» New Products

Ground Transportation and Installation of an Ultra-long Power EHV (extra-high-voltage) Cable for the Chiba-Katsunan Line Project in Tokyo Electric Power Company, Incorporated

1. INTRODUCTION

The Chiba-Katsunan Line of Tokyo Electric Power Company, Incorporated is a 275 kV XLPE cable long-distance underground transmission line with 30.4 km of cable length.

This line has an important roll for supplying electricity from Chiba region to Tokyo, and it was necessary to start its operation as early as possible for eliminating power shortage caused by the Great East Japan Earthquake in March, 2011.

The construction schedule was shortened by 200 days in comparison to the conventional method by achieving the reduction of the construction schedule based on our own study of the ground transportation and on the installation method of ultra-long cables, and the operation started without accident in March, 2014.

<Outline>
Nominal voltage : 275,000 (V)
Line : Chiba-Katsunan Line No.1
Block : Chiba-chuo S/S (Substation)–Katsunan S/S
Cable length : 30.4 (km)
Number of line : 1 line

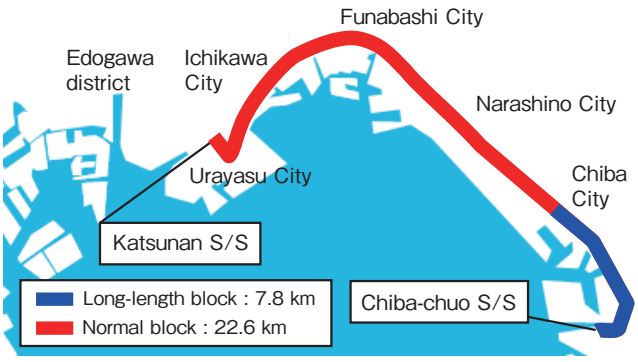

Figure 1 Location of the cable route.

2. PROBLEMS IN THE LINE CONSTRUCTION

The Chiba-Katsunan Line required an early start of the operation by the reduction of the whole construction schedule because it is one of the important power sources for eliminating power shortage. On the other hand, considering the severe circumstance after the earthquake, such methods which easily bring an increase in costs in exchange for the reduction of the construction schedule were difficult to adopt.

If mass resources related to the construction are put in simultaneously, reduction of the construction schedule is possible. However, it brings a large increase in costs. Given this factor, we were required to meet contradicting factors, the reduction of the construction schedule and the reduction in the construction costs.

2.1 For the Reduction of the Whole Construction Schedule

Long span cable installation is one of the means for reduction a construction schedule in a tunnel installation. As figure 2 shows, a cable of maximum length of about 500-600 meters is wound on a drum, transported, and provided for the construction on site in a normal installation method. However, if transporting and installing a cable longer than 1000 meters (which is more than twice as long as the normal cable) at once is possible, it can reduce the number of the cable installation in the whole construction and can reduce the cable joints which require construction on site. Particularly, in a 275 kV class cable, the reduction of the construction schedule will be several weeks per one joint because EHV class jointing works require special facilities such as clean room etc. to establish the high quality in the jointing process in the tunnels or manholes on site.

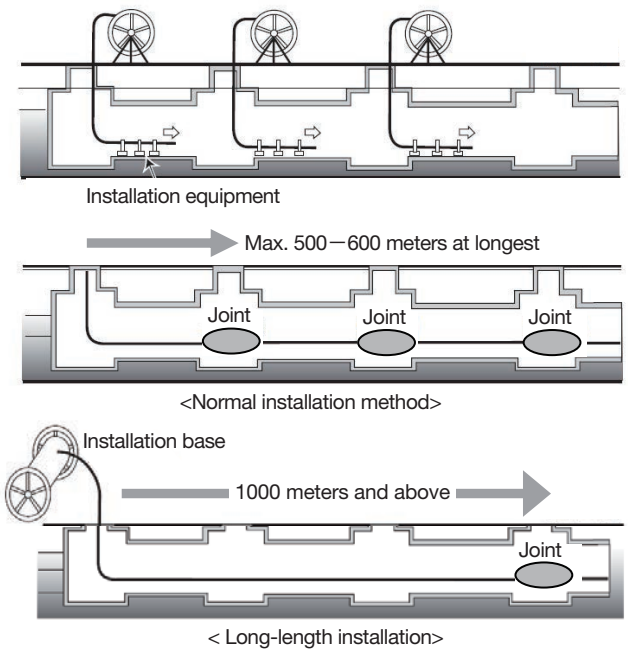

Figure 2 Cable installation methods for a normal cable and an ultra-long cable.

