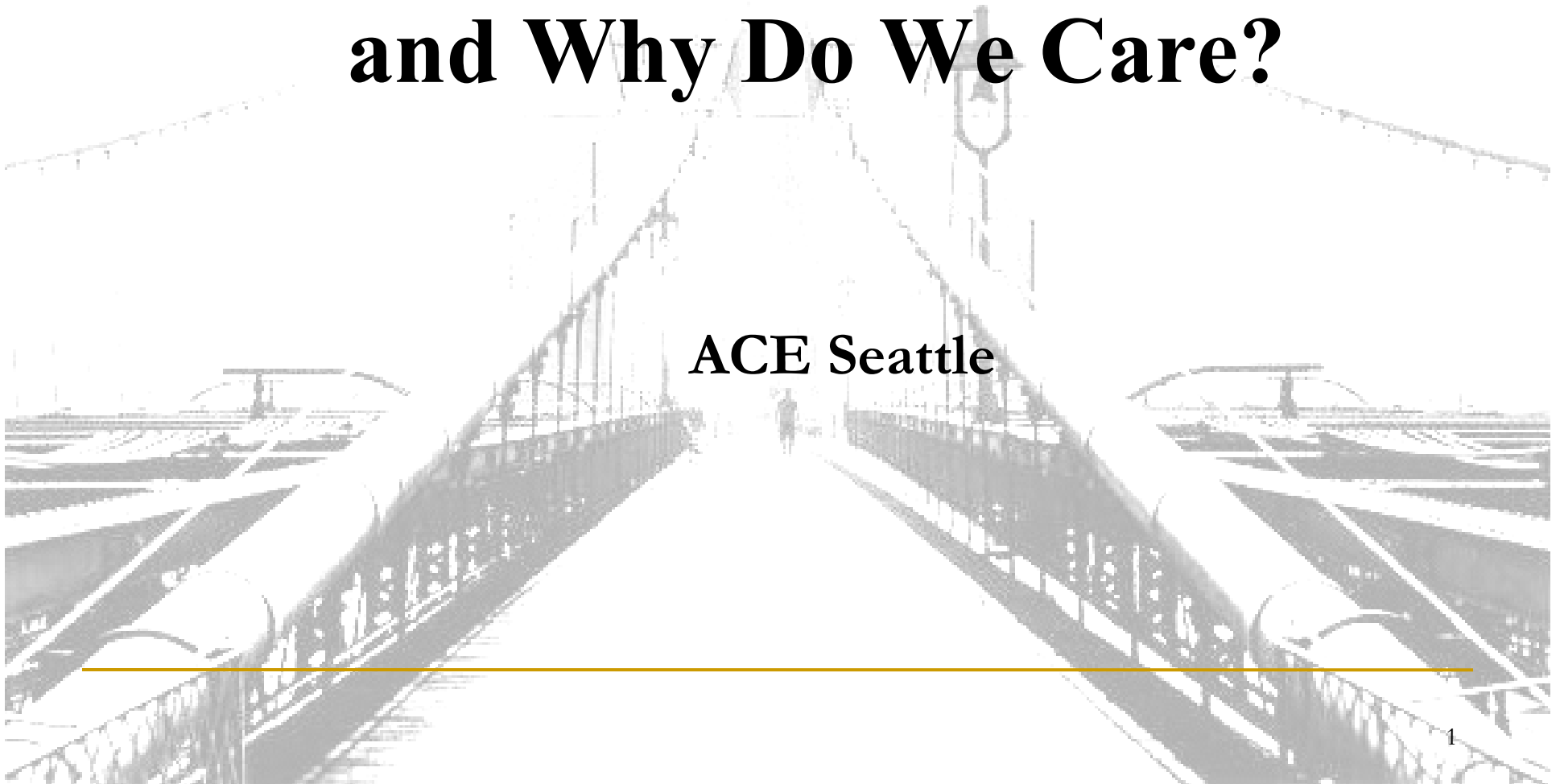


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