JTG

Industry Standards of
the People's Republic of China
中华人民共和国行业标准

JTG 5210—2018(EN)

Highway Performance Assessment Standard

公路技术状况评定标准

(英文版)

Issued date: December 25, 2018 Effective date: May 1, 2019

Issued by Ministry of Transport of the People's Republic of China

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Editing organization for English version: China Road and Bridge Corporation

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中华人民共和国交通运输部

公　　告

第10号

交通运输部关于发布《公路工程质量检验评定标准 第一册　土建工程》英、法文版等4项公路工程行业标准外文版的公告

为促进公路工程行业标准的对外交流，现发布《公路工程质量检验评定标准 第一册 土建工程》英文版[JTG F80/1—2017(EN)][代替标准号JTG F80/1—2004(E)]及其法文版[JTG F80/1—2017(FR)]、《公路路基路面现场测试规程》英文版[JTG 3450—2019(EN)][代替标准号JTG E60—2008(E)]、《公路技术状况评定标准》[JTG 5210—2018(EN)]。

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特此公告。

中华人民共和国交通运输部

2022年1月18日

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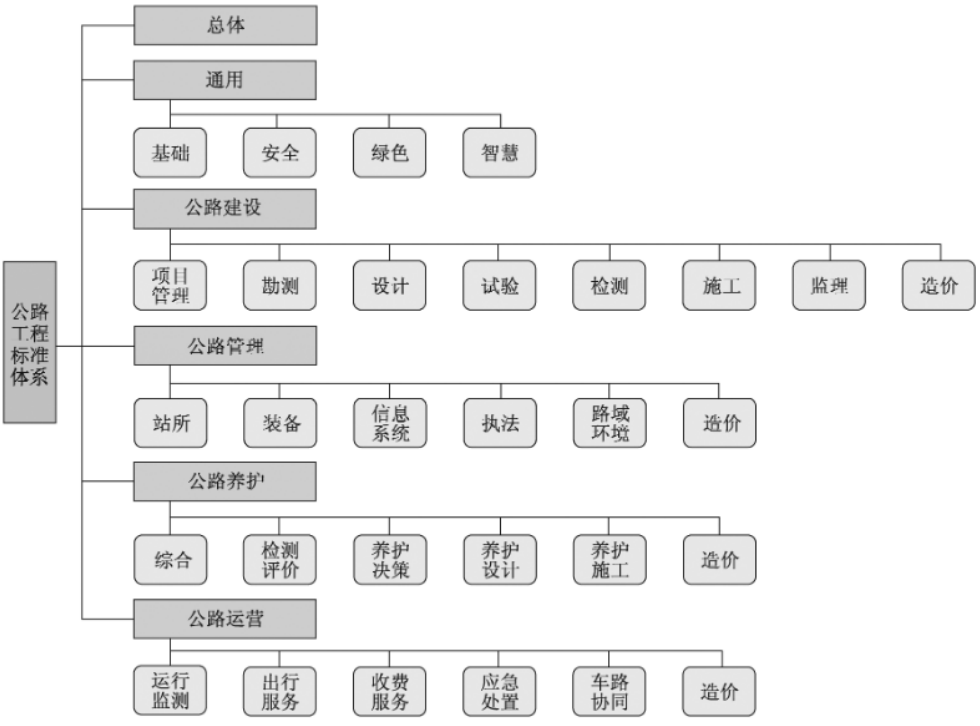
英文版编译出版说明

标准是人类文明进步的成果，是世界通用的技术语言，促进世界的互联互通。近年来，中国政府大力开展标准化工作，通过标准驱动创新、合作、绿色、开放的共同发展。在“丝绸之路经济带”与“21 世纪海上丝绸之路”，即“一带一路”倡议的指引下，为适应日益增长的全球交通运输发展的需求，增进世界连接，促进知识传播与经验分享，中华人民共和国交通运输部组织编译并发布了一系列中国公路行业标准外文版。

中华人民共和国交通运输部发布的公路工程行业标准代号为 JTG，体系范围包括公路工程从规划建设到养护管理全过程所需要制定的技术、管理与服务标准，也包括相关的安全、环保和经济方面的评价等标准。



《公路技术状况评定标准》是公路工程标准体系的重要组成部分。2007 年，为了满足路况检测自动化、路况评定信息化和养护管理规范化的现代化公路养护发展需要，交通运输部发布了《公路技术状况评定标准》（JTG H20—2007），用以替代 1994 年发布实施的路况调查评价主要依靠人工的《公路养护质量检查评定标准》（JTJ 075—94）。2018 年，为全面推动中国公路养护管理高质量发展，交通运输部发布了修订的《公路技术状况评定标准》（JTG 5210—2018），进一步丰富了路况检测的指标体系和评定方法。

《公路技术状况评定标准》实施长达 10 年之久，在此期间中国公路养护发生了巨大变化，公路路况基本实现了主要指标的全自动化检测，年度路况检测与评定里程超过了 40 万公里，国省干线公路基本实现了路况检测自动化和路况评定信息化全覆盖。《公路技术状况评定标准》大规模工程化应用，从根本上改变了 21 世纪初以前人工路况调查评价的传统模式，路况自动化检测与科学评定能力显著提升，公路养护科学决策体系基本形成，标准的发布实施有力地促进了中国公路养护管理的科技进步。

本英文版的编译工作由中华人民共和国交通运输部委托中国路桥工程有限责任公司主持完成，并由中华人民共和国交通运输部公路局组织审定。

本英文版标准的内容与现行中文版一致，如出现异议时，以中文版为准。

感谢中文版主编潘玉利先生、曹江先生在本英文版编译与审定期间给予的指导与支持。

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The People's Republic of China
Ministry of Transport
Public Notice

No. 10

Public Notice for Issuing the English version of the *Standards for Quality Inspection and Verification of Highways*, *Part 1*: *Civil Engineering Works*, and three other international versions of the Highway Transportation Industry Standards

For international cooperation and standardization of the highway transportation industry, four international versions of the Highway Transportation Industry Standards (JTG) are issued hereby:

(1) the English version of the *Standards for Quality Inspection and Verification of Highways*, *Part 1*: *Civil Engineering Works* [JTG F80/1—2017 (EN)], to replace its former edition [JTG F80/1—2004 (E)];

(2) the French version of *Standards for Quality Inspection and Verification of Highways*, *Part 1*: *Civil Engineering Works* [JTG F80/1—2017 (FR)];

(3) the English version of *Field Test Methods of Highway Subgrade and Pavement* [JTG 3450—2019 (EN)], to replace its former edition JTG E60—2008 (E); and

(4) the English version of *Highway Performance Assessment Standards* [JTG 5210—2018 (EN)].

The general administration and final interpretation of the Highway Performance Assessment Standards belong to Ministry of Transport of the People's Republic of China, while particular interpretation for application and routine administration of the international version of these Standards shall be provided by the China Road and Bridge Corporation.

Comments, suggestions and inquiries are welcome and should be addressed to the China Road and Bridge Corporation (Address: C88, Andingmenwai Dajie, Beijing, Postal Code: 100011, email: kjb@crbc.com). The feedback will be considered for future revisions.

It is hereby announced.

