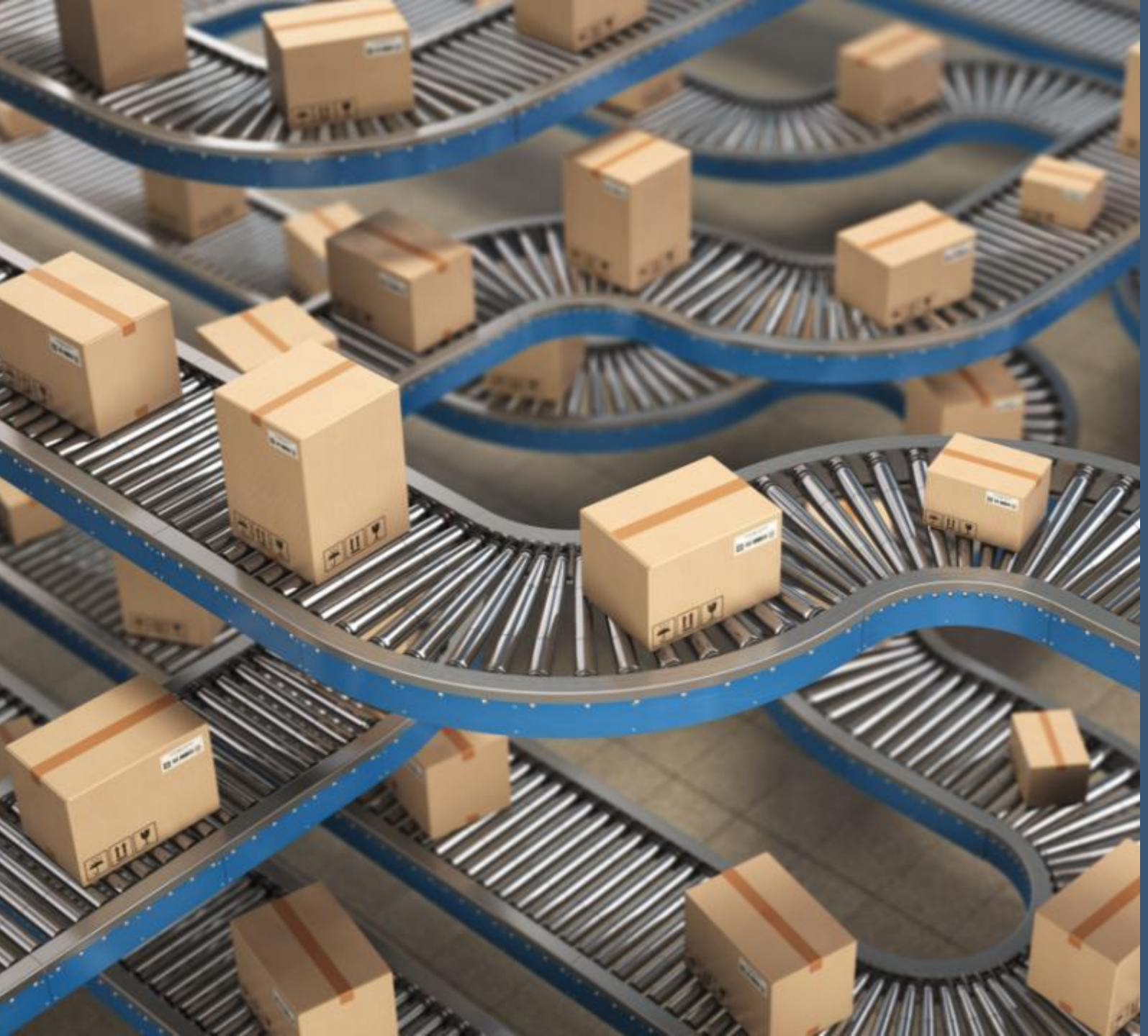

B-WIM Statistical Analysis Unveiling Extreme Live Load Effects on Indonesian Bridges

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DOB: 13 April 1991

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INTRODUCTION

- Indonesia is developing country
- Bridge as vital infrastructure for transportation
- Overloading trucks problem → damaging infrastructure
- Lack of vehicle weigh measurements data due to static weighing station limitations → overload & damage recurring