2.2 Problems in the Long Span Cable Installation

Many problems needed to be overcome for accomplishing the long span cable installation:

- Special drum: A horizontally-long special drum is needed because rolling a cable of 1000 meters long and above is impossible with normal cable drums.
- Restrictions in transportation: Ground transportation of a special drum for rolling an ultra-long cable exceeding 1000 meters is difficult with restrictions such as weight limits on roads and bridges because the drum is so large that the gross weight exceeds 50 tons. Although marine transportation is a solution to this problem, it also has many problems such as reserving a landing space and transportation after landing, other than an increase in costs.
- Restrictions in the installation site: Special equipment and a wide space require to be reserved to pull a cable out of a special, horizontally-long drum which can roll a cable of 1000 meters and above, and to install it.
- Cable installation and the conveyance technology: The length of transportation of an ultra-long cable of 1000 meters and above in tunnels and conduit lines is more than twice as long as the normal one. The number of the special equipment, the synchronism between equipment, the control and the monitoring systems of the equipment need to be optimized for installing cables.

With respect to designing and manufacturing of a special drum, and installation and transportation of a cable, we were able to deal with it because we have established technical experience such as in the construction of the Shinkeiyo-Toyosu Line, which is a 500 kV long-distance XLPE line. However, with respect to reserving the installation site and to the transportation to the installation site, studies were needed on the possibility of marine transportation and the transportation after landing, and on a massive increase in the transportation costs by marine transportation.

3. STRATEGIES FOR PROBLEM RESOLUTIONS

Long span cable installation is inevitable for a reduction of a construction schedule because it allows a reduction of a whole construction schedule including a construction period of joints with a reduction in the number of the joints in comparison with the initial plan. However, transportation of the cable of 1000 meters and above with a special drum remains an issue for accomplishing construction with ultra-long cables. Although marine transportation is a possible solution, its high transportation costs remain an issue.

Fortunately, the Chiba-chuo S/S, one end of the Chiba-Katsunan Line, is located in a relatively close to our Ichihara works, and the number of the bridges on the transportation route is not that many. We conducted a detailed investigation of the transportation route, including an investigation of the resistance of the road bed and the underground installation, and the strength calculation of the bridges as the need arose. Then, we had discussions with the related organizations including the road administrators, and we had approvals of ground transportation with a special vehicle.

With respect to the other problem, reserving an installation base, we concluded that the installation of ultra-long cables is possible by combining several construction methods in the limited space inside the Chiba-chuo S/S, as a result of an intensive study with the related organizations.

With these studies above, our unique plan, made it possible to, shorten the whole construction schedule and avoids increase in costs of the Chiba-Katsunan Line Project.

Figure 3 Ground transportation of the ultra-long power EHV cable.

Figure 4 Installation of the ultra-long power EHV cable.

4. CONCLUSIONS

The Chiba-Katsunan Line Project adopted an ultra-long cable installation by ground transportation. The lengths of the ultra-long cables are 1350 m–1850 m.

Not only the ground transportation of the ultra-long cables significantly reduced the transportation costs, long span cable installation shortened the construction schedule by 200 days by reducing the number of the joints from initially planned 48 sets to 12 sets. As a result, both a significant reduction of the construction schedule and the reduction in the construction costs were achieved.

5. ACKNOWLEDGEMENTS

The on-site installation of 275 kV XLPE cables for the Chiba-Katsunan Line Project was completed without accident in December, 2013, and the operation started in March, 2014. We would like to express the deepest appreciation to all persons concerned who provided us guidance and support in the construction of the line.

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