



EMPOWERING PROGRESS, ENRICHING LIVES



## LIONS GATE BRIDGE RENOVATION BUCKLAND & TAYLOR LTD., BRIDGE ENGINEERING

### *National Award for Engineering Achievement (co-recipient)*

The city of Vancouver had a problem. Its most famous historic landmark, the Lions Gate Bridge, was rusting away. The severely corroded deck of the suspension bridge, built in 1938, had to be replaced.

However closing the bridge for repairs meant severing a link - one of only two - that thousands Vancouverites rely on. Engineers at Buckland & Taylor Ltd, one of the world's pre-eminent bridge designers, were asked to find a way to repair Lions Gate Bridge without impacting Vancouver's economy. Although the basic concepts had been worked out in the 1970's, it was in 1997 that the firm, led by Peter Buckland, P.Eng., finally undertook something no other engineering firm in the world had tried before — design a way to replace not just the deck of a suspension bridge, but the entire suspended structure, while keeping it open, and above all safe, for the 70,000 vehicles that used it daily.

Despite the many challenges, in December 1998, on time and on budget, Buckland & Taylor completed their design. It called for 54 new bridge sections to be constructed in advance, match assembled in the fabrication shop, transported to the bridge, and raised into place.

The design incorporated wider traffic lanes and sidewalks with safety barriers between vehicles and pedestrians and new stiffening beneath the deck to improve wind stability. To retain the original towers, main suspension cable and main anchorage cables, the weight of the new bridge deck design matched that of the old deck. And they had integrated environmental concerns that included nesting birds and toxic lead paint on the 70-year-old bridge.

To verify the wind stability of the design, Buckland & Taylor conducted wind tests using the largest ever scale model of suspension bridge to be tested in turbulent wind flow. They also were able to calculate accurately, for the first time ever, the traffic loading on long span bridges. Their findings were subsequently incorporated into the Canadian and American Bridge Codes.

Computer modeling, which allows engineers to calculate structural integrity, was a tremendous challenge. While most bridges are built to a single finished model, Lions Gate required the contractor's engineers to develop some 1,100 models because of the constantly changing configuration and combination of old and new materials as the work progressed.

The work had to be done in 10-hour blocks on specific nights and on four weekends. On construction nights, high over Burrard Inlet ironworkers raced in the dark to cut away a section of the old bridge and lower it to a waiting barge. A new section was then raised and spliced in place with 800 bolts, all securely fastened in less than an hour. Buckland & Taylor's miracle design was a success. The final section was installed in September 2002.

The extensive planning and development that went into designing the project has greatly enriched the body of civil engineering knowledge.

For Peter Buckland the reward has been public satisfaction. Thanks to Buckland & Taylor's design, not only is Lions Gate wider and smoother, Vancouver's most photographed landmark is more elegant and graceful than ever. And all who travel her span can enjoy new, unobstructed vistas of Vancouver, her ocean and mountains.

For safely and beautifully restoring and enhancing a vital transportation link to the citizens of Vancouver, Buckland & Taylor received the 2003 Award for Engineering Achievement from the Canadian Council of Professional Engineers.

Peter Buckland and his engineering design team are members of the Association of Professional Engineers and Geoscientists of British Columbia.