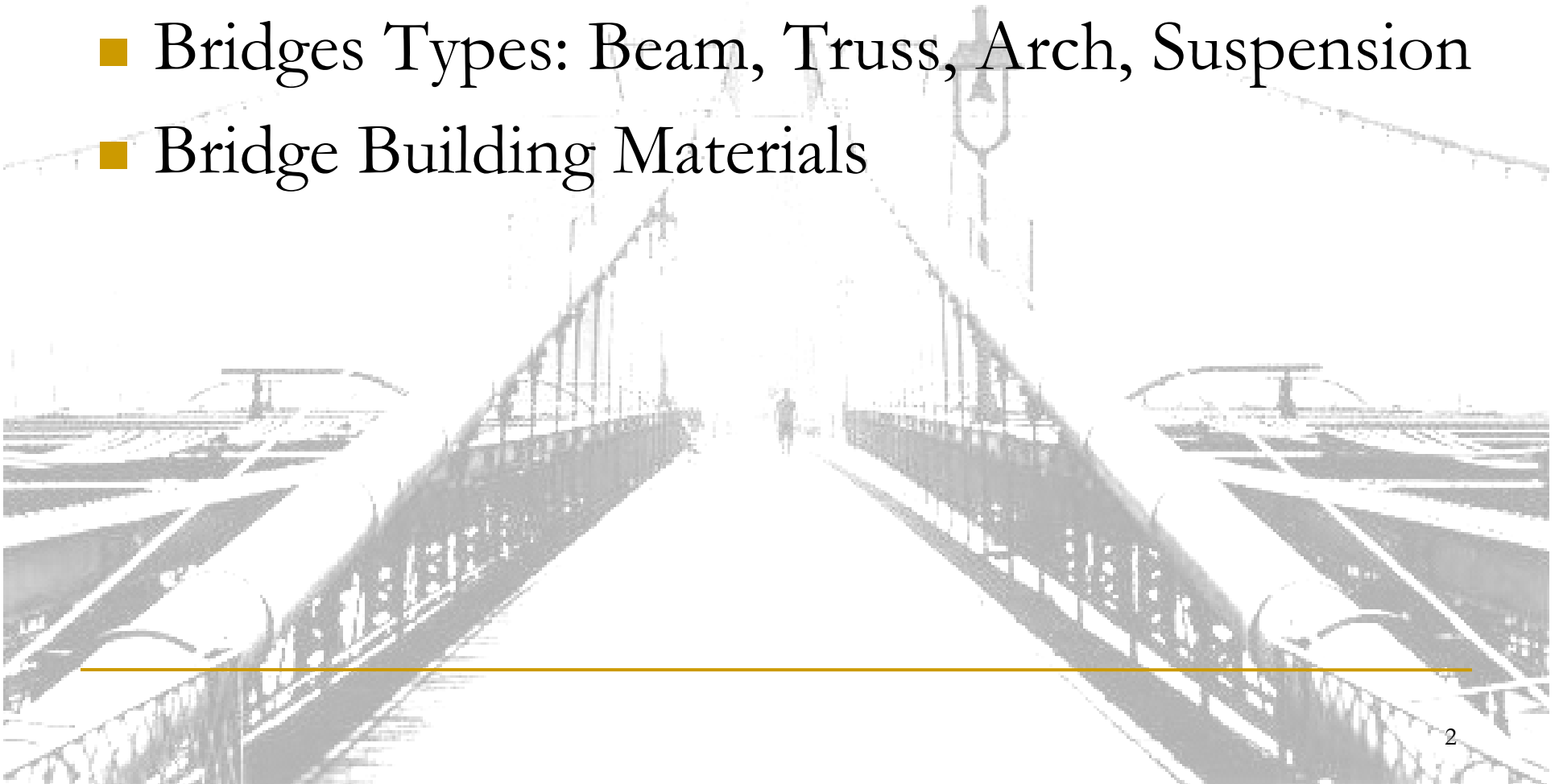
# **Bridges: How Do They Work and Why Do We Care?**

