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ENGINEERED SLOPES IN CHINA
–Approaches and Case Studies

中国典型工程边坡

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Highway and Railway Engineering Volume

交通工程卷

人民交通出版社
China Communications Press

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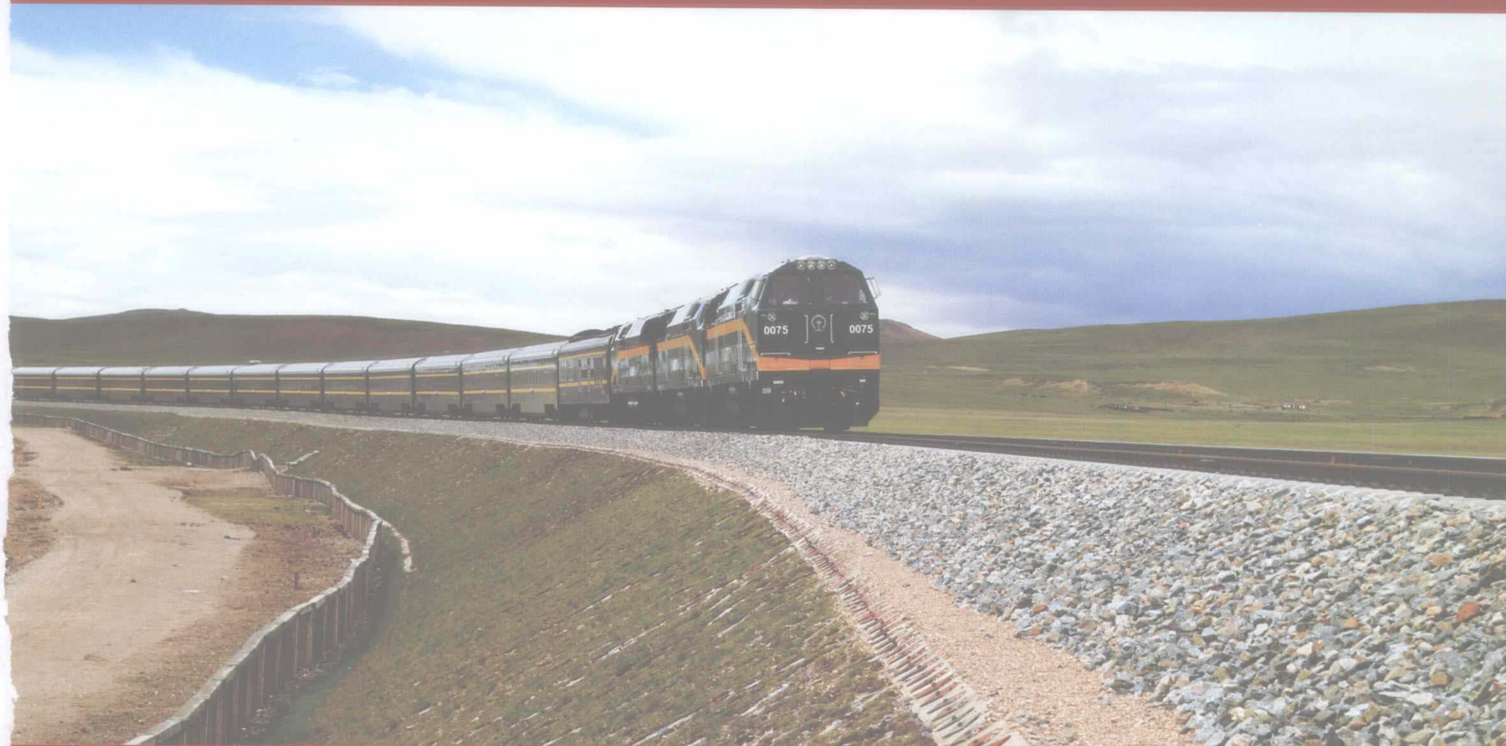

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内 容 提 要

本卷画册从中国大量交通边坡工程中遴选出具有典型意义的公路和铁路边坡工程实例，描述了中国公路和铁路建设中跨越世界屋脊、高山峡谷、黄土沟壑、沙漠旱海、寒区冻土等特殊和极端恶劣环境条件地区的工程边坡问题，以及工程边坡建设的成功与失败事例，可供国内外广大土建工程研究、设计、施工等技术人员借鉴参考。

