Designing, Constructing, and Correcting: Bridge Rideability

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Overview

- Understanding the Problem
- Potential Solutions
- Research Effort
- Pilot Rideability Specification
- Demo of:
  - Diamond Grinding Simulator
- Questions

Focused Perspective

"*Ability to safely carry loads*

and

good rideability

are NOT

mutually exclusive goals

for our structures!"

Impacts of Poor Bridge Ride

User Costs

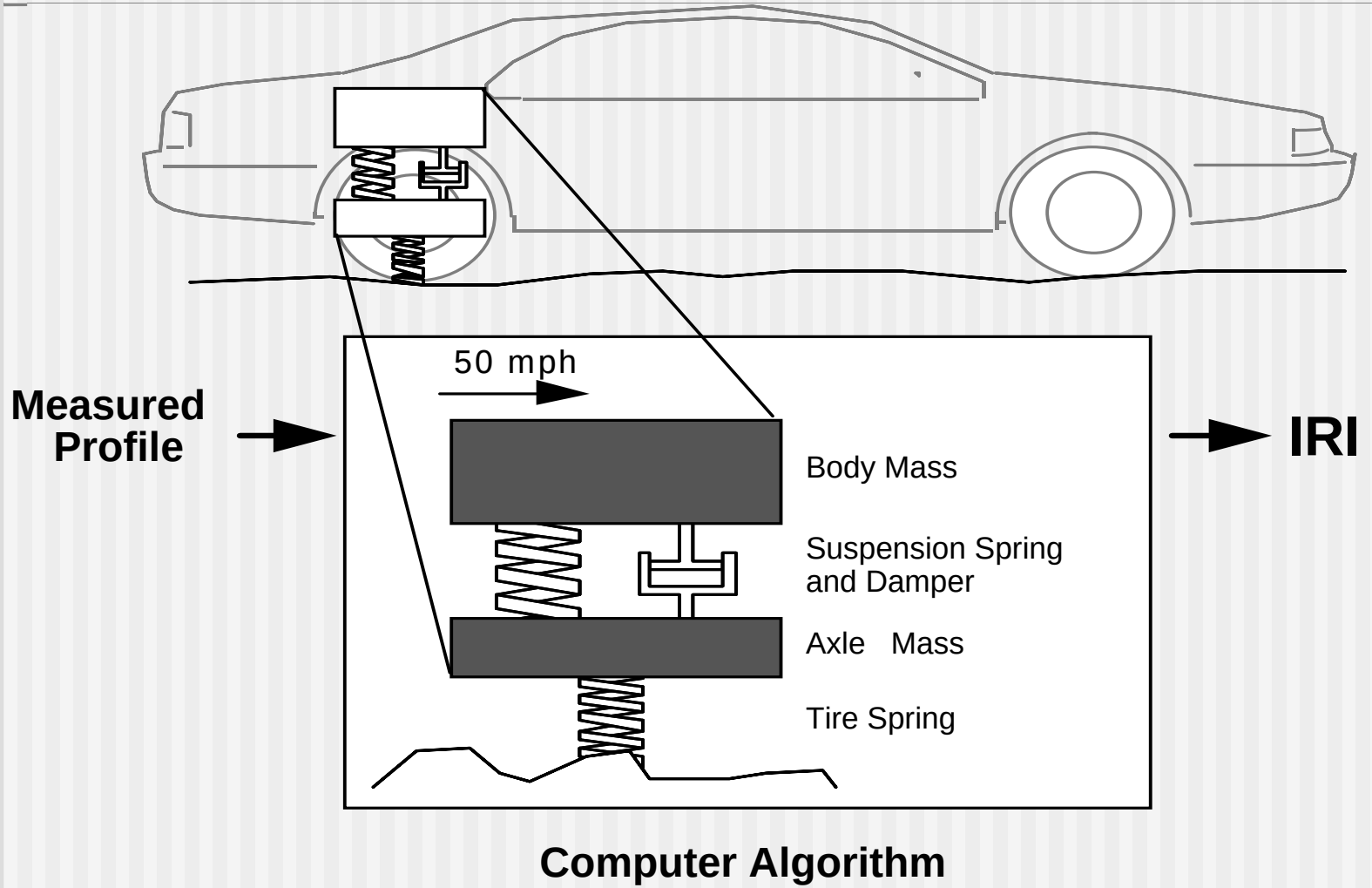
- ↓ User Satisfaction
- ↑ Vehicle Wear/Damage
- ↑ Cargo Damage
- ↑ Freight Costs
- ↓ Safety
  - ↓ handling/grip