**ACE Seattle**



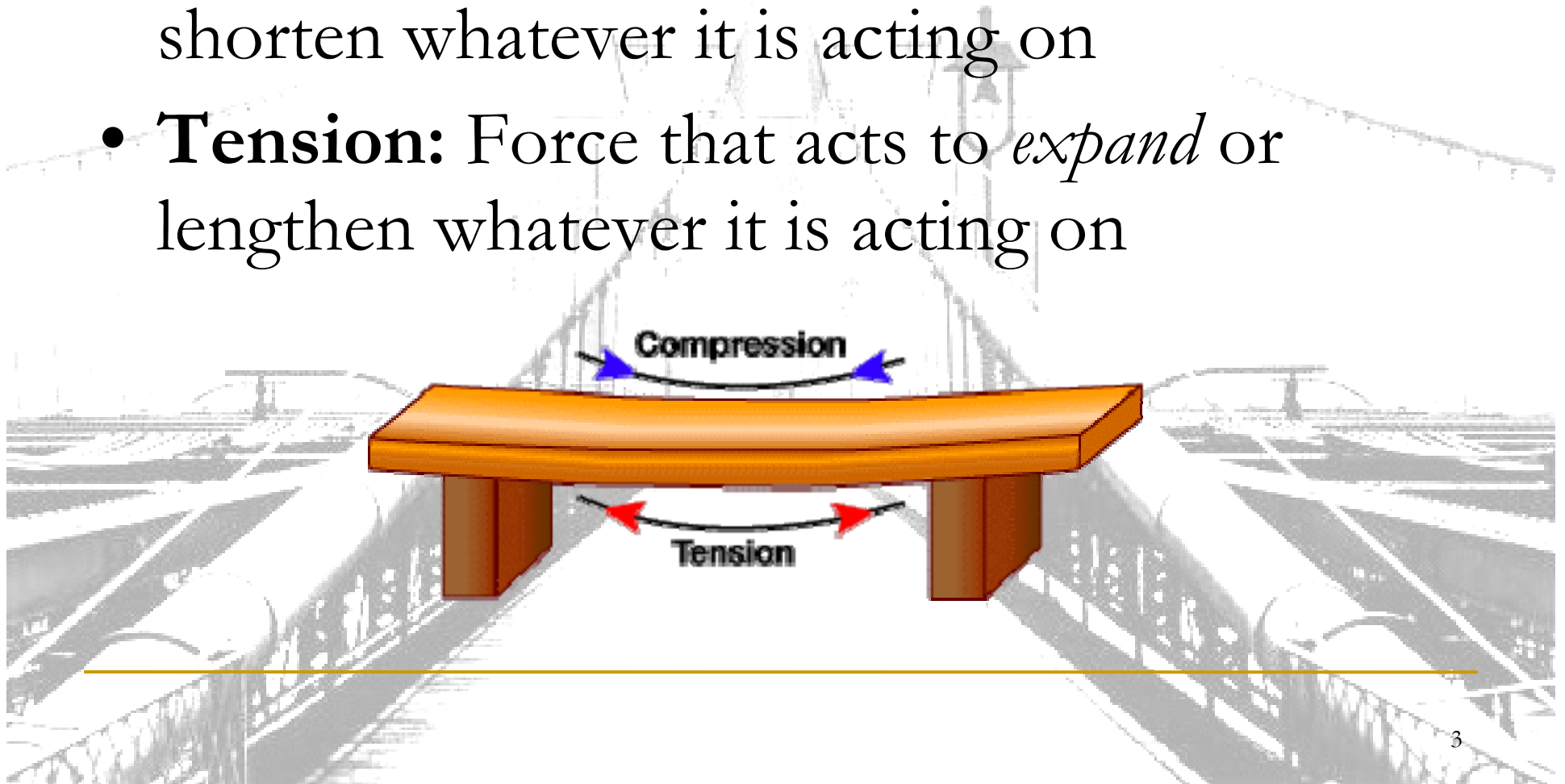
# Overview

- May the Forces be with You
- Bridges Types: Beam, Truss, Arch, Suspension
- Bridge Building Materials



# Forces

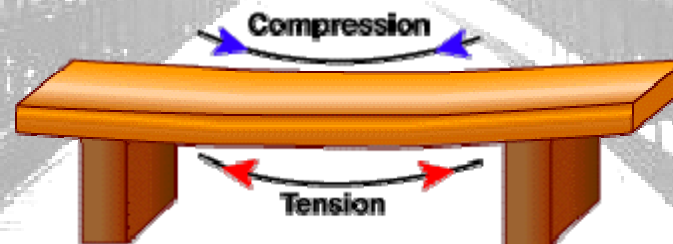
- **Compression:** Force that acts to *compress* or shorten whatever it is acting on
- **Tension:** Force that acts to *expand* or lengthen whatever it is acting on



# Forces: Dissipate or Transfer

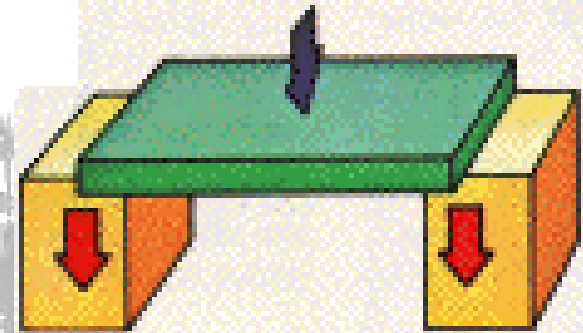
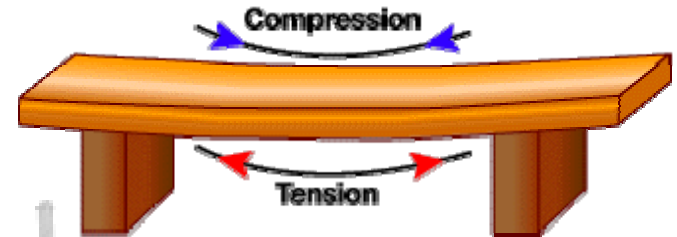
## Them!

