Asset Care Counts July 2015

Innovative Testing Services – Determining Stiffness of Vibration Isolation Materials

ALS Industrial has substantial experience in the design of testing regimes to gather the right information our clients need to make informed decisions about how to manage their sites.

A recent example comes from a project to determine the suitability of an isolation material for a client's application.

Prior to approaching ALS, the client approached many other organisations all of whom were unwilling to assist with carrying out this project.

ALS accepted the challenge and through a joint undertaking between ALS Industrial's Materials (Metallurgy) and Engineering divisions we were able to successfully complete the project.

Isolation Materials – Achieving Effective Isolation.

Isolation materials are used in many industries to reduce the vibration energy transmitted between equipment and structures. The suitability of an isolation material depends on:

- its material properties; and
- the frequencies of the vibration encountered.

If the correct isolation material is not selected it can amplify rather than reduce the energy transmitted with potentially catastrophic consequences.

To achieve effective isolation, the vibration frequency experienced must be > 1.414 times the natural frequency of the equipment mounted on the isolation material.

Our Approach to the Assessment

Testing was conducted in 2 phases, these being:

- Completing Static stiffness measurements at room and elevated temperature.
- Completing dynamic stiffness measurements under varying static loads.

Three isolation materials were compared in this assessment. The elevated temperature testing was undertaken to assess the behaviour of the samples under site conditions.

Tests were conducted in accordance with ASTM D695 with results normalised to deflection per unit pressure.

Testing of the isolation material quantified the variance in stiffness between the materials, the effect of elevated temperature on the materials and the extent to which the stiffness of each material varied with static load.

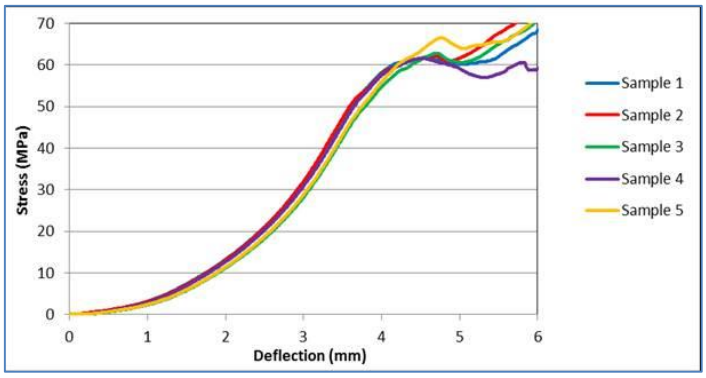

Figure 1 – Stress/Deflection Curves for Material 1

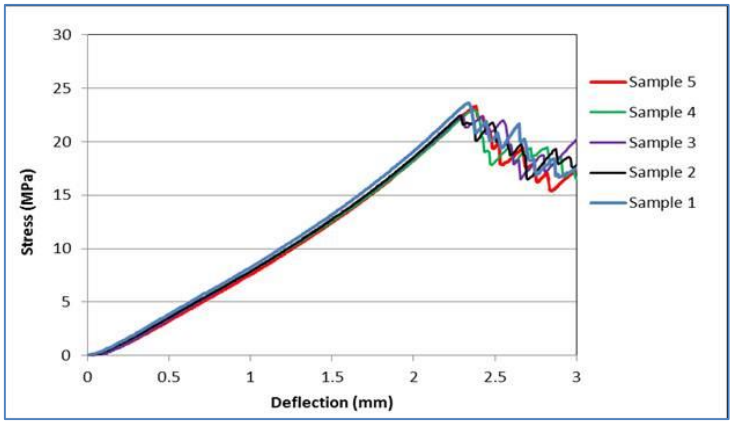

Figure 2 – Stress/Deflection Curves for Material 2

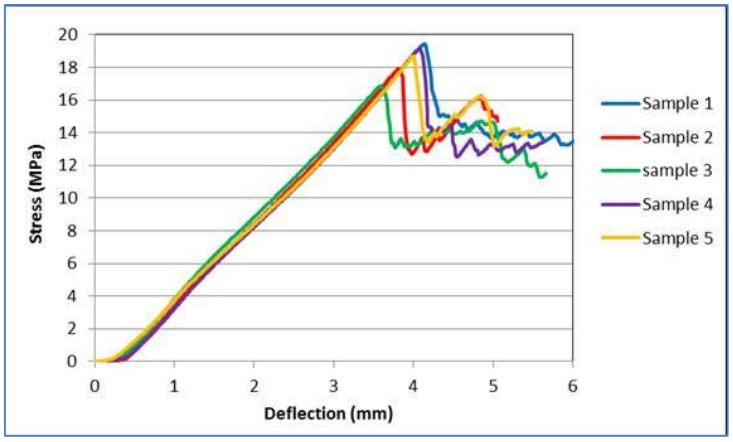

Figure 3 – Stress/Deflection Curves for Material 3

For the dynamic stiffness measurements, ALS Industrial designed and fabricated a test rig to allow testing in accordance with ISO10846-2 "Acoustics and vibration – Laboratory measurement of vibro-acoustic transfer properties of resilient elements – Part 2: Direct method for determination of resilient supports for translator motion".