Agency Costs

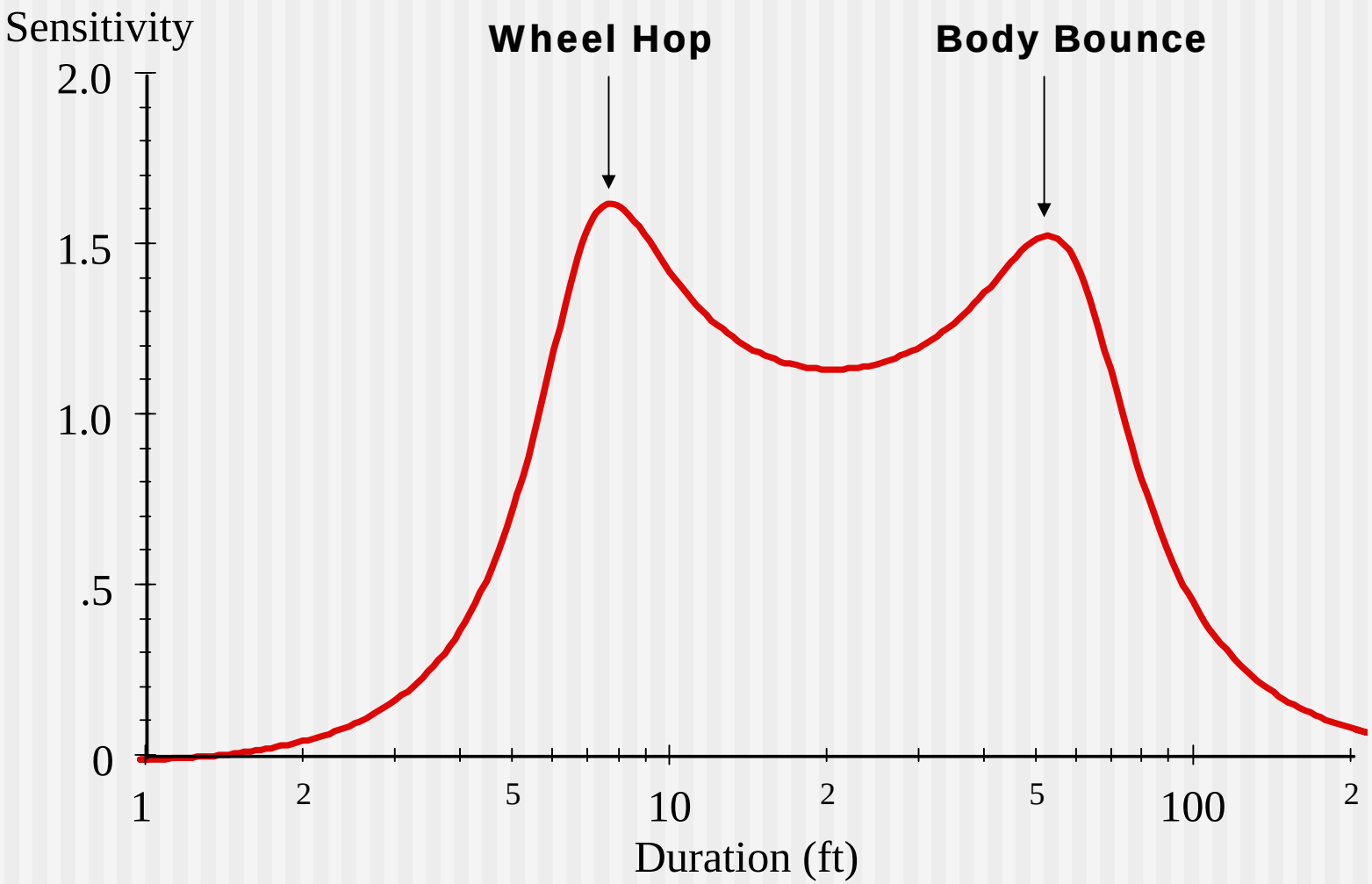
- ↓ Pavement Life
- ↓ Bridge Life
- ↑ Maintenance Costs

  Snow/Ice Removal
  - ↓ efficiency
  - ↑ costs

International Roughness Index (IRI)
Using surface road profiles to simulate vehicle response (What the public “feels”)



