

## Vibration of Bundled and Single Conductors: A Comparative Case Study

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### ABSTRACT

*During the time period from December 7 - 13, 1985, a series of field tests was undertaken in Littleton, New Hampshire, for the New England Power Company. The purpose of the tests was to measure the aeolian vibration in the new DC transmission line conductors. The objectives were (a) to evaluate the performance of the damping devices installed on the phase I line, and (b) to provide design data for specifying vibration control devices for the phase II line.*

*Both of the objectives have been met. The overall conclusions are:*

*(i) No damping devices are needed in the ground return, or in the bundle of three conductors, in order to meet or satisfy IEEE standard stress criteria (150 microstrain), regardless of how many spacer/dampers may be used (from one to five per span).*

*(ii) There is no perceivable change in the vibration level of the bundle compared with that of the single ground return conductor when two, then four, spacer/dampers are removed.*

*(iii) At all times during the measurement period, including overnight continuous recording of up to twenty hours, the vibration level of the triple bundle exceeded the vibration level of the undamped ground return by up to five times.*

*(iv) When only one spacer/damper was installed near mid-span, the use of three vibration dampers at the span end was effective in reducing the bundle vibration to the level of that of the ground return conductor.*

*(v) The field test method was used successfully to measure both the conductor torsional stiffness and the conductor damping ratio.*

### INTRODUCTION

The problem of vibration in single and bundled conductors has a long history. Generally,

the industry has accepted, more or less as a rule, that bundled conductor systems vibrate less than single conductors. This paper challenges that rule.

The tests reported here are aimed only at a comparison of vibration levels in single and bundled conductors (a bundle of three). For the first time, this paper develops a relationship between vibrations on a single conductor in the same span as a triple bundled conductor of the same diameter at the same tension, and at the same time. The only difference is between the single and bundled configurations.

Besides comparing the vibration of a single conductor with a bundle, a comparison is made for a span having only one spacer/damper at mid-span plus a single end-point damper at one end of the bundled span.

The narrow issues examined here are: (i) does the single conductor vibrate more than the bundled span, and (ii) does end-point damping plus one spacer/damper provide vibration protection?

The phase I portion of the New England Power Co. DC transmission line was constructed in 1985. It connects with a similar line of the Vermont Electric Co. and thence to the Hydro Quebec Interconnection with James Bay, Canada. The tests described here were performed on the phase I section, which comes into the state of New Hampshire near the Moore dam and reservoir, then runs more or less parallel to the Connecticut river to the Comerford station, where a converter changes the DC to AC power for local transmission. All of the tests were performed on span 18 - 19, chosen for its length of 1150 ft (348 m) and for its proximity to local AC power to drive the instruments.

The phase II portion of the line will also be DC at  $\pm 450$  kV, and will bring power from the Comerford station down an existing right-of-