Ministry of Transport of the People's Republic of China

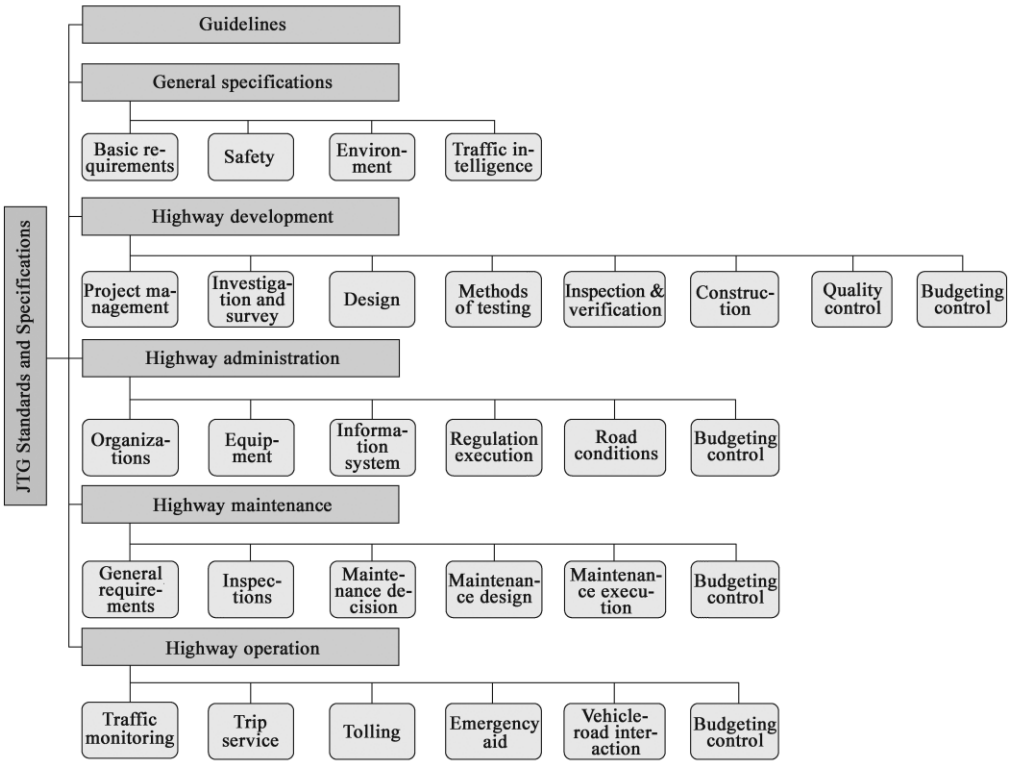
January 18, 2022

General Office of Ministry of Transport Printed on January 19, 2022

Introduction to English Version

Standards reflect the achievement of civilization, provide common language for technical communications, and improve global connectivity. In recent years, the Chinese government has been proactively implementing a strategy on standardization to stimulate innovation, coordination, greening, opening up and sharing for reciprocal development in China and worldwide. In the light of mutual development along the Silk Road Economic Belt and the 21st-Century Maritime Silk Road (so called 'the Belt and Road Initiative'), the Ministry of Transport of the People's Republic of China organized translation and published an international version of the Chinese transportation industry standards and specifications to cater for the increasing demands for international cooperation in world transportation, achieve interconnected development and promote knowledge dispersion and sharing experience.

JTG is the designation referring to the standards and specifications of the highway transportation industry, issued by the Ministry of Transport of the People's Republic of China. It covers the standards and specification in terms of technology, administration and service for the process from highway planning through to highway maintenance. The criteria for safety, environment and economic assessment are also included.



The Highway Performance Assessment Standard is one of the important component parts in the JTG Highway Transportation Standards system. In 2007, the Ministry of Transport issued the first edition of the Highway Performance Assessment Standard (JTG H20-2007) to cope with the demands for automated highway condition survey, computer aided highway performance assessment, and effective highway maintenance, and to supersede the former JTJ 075-94 Standards for Inspection and Evaluation of Highway Maintenance that was based on visual inspection and manual survey. The original Chinese version of this edition is renamed as JTG 5210-2018 according to the new coding system of the JTG Standards and was published in 2018 as an update and extension of JTG H20-2007.

In the last decade since the implementation of the JTG H20-2007: Highway Performance Assessment Standard, the technology and practice of highway maintenance in China has been significantly developed. Full automation has been widely accepted, based on which more than 400,000 kilometers of highways have been surveyed annually for their pavement condition and assessed for their performance. Currently automated condition survey and computerized performance assessment

have been effectively applied to all of the national and provincial trunk roads in China. As a result of the successful implementation of the Highway Performance Assessment Standard, a fundamental change to the traditional way of visual inspection and subjective assessment of highway maintenance, and this increased the capacity of automated survey and objective assessment, and thus contributed to the establishment of an effective decision-making system. The updating and implementation of this Standard will lead to the continuous improvement in maintenance technology and administration in China.

The original version of the standard is in the Chinese language, which was updated in 2018 and taken into effective use on May 1, 2019. The translation and updating of the English version were conducted by China Road and Bridge Corporation under the authorization of Ministry of Transport, China and approved by the Highway Department of MOT China.

The contents and numbering of the chapters, sections, clauses and sub-clauses in the English version are exactly the same as those in the Chinese version. In event of any ambiguity or discrepancies, the Chinese version should be referred to and accepted.

Appreciation is extended to Mr. Pan Yuli and Mr. Cao Jiang, the Editors in charge of the Chinese version, for the valuable assistance and suggestions during the editing and reviewing of the English version.

Comments , suggestions and inquiries are welcome and shall be addressed to the editing organization in charge of the English version: China Road & Bridge Corporation (Address: 88C Andingmenwai Dajie, Postal Code: 100011, E-mail: crbc@crbc.com). The feedbacks shall be taken into account in future editions.

Editing organization for English version：
China Road and Bridge Corporation

Chief editor for English version： Yao Haidong

Foreword to Chinese Version

Authorized by Ministry of Transport of China, the Research Institute of Highways (RIOH) MOT is responsible for the updating this standard.

The former edition of this Standard, known as JTG H20—2007: *Highway Performance Assessment Standards*, has played an outstanding role in highway technology development, setting quality standards and improving service of highway maintenance administration since its issue in 2007. Since then the scale of highway maintenance and demand for highway traveling have rapidly increased as the Chinese economy booms, which in turn requires the further development and updating of this Standard. Based on the experience in highway performance assessment, the innovative technology and methodology, and the results of research projects, this edition updates the methodology, appraisal system, model and parameters of highway performance assessment, as well as relevant provisions.

After fully updating JTG H20—2007: *Highway Performance Assessment Standard*, this edition comprises seven chapters, namely General Provisions, Terms and Definitions, Highway Maintenance Quality Indicator, Rating of Highway Performance, Type of Road Defects, Highway condition survey and Inspection, Highway Maintenance Quality Assessment.

(1) Provisions for gravel surfaced pavements have been deleted;

(2) Two technical indices, Pavement Bumpiness Index and Pavement Wear Index have been added;

(3) Adjustment has been made to the classification criteria for rating of indicators in terms of Motorway pavement and cement concrete pavement

(4) Provisions for automated pavement survey and calculation methods of pavement

distress ratio have been added;

(5) Three statistical ratings, namely ratio of excellent, ratio of good and ratio of poor, and the methods of their calculation have been added;

(6) The model and parameters for Pavement Rut Depth Index have been updated;

(7) Adjustment to the criteria of weighting and deduct score has been made to some of the indices;

(8) Method for calculating Pavement Bumpiness Index has been added;

(9) The method for calculating the standard values of pavement deflection has been added.

Chapters 1, 2, 3, and 4 of this Standard were drafted by Mr. Pan Yuli, Chapter 5 was written by Zhao Baoping, Shu Senand Yan Fei, Chapter 6 was written by Chao Jiang, Xue Zhongjun, Le Qiang, and Chapter 7 was written by Zhang Chen, Hou Yun, and Wang Haoyang, and Appendix A was drafted by Chao Jiang, Appendix B drafted by Li Liping, and Appendix C drafted by Hou Yun.

Inquiries, suggestions and comments for further and continuous improvement in highway performance assessment should be sent to National Engineering Research Center of Road Maintenance Technologies (Add.: No. 9, Dijin Road, Haidian District, Beijing, China, Post Code: 10009; Telephone: + 86-10- 82364026; Email: MQI@ roadmaint.com; Contact persons: Cao Jiang, Zhang Chen.)

Editing organization in charge:

Research Institute of Highways, Ministry of Transport

Associate editing organizations:

National Engineering Research Center of Road Maintenance Technologies
Highway Administration of Jiangsu Provincial Department of Transport
Hebei Provincial Motorway Administration
Beijing Metropolitan Highway Construction Quality Supervisory Office
China Highway Engineering Consulting Corporation
Shaaxi Provincial Highway Administration

Contents

1 General Provisions

1.0.1 This Standard is formulated to provide an objective method for highway performance assessment.

1.0.2 This Standard is applicable to classified highways.

1.0.3 Pavement condition survey and highway performance assessment shall be guided by the principles of objectivity, rationality and efficiency, and shall be conducted by advanced and reliable methods.

1.0.4 Besides this Standard, the pavement condition survey and highway performance assessment shall conform to relevant provisions in prevailing national and industry standards.

2 Terms and Definitions

2.0.1 Highway Maintenance Quality Indicator 公路技术状况指数

Indicator used for comprehensive assessment of maintenance quality of highway subgrade, pavement, structural works and traffic safety devices.

2.0.2 Pavement maintenance quality index 路面技术状况指数

The index is used for the comprehensive assessment of maintenance quality in terms of pavement distress, pavement roughness, pavement rutting, pavement bumps, pavement wear, pavement skid resistance, and pavement structural strength.

