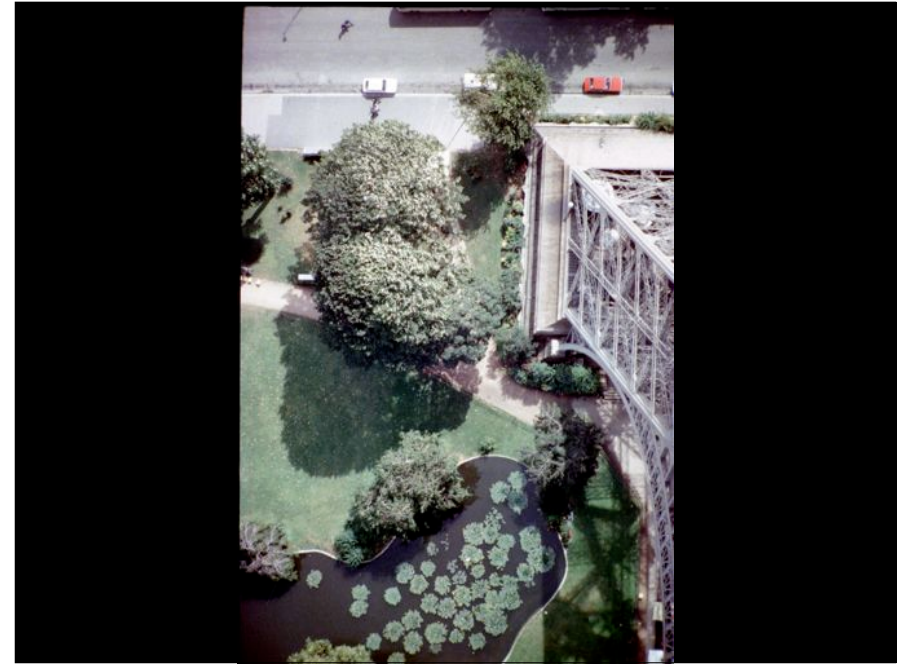
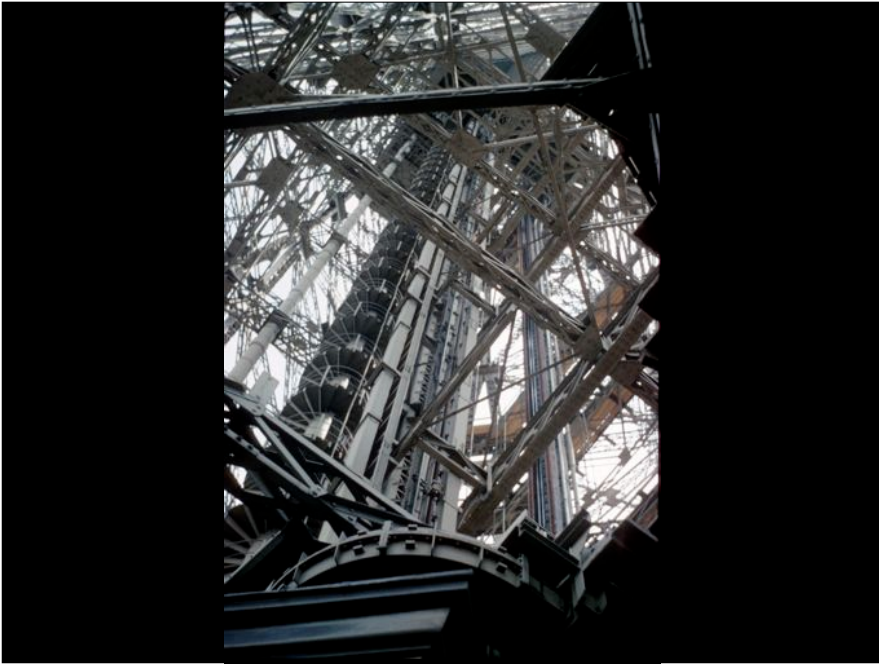
Can you think of another structure that has inspired works of fine art?

