CDM HELIPORTS

Vibration isolation systems for heliports

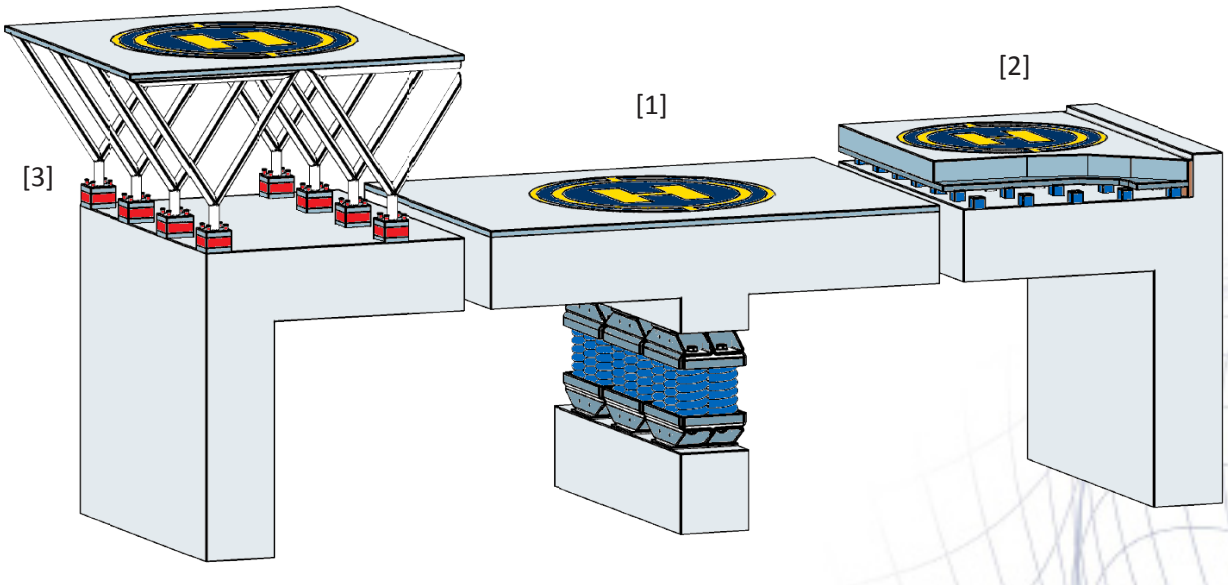
ROOF TOP HELIPORTS, A CONCERN FOR NOISE AND VIBRATION?

During take-off and landing helicopters generate a lot of noise and pressure waves which, if the heliport is located on the rooftop of a building, travel through the supporting structure thereby creating a noise nuisance in the areas below.

CDM have developed a wide range of isolation systems with resonance frequencies of 2 - 8 Hz to decouple the heliport from the supporting structure whilst also protecting the structural stability of the heliport. [1]

- For heliports which are installed directly on the surface of the roof (see fig [1]);
- For heliports supported on a floating concrete slab (see fig [2]);
- For heliports which are metal structures directly supported by the roof of the building (see fig [3]);

Solution	CDM systems	Resonance frequency
BUILDING BASE ISOLATION TECHNOLOGY **[1]**	CDM-CHR, CDM-SEB, CDM-VHS...	>2Hz
FLOATING SLABS **[2]**	CDM-FLOAT, CDM-MONT...	>4Hz
METALLIC SUPER-STRUCTURES **[3]**	CDM-FIX, CDM-SAFEFIX	>6Hz



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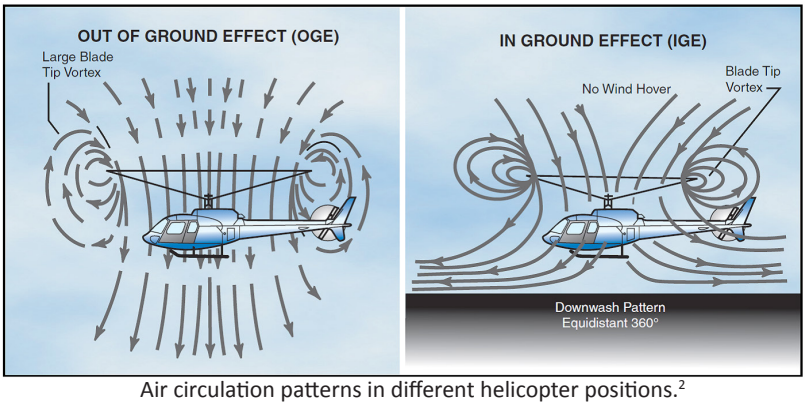
THE NATURE OF THE EXCITATIONS

