Bicycle Railing Heights

(Everything you wanted to know about design guidelines but were afraid to ask)

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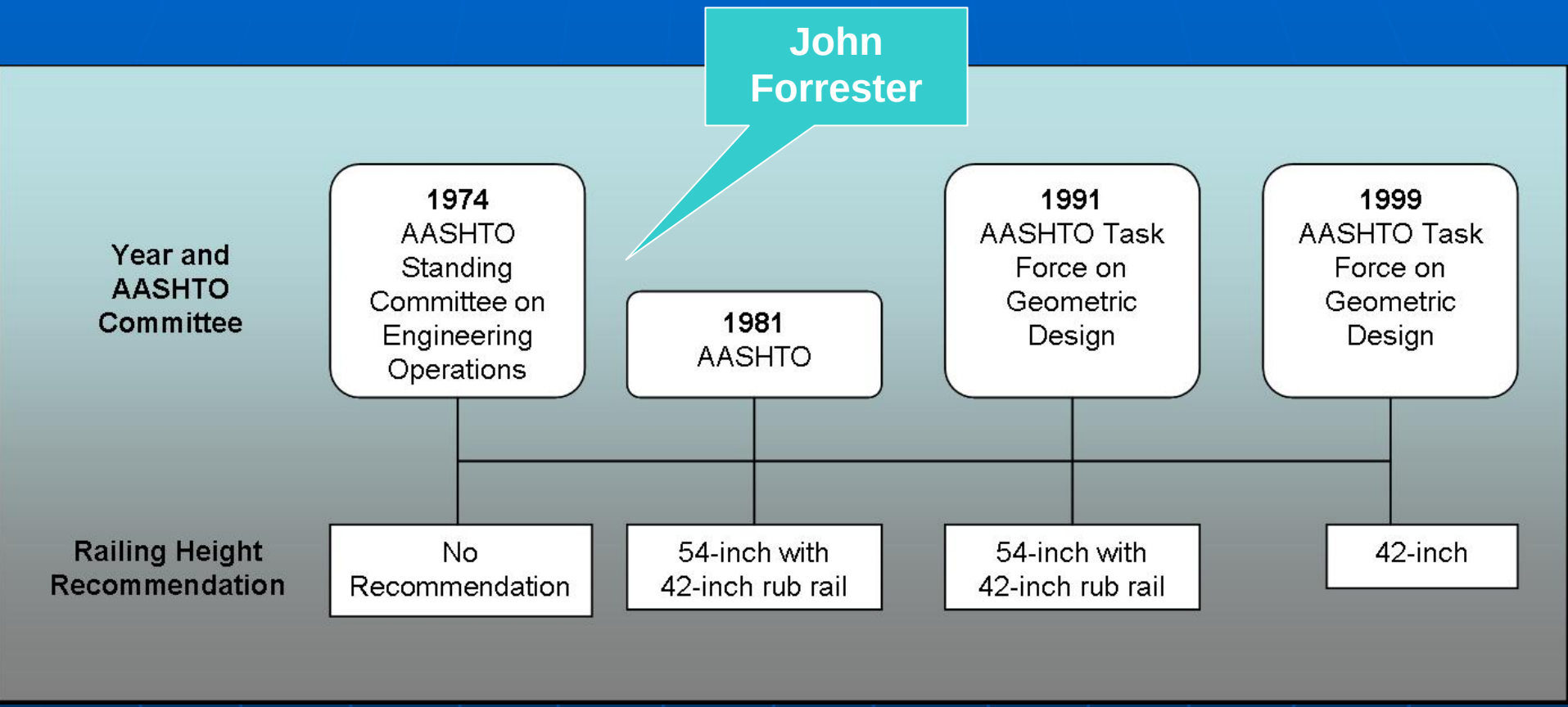
Problem Statement

- Recommended railing height was 54 inches raised numerous complaints:
  - Sight obstruction
  - High cost
  - Aesthetics
- 1999 - AASHTO Guidelines for Bicycle Facilities recommends (“should”) 42 inch height
- AASHTO Guidelines for Bridges requires (“shall”) 54 inch height

National Cooperative Highway Research Program (NCHRP)

- Basis for Heights
- Literature Search
- Preference Survey
- Investigate Accidents
- Recommendations

History


John Forrester
Year and AASHTO Committee
1974 AASHTO Standing Committee on Engineering Operations
1981 AASHTO
1991 AASHTO Task Force on Geometric Design
1999 AASHTO Task Force on Geometric Design
Railing Height Recommendation
No Recommendation
54-inch with 42-inch rub rail
54-inch with 42-inch rub rail
42-inch

The Survey

- Internet based
  - State DOT Bicycle Coordinators and Structural Engineers
  - Advocacy Groups
  - APBP
- Height Preference and Why?
- Issues related to railing height?
- Knowledge of accident records?
- Knowledge of specific accidents?

