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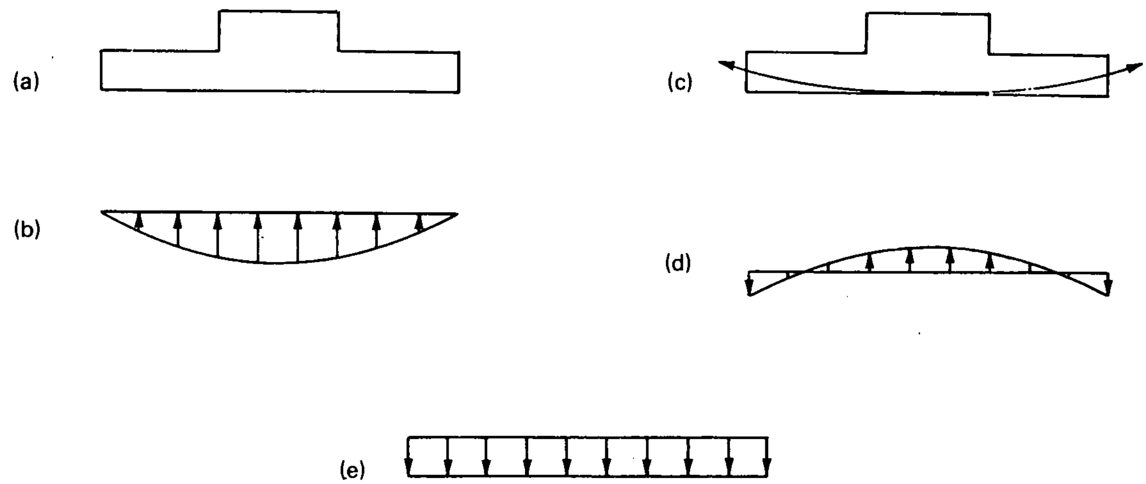
Post-Stressed Concrete Foundation May Reduce Machinery Vibration



The problem:

To reduce excessive vibrations in machinery mounted on a concrete mat supported by a soil subgrade. The vibration characteristics of a concrete mat and subgrade system are difficult to determine. Therefore, the natural frequency of a mat–subgrade system may inadvertently coincide with the vibration frequency of the mounted machinery, resulting in excessive reinforced vibration.

The solution:

A concrete mat which may be stressed in compression after the machinery is mounted, thus closing any cracks in the mat, altering the distribution of the soil subgrade reaction on the mat, and changing the mat–subgrade natural frequency. The post-stressing is accomplished by tightening cables passing through parabolic passages provided during construction in the concrete mat.

How it's done:

This vibration reducing technique depends upon the assumption that closing the cracks and altering the soil subgrade pressure distribution on the bottom surface of a concrete mat will change the mat–subgrade system natural frequency.

If a machine is mounted on a rigid mat with a centered block, as in figure (a), the bearing pressure of a noncohesive subgrade such as sand on the bottom of the mat is as shown in (b). Thus, the bearing pressure is greatest at the center of the mat, reducing to zero at the edges. When cables are passed through preformed parabolic passages in the mat and tightened, as in (c), the cables introduce a horizontal compression and an

(continued overleaf)

upward load distributed as in (d). In effect, the cables tend to lift the center of the mat and force down the edges. As a result, the pressure distribution of the sand substrate on the mat tends toward a uniform distribution as shown in (e). It is not important, however, exactly what pressure distribution between the subgrade and mat results after cable tightening. The essential feature is that the rigidity of the mat and the distribution do change, thus altering the mat–subgrade natural frequency.

For cohesive subgrades, such as clay, the initial pressure distribution on the mat is the opposite of that for noncohesive subgrades, resulting in a minimum pressure at the mat center and a maximum at the edges. The cables therefore pass through a parabolic passage which is concave downward.

This technique promises simple implementation in the field. When the subgrade is identified as either cohesive or noncohesive, a mat with the appropriate cable passage concavity is easily constructed. The machine is then mounted and energized. If no excessive vibration is experienced, no further adjustment is necessary. If vibration is excessive, cables are mounted in the passages, fastened at one end, and tightened at the other end by a hydraulic jack reacting against the edge of the mat. Cable tension can be varied until vibration is minimized, whereupon the cables are securely fastened to the mat edge and the jack removed.

Several cables may be mounted parallel to each other, and passages may be provided to allow tightening from front to back, and from side to side.

Notes:

1. The assumption that altering the rigidity of the mat and the subgrade pressure distribution will change the mat–subgrade system natural frequency has not yet been validated by testing.
2. This technique should provide a simple and effective correction procedure for equipment vibration until more accurate methods are devised for determining soil vibration characteristics.
3. Additional details are contained in: (1) Proceedings of World Conference of Prestressed Concrete, Univ. of Calif. July 29–Aug. 2, 1957, pp. 10-1, 10-6; and (2) Patent #3,015,912 available from U.S. Patent Office at $0.50 each.
4. Inquiries concerning this innovation may be Directed to:

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   Argonne National Laboratory
   9700 South Cass Avenue
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Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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