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10. Vibrations caused by traffic at the church at Port Arthur.

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Two transducers, sensitive to particle velocity, were used to measure vibrations in the church. Measurements were made of the vibrations induced by passing buses, cars, and a truck with a tare of approximately 3 t.

PARTICLE VELOCITIES RECORDED

Roadside values of 0.3-0.6 mm/s were produced by buses and trucks. Adjacent to the road vertical and transverse-horizontal movements were of similar amplitude, however the attenuation of the horizontal movements was less rapid than for the vertical. Horizontal movements are by far the most important mode of vibration in the building itself:

e.g. West window, centre of sill; vertical:transverse = 5:12.
Transverse, ground:transverse, sill = 5:4.
North window; vertical ground:vertical sill = 4:3.

In all cases, movement parallel to the wall was negligible.

The mode of vibration of the building itself is very complex, *e.g.* geophones placed on the east window sill at the south end of the building registered the greatest vibration when vehicles passed the centre of the west side and very little when they passed close by.

The most sensitive part of the building on which recordings were taken was on the sill on the west wall. A 3-tonne truck travelling at approximately 40 km/h produced transverse vibrations with particle velocities of up to 0.6 mm/s, and vertical vibrations with particle velocities of 0.25 mm/s. A car produced transverse vibrations with particle velocities of 0.25 mm/s. Effectively the west wall flexes at right angles to itself, with the largest measured movement at the centre of the sill. It is quite likely that higher vibration amplitudes are induced in the inaccessible parts of the building above the window.

No vibrations caused by wind were measurable.

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It was thought possible that the lawn-mowing tractor could be a source of vibration in these buildings. Vibrations from this source were measured approximately 1.5 m from the wheels, on grass. Maximum values were about 0.25 mm/s at 18-25 Hz. These are not high enough to cause concern.

DISCUSSION

Vibrations in a building set up small stresses which even if very small can affect it if they occur frequently. Small vibrations may cause material fatigue, but it is more probable that they will speed up other processes such as foundation settlement and thermal cracking.

Research has shown (Grover, 1970) that in old, poorly constructed buildings, the processes of deterioration are increased if they are subject to vibrations which produce a particle velocity of more than 0.5 mm/s over a long period.

Particle velocities of a little over 0.5 mm/s were recorded for part of the west wall of the church due to the passage of buses and trucks. Other accessible parts of the building do not vibrate at this level, although it

is possible that there are inaccessible and less well supported parts of the building (*e.g.* in the tower) which do respond to the vibrations.

CONCLUSION

Traffic-induced vibrations in the church are generally of low amplitude. However, in sensitive parts of the building such as the west wall, they could be speeding up other processes of deterioration.

REFERENCE

GROVER, F.H. 1970. Vibrations in structures. *Rep.A.W.R.E.* O 32/70.

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