The Use of GNSS to Monitor the Deflections of a Motorway Viaduct

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Field Tests:
• Two day feasibility trial
• Concrete Motorway viaduct, 173.7m long
• GPS, dual freq 10 and 20 Hz
Antenna Locations

Reference Station    Granary Station

Bridge Coordinates

\[
\begin{bmatrix}
\text{Lat.} \\
\text{Long.} \\
\text{Vert.}
\end{bmatrix} =
\begin{bmatrix}
\cos \theta & -\sin \theta & 0 \\
\sin \theta & \cos \theta & 0 \\
0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
E \\
N \\
H
\end{bmatrix}
\]

\[\theta = \text{Azimuth of Viaduct} = 35^\circ08'54''\]
Granary

Bridge Mid Point

Vertical FFT
Conclusions:

• GPS is a viable measurement tool in the viaduct environment
• Adequate number of satellites required for positioning were visible
• Both sites were affected to a limited degree by multipath
• Three main frequencies were clearly detected by the GPS in the vertical component
• Mean movements of ±10mm in the lateral, longitudinal and vertical direction were evident, which could be due to diurnal effects
• Peak deflections in the vertical can lie anywhere up to the order of 50mm

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