The test rig was capable of applying varying static loads to the isolation material while also applying an oscillating load. Measurement of the oscillating force, the subsequent displacement and their relative phases allowed for the determination of the dynamic stiffness using the following vector calculation.

$$k_{2,1} = \frac{\underline{F_2}}{\underline{u_1}} = -(2\pi f)^2 \frac{\underline{F_2}}{\underline{a_1}}$$

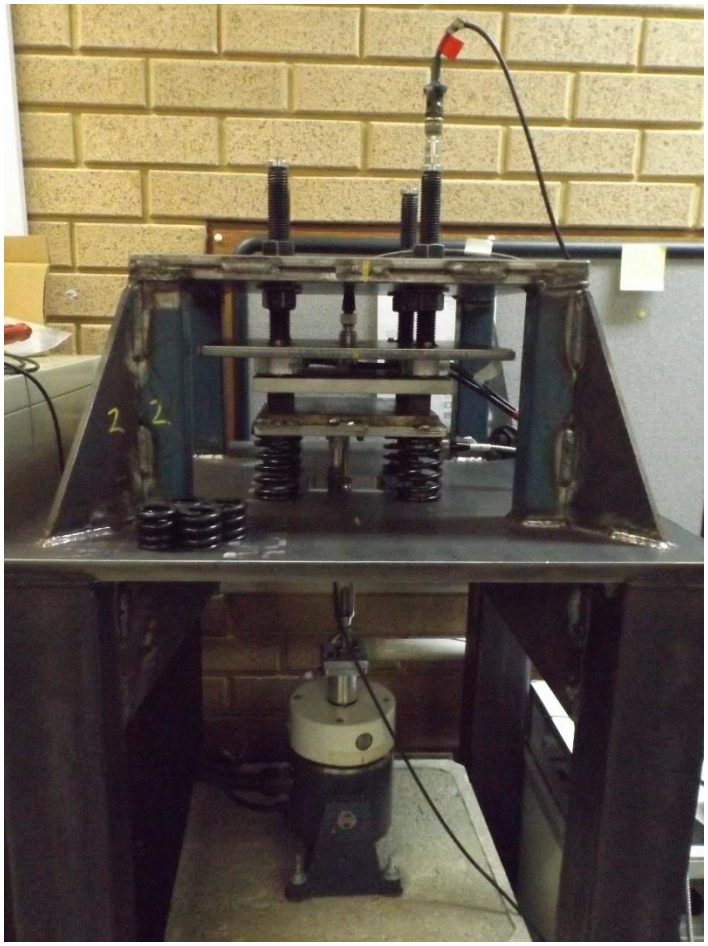

Figure 4 – Test Rig for the Measurement of Dynamic Stiffness

The Outcome

The result of this combined regime of testing was that ALS was able to determine that the third material type tested would best isolate the vibration energy at the specified frequencies.

Under some static load conditions however none of the tested materials would provide effective isolation of vibration energy between equipment and structures.

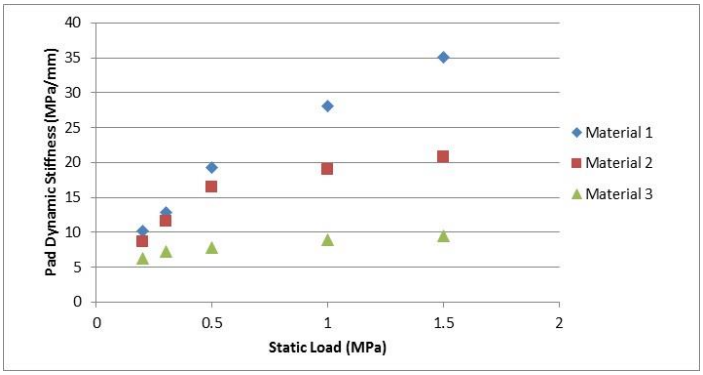

Figure 5 – Stiffness/Static Load Results for Each Material

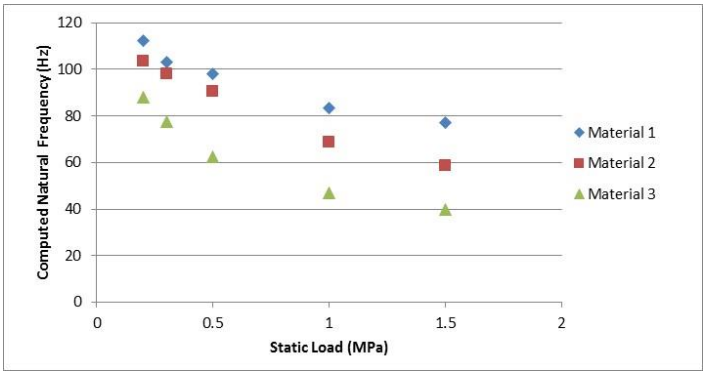

Figure 6 – Computed Natural Frequency/Static Load Results for Each Material

ALS Materials and Engineering Teams

ALS has dedicated Materials and Engineering teams capable of designing and completing tests that will deliver their clients requirements timely and professionally.

For further information or to enquire about services please contact:

AssetCareContactUs@ALSGlobal.com

POWER SERVICES
U1, 2 Alhambra Avenue
Cardiff NSW 2285
T: +61 2 4953 7999

BRISBANE
7 Brisbane Rd
Riverview QLD 4303
T: +61 7 3816 5500

MELBOURNE
450 Dynon Rd
West Melbourne VIC 3003
T: +61 3 8398 5900

PERTH
109 Bannister Road
Canning Vale WA 6155
T: +61 8 9232 0300

SYDNEY
U1a & 2, 171-175 Newton Road
Wetherill Park NSW 2164
T: +61 2 8786 3100

ADELAIDE
Unit 6/1 Burma Road
Pooraka SA 5095
T: +61 8 8260 1160