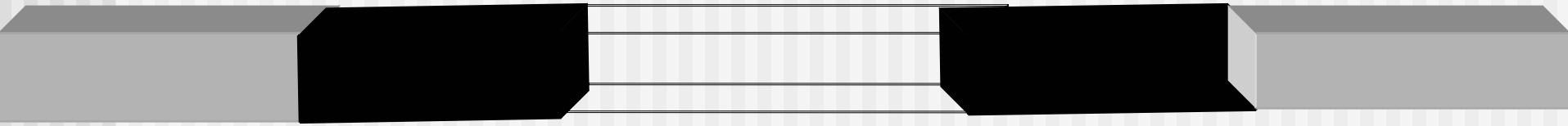
IRI Sensitivity



Desired State after Construction

CONTINUITY

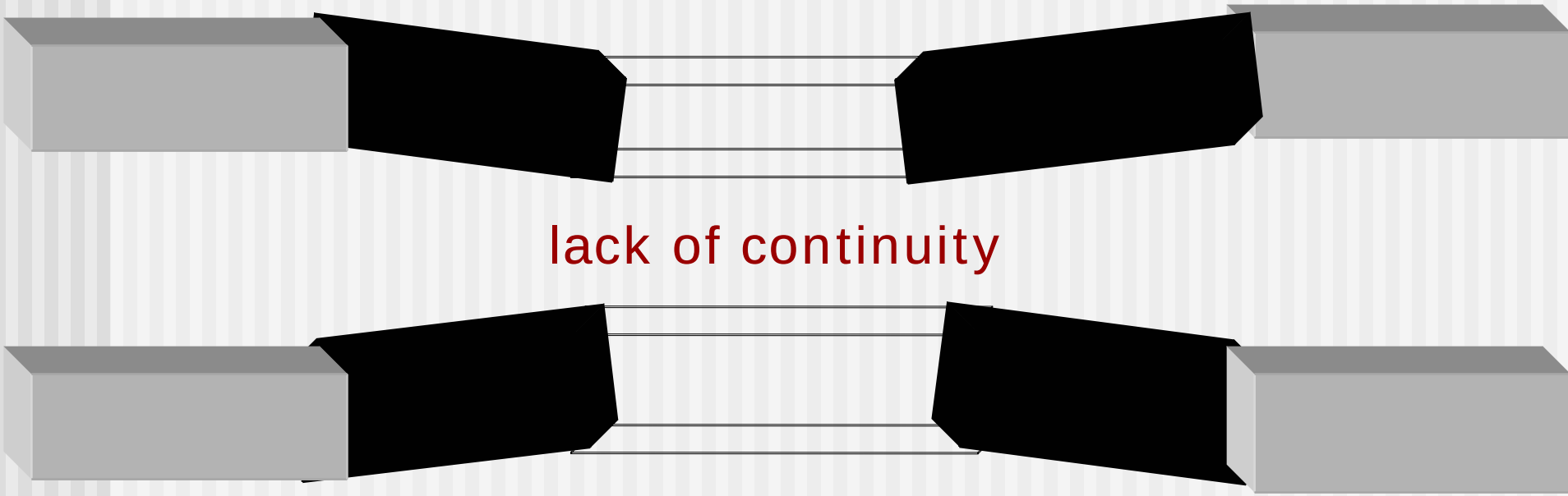
Lack of Height Deviations through bridge encounter