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中国典型工程边坡

Engineered Slopes in China - Approaches and Case Studies

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序　言

我国相当一部分国土处于崇山峻岭，遭受的滑坡和泥石流灾害十分严重。正在进行的大规模重大工程建设中的边坡稳定问题也至关重要。矿山、水利以及交通工程中发生的滑坡灾害带来了巨大的人员伤亡和财产损失。与此同时，三峡、小浪底以及青藏铁路等工程的成功建立也积累了大量的宝贵经验。

致力于减轻地质灾害和边坡工程研究的中国工程师和学者非常荣幸有机会主办2008年第10届国际滑坡与工程边坡会议。经讨论，我们决定出版有关中国滑坡和工程边坡的两个姐妹画册。中国典型滑坡画册由殷跃平博士主编，于2007年12月出版。中国典型工程边坡画册分别包括矿山工程卷、交通工程卷、水利水电工程卷及三峡库区卷。现在，我们非常高兴地看到，在各位同仁的共同努力下，该系列画册的出版已经成为现实。

本系列画册描述了工程建设中的一些重要的滑坡实例。盐池河滑坡和韩城电厂地面变形是由于地下开采引起的两个典型例子。前者掩埋了一个村庄，导致284人死亡；后者对边坡的变形和破坏影响持续了20年之久。由开挖引起的滑坡失事比较普遍。天生桥二级、小湾及漫湾等水电工程的教训值得我们重视。千将坪滑坡是三峡水库蓄水后的一次失事实例，尽管128人成功撤离，但仍导致了24人死亡。还有大量的位于黄土地区、寒冻土地区和沙漠地区的公路与铁路边坡，独具中国特色。

该画册还包括了若干成功的重大工程边坡实例。三峡船闸高边坡开挖石方量达$22\times10^6m^3$，应力释放问题受到普遍关注，争论热烈，现在已经得到了答案。小浪底进、出口边坡位于第三纪砂岩与厚黏土夹层之上。在这个边坡布置了165m高土石坝的全部引水系统，施工期及运行期的成功运用，对这个黄河上的主要工程的安全极为重要。锦屏拱坝高达304m，开挖深度达530m，边坡坡度陡竣，达1∶0.5～1∶0.3。读者还会惊叹于那些描述三峡工程120万移民新城镇的图片。为了确保这些边坡的安全我们做了大量的工作。

我们真诚地感谢国务院三峡工程建设委员会办公室、中国水电工程顾问集团公司、中国矿业大学（北京）以及中交第一公路勘察设计研究院有限公司提供的经济资助以及在收集资料方面所做的努力；特别感谢那些提供宝贵图片和文档的人员，虽然不能在此一一列出他们的名字；特别感谢谭国焕教授、岳中琦教授、吴宏伟教授和殷建华教授，是他们组织人员进行了翻译；特别感谢苏宝纨女士，她和她的助手们志愿翻译了四卷画册的中文。没有他们的努力，该画册英文内容的出版几乎是不可能的。

陈祖煜
凤懋润

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FOREWORD

With its large and mountainous topography, China has suffered from serious landslide and mudflow hazards. The large-scale economic construction has also raised serious slope stability concerns. Catastrophic landslides happened in the engineered slopes created in mining, hydropower and transportation projects, bringing huge losses of human lives and properties. On the other hand, valuable experiences have been obtained from many successful engineering slopes such as those involved in the projects of Three Gorges, Xiaolangdi, and the Qinghai-Tibet Railway, etc.

The Chinese engineers and scholars working on geohazard mitigations and slope engineering are particularly privileged to have the opportunity of hosting the 10th International Symposium on Landslides and Engineered Slopes in 2008. After a warm discussion, we decided to publish the sister-volumes of albums entitled 'Landslides in China - Selected Case Studies' and 'Engineered Slopes in China - Approaches and Case Studies' respectively as gifts to the Symposium. The landslide volume was edited by Dr. YIN Yueping and published in December, 2007. This 'early bird' brought great pressure and encouragement to us who had taken the responsibility of compiling the latter, an even big collection that consists of 4 volumes concerned with slopes of mining, highway and railway, water resources and hydropower, and the Three Gorges Reservoir projects respectively. We are happy to see that this album has now come to reality as a result of the joint efforts made by our colleagues working on different industrial and civil areas.