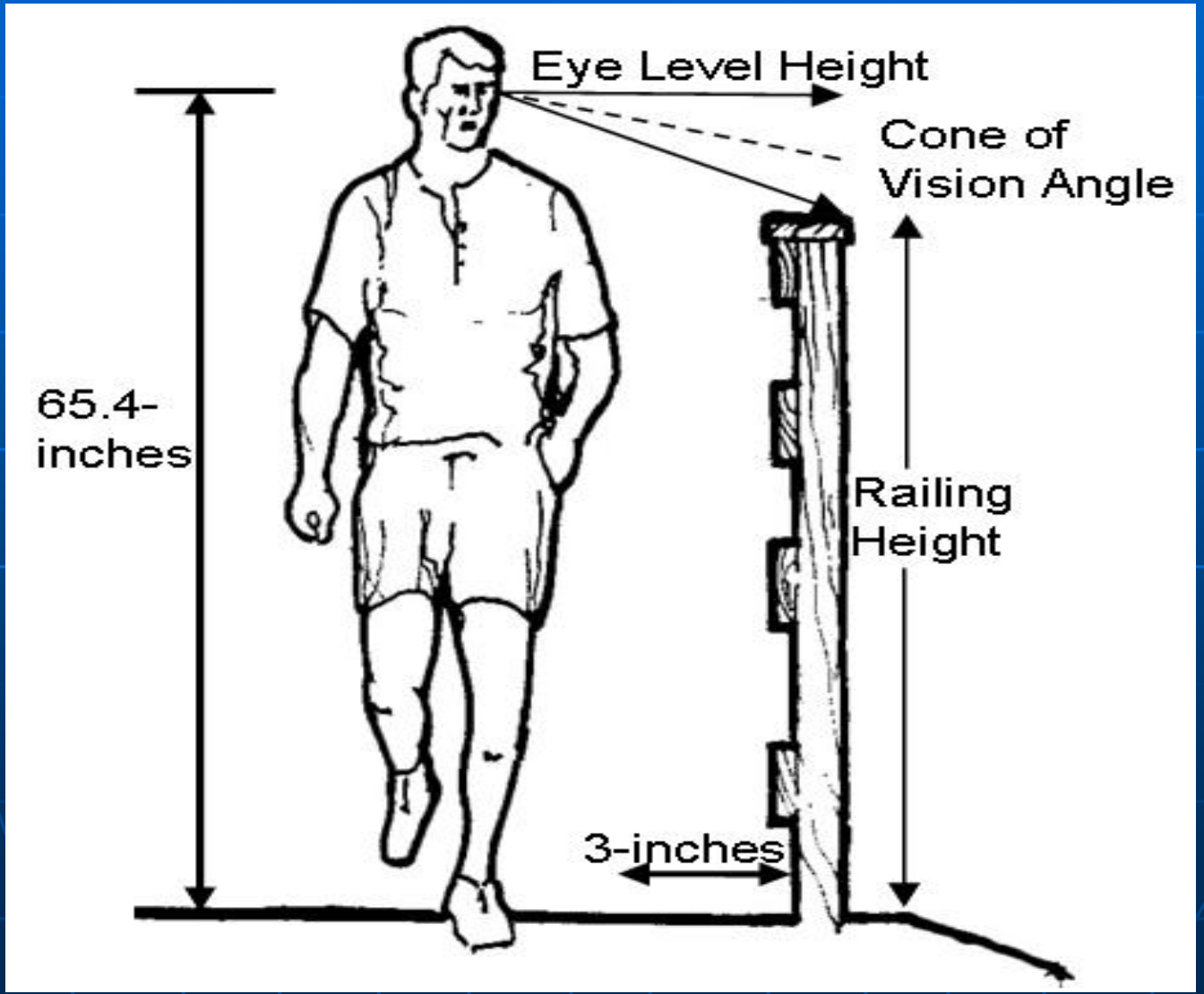
Survey Findings

- 43% of advocacy groups prefer a 1.1-meter (42-inch) railing height.
- 46% of state bicycle coordinators and bridge designers prefer a 1.1-meter (42- inch) railing height.
- Remainder evenly divided between 54” and “other”