- **Buckling:** What happens when compression force overcomes object
- **Snapping:** What happens when tension force overcomes object
- **Dissipate:** Break/Spread forces over greater area
- **Transfer:** To move a force from an area of weakness to an area of strength



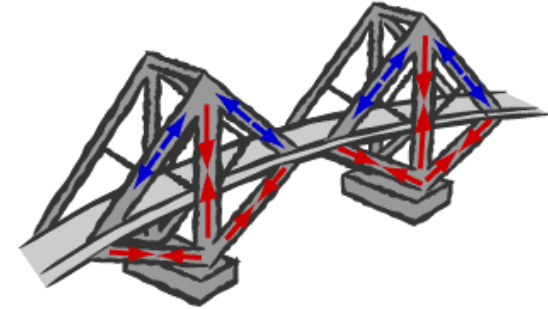
# Types of Bridges: Beam Bridge

- Compression on road
- Tension underneath
- Uses beams to dissipate forces

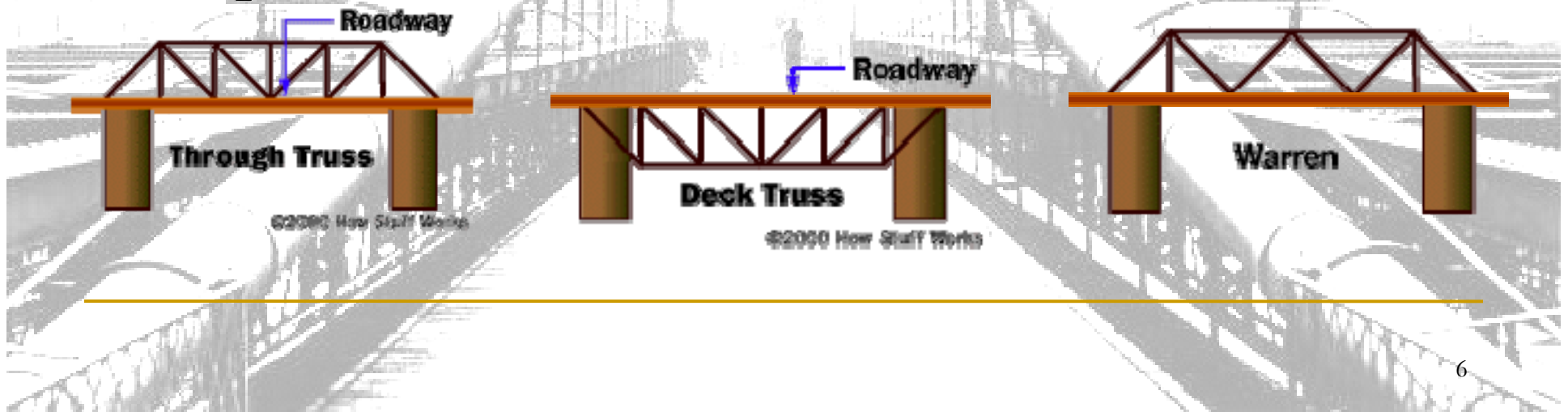


# Types of Bridges: Truss Bridge

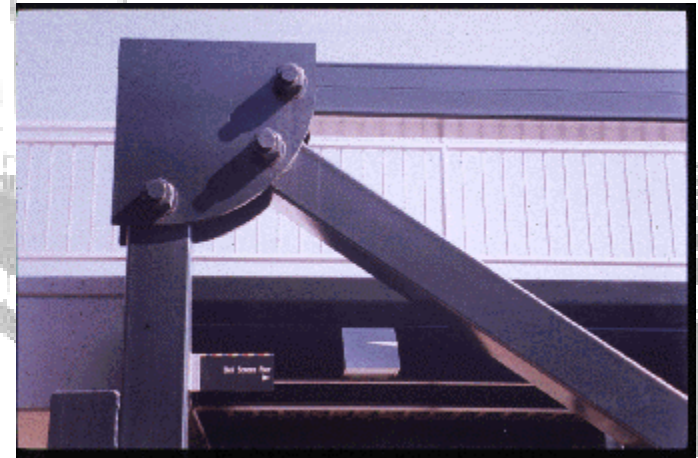
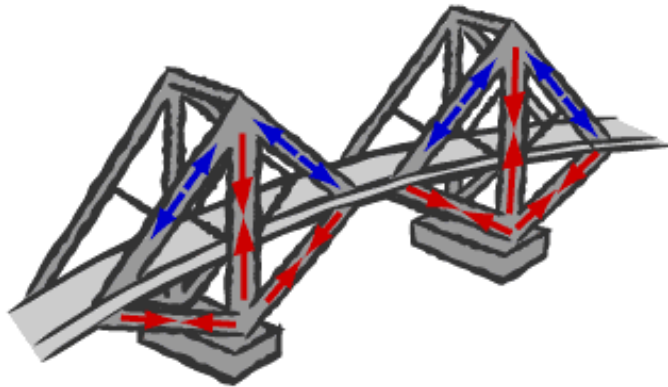
- Uses a system of beams or **truss** to dissipate forces



- Tensions and Compression are transferred throughout the truss
- A **truss** adds rigidity and strength and helps dissipate forces