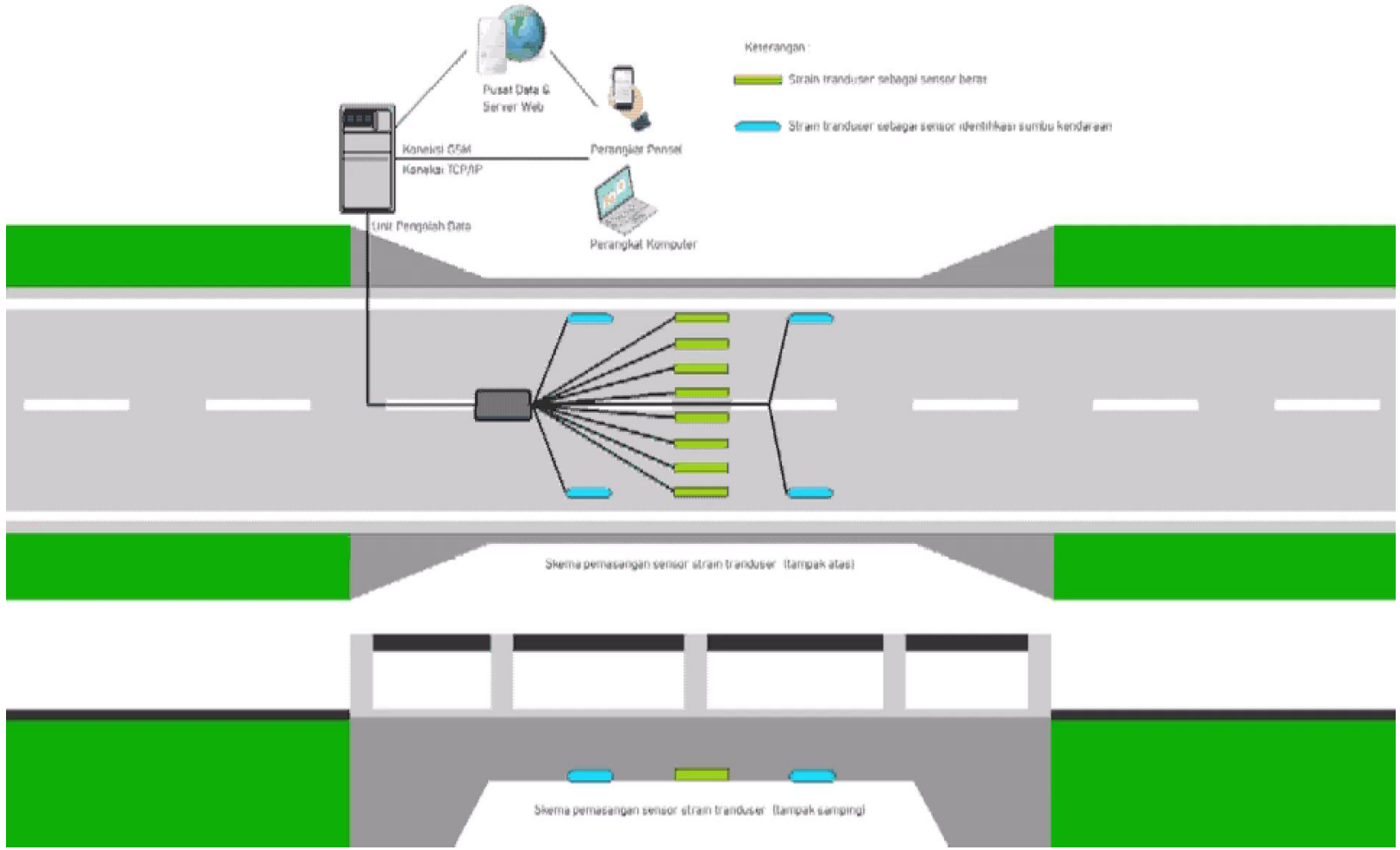
Bridge collapse due to overloading trucks (Deng et al., 2016)

INTRODUCTION

- Implementation of WIM systems → B-WIM in 2017, enable actual vehicle weigh measurements→ Bridge evaluation due to actual loading
- Extreme loading analysis was done in this study to evaluate the safety of PCI Girder Standard Bridge in Indonesia

B-WIM instrumentation on the Pawiro Baru Bridge

INTRODUCTION



- B-WIM system uses existing bridges or culverts as weighing scales to measure the weight of vehicles as they pass over the bridge.
- The system uses sensors and algorithms to estimate the weight of vehicles based on their effect on the bridge structure.
- B-WIM eliminates the need for traditional static means of weighing vehicles and provides continuous, non-intrusive traffic load data.