Height Issues

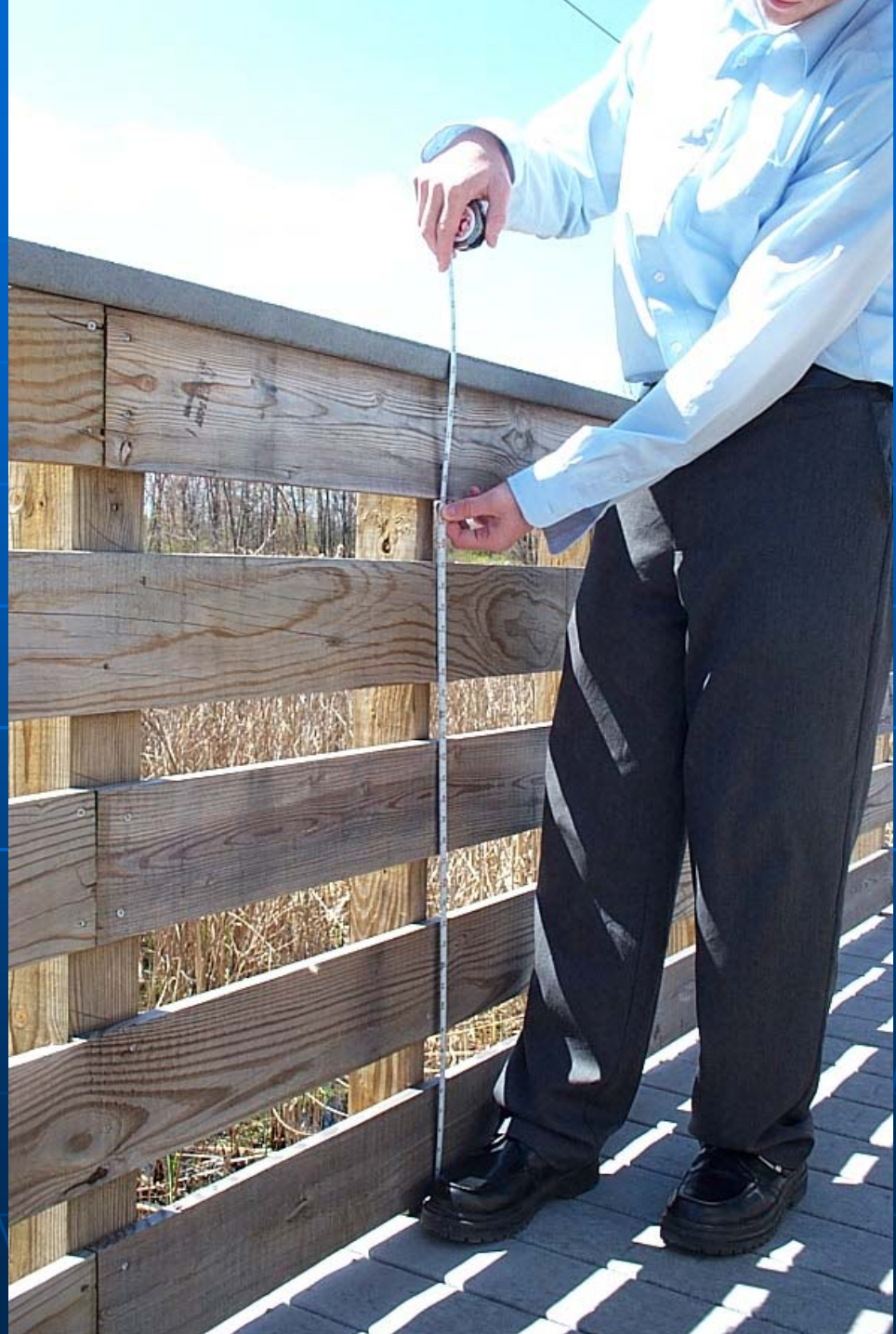
- Obstructs viewshed
- Obstructs sight distance
- Aesthetics of a trail or bridge
- Creates a feeling of confinement
  - No escape from an assault
- Greater expense
- Sense of safety
  - Falling
  - Strong cross winds