This album describes some important slope failure cases in engineering. The landslide of Yanchihe and the large ground movement of the Hancheng Power Plant are typical examples of slope failures induced by underground mining. The former buried a village and killed 284 people, and the latter caused more than 20 years sustaining slope movement and damages to the power plant. Landslides triggered by excavations are common and the slope failure cases of Tianshenqiao II, Xiaowan and Manwan projects are certainly worthwhile to be studied. Qianjianping Landslide is one case of slope failure caused by filling of the Three Gorge reservoir. Although 128 people had successfully evacuated, it still resulted in 24 fatalities.still many engineered slopes on highways and railways in the area of loess, frozen soil and deserst are specific in china.

This album contains a number of large-scale successful engineered slopes. The navigation lock of the Three Gorges project involves an excavation of 22×10^6 m^3 rocks and the issue of stress release had been a serious concern, to which the answer is available now. The intake and outlet slopes of the Xiaolangdi Project were built in Tertiary inter-bedded sandstones with thick clay seams. As these slopes accommodate all water diversion facilities of this 165 m high embankment dam, the successful performance during construction and operation has been a great contribution to this key project in the Yellow River. The left abutment of the 304 m high Jinping arch dam necessitates a 530 m deep excavation with a sloping of 0.5~0.3 (H) on 1 (V). Readers will also be impressed by the pictures that describe the new cities for the 1.2 million resettlement people of the Three Gorges Project. Tremendous efforts have been made to ensure safe performance of these slopes.

We would like to extend our sincere thanks to Office of Three Gorges Construction Council under the State Council, China Hydropower Engineering Consulting Group Corporation, China University of Mining & Technology ,Beijing and CCCC First Highway Consultants Co., Ltd for their financial support and efforts in collecting all the necessary information. Special thanks also go to those who offered their valuable photos and documents. To mention them one by one appears to be impossible, but their contributions will be remembered. We are particularly indebted to Professors George Tham, YUE Zhongqi, Charles Ng and YIN Jianhua from Hong Kong, who organized the English translation work. We are especially grateful to Mrs. So Po Yuen, Cynthia, who edited the English language voluntarily for all the 4 volumes based on her technical assistant's work. Without their effort, the English texts of this book would not have been made possible.

CHEN Zuyu
FENG Maorun

前 言

中国地域辽阔，地质条件十分复杂，地貌类型齐全，而且在独特的自然地理条件下，还发育了典型的黄土地貌、冻土地貌、风沙地貌等。在中国，山地、高原、丘陵面积约占国土面积的70%，由于山区地形地貌起伏多变，公路与铁路路基的修筑就不可避免地要出现填、挖，从而形成众多的工程边坡。同时由于山区地质条件复杂，地质环境脆弱，地质灾害发育，道路工程建设中不合理的切坡、填沟等工程活动必然会对地质环境造成破坏，还会诱发和加剧各种地质灾害，从而酿成各种类型的边坡病害。

20世纪50年代以来，伴随着中国经济的快速发展，铁路与公路建设逐步向山区延伸，工程边坡的数量和规模迅速增加，由边坡引起的工程与环境问题也日益突出。尤其是20世纪90年代中后期，我国山区高速公路建设飞速发展，公路建设中的高边坡工程数量之多、规模之大、类型之复杂、工程之艰巨，举世瞩目。

为向世人展示中国在公路与铁路工程边坡建设方面取得的业绩，总结工程边坡治理的经验与教训，借第10届国际滑坡与工程边坡会议在中国召开之际，编写组从中国大量的边坡工程实例和相关资料中，遴选出有一定典型意义的公路与铁路边坡工程，汇编为《中国典型工程边坡（交通工程卷）》。

本画册共分三大单元：第一单元（第1章）回顾评价了中国公路与铁路边坡工程的历史与现状；第二单元（第2章）详细展示了中国山区公路与铁路建设中的若干典型边坡案例；第三单元（第3、4、5章）分别展示了独具中国特色的黄土地区、寒冻地区、沙漠地区的公路与铁路边坡工程。

本画册由中交第一公路勘察设计研究院有限公司中交寒区道路工程重点实验室开放基金资助出版，由中交第一公路勘察设计研究院有限公司和中铁西北科学研究院具体组织编写，由喻文学、王传仁、谢永利三位专家主审。赵永国教授级高工为本画册的成书做了大量艰苦细致的调研和编辑工作。

本画册在编写过程中承蒙众多单位及相关人员提供资料。画册中还引用了国内外许多学者的研究成果和资料。在此对所有支持本书出版的专家和同志表示衷心感谢！

编写组

2007年8月18日

PREFACE

China is a vast country with complicated geological conditions and complex geomorphology. Typical landforms of loess, frozen soil and wind-borne sand are developed under its special physiographic conditions. In China, mountain regions, plateaus and hills cover a total of 70% of the whole country area. In the mountain regions, extensions of roads and railways both in terms of scale and numbers are inevitable. Then many engineering slopes occur. For the reasons of the complicated geological conditions, the weak geological environment and developed geological hazards in mountain regions, some engineering activities in road constructions, such as unreasonable slope cutting and gully filling, will destroy geological environment and induce or intensify all kinds of geological hazards. They will cause different types of slope failures.