2.0.3 Pavement bumpiness 路面跳车

Vehicles bounce on theroad due to pavement distresses such as depression or upheaval, or both.

2.0.4 Pavement wear 路面磨耗

The wear and tear of the pavement surface.

3 Highway Performance Assessment Indicator

3.0.1 The performance of a highway shall be assessed by Highway Maintenance Quality Indicator (MQI), and a set of indices, namely Subgrade Condition Index (SCI), Pavement Maintenance Quality Index (PQI), Bridge, Tunnel and Culvert Condition Index (BCI) and Traffic Facility Condition Index (TCI).

3.0.2 The assessment of pavement condition shall be conducted by Pavement Maintenance Quality Index (PMI), and a sub-set of indices such as Pavement Surface Condition Index (PCI), Pavement Riding Quality Index (RQI), Pavement Rut Depth Index (RDI), Pavement Bumpiness Index (PBI), Pavement Surface Wear Index, (PWI), Pavement Skid Resistance Index (SRI) and Pavement Structural Strength Index (PSSI)

3.0.3 The indicator system for highway performance assessment is shown in Fig. 3.0.3. The value of the Highway Maintenance Quality Indicator (MQI) and its subsidiary indices shall be within a range of 0 to 100.

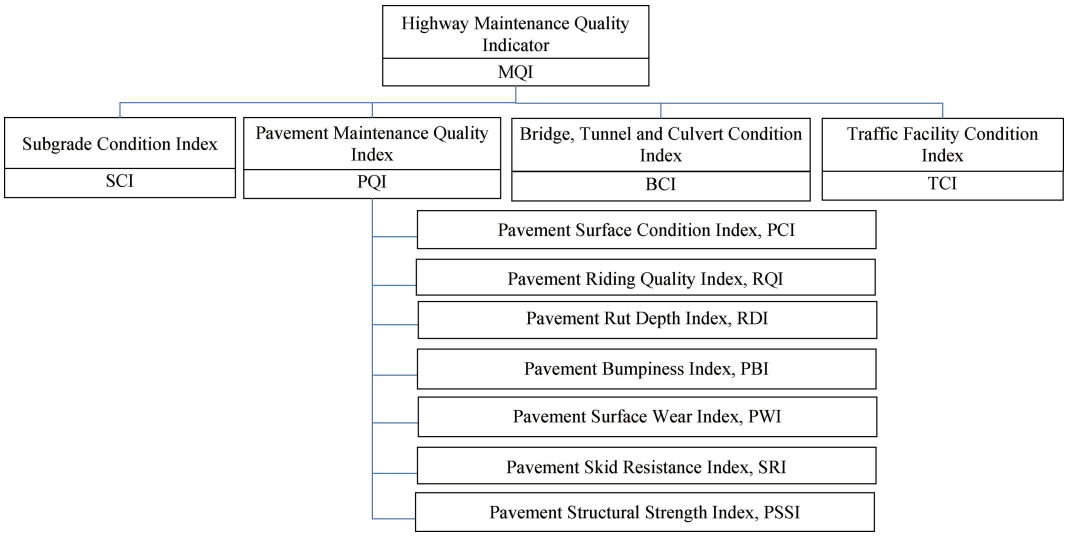


Figure 3.0.3 Structure of highway performance indicator system

4 Rating of Highway Performance

4.0.1 Highway performance shall be assessed in terms of five levels, namely excellent, good, average, poor, and bad, as shown in Table 4.0.1.

Table 4.0.1 Highway Performance Rating

Indicator	Excellent	Good	Average	poor	failed
MQI	≥90	≥80, <90	≥70, <80	≥60, <70	<60

4.0.2 The rating of each index for highway performance assessment shall be divided into five categories, namely excellent, good, average, poor and failed, as shown in Table 4.0.2.

Table 4.0.2 Rating Highway Performance Index

Index	Excellent	Good	Average	Poor	Failed
SCI、PQI、BCI、TCI	≥90	≥80, <90	≥70, <80	≥60, <70	<60
PCI、RQI、RDI、PBI、PWI、SRI、PSSI	≥90	≥80, <90	≥70, <80	≥60, <70	<60

Note: 1. For the Pavement Surface Condition Index, PCI, of Motorways, the rating 'Excellent' shall be assigned where the assessment marks are greater than or equal to 92, rating 'Good' shall be assigned for the marks between 80 and 92; and for the other rating, the required marks are the same as listed in the Table 4.0.2.

2. For the Riding Quality Index, RQI, of a cement concrete pavement, rating 'Excellent' corresponds to the assessment marks greater than or equal to 88, rating 'Good' to the marks between 80 and 88, and for the other ratings the required marks are the same as listed in Table 4.0.2.

5 Types of Road Defects

5.1 Subgrade

5.1.1 The types of defects in the shoulders of an asphalt pavement shall conform to Table 7.4.5-1. The types of defects in the shoulders of a cement concrete pavement shall conform to Table 7.4.5-2. All defects in road shoulders shall be measured as an area, for which 1 m^2 shall be used if the cumulative area is equal to or less than 1 m^2. The severity of a shoulder defect shall be determined according to the following criteria:

1 'Slight' shall refer to the slight and moderate defects listed in Tables 7.4.5-1 and 7.4.5-2.

2 'Serious' shall include the serious defects listed in Tables 7.4.5-1 and 7.4.5-2.

5.1.2 Side slope failure shall refer to a partial sliding of the side slope due to the surface raveling or cracking of a foreslope or backslope, which shall be counted as the number of occurrences. The severity of defection in the side slopes shall be assessed according to the criteria as follows:

1 'Slight' shall refer to a side slope failure over a length of less than 5m.

2 'Moderate' shall refer to a side slope failure over a length between 5m to 10m.

3 'Serious' shall refer to a side slope failure over a length greater than 10m.

5.1.3 An erosion gully shall refer to a deep ditch cut by surface water runoff, which shall be counted as the number of places. The severity of erosion gully defects shall be assessed according to the criteria as follows:

1 'Slight' shall refer to an erosion gully with a depth less than 20cm.

2 'Moderate' shall refer to an erosion gully with a depth between 20 and 50cm.

3 'Serious' shall refer to an erosion gully with a depth more than 50cm.

5.1.4 The defects in the earthwork structure shall refer to surface defects, partial damage or structural defects to concrete or masonry works, and shall be counted as the number of places. The severity of defection in the earthwork structures shall be assessed according to the criteria as follows:

1 'Slight' shall refer to the damage to masonry pointing or settlement joints, surface breakage, steel bar exposure or steel rusting, of which every 10m or less shall be counted as one place of defects.

2 'Moderate' shall refer to a partial void beneath a foundation or behind a wall, and slight cracking, bulging or depression, of which every 10m or less shall be counted as one defectiveplace.

3 'Serious' shall refer to the all-through cracking and overall tilting, sliding, or collapsing.

5.1.5 Defects in curbs shall refer to curb blocks missing or broken, and shall be measured in meters of length.

5.1.6 Embankment settlement shall refer to the settlement in a depth greater than 30mm, which shall be counted as the number of occurrences. The severity of embankment settlement defects shall be assessed according to the criteria as follows:

1 'Slight' shall refer to the subgrade embankment settlement over a length less than 5m.

2 'Moderate' shall refer to the subgrade embankment settlement over a length between 5m and 10m.

3 'Serious' shall refer to the subgrade embankment settlement over a length greater than 10m.

5.1.7 Poor drainage shall refer to the clogging in a side drain, discharge drain or interceptor drain, which shall be counted as the number of places. The severity of distress shall be assessed according to the criteria as follows:

1 'Slight' clogging shall refer to the existence of debris and trash lodged in a side drain, discharge drain or an interceptor drain, of which every 10m or less shall be counted as one defected place.

2 'Moderate' clogging shall refer to the blockage of the whole cross-section with peeling or breaking of the lining, breaking of concrete or masonry structure, or damaged pipe barrels, of which every 10m or less shall be counted as one defected place.

3 'Serious' clogging shall refer to failure of the connection of the road drainage system to the exterior drainage systems.

5.2 Asphalt pavement

5.2.1 Alligator cracking shall be measured as an area. The severity of alligator cracking defects shall be assessed according to the criteria as follows:

1 'Slight' refers to the cracked pavement where the sizes of most polygon pieces are about 0.2 to 0.5m and the average width of the cracks is less than 2mm.

2 'Moderate' refers to the cracked pavement where the sizes of most polygon piecesare smaller than 0.2m and the average width of the cracks is between 2 to 5mm.