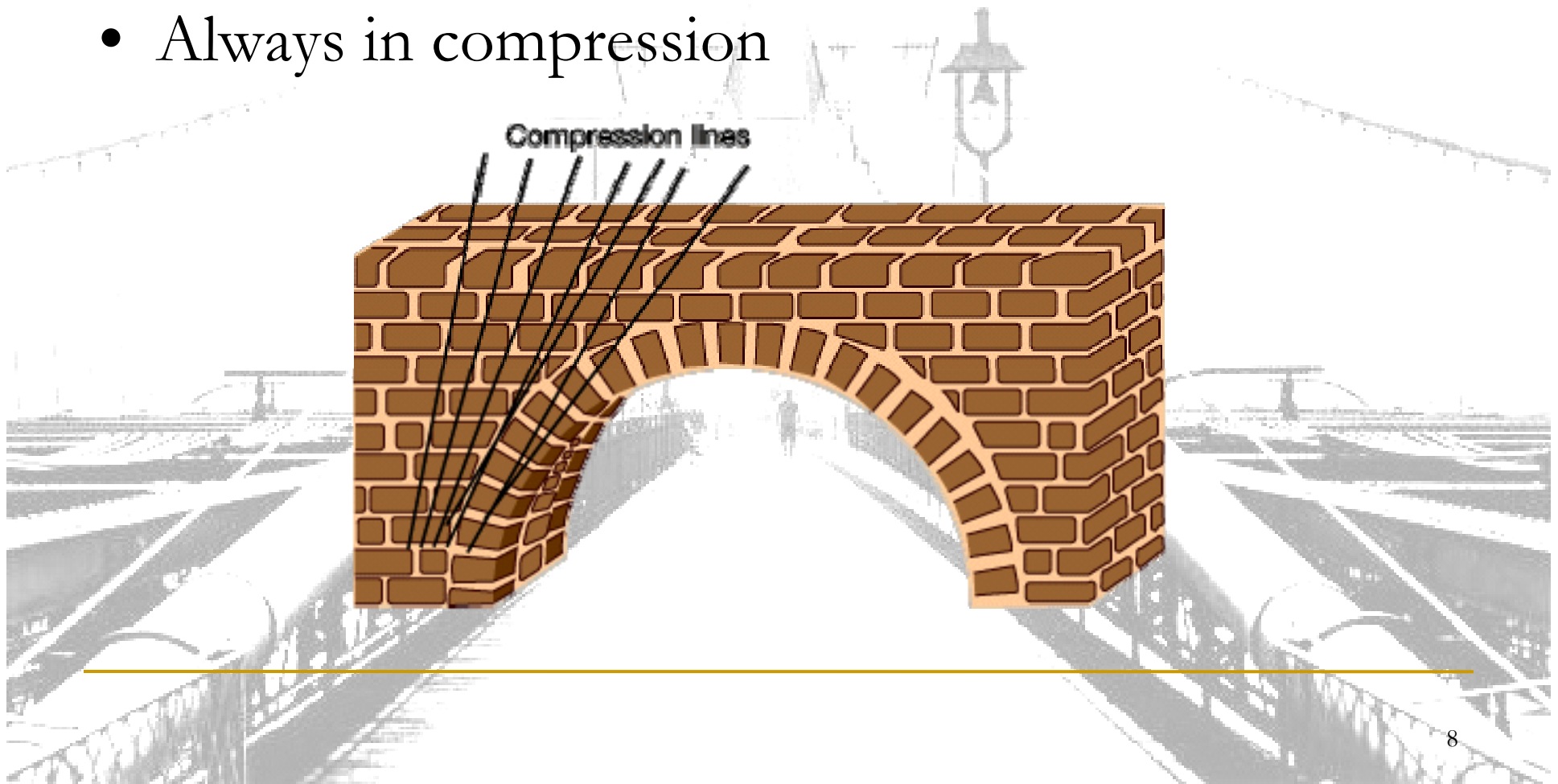


# Truss Bridge:



# Types of Bridges: Arch Bridge

- Semicircle design **transfers** forces from weaker