Scientific  
Social  
Symbolic ↔ Efficiency  
Economy  
Elegance









## Eiffel Tower

Efficiency: Efficient form of an iron cantilever (9400 tons to go 984 ft - 1/10<sup>th</sup> 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

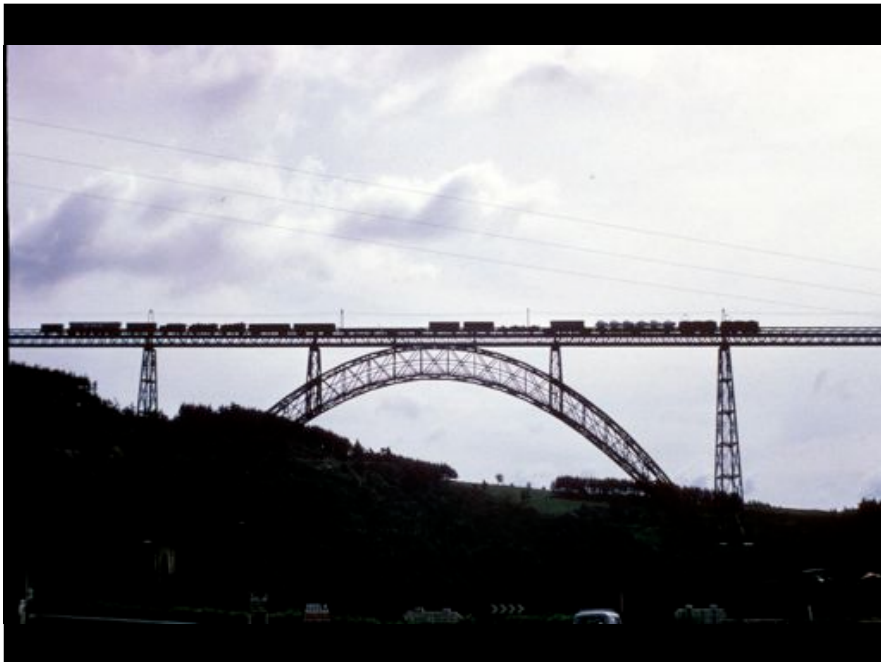




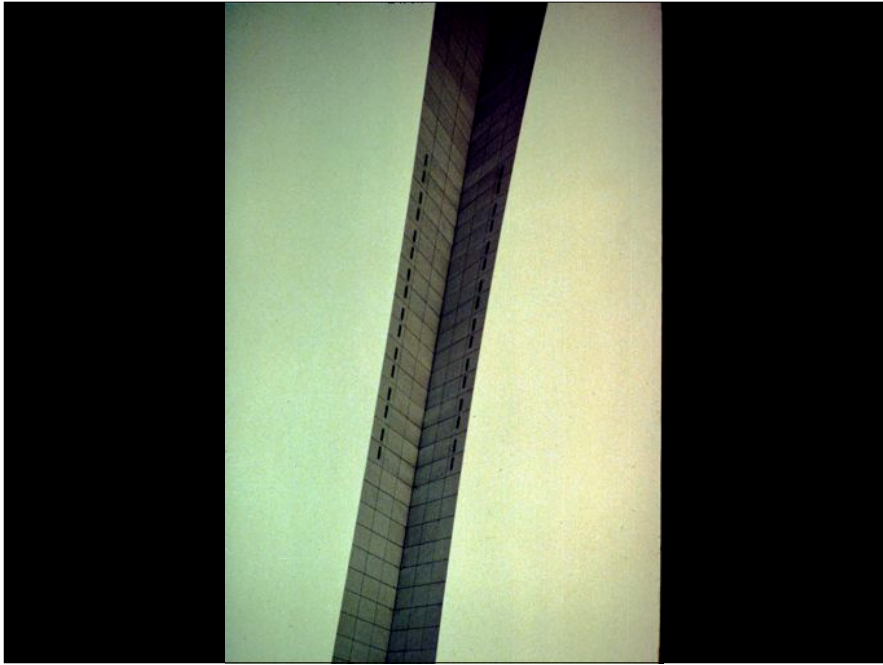
St. Louis Gateway Arch - Eero Saarinen - 1965