3 'Serious' refers to the cracked pavement where most polygon pieces is smaller than 0.2m, and the average width of the cracks is greater than 5mm.

5.2.2 Block cracking shall be measured as an area. The severity of such defects shall be assessed according to the criteria as follows:

1 'Slight' to the cracked pavement where the sizes of most blocks are smaller than 1.0m and the average width of the cracks is between 1 to 2mm.

2 'Serious' refers to the cracked pavement where the sizes of most blocksare between 0.5 and 1.0m, and the average width of the cracks is greater than 2mm.

5.2.3 Longitudinal cracking refers to cracks in the pavement predominantly parallel to the direction of traffic. The length shall be measured in meters, and then converted to defected area using an effective width (0.2m). The severity of such defects shall be assessed according to the criteria as follows:

1 'Slight' refers to the main cracks with a width less than or equal to 3mm.

2 'Serious' refers to the main cracks with a width greater than 3mm.

5.2.4 Transverse cracking refers to cracks in the pavement that are predominantly perpendicular to the direction of traffic. The length of such a crack shall be measured in meter and then converted to defected area by using an effective width (0.2m). The severity of transverse cracking defects shall be assessed according to the criteria as follows:

1 'Slight' refers to the main cracks with a width less than or equal to 3mm.

2 'Serious' refers to the main cracks with a width greater than 3mm.

5.2.5 Depression refer to partial subsidence of the pavement, and shall be calculated as an area. The severity of such a defect shall be assessed according to the criteria as follows:

1 'Slight' refers to apavement depression between 10 and 25mm, which may not cause an obvious feeling of discomfort from the vehicle bouncing.

2 'Serious' refers to a pavement depression greater than 25mm, which may cause an obvious feeling of discomfort from the vehicle bouncing.

5.2.6 Rutting shall be measured in meter of length, and then converted to defected area by using an effective width (0.4m). The severity of rutting defects shall be assessed according to the criteria as follows:

1 'Slight' refers to ruts with a depth from 10mm to 15mm.

2 'Serious' refers to ruts with a depth greater than 15mm.

5.2.7 Shoving shall be calculated as an area. The severity of shoving defects shall be assessed according to the criteria as follows:

1 'Slight' refers to the waves of which the level difference between valleys and crests isbetween 10mm and 25mm.

2 'Serious' refers to the waves of which the level difference between valleys and crests is greater than 25mm.

5.2.8 Potholing shall be calculated as an area, and the severity of potholing defects shall be assessed according to the criteria as follows:

1 'Slight' refers to the potholes with a depth less than 25mm, or with an area smaller than0.1m^2.

2 'Serious' refers to the pothole with a depth greater than or equal to 25mm. or the area of a pothole is greater than or equal to 0.1m^2.

5.2.9 Raveling shall be calculated as an area, and the severity of raveling defects shall be assessed according to the criteria as follows:

1 'Slight' refers to the loss of fine aggregate, surface peeling, and surface pitting。

2 'Serious' refers to the loss of coarse aggregate, surface peeling, surface pitting, aggregateexposure, and delamination.

5.2.10 Bleeding (or flushing) refers to a thin asphalt membrane concentrated on the surface of an asphalt pavement, which shall be calculated as an area.

5.2.11 Patching refers to the repair of cracks, potholes, raveling, depressions, ruts or other defected places. A block patch shall be measured as an area, while a stripe patch shall be calculated as the measured length multiplied by an effective width. Any full lane repair over a length greater than 5m shall not be regarded as a pavement patching defect. Any defect within a previous patch shall be calculated according to the type of the new defect.

5.3 Cement concrete pavement

5.3.1 Slab breaking shall be measured as the whole area of the slab broken. The severity of defection shall be assessed according to the criteria as follows:

1 'Slight' refers to thesituation where a concrete slab breaks into 3 or more than 3 pieces, with neither raveling nor faulting.

2 'Serious' refers to the situation where a concrete slab breaks into 3 or more than 3 pieces with raveling, faulting or both.

5.3.2 Slab cracking refers to the situation that only one crack exists in a concrete slab, and shall be measured as a length in meters, and then converted into defective area by multiplying the effective width (1.0m). The severity of defection shall be assessed according to the criteria as follows:

1 'Slight' cracking refers to a crack with a width less than 3mm, which usually does not penetrate to the full slab thickness.

2 'Moderate' refers to a crack with a width between 3 and 10mm.

3 'Serious' refers to a crack with a width greater than 10mm.

5.3.3 Corner breaking refers to the defects where a crack intersects both longitudinal and transverse joints of the concrete slab, and the distance from either intersecting point to the corner point of the slab is less than or equal to half the length of the slab.

1 'Slight' refers to a corner crack with a width less than 3mm.

2 'Moderate' refers to a corner crack with a width between 3 and 10mm.

3 'Serious' refers to a corner crack with a width greater than 10mm.

5.3.4 Faulting refers to the level difference of the two sides of a joint. The length of faulting shall be measured in meters, and then converted to a defective area by using an effective width (1.0m). The severity of defection shall be assessed according to the criteria as follows:

1 'Slight' refers to a level difference between 5 and 10mm on the two sides of a concrete slab joint.

2 'Serious' refers to a level difference greater than 20mm on the two sides of a joint.

5.3.5 A blowup refers to the slab lifting more than 10mm, on both sides of a transverse crack or joint.

5.3.6 Joint spalling refers to breaking and delamination of the concrete slab adjacent to the edge of the joint, and the cracks are at a certain angle to the slab surface. The length of spalling shall be measured in meters, and then converted to defective area by using an effective width (1.0m). The severity of defection shall be assessed according to the criteria as follows.

1 'Slight' refers to minor edge breaking and delamination.

2 'Moderate' refers to edge breaking, delamination and a few cracks in the concrete parallel to and near the joint.

3 'Serious' refers to breaking, delamination and a number of cracks in the concrete near the joint with a depth deeper than the bottom of the joint.

5.3.7 Defective joint fillers shall be measured in lengths (m), and then converted to defective by using an effective width (0.1m). The severity of defection shall be assessed according to the criteria as follows:

1 'Slight' refers to filler materials that have deteriorated with failure of waterproof, but have not yet delaminated. There are no voids filled with debris such as sand, gravel, or soil.

2 'Serous' refers to filler materials over more than one third of the joints have been either lost or the voids filled with sand, gravel or soil.

5.3.8 Popouts refer to the holes or pits with a diameter greater than 30mm and a depth greater than 10mm on the slab surface. The severity of defect may be calculated by enveloping the area of a pothole or a group of potholes.

5.3.9 Pumping refers to soil slurry of base course materials that is ejected out through the slab joints with the passage of vehicles. The defection shall be measured as a length in meters, and then converted to a defective area by multiplying by the width of influence (1.0m).

5.3.10 Aggregate exposure refers to the loss of fine aggregate thus exposing the coarse aggregate, or surface raveling and delamination. The defection shall be measured as an area.

5.3.11 Patching refers to the repair of cracks, joint spalling, popouts or other defective areas. A block patch shall be calculated as an area, while a strip patch shall be calculated as the measured length multiplied by an effective width (0.2m). Any repair over a full lane over a length greater than 5m shall not be regarded as a patch of a defective pavement. Any defect that occurs within a previous patch shall be calculated according to the type a new damage.

5.4 Traffic safety devices

5.4.1 Defects in a protective device refer to missing, damaged or the non-conformity after the

repair of protective devices such as guardrails, falling object nets, noise barriers, movable median barriers and glare screens. The damage shall be calculated as the number of occurrences, and the severity of defection shall be assessed according to the criteria as follows.

1 'Slight' shall refer to a protective length less than 4m.

2 'Serious' shall refer to a defective length greater than 4m.

5.4.2 Defects in an isolation fence refers to the part of a fence that has been damaged or does not meet the technical requirements after repair. The defects shall be calculated as the number of occurrences.

5.4.3 Defective signs refer to the missing, misplacement or improper size, the color fading or surface contamination of various traffic signs such as guide and information signs, warning signs, prohibition signs, distance markers, delineators, as well as the breakdown of variable message signs. The defects shall be counted as the number of occurrences, for which three, or less than three in total, defective delineators or distance markers shall be counted as one occurrence.

5.4.4 Damage to road marking refers to missing or defective road markings (including raised ones). The defects shall be measured as the length in meters, and shall be counted as 10m if the total length is less than 10 m. The effects of multi-lanes shall not be taken into account for assessment.

