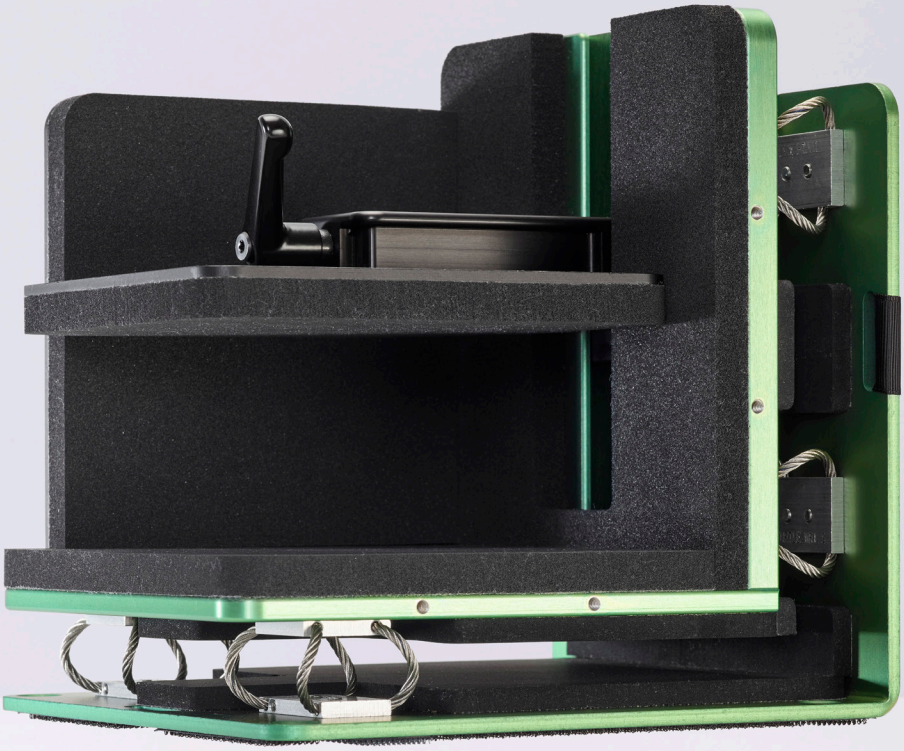
Wire Rope Isolators and the impact on valuable art during transportation

Numerous studies concern the impact of shock and vibration, and consequently the damage that can be caused during the transportation of valuable artworks. Despite innovations in art packaging solutions, art pieces still show damage and deterioration when packed in crates and foam. Experts, including the Georgia O'Keeffe Innovation (GOKI) group, noticed that cracks emerged on the surface of canvases without any exposure to drops or shocks during transportation. From this evidence, it can be concluded that the damage must have occurred due to another phenomenon, namely vibrations. The effects are hardly detectable in the first instance, however reducing exposure to vibrations is of significant relevance. (Cerkanowicz et al., 2017)