Obstruction of View



Eye Height vs. Railing Height

	Average Eye Level Height (in.)	Difference from 42” rail (in.)	Difference from 54” rail (in.)
Adult Male	65.4	23.4	11.4
Adult Female	61.5	19.5	7.5
Child - 12 yrs.	54.5	12.5	0.5



Cost
(per meter)

- Bicycle Railing
  - Pipe railing $110 to $150
  - Wood Railing $63 to $70
  - Chain Link Fence $55
- Vehicular Railing
  - Vehicular Railing $270
  - Vehicular/Pedestrian Railing $350
  - Vehicular/Bicycle Railing $475

Crash Experience

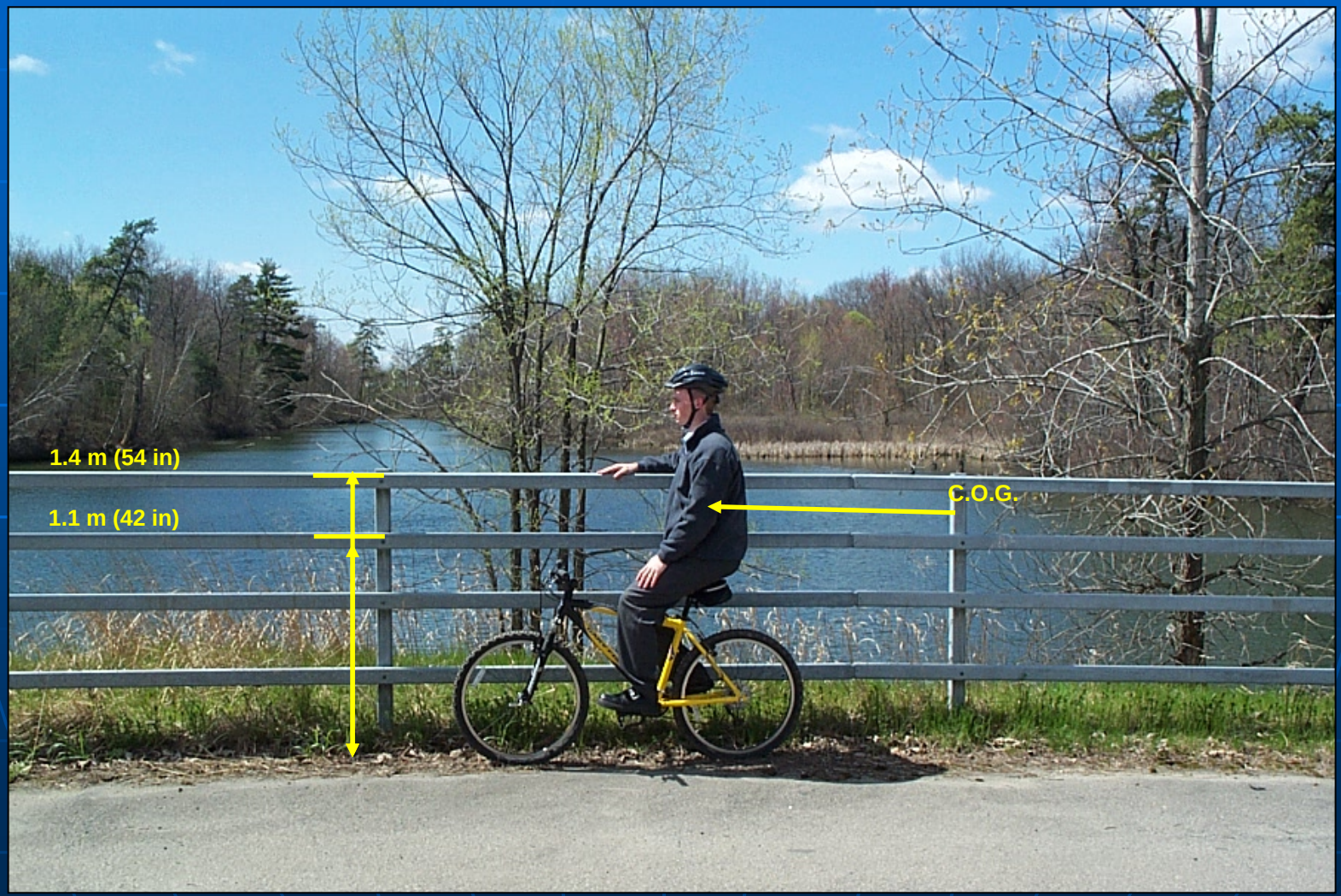
Country	Location	Height	Description
U.S.	Roadway Bridge over	<1.1 m	Bicyclist hit by overtaking vehicle and fell railing
U.S.	Roadway Bridge	<1.1 m	Bicyclist fell over bridge vehicular railing. (Cause unknown)
G.B.	Roadway Bridge	<1.1 m	Bicyclist veered off course due to slippery surface and fell over railing
U.S.	Roadway Bridge who	N/A	Motor vehicle collided with two bicyclists were thrown over railing
U.S.	Roadway Bridge	1m+/-	Collided with obstruction and fell over railing
U.S.	Shared use path while and vaulted over	1.4 m	Bicyclist traveling too fast lost control turning into curve, collided with railing
G.B.	Shared use path	N/A	Single vehicle incident. Details unknown
Can.	Shared use path on bridge	1.4 m	Bicyclist traveling too fast collided with bridge structure (did not collide with railing)
Can.	Shared-use Path into on bridge	None	Bicyclist collided with pedestrian and fell path of motor vehicle traffic