5.4.5 Defective landscaping refers to withering or missing plants, grass and flowers, poor gardening and revegetation. The defects shall be measured as the length in meters, and shall be counted as 10m if the total length is less than 10m.

6 Highway Condition Survey and Inspection

6.1 General

6.1.1 Highway condition shall be surveyed and inspected in four parts, namely road subgrade, pavement, structural works and traffic safety devices. Pavement condition survey shall consider seven items, namely surface condition, riding quality, rut depth, bumpiness, surface wear, skid resistance and structural strength.

6.1.2 The typical unit for highway condition survey (or inspection) shall be a road section of 1000m long. However, this rule may not be applicable to a survey unit or an inspection unit which involves different types of pavements, traffic volumes, widths of pavement, or different maintenance contractors or authorities.

6.1.3 Highway condition survey and inspection shall be conducted in both forward (chainage increase) direction, and backward (chainage decrease) directions respectively, but may be conducted in one direction for Class-2, -3 and -4 highways.

6.1.4 Highway condition survey and inspection shall be conducted at a frequency as specified in Table 6.1.4

Table 6.1.4 Frequency of Highway condition survey and inspection

Indicators		Asphalt pavement		Cement concrete pavement	
		Motorway and Class-1 highway	Class-2, -3 & -4 highway	Motorway and Class-1 highway	Class-2, -3 & -4 highway
Pavement PQI	Surface condition	Once a year	Once a year	Once a year	Once a year
	Riding quality	Once a year	Once a year	Once a year	Once a year
	Rutting	Once a year			

continued

Indicators		Asphalt pavement		Cement concrete pavement	
		Motorway and Class-1 highway	Class-2, -3 & -4 highway	Motorway and Class-1 highway	Class-2, -3 & -4 highway
Pavement PQI	Bumpiness	Once a year		Once a year	
	Wear	Once a year		Once a year	
	Skid resistance	Once in 2 years		Once in 2 years	
	Structural strengh	As required	As required		
Subgrade SCI		Once a year			
Structural works BCI		As specified in current specifications			
Traffic safety devices TCI		Once a year			

Note: 1 Pavement structural strength is obtained by measuring a sample length of the road. The sample of the route or segment shall depend on the managerial needs for pavement maintenance. The sampling rate shall not be less than 20% of the maintenance kilometers scheduled in the highway network.

2 Pavement wear and pavement skid resistance are optional indicators; either may be selected for survey or inspection.

6.1.5 Manual inspection may be adopted for surveys on routes where automated survey is not suitable or not available, and where portable equipment should be used.

6.2 Survey and inspection of subgrade condition

6.2.1 Road subgrade condition may be detected by manual inspection or automated survey.

6.2.2 Road subgrade condition shall be inspected according to the types of defect specified in Section 5.1. The format of tables for road subgrade inspection is given in Appendix A, Table A-1.

6.3 Automated survey of pavement condition

6.3.1 The indicators of pavement condition by automated survey shall include pavement distress ratio (DR), international roughness index (IRI), rut depth (RD), pavement bumpiness (PB), mean profile depth (MPD), Sideways force coefficient (SFC) and pavement deflection (1). The pavement mean profile depth (MPD) and sideways force coefficient (SFC) are either/or alternatives.

6.3.2 Automated survey of pavement condition shall conform to the current GBT/T 26764: Multifunctional high-speed highway condition monitor, and JTG/T E61: Specifications of

Automated Pavement Condition Survey.

6.3.3 Automated survey equipment shall be adopted for surveying pavement condition. At least one of the major lanes shall be surveyed in each survey direction. For Class-2, -3 or -4 highways, the direction with the worst condition should be selected for the pavement condition survey.

6.3.4 Automated survey of pavement surface condition shall conform to the requirements as follows:

1 The surveyindicator shall be pavement distress ratio, DR, for which one statistical value shall be calculated for every 10m.

2 Pavement surface condition shall be surveyed continuously in the longitudinal direction, with a survey width not less than 70% of the lane width. The survey equipment shall be able to identify 1mm wide surface cracks. Survey data should be automatically processed in digital format, and the recognition accuracy shall be at least 90%, or above 95% for Motorways.

6.3.5 Automated survey of pavement riding quality shall conform to the requirements as follows:

1 Profile survey equipment shall be used.

2 The survey indicator shall be International Roughness Index, IRI, for which one statistical value shall be calculated for every 10m.

3 Any data collected by a survey vehicle at a speed beyond the effective survey speed or the effective deceleration range shall be considered as invalid data.

6.3.6 Automated survey of pavement rutting shall conform to the requirements as follows:

1 Profile survey equipment shall be used.

2 The survey indicator shall be rut depth, RD, for which one statistical value shall be calculated for every 10m.

3 In the case of abnormal or incomplete data, the surveyed profile shall be invalid.

6.3.7 Automated survey of vehicle bumpiness on a pavement shall conform to the requirements as follows.

1 Profile survey equipment shall be used.

2 The survey indicator shall be pavement bumpiness, PB, which shall be calculated at each occurrence, and one statistical value shall be calculated over every 10m. The calculation procedure is presented in Appendix B.

6.3.8 Automated survey of pavement wear shall conform to the requirements as follows:

1 Profile survey equipment shall be used.

2 The survey positions shall be in the left wheel path, right wheel path and an unworn point either at mid-lane or on a homogenous shoulder.

3 The survey indicator shall bemean texture depth, MPD, for which one statistical value shall be calculated over every 10m.

6.3.9 Automated survey of skid resistance shall conform to the requirements as follows:

1 The survey equipment for measuring the sideways force coefficient or other effectively correlated automated equipment shall be used. The correlation coefficient shall not be less than 0.95.

2 The survey indicator shall be sideways force coefficient, for which one statistical value shall be calculated over every 10m.

6.3.10 Automated survey of pavement surface structural strength shall conform to the requirements as follows:

1 Automated deflection survey equipment that effectively relate to the Benkelman beam shall be used. The correlation coefficient shall not be less than 0.95;

2 The survey measurement shall be pavement deflection l, for which one statistical value shall be calculated over every 20m.

3 The measurement of pavement deflection shall conform to the current JTG E60: Field Test Methods for Subgrade and Pavement for Highway Engineering.

6.4 Manual inspection of pavement condition

6.4.1 Manual inspection of pavement surface condition shall conform to the requirements as follows.

1 The types of pavement distresses identified by manual inspection shall conform to Sections 5.2 and 5.3. Where more than one type of defect exists in one location, only the type of defect with the largest weighting shall be taken into account.

2 Each type of defects is assessed in terms of its severity for every 100m, and then the accumulated defection is calculated for the inspection unit.

3 Manual inspection of pavement surface condition shall involve all traffic lanes. Turnouts, or emergency bays, shall be regarded as shoulders. Tables for calculating the damage to asphalt pavement and cement concrete pavement are shown in Table A-2 and Table A-3 of Appendix A.

6.4.2 The manual inspection of the structural strength of a pavement shall conform to the requirements as follows:

1 A Benkelman beam shall be used;

2 The indicator of survey shall be the pavement deflection l_0.

3 The survey method shall conform to the current JTG E60:

6.5 Survey and inspection of the condition of structural work

6.5.1 Either manual inspection or automated survey, or both may be used for the assessment of bridge and tunnel condition.

6.5.2 The survey and inspection of the condition of a bridge shall conform to the current *JTG/T H21: Standards for technical condition evaluation of highway bridges*. The survey and inspection of the condition of a tunnel conditions shall conform to the current *JTG H12: Technical Specifications of Maintenance for Highway Tunnel*. The survey and inspection of a culvert shall conform to the current *JTG H11: Code for Maintenance of Bridges and Culverts*.

6.5.3 Table for survey of the damage to structural works is shown in Table A-4 of Appendix A.

6.6 Survey and inspection of the condition of traffic safety devices

6.6.1 Either manual inspection or automated survey, or both may be used for the assessment of the condition of traffic facilities.

6.6.2 The types of defects in traffic safety devices shall conform to the provisions in Section 5.4.

6.6.3 The table for inspection of traffic safety devices is shown in Table A-5 of Appendix A.

7 Highway Performance Assessment

7.1 General

7.1.1 A typical unit for highway maintenance quality assessment shall be a road section of 1000m long. However, this rule may not be applicable to an assessment unit which involves different types of pavement, traffic volumes, widths of pavement, or different maintenance contractors or authorities.

7.1.2 Three statistical indicators shall be calculated for highway maintenance quality assessment. These indicators are the ratio of excellent, the ratio of good, and the ratio of poor condition.