Pavement Approach Slab Bridge Deck Approach Slab Pavement

Causes of Poor Ride Across Bridges

Decks are higher/lower than pavement



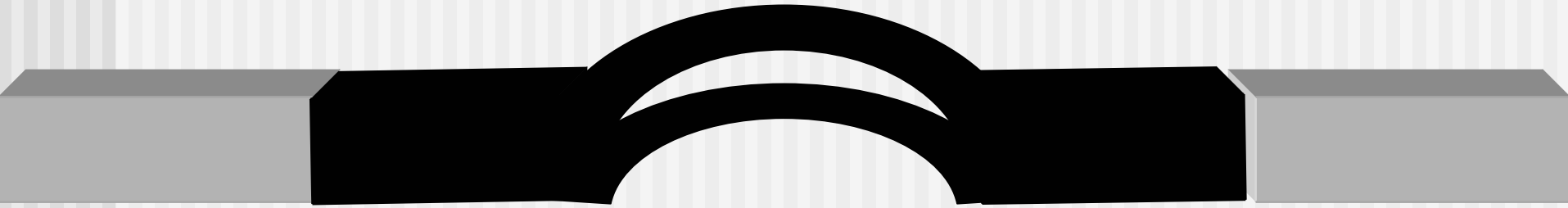
lack of continuity

Pavement Approach Slab Bridge Deck Approach Slab Pavement

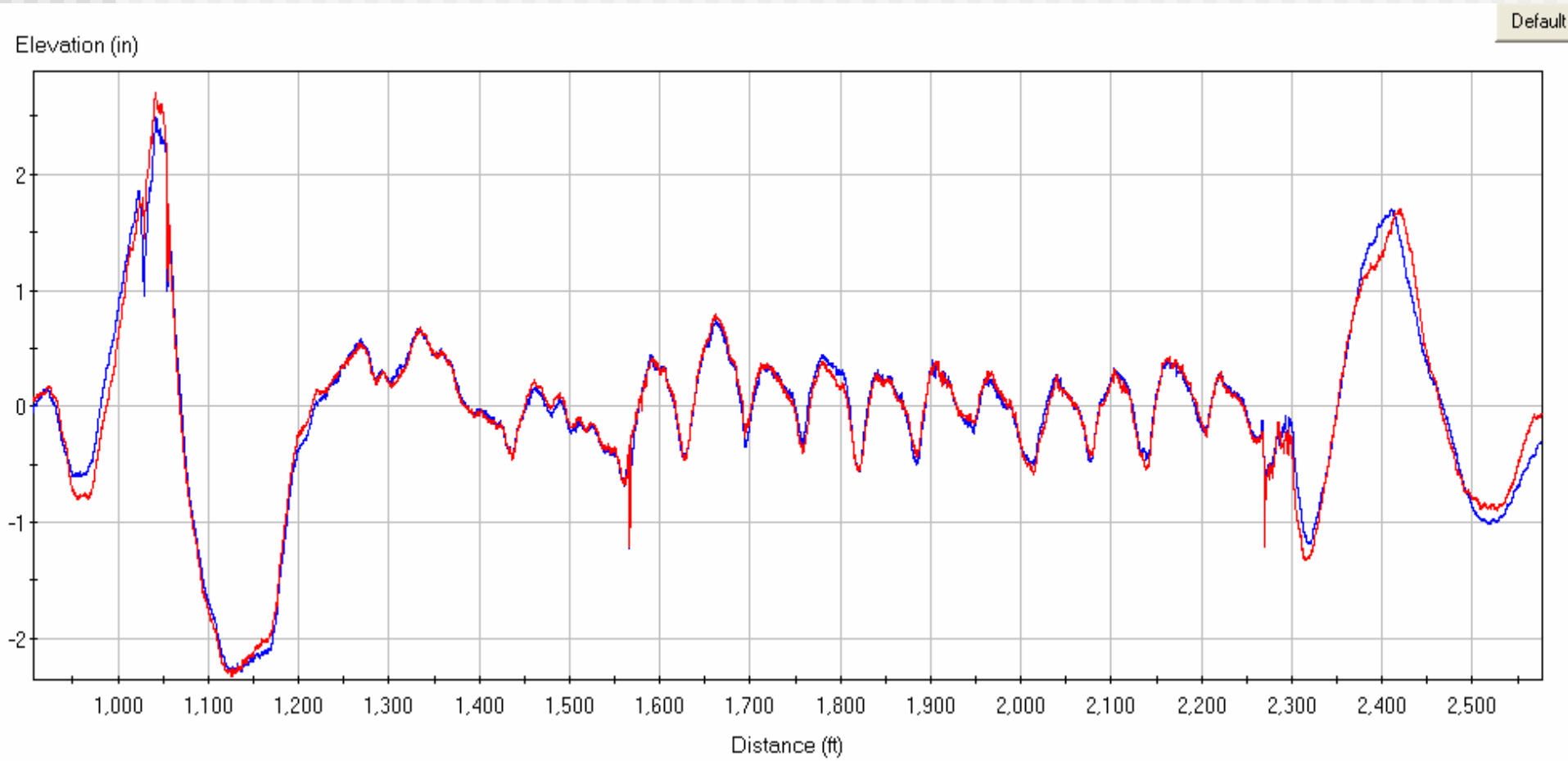
Causes of Poor Ride Across Bridges

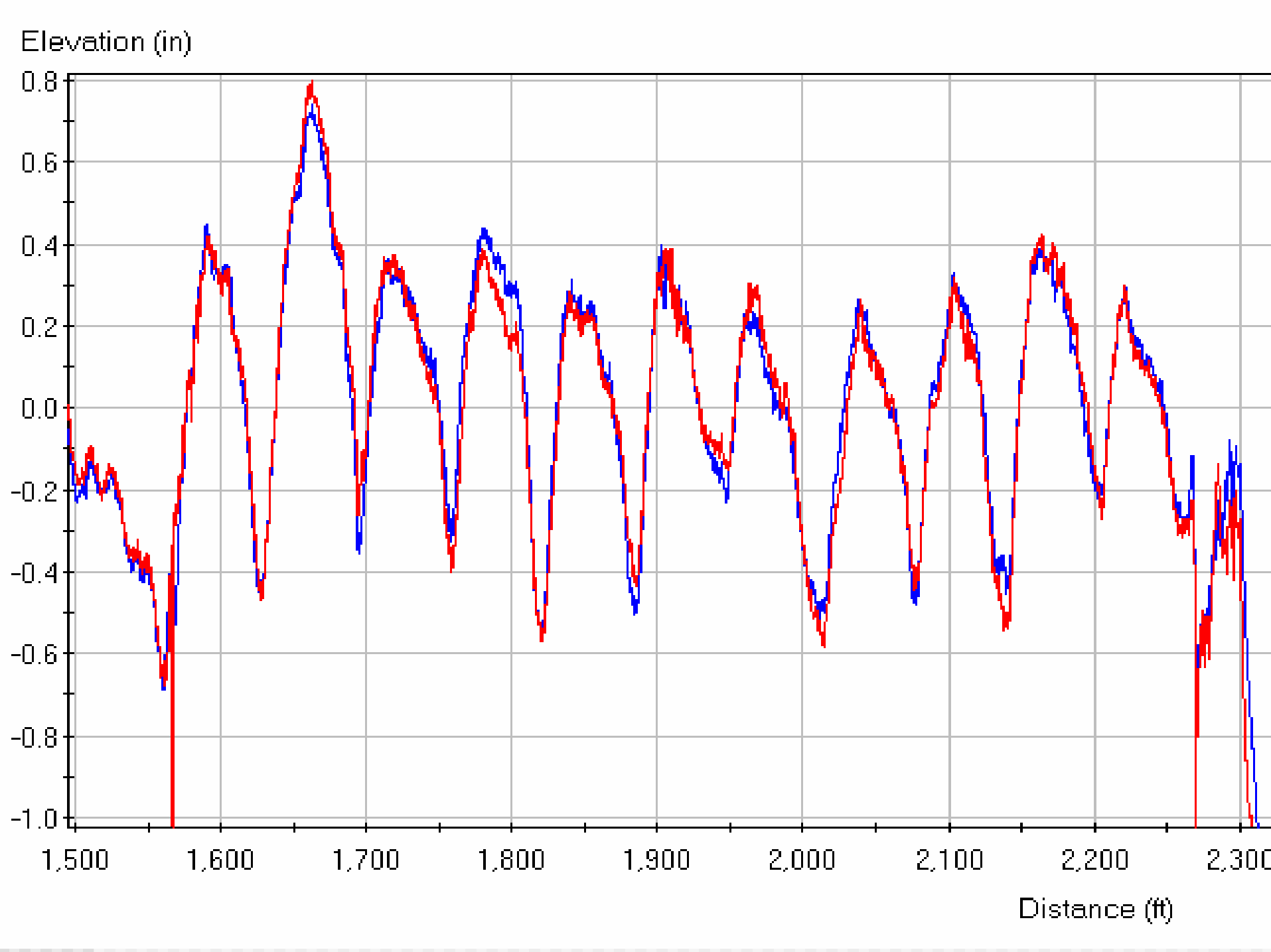
Camber in structure/spans

lack of continuity



Pavement Approach Slab Bridge Deck Approach Slab Pavement


Default
Elevation (in)
2
1
0
-1
-2
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
2,100
2,200
2,300
2,400
2,500
Distance (ft)


Elevation (in)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
1,500
1,600
1,700
1,800
1,900
2,000
2,100
2,200
2,300
Distance (ft)