center to stronger abutments
- Always in compression





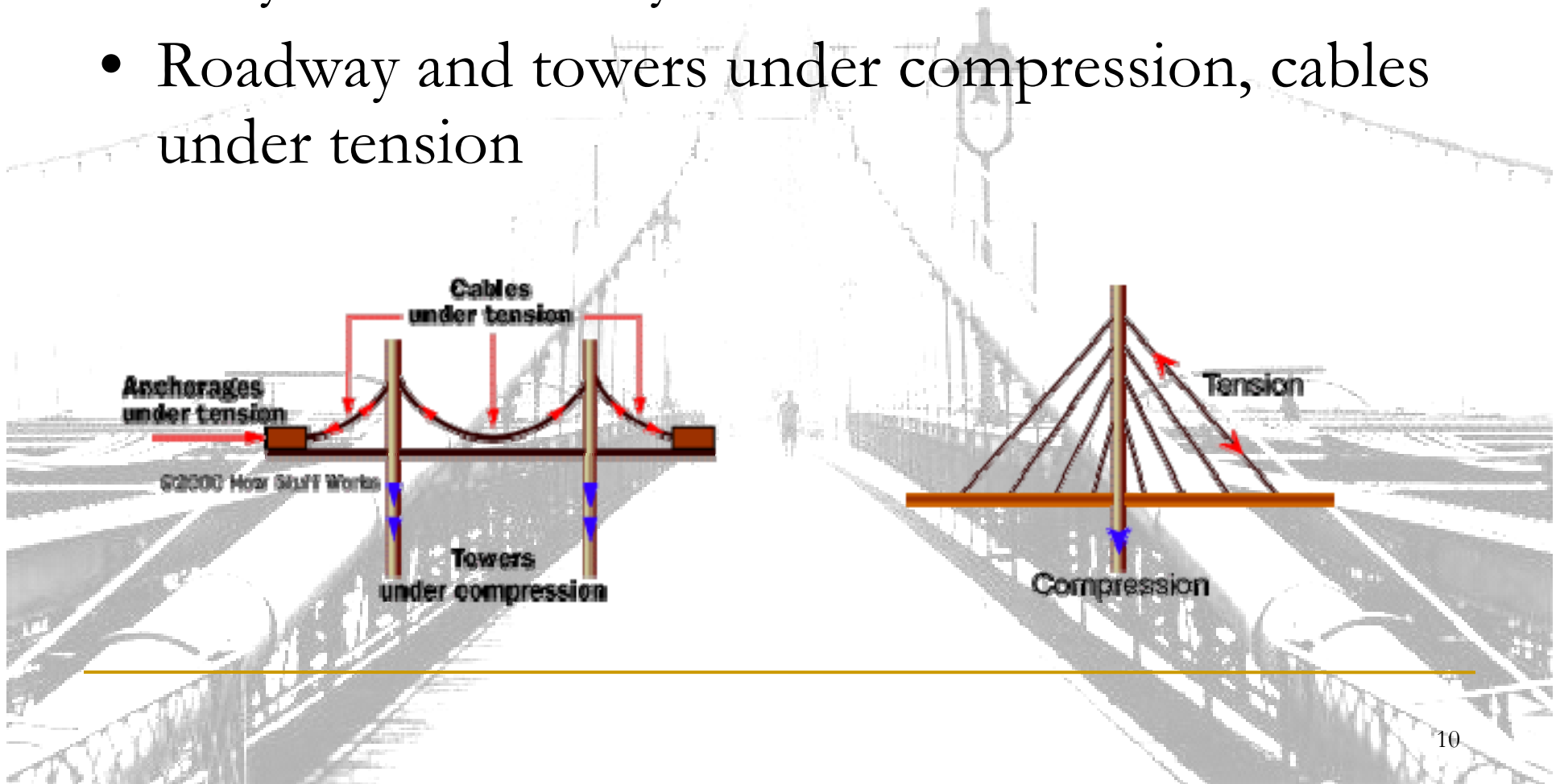
# Arch Bridge: Portland's Fremont Bridge