Bicycle Railing Crash Lessons Learned

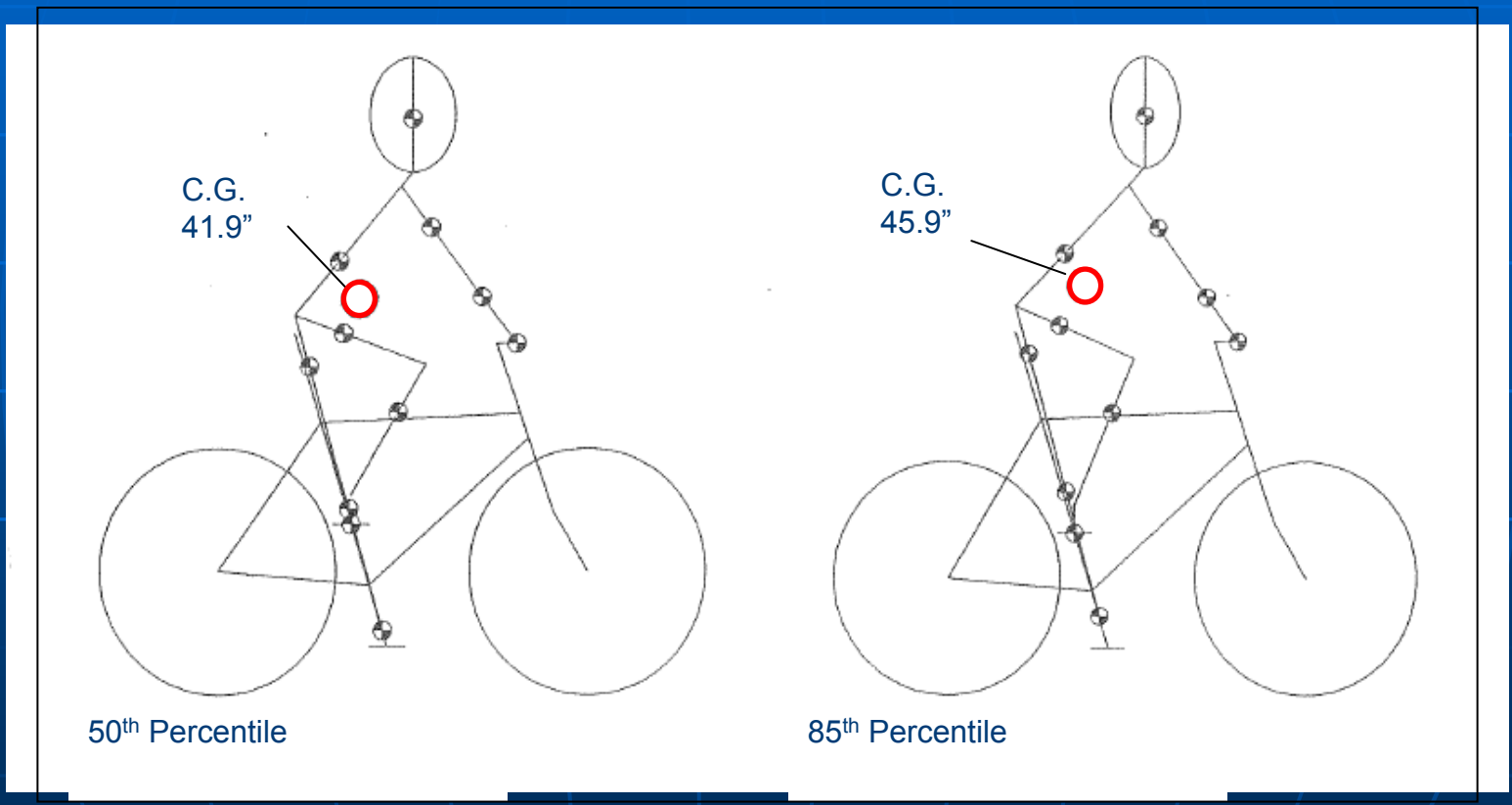
- Greatest threat – Low vehicular railings on bridges
- Most crashes occurring on roadway bridges or shared use paths on bridges
- Bicycle accident surveillance systems do not record road conditions
- One crash related to vaulting over a 54 inch railing

