Realistic Testing of Bend-Insensitive Drop Cables for Multidwelling Unit (MDU) Installations

Optical fibers incorporated with Corning® ClearCurve® technology are specifically designed to more tightly confine light to the core and enable unmatched macrobending resistance in backward-compatible optical fibers. Consequently, rugged fiber optic drop cables using this fiber technology are easily installed into multidwelling units (MDU), particularly in the harsh environment of a brownfield deployment. Furthermore, compact drop cables with the same bend-limiting design may be routed less conspicuously for greater aesthetic appeal.

ClearCurve drop cables allow fiber bend radii as low as 5 mm, with less than 0.1 dB increased attenuation per turn at 1550 nm. This truly bend-sensitive performance capability (exceeding even the most stringent demands of ITU-T Recommendation G.657.B) has been identified as a key requirement in MDU applications by several carriers around the globe.

The mechanical reliability of the fiber is equivalent to single-mode. The predicted failure rates in the low single-digit parts per million (ppm) span more than 20 years and are negligible when compared to other sources of network failure and the significant cost savings the cable solution enables. Truly bend-insensitive performance results in several key advantages for drop cables.

The main problem associated with optical power loss due to macrobending at tight bend radii, either during installation or post installation, is virtually eliminated. The rugged drop cable features a self-bend-limiting design which prevents the cable from exceeding its minimum bend radius. When combined with the bend-insensitive nature of the fiber optic cable, installers can route rugged bend-insensitive drop cables around tight corners or directly staple these cables to wall joists or studs with virtually no increase in attenuation.

To prove this point, an MDU obstacle course was developed to simulate realistic drop runs both typical and severe in character (see Table 1). Both courses featured a fixed number of hard 90-degree bends down to 5 mm radius, corner bends under load, staples, and mandrel wraps. The actual obstacle course is shown in Figure 2.

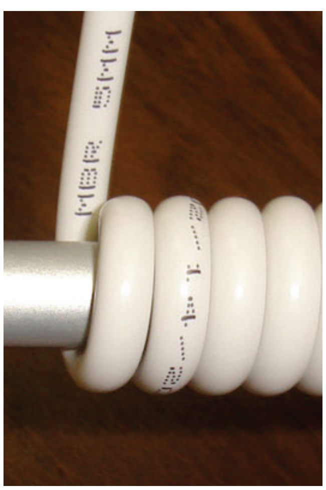

Figure 1.
Bend-Insensitive Rugged Drop Cable Wound Around a Mandrel with Radius 5 mm (0.2 in)

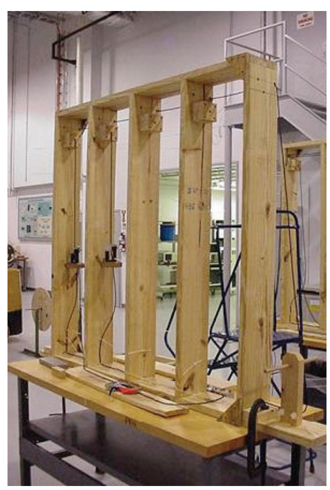

Figure 2.
Realistic MDU Obstacle Course

Table 1: MDU Obstacle Course

	Typical Drop Run	Severe Drop Run
Drop run length (ft)	150	300
Number of hard 90-degree bends	10	20
Corner bends under load at 5 lbf	2	1
Corner bends under load at 30 lbf	-	1
Number of T25 (round) staples	30	80
Number of T50 (flat) staples	-	10
Number of mandrel wraps	4	10

Obstacle Course

MDU drop cables using truly bend-insensitive fiber technology were installed in the obstacle courses and the macrobend loss induced by the arduous routes was measured. Performance was compared with MDU drop cables featuring the same cable design, but containing a commercially available bend-tolerant fiber with a chemically fluorine-doped cladding. The results are shown in Figure 3.