MATERIAL & METHODS

Data Collection

- B-WIM from Site ID-001 Pawiro Baru Bridge in Central Java
- 1 month worth of data: October 1 to October 31, 2018
- Data description:
  - vehicle weight,
  - Vehicle speed,
  - axle spacing,
  - Axle distance

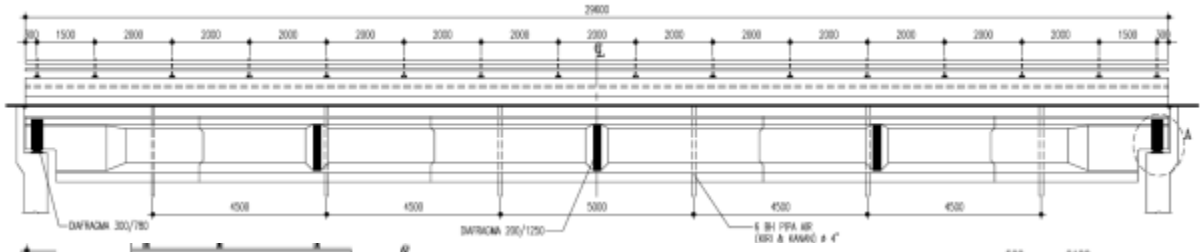
Event overview

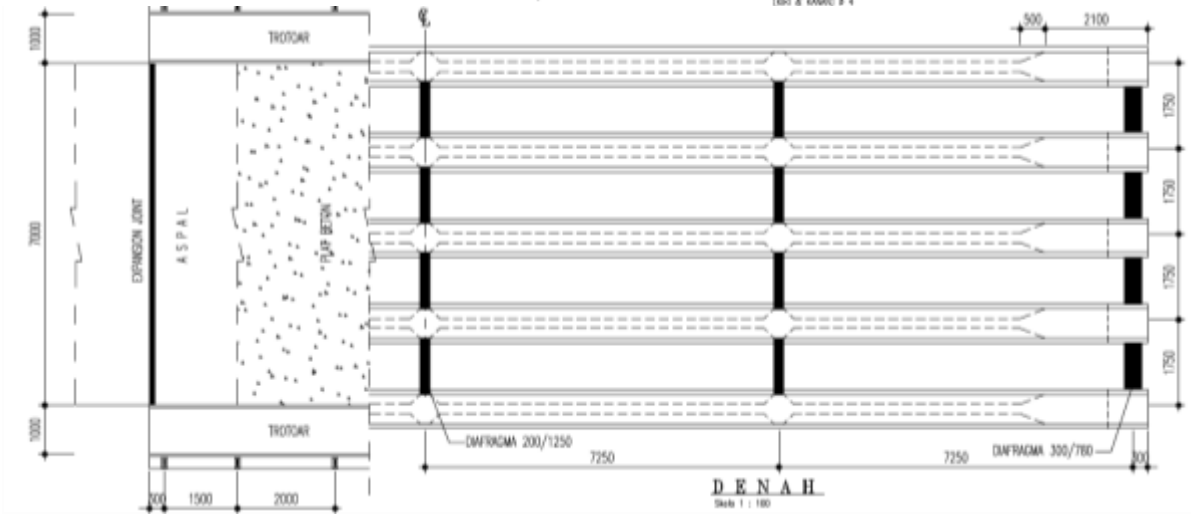
Vehicle:

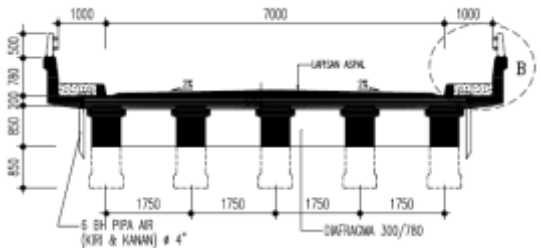
Mass: 59.72 t
Distribution: 4.29 t – 10.55 t – 10.55 t – 11.44 t – 11.44 t – 11.44 t
Axle distance: 3.39 m – 1.36 m – 6.84 m – 1.36 m – 1.34 m

Time: 26. 6. 2020 6:09:22
Classification: 120
Lane: 1
Direction: Semarang
Speed: 32.91 km/h

