

How the Quality of Cable to be Secured on Cable-Supported Bridge

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Summary

Recently many new cable-supported bridges have been built especially in Asian countries. Some of them have the potential issues concerned especially on cables. From experiences on the recent projects which author has been involved in, the followings should be taken into account from the viewpoint to develop the better quality of cables for the further projects.

- (1) Deeper examination process on the production of high strength wire for bridge cable should be necessary in order to get rid of insecure elements.
- (2) More actual experiences on the existing bridges should be reflected in detail design and production on cable anchor.
- (3) With regards to installation on suspension bridge cable, more careful planning and execution on cable compaction should be necessary to avoid less quality of cable or damage of wires as much as possible.

These particular issues would sometimes become vital problems in the future of bridge but be sometimes unnoticed at the construction stage.

Keywords: *suspension bridge; cable; cable wire; cable compaction; strand*

1. Introduction

Many bridges have been built especially in Asian countries for last 10 to 20 years and the number of bridge collapse has increased accordingly. This means pretty new bridges have failed and collapsed. Even if the problem on small portion or component is contained in the bridge structure, such problem might become the vital problem for the whole bridge structure. The problems on bridge building especially for cable-supported bridge cable in recent projects are herein reviewed and the essential points to improve are pointed out.

2. Secure Quality of High Strength Wire for Suspension Bridge Cable

Recently 190 k (1,860 MPa) wire and 200 k (1,960 MPa) wire for main cable of suspension bridge will be used in some bridges. Those high strength wires with silicon inclusion should be more carefully examined from additional factors or various viewpoints. From author's experience, one of the most concerned issues is related to the fretting corrosion or fretting fatigue. In addition to fundamental requirements in the conventional specification, following items should be examined.

- (1) Fretting fatigue
- (2) Corrosion fatigue
- (3) Rotation fatigue

3. Design Details on Cable Anchor

3.1 Secure Quality of Cable Product with Cable Anchor

Many types of cable anchor have been developed in the world. As those developed anchors are in the knowhow which belong to the producers who developed such anchors, the design and manufacture method on developed anchor are not generally opened in public. Some cable manufacturers have made the similar anchors which others had developed originally. In that case, poor product has been sometimes appeared, for instance, such that the casting status of one anchor is differed from the other side anchor. To secure the sufficient quality of cable product with cable



anchor, the sufficient fundamental process from confirming design theory to production with QA/QC should be taken with understanding original R&D background in all newly-participated manufactures.

3.2 Inspection and Maintenance on HDPE Covered Cable

Suspenders for many suspension bridges and stay-cables for most of cable-stayed bridges have been coated or covered by High Density Polyethylene which is excellent protection of cable but the inside of HDPE coat is invisible. From the viewpoint of maintenance, the research for the sophisticated diagnosis system is necessary but meantime until it realizes, it would be proposed that one of the countermeasures is to place the inspection window at the mouth of anchor.

3.3 Mouth Piece of Cable Anchor

(1) Bending Stress of Cable

The bending stress is introduced at the front of cable-anchor when the cable is laterally deformed or oscillated. Thus mouth piece as a buffer is useful to relax the bending stress. Meanwhile this mouth-piece may contain rainwater in its inside, which leads to the corrosion of cable. One of the protection measures is to pour the Polybutadiene into it. This resin is with high penetration so as to be filled in the whole section of cable. It should be noted that most of damages on suspenders or stay-cables have been from corrosion which has often occurred at the front of bottom anchor.

(2) Long Mouth Structure with Screw Joint

The particular mouth piece as shown in *Fig. 3.1* has been widely used mainly in China.

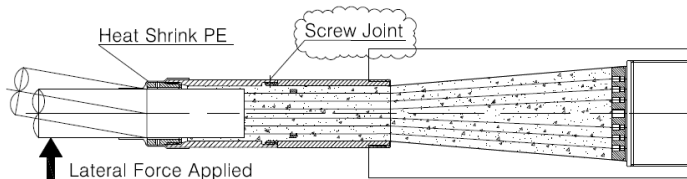


Fig. 1 Concerned Mouth Piece of Cable Anchor

As shown in the figure 1, it would be clear that once the lateral force is applied at the front of anchor, the joint of mouth piece would be damaged because of thin thickness at the screw joint. It should be considered that to avoid the risk on bending stress introduced, the other designs should be hired as alternatives instead of the screw joint.

4. Installation of Suspension Bridge Cable

With regards to quality of installed cable on suspension bridge, one of key issues is how the parallelism of composed wires is achieved because the wire crossings would lead to the stress corrosion cracking or pitting corrosion. One of key issues is related to cable compaction such as; (1) pre-compaction process should be executed before compaction by compaction machine, (2) excessive capacity of compaction machine should be avoided because of the damage of wire such as dent, kink and even failure under excessive pressure.

5. Conclusion

Because of many components on cable for long-span bridges, once the problems are found, that would be the vital problem with large amount of retrofit cost. Recently many new designers, manufacturers and contractors have participated into this field. As the issues as mentioned above would be somehow attributed to the less experience, it is important to consider more about the actual problems in the existing bridges and to realize the original R&D for the future long cable-supported bridge construction.