Overview:

This document is used to summarize the verification study I conducted for converting 3D bridge FEMs or experiments to 1D beam element representations. The first mode’s natural frequency was used as a comparative criteria between the 3D bridge and 1D transformed beam element.

Verification:

1. Rob’s verification.

Timeline

Description automatically generated with medium confidence

* First Natural Frequency:

|  |  |
| --- | --- |
| His FEM | **Transformed Section** |
| 6.0 Hz | **5.98 Hz** |

1. Fatigue analysis and life prediction of composite high-way bridge decks under traffic loading (2013):

* Bridge properties:

Span length = 40.0 m; Ec = 30.5 GPa; Es = 205 GPa

Diagram, engineering drawing

Description automatically generated

* First Natural Frequency:

|  |  |
| --- | --- |
| Their FEM | **Transformed Section** |
| 2.90 Hz | **2.92 Hz** |

1. Using drive-by health monitoring to detect bridge damage considering environmental and operational effects

* Bridge properties:

Span length= 16.0m; Ec = 26.4 GPa; Es = 210 GPa

Diagram

Description automatically generated

* First Natural Frequency:

|  |  |
| --- | --- |
| Their FEM | **Transformed Section** |
| 6.53 Hz | **6.52 Hz** |

b