MATERIAL & METHODS



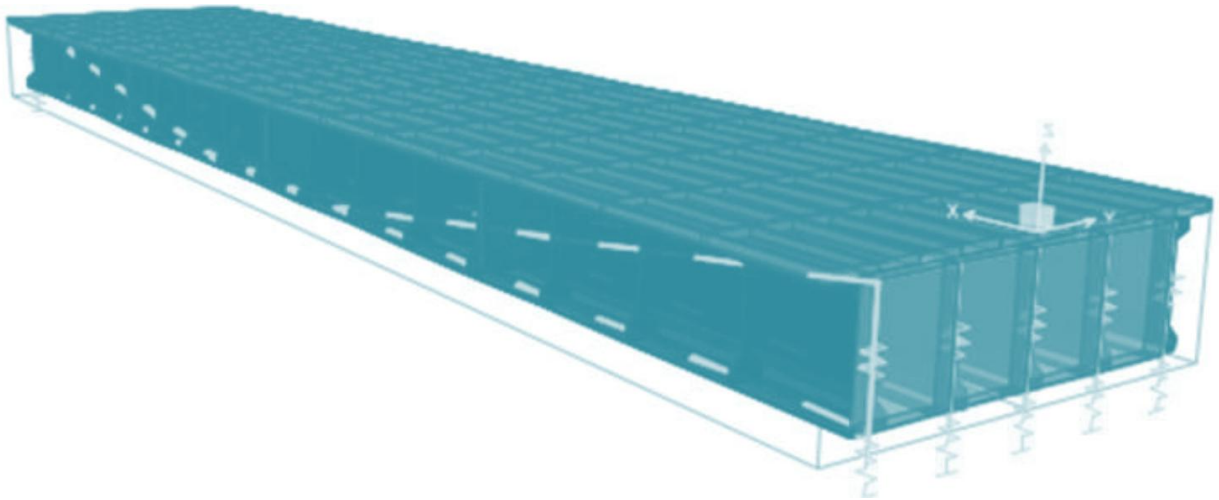




Study Bridge: 4 Bina Marga PCI Girder Standard Bridge

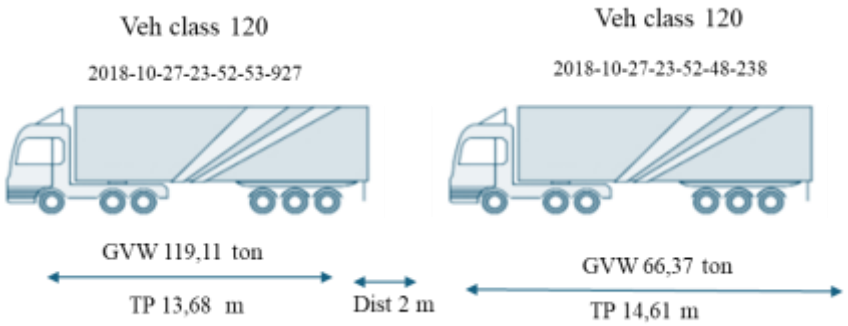
No	L (m)	B (m)	N	S (mm)	Girder H x b (mm)		t (mm)
1	25	9	5	1750	1600	650	270
2	30	9	5	1750	1700	700	200
3	35	9	5	1750	2100	700	200
4	40	9	5	1750	2300	700	200