(c)2004 Andrew Hall, PortlandBridges.com

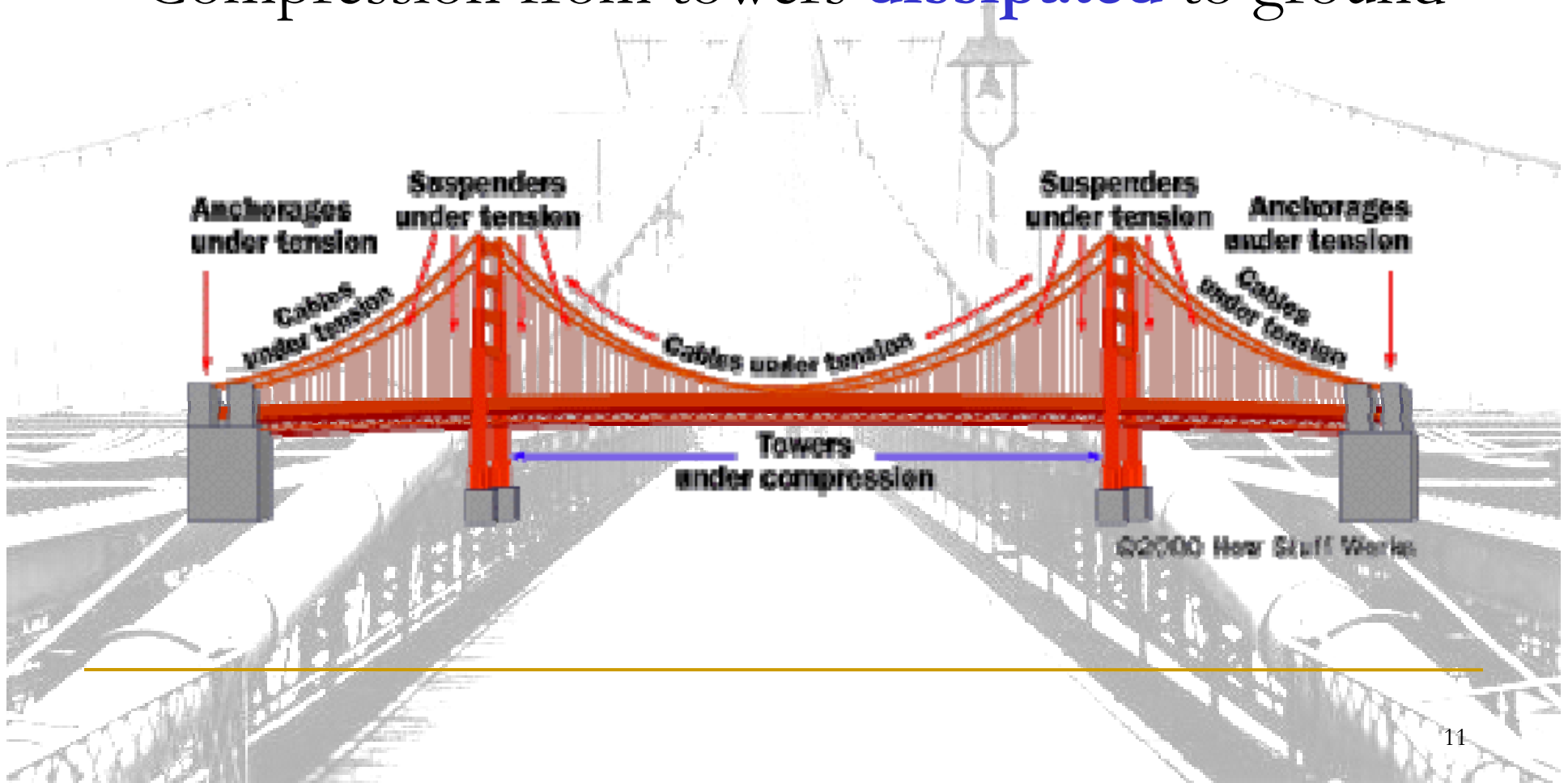
# Types of Bridges: Suspension Bridge

- Suspension cables and towers **transfer** forces away from roadway
- Roadway and towers under compression, cables under tension