Since the 1950s, with the rapid development of Chinese economy, highway and railway construction has gradually extended to the mountainous regions. At the same time, the number and scale of engineered slopes have surged, bringing into prominence the engineering and environmental problems caused by such slopes. The late 1990s saw the peak of such developments when the construction of expressways in the mountainous regions made a quantum leap. The number, scale, complexity in types and difficulty of construction of the high slopes involved in road construction caught worldwide attention.

In order to share China's experience and achievements in highway and railway engineered slope construction with the world, the editorial committee has selected typical cases of highway and railway engineered slopes, and compiled Book of Engineered Slopes in China (Highway and Railway Engineering Volume) to coincide with the 10th International Symposium on Landslide and Engineered Slopes to be held in June 2008, China.

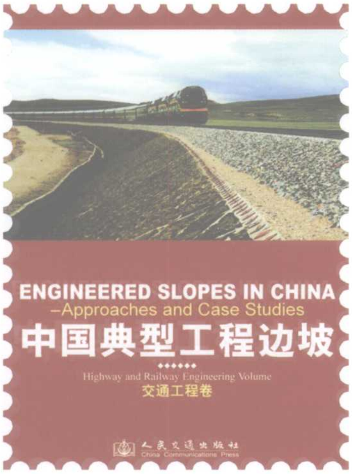
This book consists of three parts. In part one (Chapter 1), the development of highway and railway slope engineering in China is reviewed and evaluated. In part two (Chapter 2), typical cases of engineered slopes in the construction of highways and railways in mountainous areas are illustrated. In part three (Chapters 3, 4 and 5), engineered slopes on highways and railways in the unique loess, frozen soil, and desert regions in China are shown respectively.

The book was sponsored by an open fund from the Key Laboratory on Road Engineering in Frozen Soil Regions, First Highway Consultant Co., Ltd (FHCC). It was organized and compiled by FHCC and Northwest Research Institute Co., Ltd. of China Railway Engineering Corporation. The book was checked by YU Wenxue, WANG Chuanren, XIE Yongli. Professor ZHAO Yongguo worked hard and made considerable contribution to this book in research and editing.

It is grateful to the units and individuals who provided relevant information during the compilation of this book. The book has also cited research results and data of researchers at home and abroad. We would like to express our gratitude to all the experts who have made this publication possible.

Editorial Committee

18 August 2007



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第Ⅰ章　中国公路与铁路工程边坡的历史与现状

Chapter Ⅰ Development of Highway & Railway Engineered Slopes

公路和铁路都是具有一定空间几何标准的线状工程，受山区地质、地貌条件的限制和公路、铁路几何标准的制约，山区筑路不可避免地要切割山体或对既有边坡灾害进行整治，从而形成大量的工程边坡。20世纪50年代以来，伴随着中国经济的快速发展、丘陵和山区的开发利用、铁路与公路向山区延伸，边坡稳定问题变得日益突出，相应地其理论研究和防治工程技术也得到迅速发展。其发展演变具有以下几个特点：

（1）在建设规模上，经历了由少到多、单体规模由小到大的迅速扩张，并形成两个高峰期：一个是20世纪50～60年代以宝成铁路、川藏公路等为代表的一大批山区公路、铁路建设形成的工程边坡；另一个是20世纪90年代以来，大量山区高速公路建设所形成的工程边坡。

（2）在治理理念上，经历了由“先破坏后治理”→“一次根治、不留后患”→“预防为主、综合治理”的转变，人地关系日趋和谐。

（3）在防护加固形式上，经历了由“少防护或无防护”→“以高大圬工混凝土或浆砌工程防护为主”→“刚柔结构相结合、多层防护与生态植被防护相结合”的演变，防护体系日趋完善。

（4）特殊复杂高边坡的勘察设计和监测、测试技术日益成熟。主要表现是普遍重视了针对高边坡的工程地质勘察工作，基于综合监测、测试获取的信息进行“动态设计、信息化施工”。

Highway and railway structures are linear constructions with spatial and geometrical specifications. Due to geological topographical and road geometry constraints, road construction in mountainous areas requires slope cutting or treatment of existing failed slopes, giving rise to a large number of engineered slopes along the highway. With the rapid development of the Chinese economy since the 1950s, hilly and mountainous areas have been developed and railways and highways have been extending into these regions. This highlighted the issue of slope stability and gave impetus to relevant theoretical research and prevention and control technology. Several characteristics of development are presented as follows.