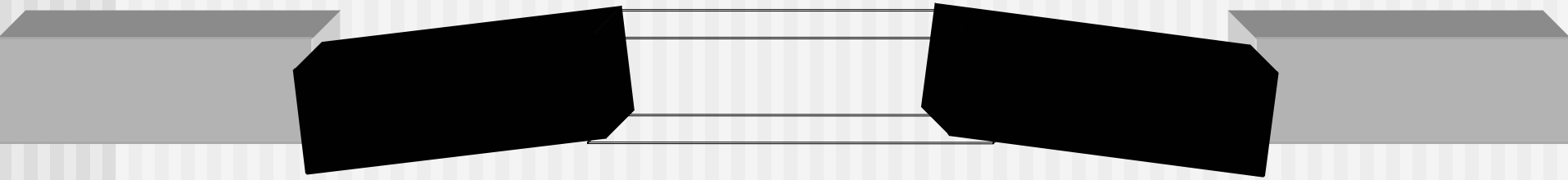
Vehicle Simulation

Causes of Poor Ride Across Bridges

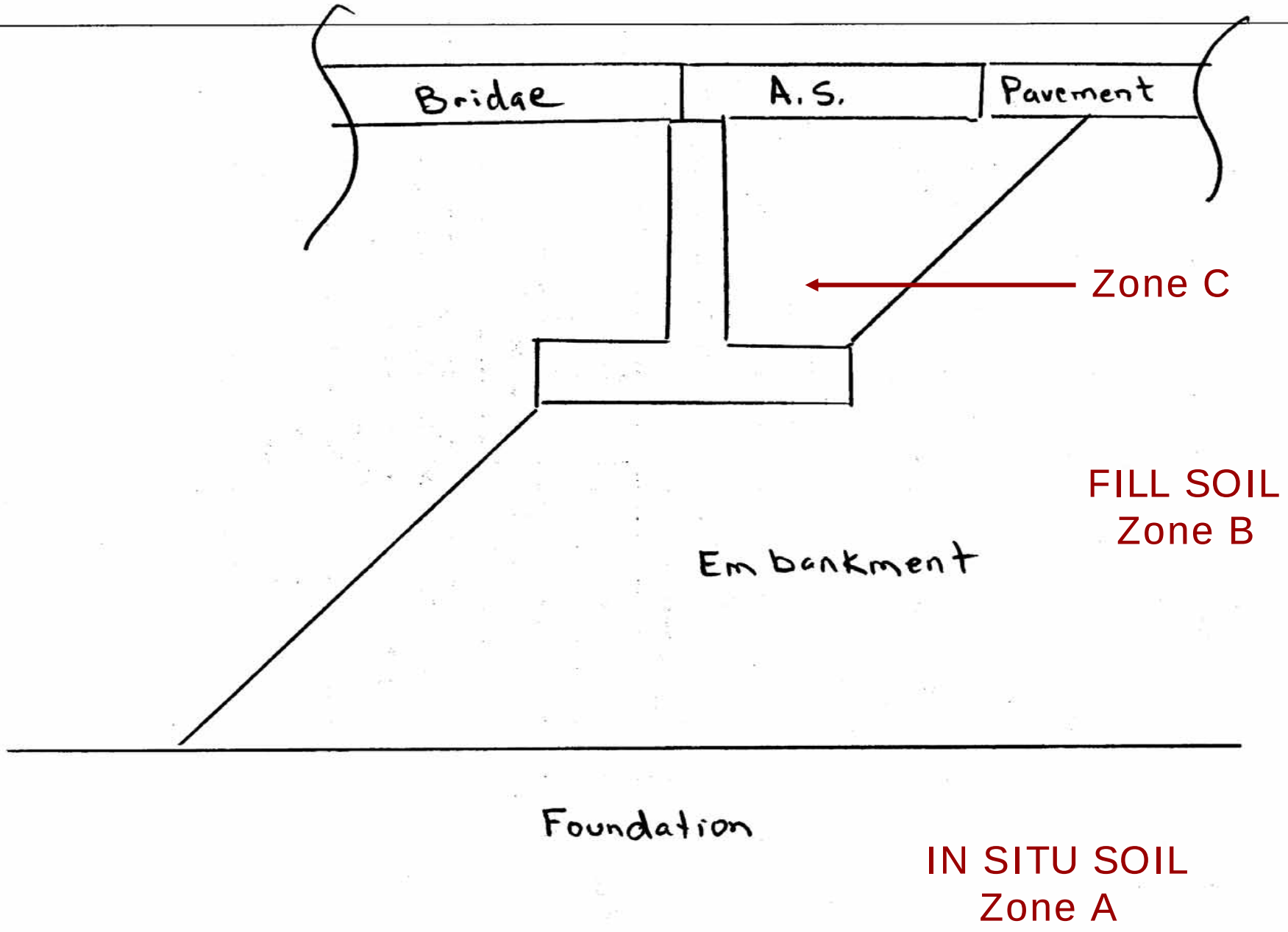
Approach slab settlement

Deep fill settlement

lack of continuity



Pavement Approach Slab Bridge Deck Approach Slab Pavement


Bridge
A.S.
Pavement
Zone C
FILL SOIL
Zone B
Embankment
Foundation
IN SITU SOIL
Zone A

Causes of Poor Ride Across Bridges

- Roughness in Deck Surface
  - Construction Joints
  - Closure pours
  - Deformation of Girders/Beams when deck is constructed

Leading Causes of Poor Ride Across Bridges

Surface Discontinuities

- **Decks higher / lower than surrounding pavement**
- **Settlement**
  - Approach Slabs
  - Deep Fills
- **Residual Camber in surface over spans**
- **Deck roughness**
  - Construction joints & closure pours
  - Girder / Beam deformation

Potential Solutions

- Diamond grinding
- Mud jacking and/or AC wedges
- Overlays
- Maximum allowable skew angles
- Lowered approach slabs
- Trapezoidal shaped approach slabs
- Etc.
- ?

Research Proposal: PS-08-03

Identification and Evaluation of Pavement-Bridge Interface Ride Quality Improvement and Corrective Strategies

Research Proposal: PS-08-03

Pre-Construction / Construction

Specifications

- Materials
- Testing

Research Proposal: PS-08-03

Pre-Construction / Construction

Design

- Interfaces
- Drainage
- Constructability
- Assumptions

Research Proposal: PS-08-03

Pre-Construction / Construction

Means and Methods

- Best Practices

Research Proposal: PS-08-03

Post Construction

Performance Index

Corrective strategies

- AC wedges
- Overlays
- Diamond grinding
- Maintenance of Drainage
- Mud Jacking

Research Proposal: PS-08-03

Post Construction

Field Test Cases

Evaluation Based on:

- Effectiveness (IRI)
- Cost
- Time
- Complexity / Expertise

Research Proposal: PS-08-03

Time Frame: 18 Months

Cost: $100,000 - $150,000

Current Situation/Specs

Smoothness specifications

1. 10’ Rolling Straightedge – bridge decks
2. CA Profilograph / IRI- pavement
3. No specification at transitions

Exp Spec for New Projects or Major Rehabs (pave & bridge)

Can we build them smooth to begin with?

