Land Transport Innovation Portal
Innovation @ LTA

Viaduct Bearing Inspection with Drones

- Research Partner: Singapore University of Technology and Design (SUTD)
- LTA User: Asset Engineering (Infrastructure) Division (AEINF)

There are over 17,000 viaduct bearings along the North-South-East-West Line (NSEWL). In accordance to LTA's Code of Practice, these must be inspected every 5 years - a process which is currently performed manually. Besides checking the viaduct bearings' general condition, we also inspect key parameters such as longitudinal displacement and bearing rotations.

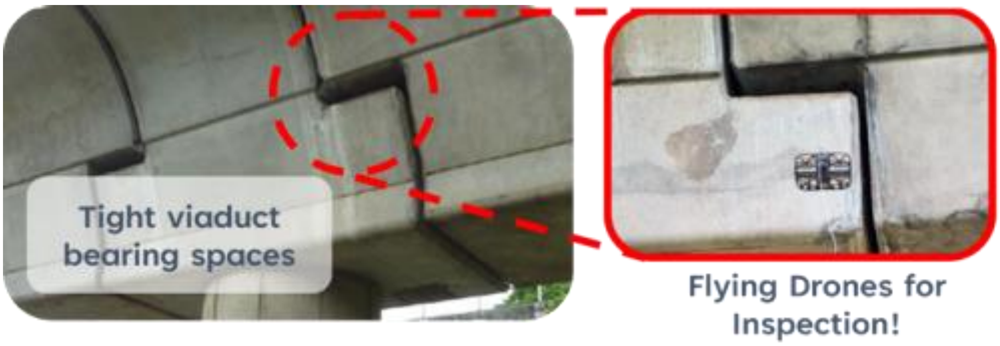
The challenges we face:

- Accessibility: Bearings are not easy to reach. They are typically elevated at a height of six metres or more, and found within small cavity spaces or above water bodies.
- Technology limitations: Current commercial-off-the-shelf drones are too large to fly close to the bearings and cannot capture close-up images in low-light. Instead, we would need to use scaffolds, cherry-pickers, and other specialised equipment to reach the bearings.
- Human error: The work is manually done by people. This can result in parallax errors and inconsistency.

Helping Viaduct Bearing Inspection Take Flight

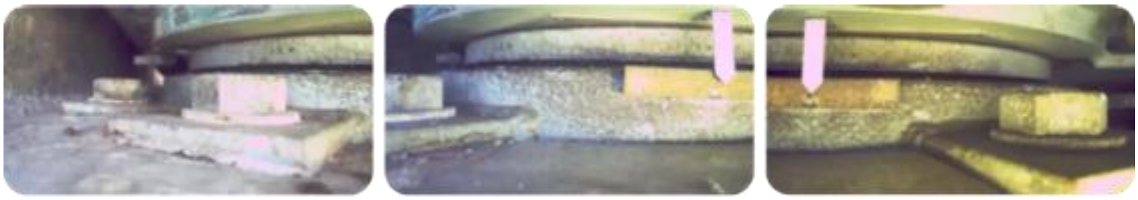
We approached Singapore University of Technology and Design (SUTD) to develop a drone to meet our inspection needs.

They designed a lightweight mini-drone not exceeding 230mm in length, that can connects to a ground power unit via a tethered-line. Components are encased within the drone's body so the pilot can fly it to different heights and access small cavity spaces. This eliminates the need for elaborate setups for workers to manually inspect each bearing.



Automatic and Accurate Measurements

At each location, the drone will take high-definition images covering the entire width of the bearing and a 3D image will be generated. An automatic AI-enabled displacement extraction framework will be run to extract critical infrastructure measurements. This ensures accuracy of the inspection.



Pictures taken by the Drone
(Inside the tight viaduct bearing space)

Reaching New Heights

The drone system will be used at viaduct bearing inspections for the NSEWL. It seeks to:

1. Reduce the time taken to inspect each bearing from one hour to fifteen minutes
2. Eliminate work-at-height risks and cumbersome logistical setups
3. Allow for inspections to be done both during the day and night
4. Improve accuracy and consistency of required measurements
5. Overcome accessibility issues

We are exploring if the same drone system can be used in other areas such as ceiling inspections at MRT stations and road bridges.