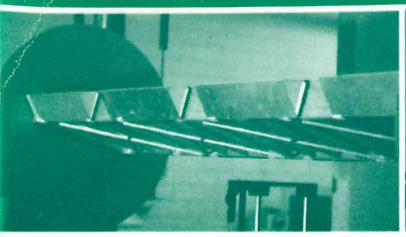
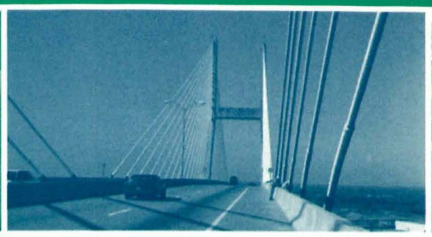
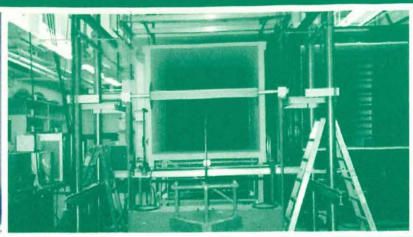
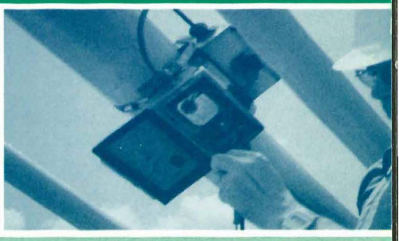

AERODYNAMICS LABORATORY FACT SHEET

Research that is Essential, Indispensable, and Connected to our Customers.

PURPOSE

The Aerodynamics Laboratory is used to study the complex interactions between wind and bridges or other highway structures.

DESCRIPTION

The Aerodynamics Laboratory is the only wind-tunnel facility in the United States that is dedicated solely to the study of wind effects on transportation structures. It has the longest continuous history of exploring bridge aerodynamics to ensure the performance and safety of long-span bridges in strong winds and to advance our understanding of wind effects on transportation structures.

CAPABILITIES

- Model design.
- Model fabrication.
- Instrument design.
- Instrument deployment.
- Computer simulation and analysis.
- Structural analysis.
- Full-scale testing and analysis.

MAJOR/UNIQUE COMPONENTS

- Extensive model inventory.
- Bridge plan library.
- Unique reference library.
- Data archives.
- Large, low-speed, laminar, open-circuit wind tunnel.
- Small-scale smoke tunnel for flow visualization.
- Two-DOF (degrees of freedom), large-scale, active-turbulence generator (computer-controlled).
- Three-DOF motor-driven sensor traverse system (8 ft. by 8 ft. by 8-ft, computer-controlled).
- A three-component, high-frequency, dual force-balance system.
- Two parallel rigid test frames for model installation.
- Six-foot-diameter motor-driven turntable (computer-controlled).
- High-speed, pressure-scanning system.
- Two high-speed data acquisition systems for lab use (average 64 channels per system).
- Six high-speed data acquisition systems for field use (average 64 channels per system).
- Thermo-Systems Inc. (TSI) hot-wire and hot-film velocity sensors.
- Pitot-static velocity probes (various configurations) and stand-alone pressure transducers (various ranges).
- Six non-contact laser transducers to measure deplacement.
- One IBM Risc 6000 workstation.
- One Dell Precision 620 workstation.

ACCOMPLISHMENTS

- Advanced our understanding of wind and structure interactions.
- Developed new methods for evaluating aerodynamic performance in lab.
- Improved procedures for predicting prototype behavior from model studies.
- Certified the acceptability of numerous new bridge designs.
- Designed modifications for several problem structures.
- Developed software for simulation of wind flow around and interaction with bridge structures.
- Established extensive data archives from full-scale testing program.
- Automated laboratory testing procedures and established standard production test programs.

PRODUCTS

Some of the products delivered by the Aerodynamics Laboratory are:

- Numerous staff research reports, journal articles, and conference papers.
- Software for aerodynamic analysis.
- Software for flow simulation.
- Design certifications.
- Recommended design modifications or retrofits.
- Laboratory data (force coefficients, flutter

The Turner-Fairbank Highway Research Center (TFHRC) has more than 24 laboratories for research in the following areas: safety; operations, including intelligent transportation systems; materials technology; pavements; structures; and human centered systems. The expertise of TFHRC scientists and engineers covers more than 20 transportation-related disciplines. These laboratories are a vital resource for advancing this body of knowledge created and nurtured by our researchers. The Federal Highway Administration's Research, Development, and Technology Service Business Unit operates and manages TFHRC to conduct innovative research to provide solutions to transportation problems both nationwide and internationally. TFHRC is located in McLean, Virginia. Information on TFHRC is available on the Web at ***www.tfhrc.gov****.*

FHWA-RD-01-111

This RD&T fact sheet provides concise information about a TFHRC facility.

derivatives, etc.) for design.
- Recommended design specifications.
- Data archives.

SERVICES

- Services provided by the laboratory include:
- Design of stay cable damping systems.
- Field measurement of cable dynamic properties.
- Short- or long-term monitoring of structural behavior and site wind conditions.
- Wind-tunnel testing of new or proposed designs.
- Review to determine the appropriateness of test programs and results.
- Design and deployment of automated remote instrumentation systems.
- Evaluation of performance problems and design of retrofits.
- Static, dynamic, and aerodynamic analysis of long-span bridge structures.

EXPERTISE

The lab is managed by a research structural engineer/aerodynamicist and is supported by a part-time, contract staff, including a level-III research engineer (aerodynamics), a level-III research technician (instrumentation), a level-II data manager, four level-I data managers, two computational fluid dynamics (CFD) specialists, a senior programming specialist, a model builder, a computer-assisted design and drafting (CADD) specialist, and a mechanical design specialist.