7.1.3 The format of a detailed sheet for highway maintenance quality assessment is shown in Table A-6 of Appendix A. The format of a summary sheet for highway maintenance quality assessment is shown in Table A-7, and the format of a summary sheet of pavement maintenance quality assessment is shown in Table A-8.

7.2 Assessment of Highway Maintenance Quality (MQI)

7.2.1 Highway performance is assessed by maintenance quality indicator (MQI) calculated according to Equation (7.2.1) as follows:

$$MQI = w_{SCI}SCI + w_{PQI}PQI + w_{BCI}BCI + w_{TCI}TCI \quad (7.2.1)$$

where: w_{SCI}——the weighting of SCI to MQI, taking the value 0.08;

w_{PQI}——the weighting of PQI to MQI, taking the value 0.70;

w_{BCI}——the weighting of BCI to MQ, taking the value 0.12;

w_{TCI}——the weighting of TCI to MQI, taking the value 0.10。

7.2.2 A non-typical unit may refer to such an assessment unit which length is either greater or

less than 1000m. The actually deduct score of SCI, BCI and TCI, not including PQI, for a non-typical unit shall be converted to those for a typical unit, i. e., the actual deduct score times the length of a typical unit divided by the length of the non-typical unit under assessment. The assessment results of bridge, tunnel and culvert condition (BCI) shall be included in the assessment unit that the structural works or culverts belong to.

7.2.3 For an assessment unit in which there is a structure (bridges or tunnels) at level 5, dangerous culverts or serious side slope collapse affecting traffic safety, the value of MQI shall be 0.

7.2.4 In the case of maintenance quality assessment of a highway route, the arithmetic mean of the MQIs of all assessment units within the route shall be taken as the MQI of the highway route under assessment.

7.2.5 In the case of maintenance quality assessment of a highway network, the arithmetic mean of the MQIs of all highway routes in the network shall be taken as the MQI of the highway network under assessment.

7.2.6 Assessment results ofMQI and subsidiary indices shall be accurate to two decimal places.

7.3 Assessment of Subgrade Condition (SCI)

7.3.1 Road subgrade performance shall be assessed by the Subgrade Condition Indicator (SCI) calculated according to Equation (7.3.1) as follows:

$$SCI = \sum_{i=1}^{i_0} w_i (100 - GD_{iSCI}) \qquad (7.3.1)$$

Where: GD_{iSCI}——Cumulative score deducted in terms of type i damage to the subgrade, which is calculated as specified in Table 7.3.1. The maximum score deducted is 100;

w_i——Weighting of type i damage to subgrade, taking the value from Table 7.3.1;

i——Type of defect to subgrade;

i_0——Total number of types of defect to subgrade, taking 7 as the value.

Table 7.3.1 Criteria for Score Deduction of SubgradeDamage

Type (i)	Damage to	Severity	units	Unit score deduction	weighting (w_i)	Remark
1	Shoulder	slight	m^2	1	0.10	
		serious		2		

continued

Type (i)	Damage to	Severity	units	Unit score deduction	weighting (w_i)	Remark
2	Side slope	slight	Locations	20	0.25	MQI of the assessment unit shall be 0 where a side slope collapse is serious, and affects traffic safety
		moderate		50		
		serious		100		
3	Erosion gully	slight	Locations	20	0.15	
		moderate		30		
		serious		50		
4	Earthworks structure	slight	Locations	20	0.10	SCI of the assessment unit shall be 0 where the damage to an earthwork structure is serious
		moderate		50		
		serious		100		
5	Curb		meter	4	0.05	
6	Embankment settlement	slight	Locations	20	0.25	
		moderate		30		
		serious		50		
7	Poor drainage	slight	Locations	20	0.10	
		moderate		50		
		serious		100		

7.4 Assessment of Pavement Maintenance Quality (PQI)

7.4.1 The maintenance quality assessment of an asphalt pavement shall include the assessment of seven aspects, i. e., pavement distress, surface roughness, rutting, bumpiness, wear, skid-resistance, and the strength of the pavement structure.

7.4.2 The maintenance quality assessment of a cement concrete pavement shall include the assessment of five aspects, i. e., pavement distress, surface roughness, faulting, surface wear, and surface skid-resistance. Cement concrete pavements with grooving shall not be assessed for surface wear.

7.4.3 Pavement Maintenance Quality Index (PQI) shall be used for assessment of pavement maintenance quality and calculated according to Equation (7.4.3)

$$PQI = w_{PCI}PCI + w_{RQI}RQI + w_{RDI}RDI + w_{PBI}PBI + w_{PWI}PWI + w_{SRI}SRI + w_{PSSI}PSSI \quad (7.4.3)$$

Where: w_{PCI}——weighting of PCI for calculating PQI, taking the value from Table 7.4.3;

w_{RQI}——weighting of RQI for calculating PQI, taking the value from Table 7.4.3;

w_{RDI}——weighting of RDI for calculating PQI, taking the value from Table 7.4.3;

w_{PBI}——weighting of PBI for calculating PQI, taking the value from Table 7.4.3;

w_{PWI}——weighting of PWI for calculating PQI, taking the value from Table 7.4.3;

w_{SRI}——weighting of SRI for calculating PQI, taking the value from Table 7.4.3;

w_{PSSI}——weighting of PSSI for calculating PQI, taking the value from Table 7.4.3.

Table 7.4.3 The Weighting of the Subsidiary Indices of PQI

Type of Pavement	Weighting	Motorway & Class-1 highway	Class-2, -3, -4 highway
Asphalt pavement	w_{PCI}	0.35	0.60
	w_{RQI}	0.30	0.40
	w_{RDI}	0.15	—
	w_{PBI}	0.10	—
	w_{SRI}(PWI)	0.10	—
	w_{PSSI}	—	—
Cement concrete pavement	w_{PCI}	0.50	0.60
	w_{RQI}	0.30	0.40
	w_{PBI}	0.10	—
	w_{SRI}(PWI)	0.10	—

Note: Either Pavement Skid-resistance Indicator (SRI) or Pavement Wear Indicator (PWI) shall be used In Equation (7.4.3).

7.4.4 Pavement Structural Strength index, PSSI, shall be assessed separately and independently based on spot check data, and shall be not used in the PQI calculation.

7.4.5 Pavement Surface Condition Index (PCI) shall be calculated using Equations (7.4.5-1) and (7.4.5-2)

$$PCI = 100 - a_0 DR^{a_1} \qquad (7.4.5\text{-}1)$$

$$DR = 100 \times \frac{\sum_{i=1}^{i_0} w_i A_i}{A} \qquad (7.4.5\text{-}2)$$

where: DR ——Pavement Distress Ratio (%);

a_0——15.00 for asphalt pavement, or 10.66 for cement concrete pavement;

a_1——0.412 for asphalt pavement, or 0.461 for cement concrete pavement;

A_i——Cumulative area of type i damage to pavement (m^2);

A——The area of pavement condition survey or inspection (m^2);

w_i——For the weighting or conversion factor of type i defect to pavement, refer to Tables 7.4.5-1 and Table 7.4.5-2;

i——type of defect to pavement, including severity of defection (slight, moderate, and serious);

i_0——Total number of types of defect －21 for asphalt pavement, and 20 for cement concrete pavement.

Table 7.4.5-1 Type, Weighting and Conversion Factor of Asphalt Pavement distress

Type (i)	Type of defect	Severity of defection	Unit (m^2)	Weighting (w_i) (Manual inspection)	Conversion factor (w_i) (Automated survey)
1	Alligator cracking	slight	area	0.6	1.0
2		moderate		0.8	
3		serious		1.0	
4	Block cracking	slight	area	0.6	1.0
5		serious		0.8	
6	Longitudinal cracking	slight	Length × 0.2m	0.6	2.0
7		serious		1.0	
8	Transverse cracking	slight	Length × 0.2m	0.6	2.0
9		serious		1.0	
10	Depression	slight	area	0.6	1.0
11		serious		1.0	
12	Rutting	slight	Length × 0.4m	0.6	—
13		serious		1.0	
14	Shoving	slight	area	0.6	1.0
15		serious		1.0	
16	Popout	slight	area	0.8	1.0
17		serious		1.0	
18	Raveling	slight	area	0.6	1.0
19		serious		1.0	
20	Bleeding		area	0.2	0.2
21	Patching		Either area or length × 0.2m	0.1	0.1(0.2)

Note: 1 In the case of a manual inspection, the survey length of a strip patch shall be converted to area by multiplying length by the effective width (0.2m).