- Pilot Bridge Ride Specification
  - ODOT Structures
  - ODOT Construction
  - ODOT Pavement Engineering
  - Industry
- (25’ pavement, approach slab, deck, approach slab, 25’ pavement) = ??? IRI

Exp Spec for New Projects or Major Rehabs (pave & bridge)

- Each lane of encounter must have an IRI below 150 in/mile *(proper threshold?)*

  (25’ pavement, approach slab, deck, approach slab, 25’ pavement) IRI <= 150”/mi

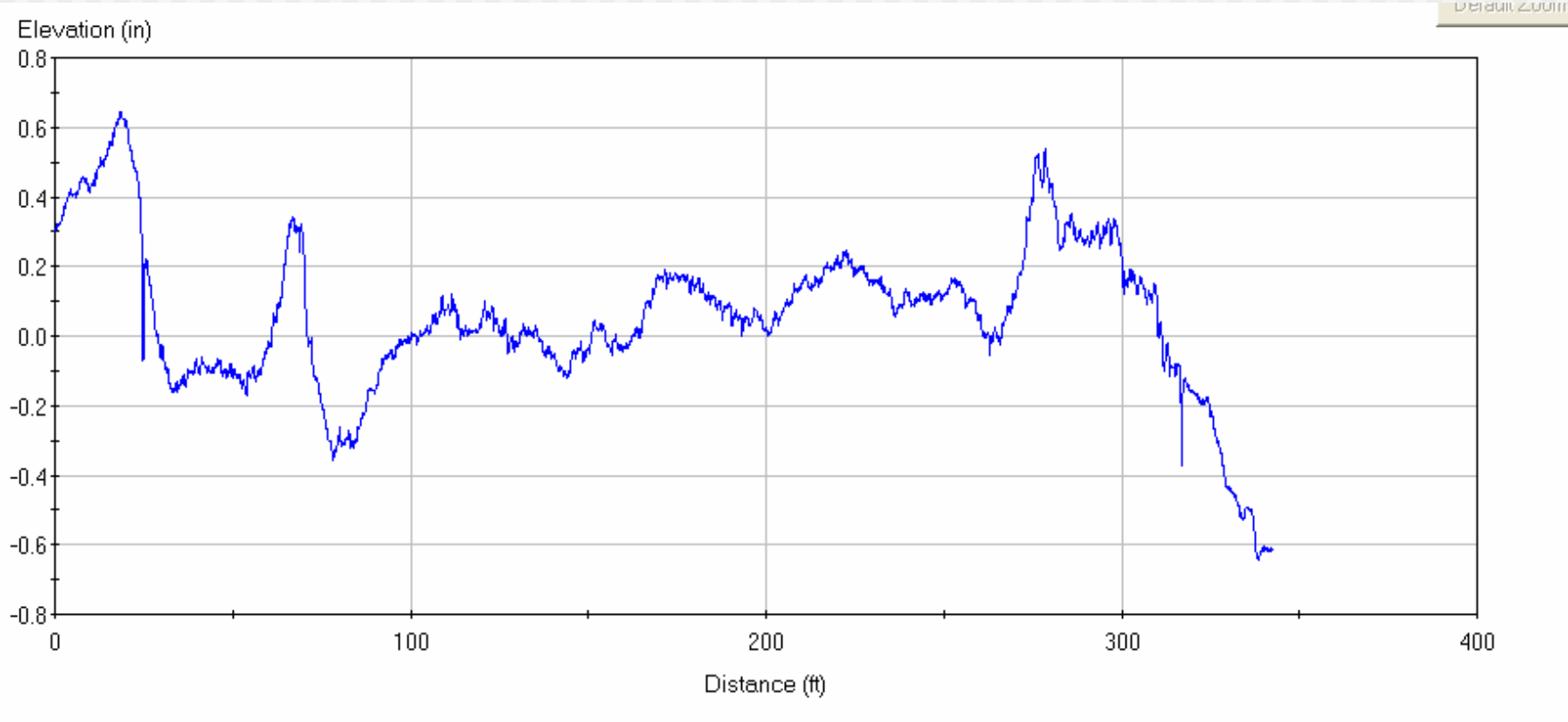
- Achievable – communication
  - IRI from recent bridge projects
  - pre construction meetings
- Incentive – max of 20% with IRI <= 80”/mi

  paid on price concrete in deck

  (appropriate incentive?)

