



## Evaluation on Remaining Bearing Capacity and Service Life for Parallel Wire Cable

**Weizhen CHEN**  
Dr.-Ing Professor  
Tongji University  
Shanghai, China  
[vogel@sh163.net](mailto:vogel@sh163.net)



Weizhen Chen, born 1962, received his doctor's degree from Technical University of Munich, Germany, in 1999. Now he works at Tongji University, Shanghai, China.

**Xue LIU**  
Civil Engineer  
Tongji University  
Shanghai, China  
[Wesoto\\_Weld@hotmail.com](mailto:Wesoto_Weld@hotmail.com)

Xue Liu, born 1978, received his MS degree in bridge engineering from Tongji Univ., Shanghai in 2004. Currently he is a PhD. candidate in civil engineering.

**Jun XU**  
Graduate student  
Tongji University  
Shanghai, China  
[jxuun@x263.net](mailto:jxuun@x263.net)

Jun Xu, born 1978, received his MS degree from South West Jiaotong University. He has been involved in bridge design and inspection for 12 years.

### Summary

Since 1980s China has forged more than one hundred cable-stayed bridges. With the passage of time, the stay cables of many bridges have been gravely corroded and some of them were broken causing collapses. In the grim situation, apprehensions about the safety of these cable-stayed bridges arise. This paper advances a series of pragmatic methods to attack inspection and evaluation of parallel wire cables.

First of all, a grading contrast standard for corrosive wires is established for the convenience of visual inspection. Inspections are then carried out on cables dismantled from cable-stayed bridges to find out the distributing rule of internal corrosion. Furthermore, a single wire modelling is built based on wire deterioration mechanism. It is required that the modelling should consider the dual influences of corrosion (including homogenous corrosion and rust pit etc.) and fatigue, which can be adjusted through testing. On the basis of the single wire modelling, a parallel cable model can be applied to figuring out remaining bearing capacity and forecasting remaining service lives of the cables. Finally, the experimental values of the discarded cables are compared with theoretical ones to verify the precision of the theoretical analysis.

The method proposed in the paper was once applied to the inspection and evaluation of Shimen Bridge to determine the first replacement of stay cables. In the evaluation, the remaining service lives of the remaining cables were successfully estimated.

**Keywords:** Stay cables; Remaining bearing capacity; Remaining service life.

### 1. Introduction

China has constructed more than a hundred of cable-stayed bridges. At least twenty of them have been ascertained to have cable corrosion problem. Ten of the twenty were forced to have a complete replacement of their stay cables. Presumably, the growing age of the bridges will further deteriorate the corrosion problem threatening the safety of the cable-stayed bridges.

Bridge management engineers, for lack of governing theories and previous experience, are unable