

Bridge Expansion Joint Test Facility

A bridge is built not to move. Except here.

THE ONLY MOVING PART IN A CENTURY-LONG STRUCTURE

Everything else on a bridge is designed to stay still. The expansion joint exists because the deck cannot: it grows and shrinks with temperature - a long span moves well over a hundred millimetres between summer and winter - and something has to absorb that while traffic drives across the gap. Which makes the joint the one component with a service life rather than a strength, and the one that fails first: it takes every wheel impact directly, it sits in the drainage path and it collects de-icing salt. So it is tested the way a wear item is tested - for millions of cycles, to find where it stops working - not the way a structure is tested, for a load it must survive once.

TWO MOTIONS AT ONCE, OR THE TEST IS FICTION

A joint on a real bridge is doing two things simultaneously: opening and closing slowly through a large thermal stroke, and being struck quickly by wheel after wheel. The rig must superimpose them. A facility that applies the stroke, stops, then applies traffic loading is testing a condition that never occurs - and the distinction is not academic, because a joint loaded near the ends of its travel behaves quite differently from one loaded in the middle, and the ends are where the seals and bearings are most extended. Coordinating a slow, long-stroke axis with a fast, short-stroke axis is the defining difficulty of the machine. The movement rate is capped by thermal effect rather than by actuator capability, because working an elastomer quickly warms it, and warm rubber is softer, seals better and flatters the specimen without announcing it.

WATER IS PART OF THE TEST, NOT AN AFTERTHOUGHT

A joint that carries its load perfectly and leaks has still failed, because what it exists to protect is the bearings and pier tops underneath it - and water carrying de-icing salt through a joint destroys the structure below far faster than traffic destroys the joint above. Water-tightness is therefore measured while the joint is moving and loaded, not statically on a bench: a seal that holds at rest and opens a path at full extension under a wheel is exactly the failure the test exists to catch.

THE SPECIMEN IS FULL SIZE, AND IT COMES WITH ITS FOUNDATION

A joint cannot be scaled - its behaviour lives in the seals, the anchorage and the way load enters the concrete - so the test article is a real joint cast into real concrete blocks. The rig must hold those blocks rigidly, because any movement of the anchorage is credited to the joint and makes it look more accommodating than it is. The foundation is designed as part of the instrument and verified at commissioning. Specimens are heavy, and on a facility running multi-week endurance programmes changeover time dominates throughput.

THE MACHINE

- Movement axis - slow, long stroke, full range, rate capped by thermal effect
- Load axis - fast, high cycle, through a wheel patch, superimposed on the movement
- Specimen foundation and fixturing - real concrete, held rigidly, changeover designed
- Water-tightness, measurement and control - leak measured under movement and load

VARIANTS

Modular / finger joint facility · Elastomeric joint facility · Combined movement, fatigue and water-tightness cell · Bridge bearing test addition

SCOPE

Ours: facility design and integration, movement and load actuation and their coordinated control, specimen foundation, anchorage and fixturing, water collection and leak measurement, instrumentation, cycle counting and data, installation, commissioning, correlation, documentation, training, spares and AMC - including build to the customer's specification. Bought-in certified: hydraulic actuators and power pack, load cells and displacement transducers, control hardware. The customer's: the specimens, the applicable standard and the test programme.

STATUS

Engineered to order. Equipment of this class has been quoted against a bridge expansion joint test facility requirement for a road research institute; no delivered bridge expansion joint test facility is claimed.