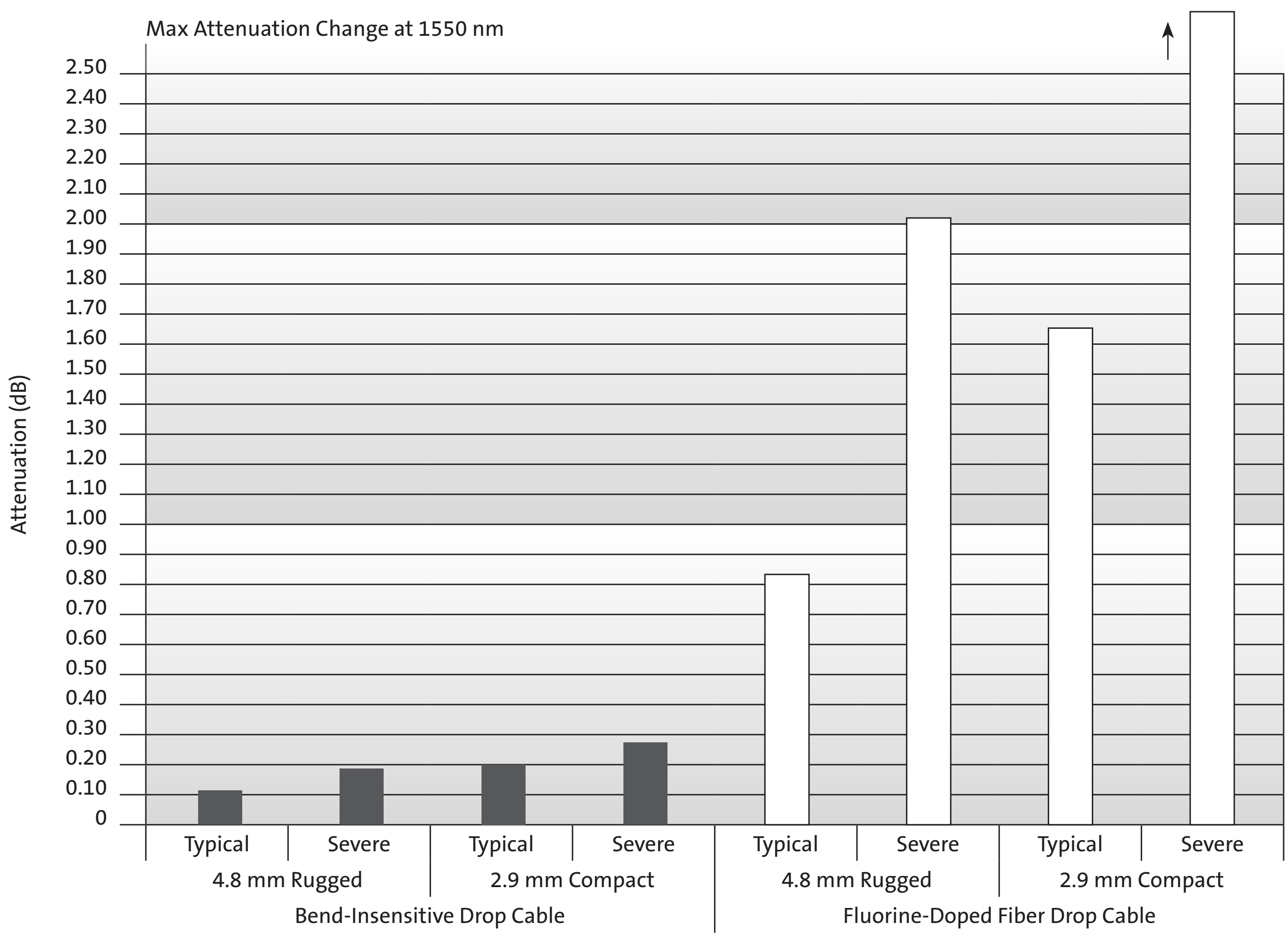

Figure 3. Obstacle Course Test Results

Test results for bend-insensitive rugged drop cables show maximum attenuation increases up to 0.1 dB in the typical drop course and up to 0.19 dB in the severe drop course. Equivalent cables employing fluorine-doped fibers experienced increased attenuation values up to 0.8 dB for the typical drop course and 2.0 dB in the severe drop course. The graph also shows the impact of the obstacle course on compact drop cables with 2.9 mm outer diameter, an aesthetically attractive alternative for in-building installation. The increase in attenuation in this cable is understandably higher, but easily manageable when bend-insensitive fibers are used. However, it becomes evident that fluorine-doped fibers with compact drop cables of approximately 2.9 mm outer diameter exhibit very high attenuation in the typical drop run (up to 1.6 dB) and more so in the severe drop run (higher than the scale of the graph).

The importance of the results above becomes evident when considering the in-building optical power budget. Installers do not want to budget for additional loss on inside wiring. As a result, there is typically only 0.2 dB to 0.3 dB margin for drop cable loss. A single bend on standard drop cables can easily exceed this budget, even when deploying a fiber that is compliant with ITU-T Recommendation G.657. However, the bend-insensitive rugged drop and compact drop cables meet these requirements in both the typical and severe test setups. The fluorine-doped fiber demonstrates much higher loss and may not meet these requirements.

Due to the bend-insensitive nature of the fiber as well as the self-bend-limiting feature of the cable, rugged drop cables can be installed just like copper communication cables but with the improved bandwidth of single-mode optical fiber. Figure 4 demonstrates the self-bend-limiting feature.

This outstanding performance generates opportunities for significant cost-savings associated with installing bend-insensitive drop cables in MDUs. The savings arise as a result of the reduction or elimination of microducts and raceways, reduction of skill levels needed to install the cable, and reduction in time taken locating and correcting macrobend-related problems.

In summary, bend-insensitive drop cables are an attractive solution in MDU applications with providing low bend losses and mechanical reliability, as well as quick and easy installations. The realistic test environment demonstrates that drop cables based on chemically doped trench-assisted fiber designs cannot meet all of the required performance levels of MDU installation.

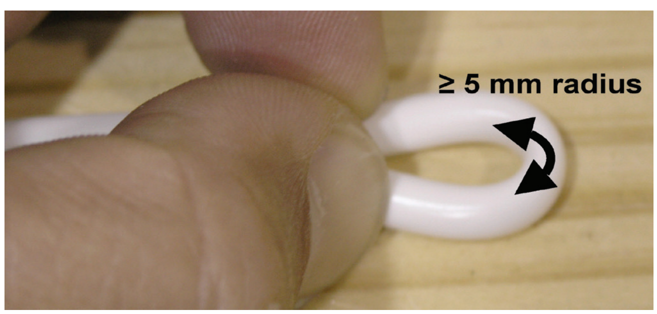

Figure 4.
Bend-Limiting Design

Notes:

Corning Optical Communications LLC • PO Box 489 • Hickory, NC 28603-0489 USA
800-743-2675 • FAX: 828-325-5060 • International: +1-828-901-5000 • www.corning.com/opcomm