(1) In terms of scale of construction, it has gone from less to more, and from single entities to rapid expansion, culminating in two peak periods. The first period was from 1950s to 1960s, when a large number of engineered slopes came into being as a result of highway construction in mountainous areas, representative projects being the Baoji-Chengdu Railway and the Sichuan-Tibet Highway. The second period was from the 1990s onwards, when the construction of expressways in mountainous areas gave rise to large numbers of engineered slopes.

(2) With regard to treatment approach, it has evolved first from “damage followed by treatment” into “radical treatment once and for all”, and then into “protection and comprehensive treatment”, which makes for a more harmonic relationship between man and land.

(3) In terms of protection measures, they have gone from “little or no protection” to “mainly massive concrete or mortared rubble masonry structures”, and “more recently to a combination of rigid and flexible structures by using multi-layered protection and vegetation”. Protection systems are being perfected all the time.

(4) Survey design, monitoring and testing techniques for special and complex high slopes are becoming more sophisticated each day. It is shown in the general emphasis placed on the geological investigation of these slopes, and the implementation of “dynamic design and informed construction” based on information obtained from comprehensive monitoring and testing.

■ 20世纪50年代，国家物流急需铁路大干快上，宝（鸡）成（都）铁路、陇海铁路宝鸡至天水段、鹰（潭）厦（门）铁路等山区铁路相继开工建设，经验不足、技术薄弱等导致在铁路建设中发生众多边坡失稳变形和古滑坡复活，影响久远。如宝成铁路全长669km，沿线共发生比较严重的边坡病害447处，个别高边坡病害历经30多年才得到根治。

■ In the 1950s, in order to meet national logistic requirements, there was large-scale and rapid construction of railways such as the Baoji-Chengdu Railway, the Long-Hai Railway extension from Baoji to Tianshui, and the Yingtan-Xiamen Railway. Due to inadequate experience and poor techniques available that time, road construction led to instability and deformation of many slopes and the revival of fossil landslides. This remained problematic for a long time. For instance, the Bao-Cheng Railway, with a total length of 669km, experienced 447 slope failures. Some high slope failures were only resolved after more than 30 years.

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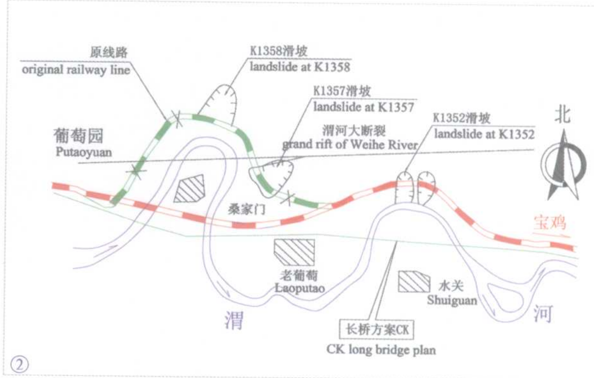

图1.1　陇海铁路宝鸡至天水段被誉为中国铁路的"盲肠"。1963年发生K1358滑坡(左)，1981年发生的K1357高速远程滑坡(右)使渭河断流。为彻底避开滑坡危害，不得不两跨渭河改移线路。

Fig 1.1 The Long-Hai Railway extension from Baoji to Tianshui is named the "caecum" of Chinese railway. A slide took place in 1963 at milestone K1358 (left side in the figure). A high-speed landslide (right side) in 1981 had a far runout distance and blocked the Weihe River. To avoid further slides, two railway bridges were built across the Weihe River as a diversion.

■20世纪50～70年代，川藏公路、新藏公路、天山公路等国家干线公路相继建设，受当时经济条件的制约，公路路线平纵指标较低，路基填挖规模一般较小，公路沿线的边坡以自然坡面为主，边坡基本不做防护，主要靠后期养护、抢修维持通行，公路抗灾能力较差，许多路段或因地质灾害多发，或因人工开挖（填筑）破坏而留下诸多边坡隐患。

■ From the 1950s to 1970s, the Sichuan-Tibet Highway, Xinjiang-Tibet Highway and Tianshan Highway were constructed successively. Due to economic constraints, the alignment standard of the highways was low, and road base excavations were generally small-scale. The slopes along the highways were primarily natural slopes with little protection, relying mainly on subsequent maintenance and repair to keep the roads clear, and were more failure prone. As a result, many road segments became problematic due to frequent geological disasters, or damage by excavation (cut and fill).