MATERIAL & METHODS



FEM Model of 30-meter Bina Marga PCI Girder Standard Bridge

Traffic Loading Simulation

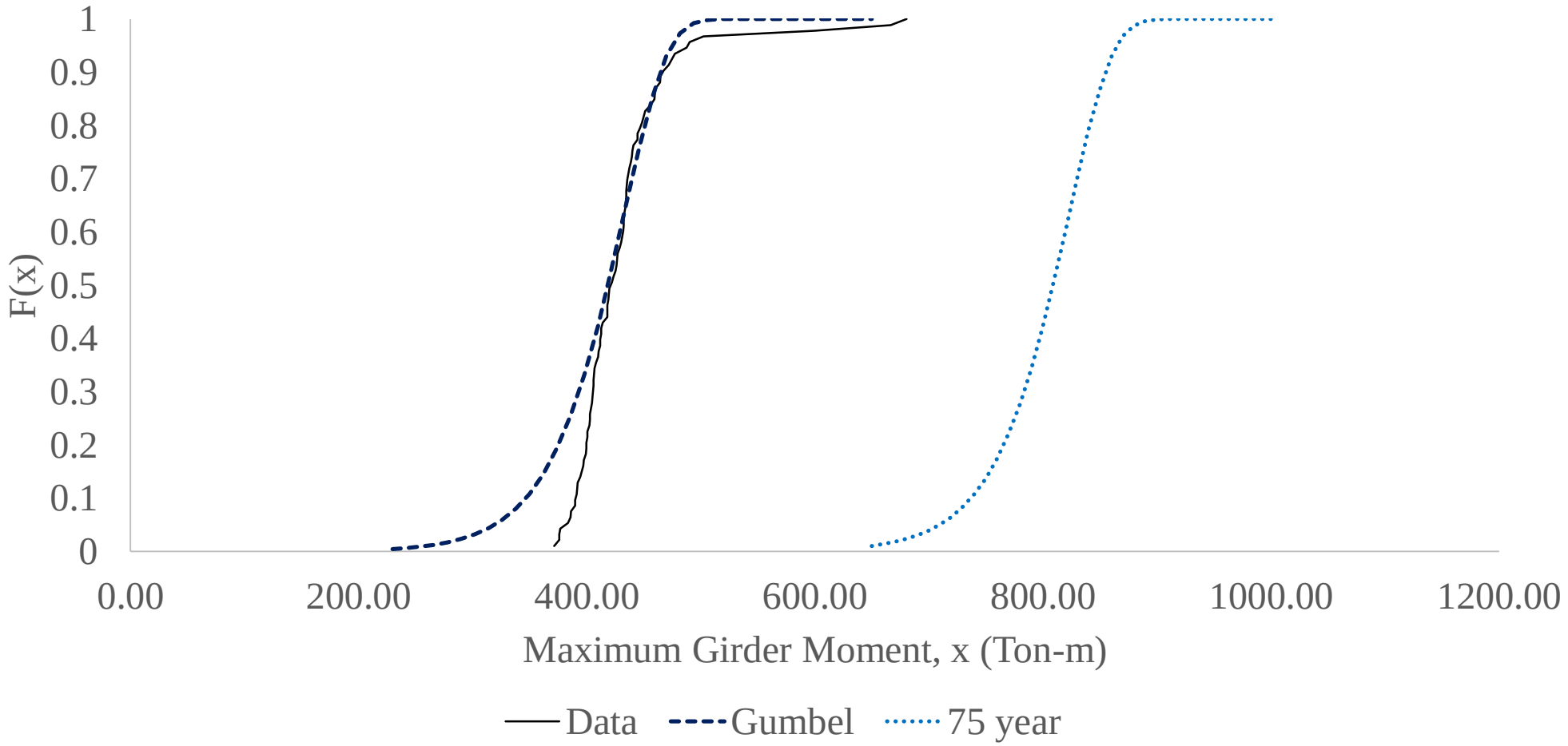


Heaviest 30-m length vehicle sequence of 27 October 2018 B-WIM Measurements

Statistic Analysis of Extreme using Gumbel

RESULTS

Daily maximum girder bending moments from FEM analysis due to B-WIM loading → Projection using Gumbel Theory



RESULTS

Comparison of PCI girder bending moments from 75-year maximum and SNI 1725 2016

Bridge Span	Mmax 75th (ton-m)	Mmax SNI 1725 2016 (ton-m)	Ratio
25	498.34	424.54	117%
30	845.07	593.12	142%
35	1083.76	789.59	137%
40	1094.50	1013.95	108%

CONCLUSION

- Comparison with SNI Standards:
  - B-WIM measurements actual loading data and FEM modeling reveal significant differences between current SNI 1725:2016 design standards and actual extreme loads.
  - The 75-year maximum bending moments often exceed SNI design limits, especially for shorter spans.
- Needs for Revising Standards:
  - Revise SNI 1725:2016 to better account for extreme loading conditions.
  - Ensure structural integrity and longevity based on accurate data.
- Bridge Management Implications:
  - Use B-WIM and FEM methods for bridge assessments.
  - Improve load predictions and enhance safety.
- Future Research:
  - Analyze other bridge types and refine statistical methods.
  - Explore materials and design techniques for heavy vehicle demands.

Thank You For Your Attention

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