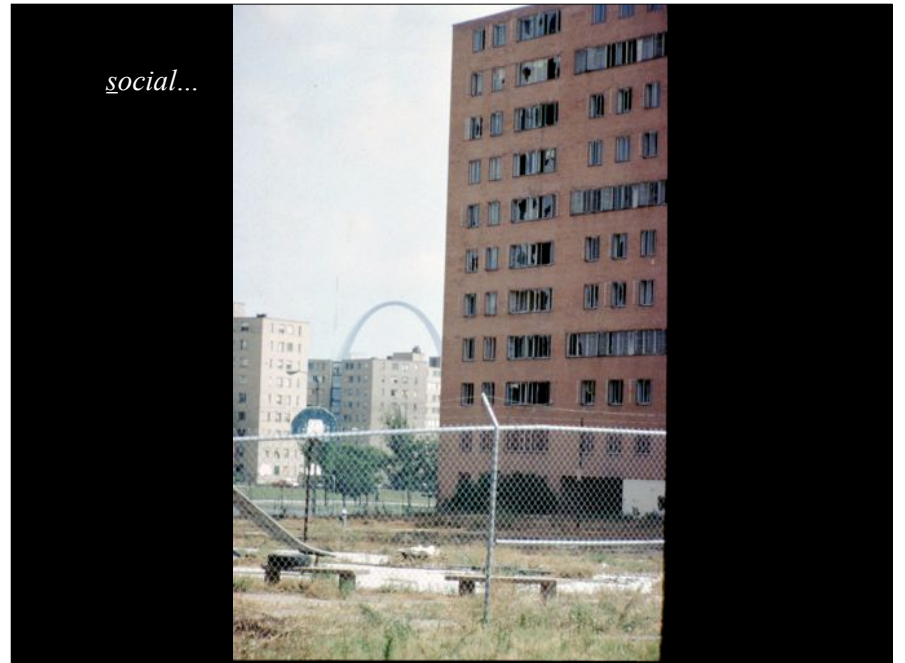


Garabit Viaduct - Eiffel

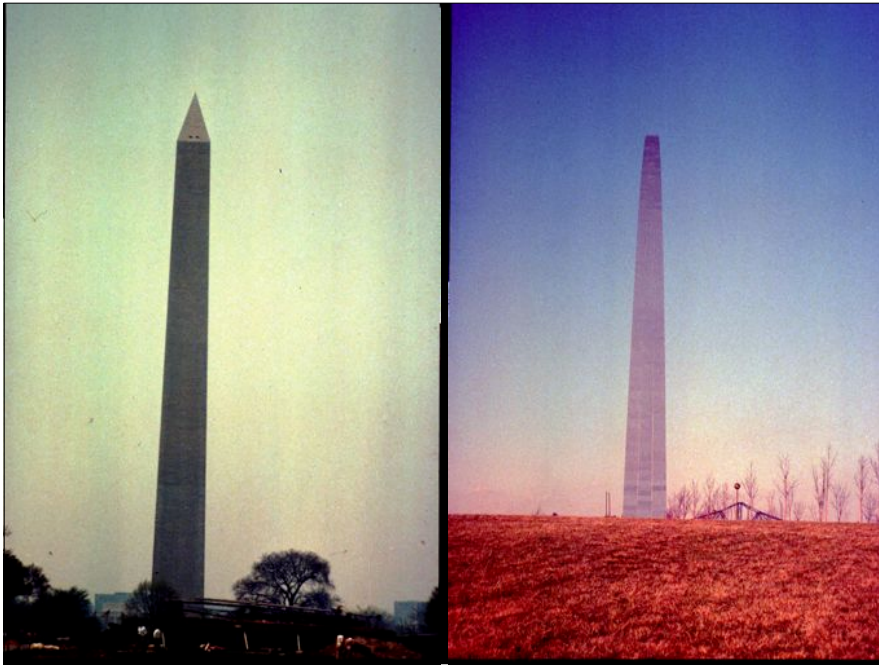












## Gateway Arch

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

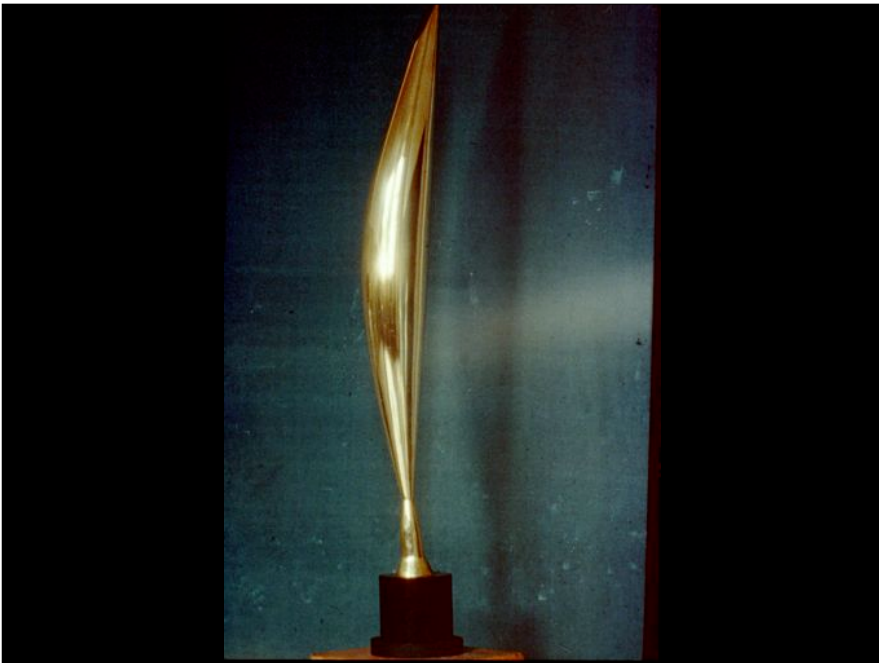
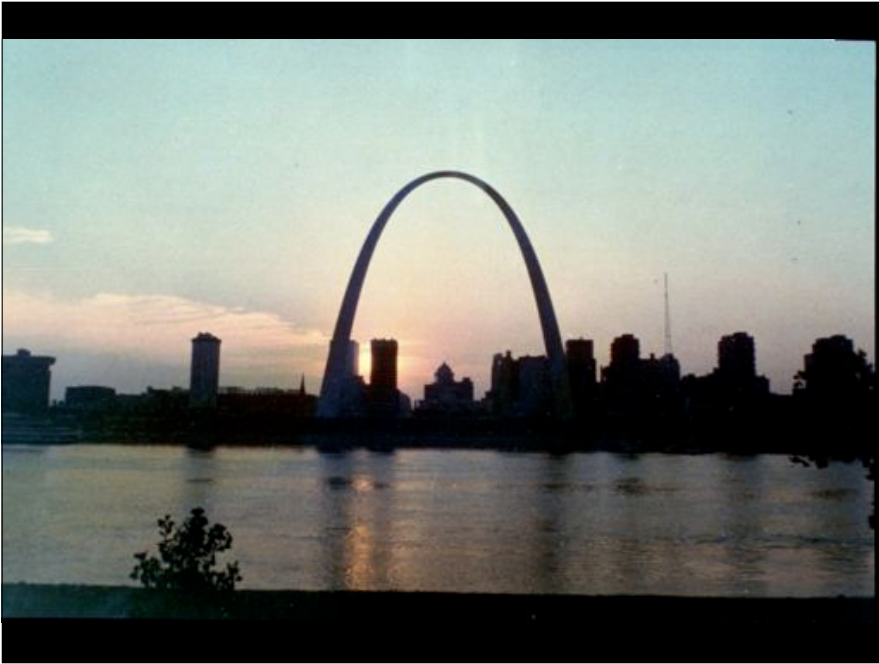
Efficiency: 20,000 tons for 600 feet (vs. 9400 tons for 984 ft with Eiffel's Tower)

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

<u>Structural Engineering</u> Efficiency		<u>Structural Art</u> 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)

Structural Engineering	Architecture (Vitruvius)	Structural Art
Efficiency	Strength (Firmitas)	Efficiency (Scientific)
Safety	Usefulness (Utilitas)	Economy (Social)
Permanence	Beauty (Venustas)	Elegance (Symbolic)

Q: What do you think Vitruvius meant by his 3 ideals?

Q: How are Vitruvius' ideas reflected (or not) in structural art?

Structural Engineering	Architecture (Vitruvius)	Structural Art
Efficiency	Strong (Firmitas)	Efficiency (Scientific)
Safety	Useful (Utilitas)	Economy (Social)
Permanence	Beautiful (Venustas)	Elegance (Symbolic)

Q: What ideals does the Arch meet?  
Which ones does it fail to meet?

# Tower and the Bridge Ch. 1

## *Subsections*

### 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

# Tower and the Bridge Ch. 1

## *Subsections*

### A New Tradition Art in Engineering

- 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](http://www.ce.jhu.edu/perspectives)  
select assignments, writing 1