新藏公路K149段

K149 section in Xinjiang-Tibet highway

图1.2　穿行于西昆仑山区峡谷地带的新藏公路，常因边破坍塌、坠石及路基水毁而断道。(童海刚　摄)

Fig 1.2 A section of the Xinjiang-Tibet Highway through the west Kunlun valley is often blocked by slope collapse, rock fall and pavement erosion. (TONG Haigang)

川藏公路大柏牛崩塌 *Daboniu rock avalanche in Sichuan-Tibet highway*

图1.3 川藏公路前龙段在修建和改造过程中，以切坡方式通过岩性破碎、构造复杂的区域，引发了大规模的边坡病害群。（王传仁 摄）

Fig 1.3 The Sichuan-Tibet Highway passed through a slope composed of crushed rocks in the Qianlong section. Large-scale landslides were induced .(WANG Chuanren)

■ 20世纪60年代以来，中国铁路建设认真汲取了宝成线等山区铁路建设中的经验和教训，采取了"预防为主"的原则，在选线阶段采用较多的隧道和桥梁方案而避免了大量的高边坡工程，并总结提出了"治早治小"、"一次根治、不留后患"的经验，出现了以抗滑桩、锚杆挡墙为代表的新型支挡结构以及桩墙结合、桩隧结合、桩板结合的边坡病害治理结构。

■ Since the 1960s, based upon the experience gained in the construction of the Baoji-Chengdu Railway in the mountainous areas, railway construction in China has adopted the principle of "prevention over cure", giving preference to schemes comprising more tunnels and bridges at the route planning stage to avoid too many high-rising slopes. With the adoption of the principles of "A stitch in time saves nine" and "radical treatment once and for all", various structures have been used to protect slopes: new support structures such as slope stabilizing piles and anchored retaining walls, and comprehensive protection measures such as piles combined with retaining walls, piles combined with tunnels and pile combined with plates.

图1.4 襄（樊）渝（重庆）铁路赵家塘滑坡为巨型深层基岩滑坡。采取抗滑桩和抗滑挡土墙整治，抗滑桩最大截面为4.5m × 7.5m，最大桩长47m。

Fig 1.4 A large-scale landslide took place at Zhaojiatang, Xiang-Yu Railway, which was a typical deep slide in the bedrock. Slope stabilizing piles and Antiskid retaining walls were used to repair the slope. The piles have a maximum cross section of 4.5 m × 7.5 m, and a maximum length of 47 m.

图1.5　西安至南京铁路岭底滑坡为一处于不稳定状态的巨型老滑坡。采取桩板复合结构整治，抗滑桩截面 3.5m × 3.5m，桩长 21 ~ 30m，桩间设置挡土板。

Fig 1.5　A massive fossil landslide took place on an unstable slope at Lindi, Xi'an-Nanjing Railway. The slope was repaired by a combination of piles and plates. The slope stabilizing piles have a cross section of 3.5 m × 3.5 m, and a length of about 21~30 m. Retaining plates were installed between the piles.

图1.6　渝（重庆）怀（化）铁路武隆纸厂滑坡为一巨型堆积层滑坡。铁路采用隧道穿越滑坡中部。采用抗滑桩、抗冲刷挡土墙及河岸防护工程综合整治滑坡。

Fig 1.6　A huge scale deposit landslide took place near Wulong Paper Workshop, Yu-Huai Railway. A tunnel was cut through the middle part of the landslide, and comprehensive measures were taken to protect the slope, namely slope stabilizing pile, erosion resistant retaining walls and embankment protection buildings.

■20世纪90年代以来，中国高速公路建设迅猛发展并逐步向山区延伸，其标准高、路幅宽，尽管有的路段桥隧比例已占路线的30%以上，但仍在工程建设中形成了大量的高陡边坡。而这些高边坡当中稳定性差和不稳定的高边坡占了较大比例。高速公路高边坡问题在20世纪中后期成为一个非常具有中国特色的重大工程地质问题。

■Since the 1990s, the construction of expressways in China has progressed at great speed and has gradually extended to mountainous areas. The construction standards are high and the road surfaces are wide. Although bridges and tunnels already account for over 30% in certain road sections, many high slopes have nevertheless been formed. Among these slopes, most are unstable. The highway slope problem had become a major geological engineering issue for China by the latter half of the 20th century.