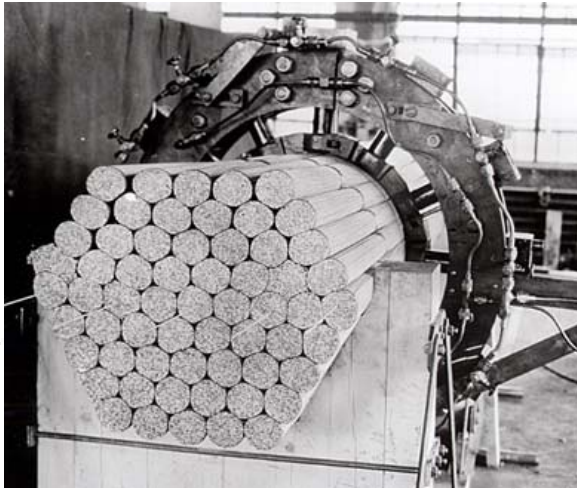


# Types of Bridges: Suspension Bridge

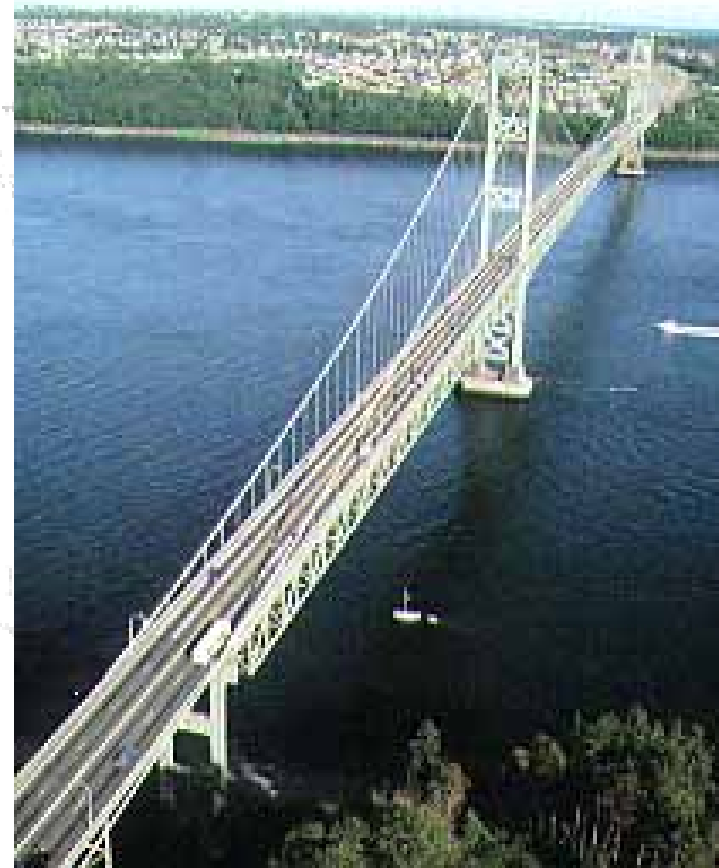
- Tension from anchorages **dissipated** to ground
- Compression from towers **dissipated** to ground



# Suspension Bridge:



# Suspension Bridge: Tacoma Narrows Bridge



# Floating Bridge: I-90 Bridge over Lake Washington



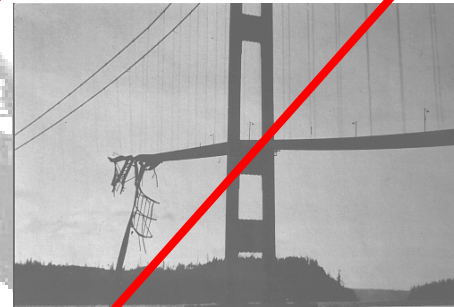
# Bridge Building Materials

- Timber
- Stone
- **Concrete**
- **Steel**
- **Today Only: PAPER**



# Summary

- Tension and Compression Forces need to be **transferred** and **dissipated**
- If these forces are not accounted for, buckling, snapping or bridge collapse could occur!
- Main types of bridges are
  - ❑ Beam Bridge
  - ❑ Truss Bridge
  - ❑ Arch Bridge
  - ❑ Suspension Bridge





# Don't Try This at Home, Yet