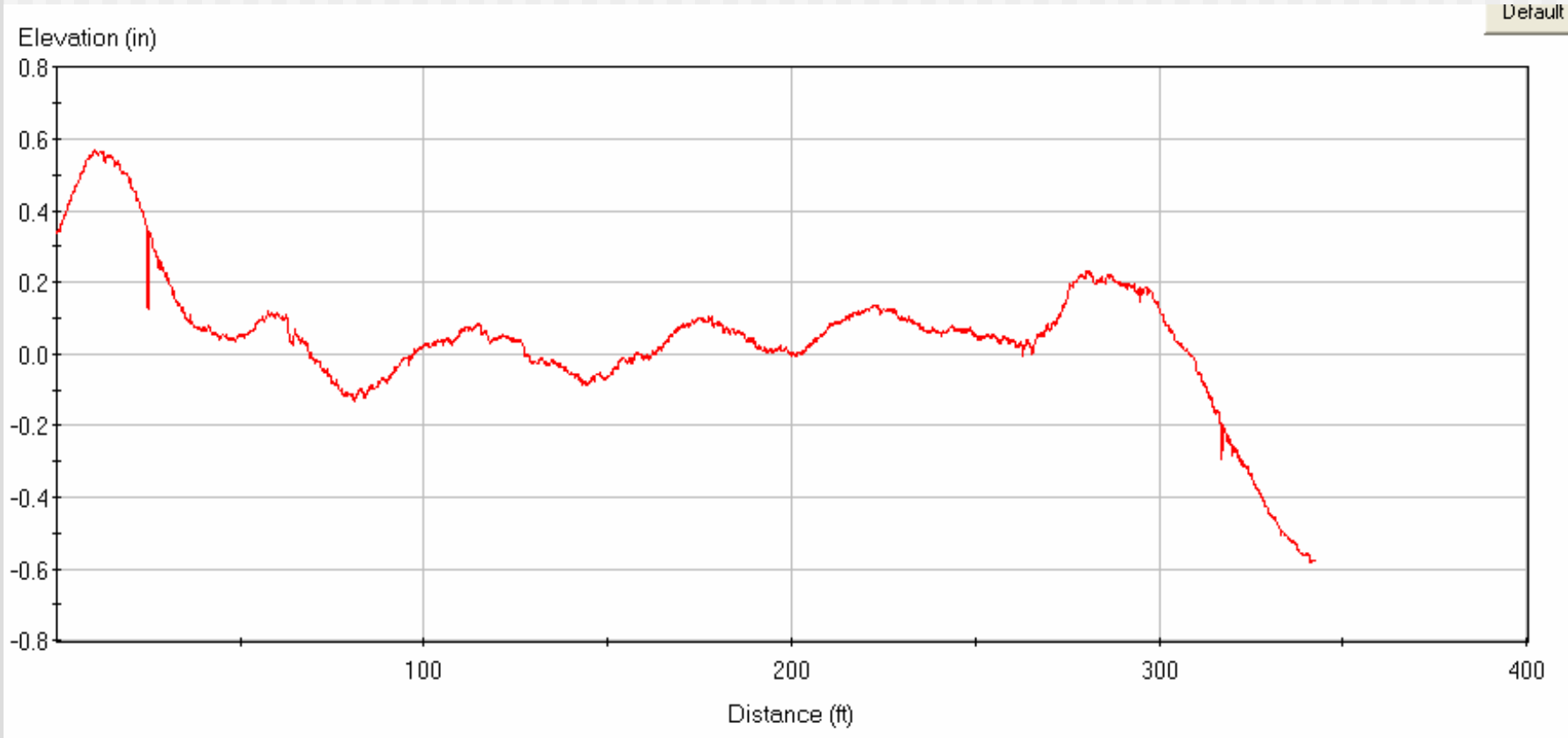
1st Bridge Built using Pilot Specification

Bridge Encounter 130 in/mile IRI avg



1st Bridge Built using Pilot Spec after grinding

Bridge Encounter 53 in/mile IRI avg



FHWA ProVAL Software free

Diamond Grinding Simulation Demo

Other Considerations

- Evaluate initial pilot projects
  - Baselength/continuous reporting methodology?
- Additional specs
  1. Just replacing decks/approach slabs
  2. Just resurfacing but not touching bridges
- Can IRI specs improve bridge rideability?
  - If so, do we gain anything else?

Questions ???????

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THANK YOU


COLD BIRD
TRANSPORT
SPEED LIMIT 7 MPH
SLOW PLEASE
DANGER LAUNCH AREA
PREPARE TO FLY !!!!!