图1.7　某山区高速公路路堑高边坡在施工中发生滑坡，已施工的防护工程遭到破坏。

Fig 1.7　A landslide on expressway during construction, damaging protection structures already in place.

■传统的边坡的防护多以工程防护措施为主，且多采用混凝土或浆砌高挡墙、护坡、护面墙以及喷浆(混凝土)、锚杆挂网喷浆(混凝土)等进行大段落防护，边坡人工痕迹明显，与周围环境的协调性差。

■ Conventional slope protection often turns to engineering protection measures. In most cases, concreted or mortared retaining walls, slope covers, face wall covers and grouting, or shotcrete and anchors are used in large stretches, resulting in an obtrusively artificial look not in harmony with its surroundings.

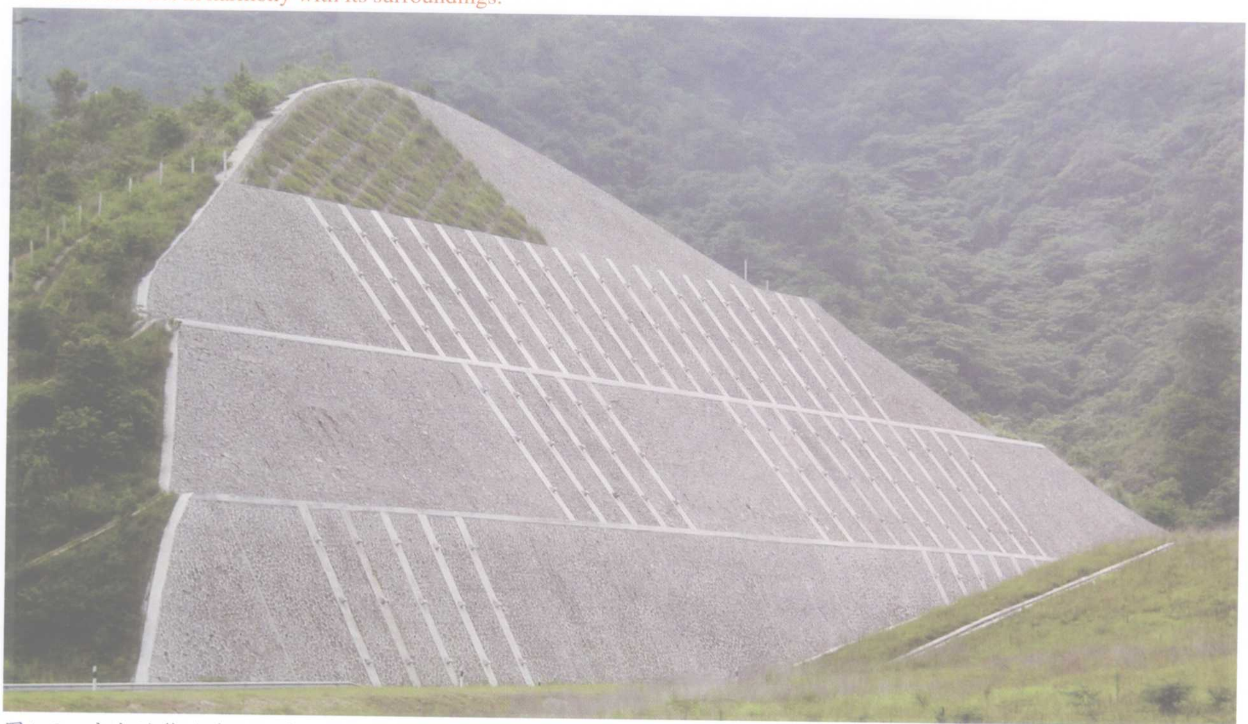

图1.8　高大的浆砌片石护坡工程尤显突兀，与周围环境极不协调。(王园　摄)

Fig 1.8　This high-rising mortar rubble masonry work for slope protection appears particularly obtrusive against the backdrop of its surroundings. (WANG Yuan)

图1.9　高大、突显的路侧桩、墙支挡结构显得厚重、压抑。(朱聪功　摄)

Fig 1.9　This large and obtrusive roadside pile and retaining structure look massive and oppressive. (ZHU Conggong)