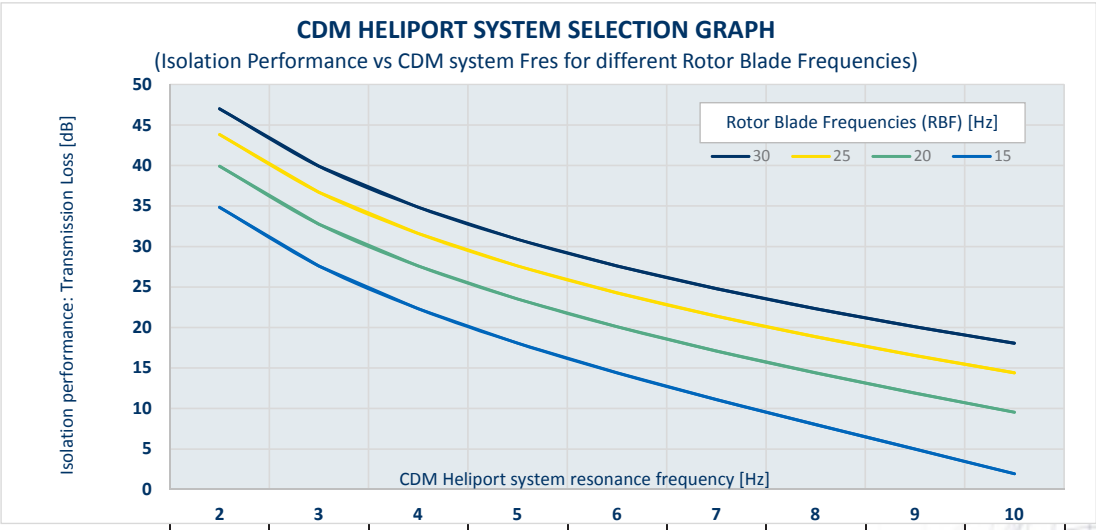
The rotors that create the upwards force that make a helicopter fly create downward pressure waves which excite the structure that the helicopter lands on. The lowest driving frequency is determined by the number of blades (n) and the rotor frequency (Ω), and is normally below the audible spectrum. However, it is by far the most important source of excitation in terms of vibration and transmitted energy. In addition, there are also several harmonics (2nΩ etc.) that create significant noise along with engine and exhaust noise sources.[1]



Air circulation patterns in different helicopter positions.[2]

According to FAA guidelines, the heliport structure should be designed to take two types of dynamic forces: an aerodynamic oscillatory load at multiple harmonics and a dynamic contact load during take-off and landing. The latter has an amplitude of 1.5 times of the maximum take-off weight that would be applied to the contact area (the area of wheels or skids) over a very short duration of 0.2 seconds. Both load cases generate noise and vibration inside the building.[3, 4]

ISOLATION EFFICIENCY



Materials	CDM Springs		CDM Elastomers (CDM-HR, CDM-PF)
BBI systems [1]	CDM-CHR-BOX (incl. lateral buffers, fail-safe, uplift snubbers etc.)		CDM-CAS-BOX & CDM-SEB (incl. lateral buffers, fail-safe, uplift snubbers etc.)
Floating Slabs [2]		CDM-MONT & CDM-FLOAT with springs	CDM-MONT & CDM-FLOAT with elastomers
Metallic Superstructures [3]			CDM-FIX & CDM-SAFEFIX with elastomers

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PROJECT REFERENCES (please refer to relevant Project Data Sheets)

[1] BBI Technology
Orléans Hospital [FR]
System: CDM-SEB

[2] Floating slab
County hospital, Zalaegerszeg [HU]
System: CDM-FLOAT

[3] Metallic superstructure
Maksoud Plaza Hotel, São Paulo [BR]
System: CDM-FIX

TECHNICAL REFERENCES AND SELECTED READING

[1] A. R. Bramwell, G. Done and D. Balmford, "Helicopter Dynamics", second edition, Butterworth-Heinemann (2001).
[2] Rotorcraft flying handbook, Federal Aviation Administration (FAA) publication, U.S. Department of Transportation (2000).
[3] Standards for the design of heliports, Federal Aviation Administration (FAA) publication, U.S. Department of Transportation (2012).
[4] International civil aviation organization (ICAO) Heliport manual, third edition (1995).

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