Previous studies have examined the impact that the road surface has on impact factors. Many analytical studies have shown that a rough road surface may result in higher dynamic amplification. However, the studies do not agree how much road surface effects dynamic amplification, which is likely due to variety of bridge and vehicle model types employed.

Chatterjee et al used a single line girder model of a continuous bridge, and showed that for certain combinations of speed and frequency ratio between the vehicle and structure, the dynamic amplification (DAF) could exceed 4.

However, field measurements have yielded much lower DAF’s. Cooper instrumented two bridges in England and recorded a maximum DAF of 1.42. Cooper also created a probabilistic model of DAF based on road roughness and span length that suggests a maximum mean DAF of 1.27.

Furthermore, research has shown that by

Rough road surface results in higher DAF than smooth pavement, dependent on speed and vehicle to bridge frequency ratio. Simulation done with simplified model (single line), conclusions not related to actual useable parameters. Profile generated by PSD function [[1]](#endnote-1)

Surface roughness increases DAF for a cable stay bridge, especially at certain speeds. Surface generated from PSD function (ISO). [[2]](#endnote-2)

Suggested DAF for given road surface roughness (but way too low). [[3]](#endnote-3)

Simulation of vehicle-bridge with rough road surface. Simple model, unsprung mass for vehicle, force model to simulate road roughness. High amplification. [[4]](#endnote-4)

Removal of bumps at joints reduces dynamic reaction force (at bearings) (simulated profile). [[5]](#endnote-5)

Simulation of road surface and braking. ISO-8608 used to generate profile. Good intro on DAF. [[6]](#endnote-6)

Bridge surface roughness has little effect on deflections(made up profile). Continuous multi-girder bridge. 3-d model. [[7]](#endnote-7)

Railway bridges: track irregularities great effect on train response, but little on DAF. [[8]](#endnote-8)

Early look at all things bridge vibration. Used sine waves for roughness. Concluded it can have a large effect. [[9]](#endnote-9)

FE model, simulated roughness plus long term deflection. Roughness has a large influence on DAF (~1.8). [[10]](#endnote-10)

Measured profiles of 25 bridges, load tests to measure DAF. Correlated DAF to IRI and Roughness coefficient: decent correlation, but only saw DAF 25% and less. [[11]](#endnote-11)

Testing and simulation to look at dynamic response. Used plank in tests to represent bad road condition, resulting in very high impact factors (as high as 3). Simulated other road surfaces. Impact factor almost 3 for poor road. Vehicle-bridge frequency ratio also has a large effect. [[12]](#endnote-12)

# Appraisal of specified DAF

Full 3d model with comparison with field testing data. Road roughness included (constructed with ISO PSD methods). Based on this investigation, it is concluded that the current design codes tend to underestimate dynamic amplification factors of the long-span continuous bridges (1.55 recommended). [[13]](#endnote-13)

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