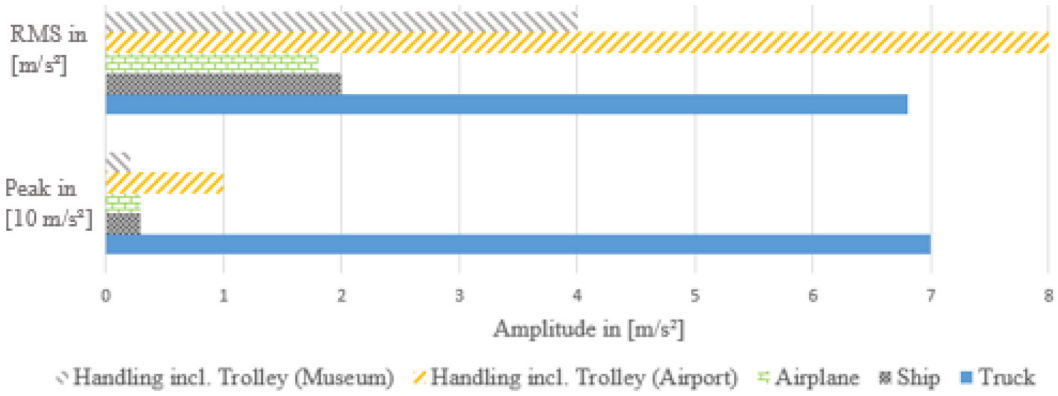
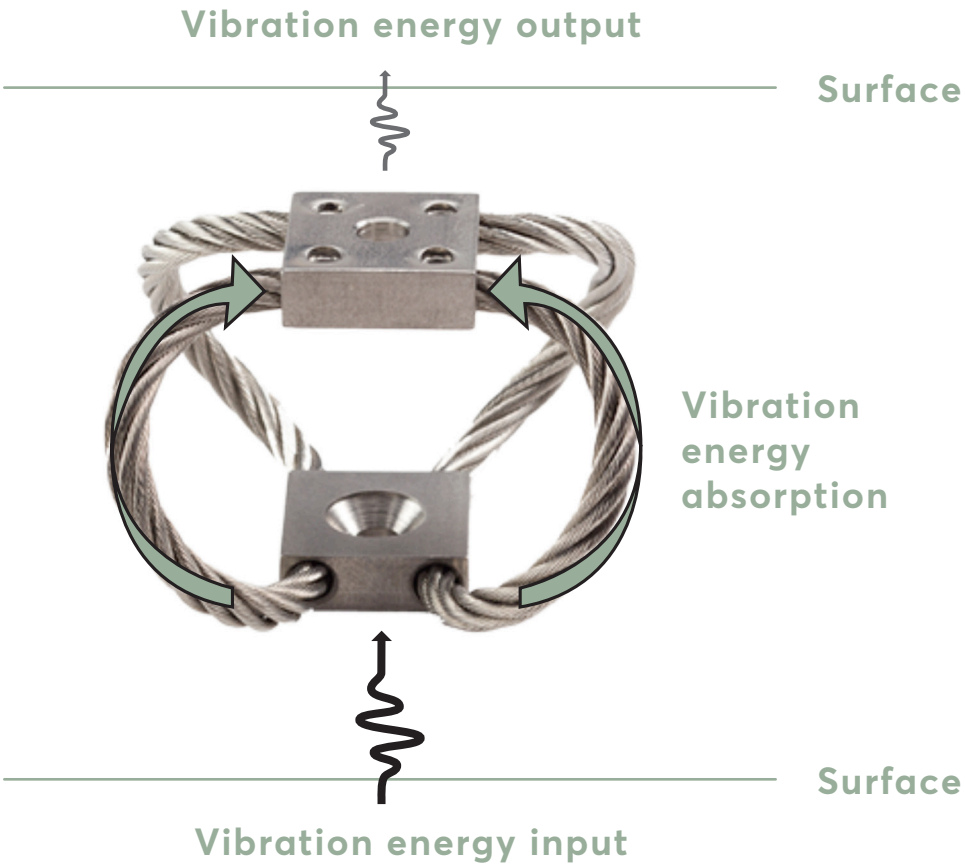


Figure 1: Emission levels and frequency ranges of different vehicles (Läuchli et al., 2014).

Figure 1 showcases the average of measurements results according to transportation processes data collected by Palmbach (2013), Kracht (2011), Braun (2013), and Läuchli and Bäschlin (2014). From these results, it has become evident that the main generator of continuous vibrations during transportation is truck transport. The vibrations transmit easily through packing materials where the vibration amplitude directly translates into the extent the surface of the canvas will bend. Thus, a higher amplitude relates to an increased chance of cracks forming (Lasyk, 2008).



During the design process of current packaging solutions, the main focus of consideration has been on shocks, neglecting the impact of vibration, specifically continuous vibration (Kracht and Kletschkowski, 2017). It has become evident that continuous vibrations are enhanced rather than eliminated through the use of foam materials, despite their ability to successfully dampen severe shocks (Läuchli et al., 2014). Thus, development of an art packaging solution with the aim of eliminating damage caused during transportation should consider reducing both continuous vibration and shock emission.

Passive vibration isolation refers to the use of passive techniques (non-electrical) for the isolation of vibration, such as rubber pads or mechanical springs (Balaji et al., 2015). Wire Rope Isolator (WRI), a type of non-linear passive isolator, is used in circumstances when both vibration and shock protection are required (Hussain and Balaji, 2018; Chaudhuri and Bharat, 2008). According to Balaji et al., (2015), the WRI provides better isolation than the conventional passive isolators. The damping characteristics of the WRI are resultant to friction damping (Coulomb damping) between the individual wire strands of which the larger wires are composed. This frictional contact results in the diminution of vibrational energy (Hussain and Balaji, 2018), and thus the impact on valuable art pieces during transportation. Complementary to vibration and shock protection, WRI are insensitive to aging and thermal influences. According to vibration control expert van der Vliert (2021), the performance of WRIs is stable and constant regardless of the intensity of use. Thus, when applied properly, the use of WRIs to complement developments in packaging solutions for safe art transportation is highly recommended

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