Wyoming Vehicular Railing

Bicycle Railing Crash Theory

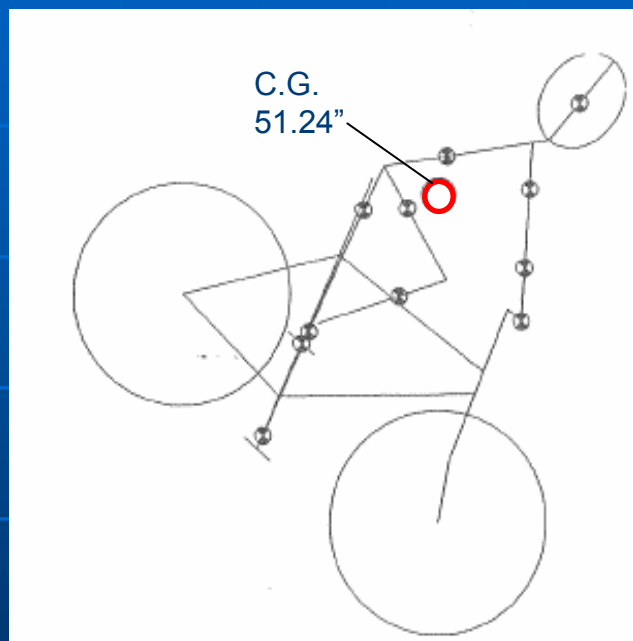


Bicyclist Center of Gravity

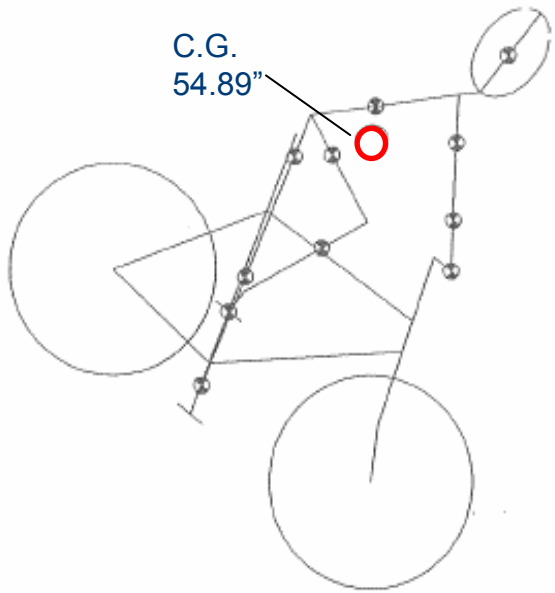


David Orr – Texas A&M University

Bicyclist Center of Gravity



50th Percentile Cyclist



95th Percentile Cyclist

Source: Orr, TTI

David Orr – Texas A&M University

1.2 Meter (48 inch) High Railing

- Bicycle facility immediately adjacent to the edge of a highway bridge.
- Where a bicyclist may fall over a railing into the path of oncoming traffic.
- A bikeway bridge with a drop off of 0.6 meters (2 feet) or greater
- A shared use path adjacent to a hazard where the bicyclist would could be severely injured


Golden Gate Bridge

1.4 Meter (54 inch) High Railing

- On a shared use path or the approach to a bridge where the radius of a curve adjacent to a hazard is not adequate for the anticipated speed.
- On a shared use path where inadequate sight distance or large volume of users could cause a bicyclist to take evasive action and collide with a railing at a sharp angle.
- On a shared use path or bridge at the end of a long descent where speeds of bicyclists are greater.