① 与周围绿色环境极不协调 *Incompatible with the green surroundings*

② 局部剥落 *Localized collapse*

图 1.10　20世纪90年代中后期曾一度流行的喷浆（混凝土）、锚杆挂网喷浆（混凝土）防护对环境破坏较大，不仅使坡面缺乏生机，且易开裂、剥落，耐久性差。（焦臣　摄）

Fig 1.10 Shotcrete and anchor and shotcrete protection popular during the mid to late 1990s have caused relatively more damage to the environment. Slopes surfaces lack life, easy to crack and peel,are of poor durability. (JIAO Chen)

■20世纪后期以来，中国交通行业将如何有效预防边坡失稳和造成灾害作为重要研究课题广泛深入地开展了研究，取得了显著成效，主要表现在：公路建设中普遍贯彻“地质选线”原则，绕避严重地质不良路段；强化对高边坡的综合工程地质勘察与评价，对潜在不稳定边坡采取“预加固”措施；控制路基填挖高度，尽可能地减少高边坡数量，降低边坡高度；边坡防护注重工程防护与生态植被防护相结合。

■Ever since the late 20th century, communication construction industries in China have carried out extensive and rigorous research on the prevention of slope instability and slope disasters with outstanding results. The achievements include upholding the principle of “geological considerations” in the choice of routes, avoiding imperfect geologic sections. Secondly, integrated geotechnical investigation and assessment of slopes are being enhanced, applying “proactive reinforcement”to potentially unstable slopes. Thirdly, the height of excavation of road bases is being controlled, the number of high slopes and the height of slopes are being reduced. Lastly, the integration of engineering protection and vegetation slope protection is favoured.

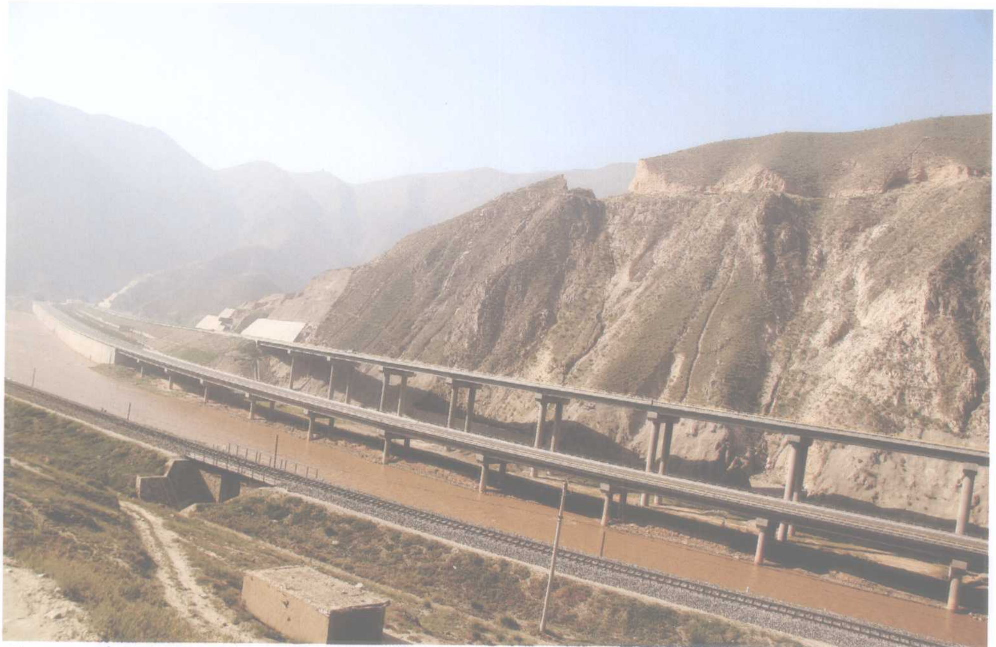

图1.11　青海马场垣至西宁高速公路利用竖向分离式路基、半桥半路及顺河纵向桥避免了因深挖而破坏原已稳定的天然边坡。(韩文宪　摄)

Fig 1.11　Vertical separated roadbeds, and a road-bridge generally parallel to the river were exploited to avoid failure of stable natural slopes by deep cutting on the expressway from Machangyuan, Qinghai to Xining. (HAN Wenxian)

图1.12　重庆渝黔高速公路采用半隧半路绕避边坡病害。(邓卫东　摄)

Fig 1.12　Tunnel-roads were used to avoid slope problems on the Express way from Chongqing to Guizhou. (DENG Weidong)

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