Higher Railing Needed


Railing Used as a Physical Barrier

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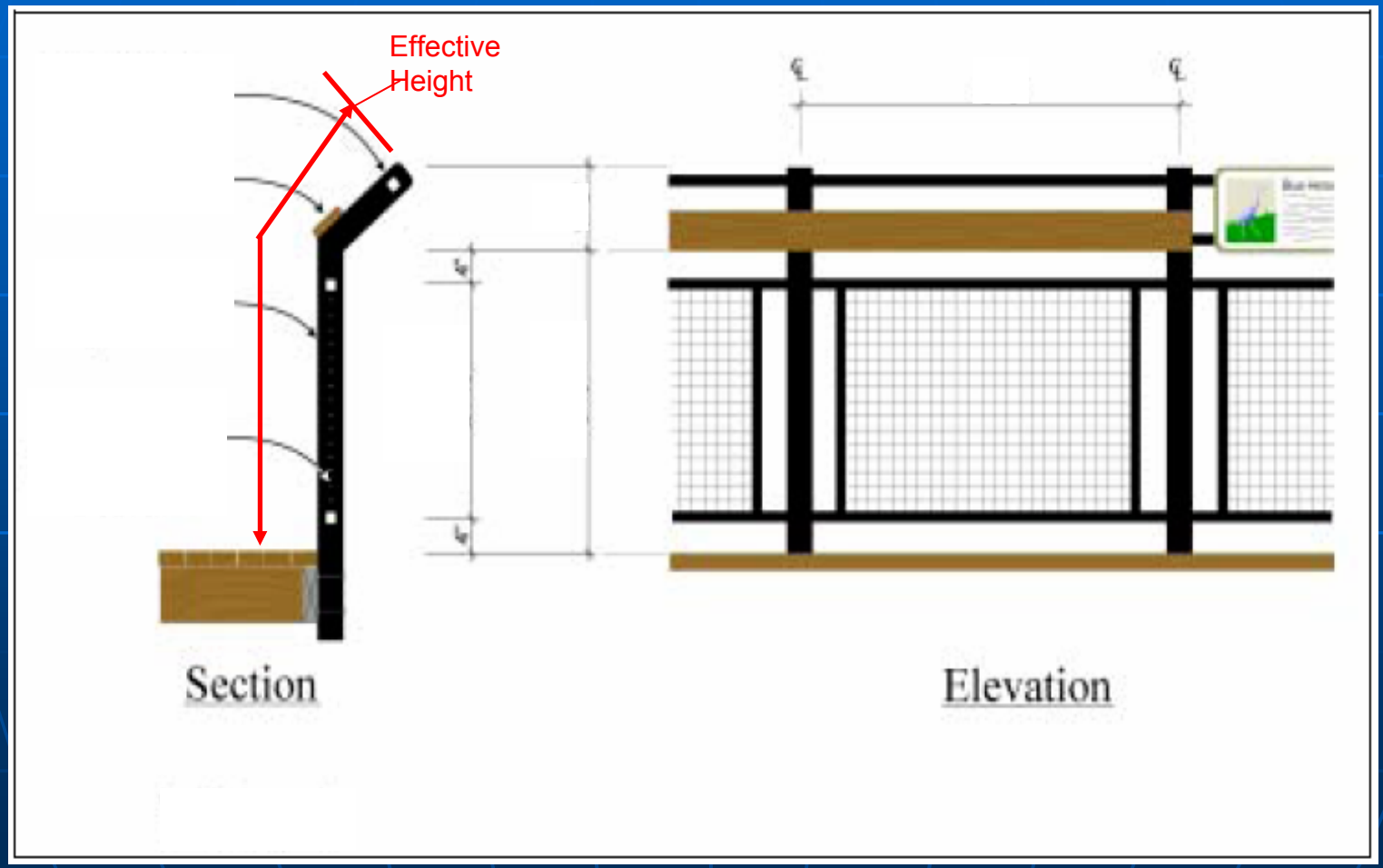
Transparency

Railing Setback

Cantilevered Top Rail



Lessons Learned

- In a litigious society, guidelines are dictating design
- Guidelines are often based on best judgment at the time – not science
- Guidelines are guidelines, not standards
- Deviation from guidelines should be documented
- Good design requires flexibility
- Use experienced professionals