2 In the case of an automated survey, the conversion factor, wi, is 0.1 for a block patch, or 0.2 for a strip patch.

Table 7.4.5-2 Type, Weighting and Conversion Factor of Cement Concrete Pavement distress

Type(i)	Type of defect	Severity of defection	Unit (m^2)	Weighting (w_i) (Manual inspection)	Conversion factor (w_i) (Automated survey)
1	Slab breaking	slight	area	0.8	1.0
2		serious		1.0	

continued

Type(i)	Type of defect	Severity of defection	Unit (m^2)	Weighting (w_i) (Manual inspection)	Conversion factor (w_i) (Automated survey)
3	Slab cracking	slight	length × 1.0m	0.6	10
4		moderate		0.8	
5		serious		1.0	
6	Corner breaking	slight	area	0.6	1.0
7		moderate		0.8	
8		serious		1.0	
9	Faulting	slight	length × 1.0m	0.6	10
10		serious		1.0	
11	Blowup		area	1.0	1.0
12	Joint spalling	slight	length × 1.0m	0.6	10
13		moderate		0.8	
14		serious		1.0	
15	Defective joint filler	slight	length × 1.0m	0.4	6
16		serious		0.6	
17	Popout		area	1.0	1.0
18	Pumping		length × 1.0m	1.0	10
19	Aggregate exposure		area	0.3	0.3
20	Patching		Either area or length × 0.2m	0.1	0.1(0.2)

Note: 1 In the case of a manual inspection, the survey length of a strip patch shall be converted to area by multiplying with the effective width (0.2m).

2 In the case of an automated survey, the conversion factor, wi, is 0.1 for a block patch, or 0.2 for a strip patch.

7.4.6 In the case of an automated survey, A_i shall be calculated by Equation (7.4.6):

$$A_i = 0.01 \times GN_i \tag{7.4.6}$$

Where: GN_i——the number of grids containing type i pavement distress.

0.01——area conversion factor, the size of a typical grid is 0.1m × 0.1m.

7.4.7 Riding Quality Index shall be calculated by Equation (7.4.7) as follows:

$$RQI = \frac{100}{1 + a_0 e^{a_1 IRI}} \tag{7.4.7}$$

where IRI——International Roughness Index (m/km);

a_0——use 0.026 for Motorways and Class-1 highways, or 0.0185 for other classified highways;

a_1——use 0.65 for Motorways and Class-1 highways, or 0.58 for other classified highways.

7.4.8 Pavement Rut Depth (RDI) shall be calculated by Equation (7.4.8) as follows:

$$RDI = \begin{cases} 100 - a_0 RD & (RD \leqslant RD_a) \\ 90 - a_1 (RD - RD_a) & (RD_a < RD \leqslant RD_b) \\ 0 & (RD > RD_b) \end{cases} \tag{7.4.8}$$

Where RD——Rut depth (mm);

RD_a——Coefficient for rut depth, taking 10.0;

RD_b——Coefficient of rut depth, taking 40.0;

a_0——Model parameter, taking 1.0;

a_1——Model parameter, taking 3.0.

7.4.9 Pavement Bumpiness Index (PBI) shall be calculated by Equation (7.4.9) as follows:

$$PBI = 100 - \sum_{i=1}^{3} a_i \, PB_i \tag{7.4.9}$$

Where PB_i——pavement bumpiness type i;

a_i——unit score deduction for pavement bumpiness type i, taking value from Table 7.4.9;

i——pavement bumpiness type

Table 7.4.9 Criteria for Score Deduction of Pavement Bumpiness

Type (*i*)	Bump intensity	Unit	Unit score decuction
1	slight	location	0
2	moderate		25
3	serious		50

7.4.10 Pavement Wear Index (PWI) shall be calculated by Equations (7.4.10-1) and (7.4.10-2) as follows:

$$PWI = 100 - a_0 WR^{a_1} \tag{7.4.10-1}$$

$$WR = 100 \times \frac{MPD_C - \min\{MPD_L, MPD_R\}}{MPD_C} \tag{7.4.10-2}$$

where WR——wear ratio (%);

a_0——model parameter, taking 1.696;

a_1——model parameter, taking 0.785;

MPD_C——reference value of mean profile depth, obtained from the profile depths along the unworn centerline of a traffic lane (mm);

MPD_L——Mean Profile Depth of Left Wheel Path (mm);

MPD_R——Mean Profile Depth of Right Wheel Path (mm);

7.4.11 Pavement Surface Skid Resistance Index (SRI) may be calculated by Equation (7.4.11):

$$SRI = \frac{100 - SRI_{min}}{1 + a_0 e^{a_1 SFC}} + SRI_{min} \quad (7.4.11)$$

where SFC——Sideways Force Coefficient;

SRI_{min}——calibrating parameter, taking 35.0;

a_0——model parameter, taking 28.6;

a_1——model parameter, taking −0.105.

7.4.12 Pavement Structural Strength Index (PSSI) shall be calculated by Equations (7.4.12-1) and (7.4.12-2):

$$PSSI = \frac{100}{1 + a_0 e^{a_1 SSR}} \quad (7.4.12\text{-}1)$$

$$SSR = \frac{l_0}{l} \quad (7.4.12\text{-}2)$$

where SSR——Pavement Structural Strength Ratio, which is the ratio of the standard value to the measured representative value of a pavement;

l_0——standard value of pavement deflection (0.01mm), which shall be calculated according to Appendix C;

l——measured representative deflection of pavement (0.01mm);

a_0——model parameter, taking 15.71;

a_1——model parameter, taking −5.19.

7.5 Assessment of Bridge, Tunnel and Culvert Condition (BCI)

7.5.1 Bridge, Tunnel and Culvert Condition Indices shall be used for assessing the conditions of bridges, tunnels and culverts respectively

$$BCI = \min(100 - GD_{iBCI}) \quad (7.5.1)$$

Where GD_{iBCI}——Cumulative deduct score for a type *i* structure, using the value in Table 7.5.1. The maximum value is 100;

i——type of structure. There are three types, namely bridge, tunnel, and culvert.

Table 7.5.1 Criteria for Deduct Score of Structural Works

Type(i)	Structure	Level	Unit	Deduct value	Remarks
1	Bridge	1	number	0	The method of assessment refers to JTG/T H21: *Standards for technical condition evaluation of highway bridges*, and MQI shall be 0 for the assessment unit in which there is a bridge at Level 5
		2		10	
		3		40	
		4		70	
		5		100	
2	Tunnel	1	number	0	The method of assessment refers to JTG H12: *Technical Specifications for Maintenance for Highway Tunnel*, and MQI shall be 0 for the assessment unit in which there is a tunnel at Level 5
		2		10	
		3		40	
		4		70	
		5		100	
3	Culvert	Excellent	number	0	The method of assessment refers to *JTG H*11: *Code for Maintenance of Bridges and Culverts/*, and MQI shall be 0 for the assessment unit in which there is any culvert in Dangerous Level.
		Good		10	
		Fairly poor		40	
		Poor		70	
		Dangerous		100	

7.5.2 For any assessment unit that contains no structural works, the value of BCI shall be 100.

7.6 Assessment of Traffic safety device Condition

7.6.1 Traffic safety device Condition Index shall be calculated by Equation (7.6.1) as follows:

$$TCI = \sum_{i=1}^{i_0} w_i (100 - GD_{iTCI}) \quad (7.6.1)$$

Where GD_{iTCI}——Cumulative deduct score for a type i damage to a traffic safety device, taking value from Table 7.6.1. The maximum value is 1000.

w_i——the weighting of type i damage to a traffic safety device, using the value from Table 7.6.1;

i——type of defect;

i_0——Total number of types of defect to a traffic safety device, namely 5。

Table 7.6.1 Criteria for Deduct Score for a Traffic safety device

Type(i)	Defect	Severity	Unit	Unit-deduct Score	Weighting (w_i)	Remarks
1	Protective devices	Slight	Location	10	0.25	
		Serious		30		

continued

Type(i)	Defect	Severity	Unit	Unit-deduct Score	Weighting (w_i)	Remarks
2	Isolation fence		Location	20	0.10	
3	Sign board		Location	20	0.25	
4	Road marking		m	0.1	0.20	One unit score deducted for every 10m or less than 10m
5	Poor landscaping		m	0.1	0.20	

APPENDIX A
TABLES FOR HIGHWAY CONDITION SURVEY AND INSPECTION

Table A-1 Defects in Road Subgrade

surveyed on: by:

Route code:			Direction:		Start station:				Length of unit:						Width of pavement
Type	Severity	Deduct score	weighting w_i	Unit	Damage in every 100m segment										Cumulative defection
					1	2	3	4	5	6	7	8	9	10	
Shoulder damage	slight	1	0.10	m^2											
	moderate	2													
Side slope collapse	slight	20	0.25	occurrence											
	moderate	50													
	serious	100													
Erosion gully	slight	20	0.15	occurrence											
	moderate	30													
	serious	50													
Earthwork structural damage	slight	20	0.10												
	moderate	50													
	serious	100													
Curb damage		4	0.05	m											
Embankment settlement	slight	20	0.25	place											
	moderate	30													
	serious	50													
Poor drainage	slight	20	0.10	occurrence											
	moderate	50													
	serious	100													

Table A-2 Defects in Asphalt Pavement

surveyed on: by:

Route code:	Survey direction:			Start station:				Length of unit:						Width of pavement:
Type of defect	Extent	Weighting (w_i)	Unit	Damage in every 100m segment										Cumulative defection
				1	2	3	4	5	6	7	8	9	10	
Alligator crack	slight	0.6	m^2											
	moderate	0.8												
	serious	1.0												
Block crack	slight	0.6	m^2											
	serious	0.8												
Longitudinal crack	slight	0.6	m											
	serious	1.0												
Transversal crack	slight	0.6	m											
	serious	1.0												
Depression	slight	0.6	m^2											
	serious	1.0												
rutting	slight	0.6	m											
	serious	1.0												
shoving	slight	0.6	m^2											
	serious	1.0												
potholing	slight	0.8	m^2											
	serious	1.0												
raveling	slight	0.6	m^2											
	serious	1.0												
bleeding		0.2	m^2											
patching		0.1	m^2											
			Strip m											

Table A-3 Defect inCement Concrete Pavement

surveyed on: by:

Route code:	Survey direction:			Start station:				Length of unit:						Width of pavement:
Type of defect	Extent	Weighting (w_i)	Unit	Damage in every 100m segment										Cumulative damage
				1	2	3	4	5	6	7	8	9	10	
Slab breaking	slight	0.8	m^2											
	serious	1.0												

continued

Type of defect	Extent	Weighting (w_i)	Unit	Damage in every 100m segment										Cumulative damage
				1	2	3	4	5	6	7	8	9	10	
Slab cracking	slight	0.6	m											
	moderate	0.8												
	serious	1.0												
Corner breaking	slight	0.6	m^2											
	moderate	0.8												
	serious	1.0												
faulting	slight	0.6	M											
	serious	1.0												
Blowup		1.0	m^2											
Joint spalling	slight	0.6	M											
	moderate	0.8												
	serious	1.0												
Defective joint filler	slight	0.4	m											
	serious	0.6												
Popout		1.0	m^2											
Pumping		1.0	M											
Aggregate exposure		0.3	m^2											
Patching		0.1	Zone m^2											
			Strip m											

Table A-4 Damage to Structural Works

Surveyed on: by:

Route code:	Survey direction:	Start station: Length of unit: Width of pavement:										
Type of structure	Level	Score deduct	Unit	Damage in every 100m segment										Cumulative damage
				1	2	3	4	5	6	7	8	9	10	
Bridge	1	0	No.											
	2	10												
	3	40												
	4	70												
	5	100												
Tunnel	1	0	No.											
	2	10												
	3	40												
	4	70												
	5	100												

continued

Type of structure	Level	Score deduct	Unit	Damage in every 100m segment										Cumulative damage
				1	2	3	4	5	6	7	8	9	10	
Culvert	good	0	No.											
	Fairlygood	10												
	Fairly poor	40												
	poor	70												
	dangerous	100												

表 A-5 Damage to Traffic safety devices

Surveyed on: by:

Route code: Survey direction:					Start station: Length of unit: Width of pavement:										
Type of defect to	Severity	Deduct Score	Weighting w_i	Unit	Damage in every 100m segment										Types of defect
					1	2	3	4	5	6	7	8	9	10	
Protection device	Slight	10	0.25	Number											
	Serious	30													
Fence		20	0.10	Number.											
Traffic sign		20	0.25	Number.											
Road marking		0.1	0.20	m											
Landscape		0.1	0.20	m											

TableA-6 Details on Highway Maintenance Quality Assessment

Admin. Zone: Route code: Tech. classification:

Type of pavement: Survey direction: Date: yyyy/mm/dd/

Start station	Assessment unit Length: m	MQI	SCI	PQI	Indices of PQI							BCI	TCI
					PCI	RQI	RDI	PBI	PWI	SRI	PSSI		
Total													

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Table A-7 Summary of Highway Maintenance Quility Assessment

Admin. Zone: Organization in charge: Date:

Route code	Route name	Start station	Length of assessment km	Survey direction	Tech. Class	Type of pavement	MQI	Subsidiary Indices of MQI				MQI distribution (km)					MQI statistics(%)		
								SCI	PQI	BCI	TCI	E	G	M	P	F	% of Excellent	% of Good	% of Poor
				Full width															
				forward															
				reverse															
计																			

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表 A-8　Summary of Pavement Maintenance Quality Assessment

Admin. Zone：　　Organization in charge：　　Date：

Route code	Route name	Start station	Length of assessment km	Survey direction	Tech. class	Type of pavement	PQI	Results of Indices under PQI							PQI distribution (km)					PQI statistics (%)		
								PCI	RQI	RDI	PBI	PWI	SRI	PSSI	E	G	M	P	F	% of Excellent	% of E&G	% of P&F
				Full width																		
				forward																		
				reverse																		
Total																						

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APPENDIX B
CALCULATION OF PAVEMENT BUMPINESS

B.0.1 Pavement bumpiness shall be determined by the elevation difference along a longitudinal profile on the pavement. The elevation difference shall be computed by Equation (B.0.1):

$$\Delta h = \max\{h_1, h_2, \cdots, h_i, \cdots h_{100}\} - \min\{h_1, h_2, \cdots, h_i, \cdots h_{100}\} \quad (B.0.1)$$

Where Δh ——Elevation difference along a longitudinal profile on the pavement, which shall be difference from the highest elevation to the lowest one within a 10m long segment of pavement longitudinal profile;

h_i——the elevation of point i on the pavement longitudinal profile;

i——any point on the a longitudinal profile on the pavement, on which elevation data is surveyed. The elevations of a longitudinal profile on the pavement are measured by automated survey, during which one elevation data point is taken every 0.1m, and thus 100 data points in total shall be taken along a 10m long segment of pavement longitudinal profile.

B.0.2 Bump intensity shall be classified according to Table B.0.2.

Table B.0.2 Classification of Bump Intensity

Survey indicator	Slight	Moderate	Serious
Elevation difference of the longitudinal profile on a pavement(Δh),cm	≥2, <5	≥5, <8	≥8

B.0.3 Pavement bumpiness shall be measured at number of places. Any 10m long segment where bumps exist, no matter whether slight, moderate or serious, shall be counted as one location of pavement bumpiness.

APPENDIX C
METHOD FOR DETERMINING THE STANDARD VALUE OF PAVEMENT DEFLECTION

C.0.1 A standard value of pavement deflection shall be determined according to the technical classification, cumulative equivalent standard axle loads, type of pavement surface course, type of pavement structure, and calculated by the Equation (C.0.1).

$$l_0 = 600 N_e^{-0.2} A_c A_s A_b \qquad \text{(C.0.1)}$$

where l_0——Standard value of pavement deflection(0.01mm);

N_e——The design service life in terms of equivalent single standard axles of the asphalt repair.

A_c——Factor of highway classification, taking 1.0 for Motorways and Class-1 highways, 1.1 for Class-2 highways, and 1.2 for Class-3 and -4 highways;

A_s——Factor of pavement type, taking 1.0 for asphalt concrete surface course, and 1.1 for hot mixed or cold mixed asphalt macadam (including asphalt penetration macadam with hot-mix overlay) and asphalt surface treatment;

A_b——Factor of pavement structure; taking 1.0 for asphalt pavement with semi-rigid base course, and 1.6 for asphalt pavement with flexible base course.

C.0.2 Equivalent Single-Axle Loads (N_e) shall be calculated by Equation (C.0.2-1)

$$N_e = \frac{[(1+\gamma)^t - 1] \times 365}{\gamma} N_1 \qquad \text{(C.0.2-1)}$$

Where N_1——initial Annual Average Daily Traffic (number of repetitions/d);

t——the design life of newly constructed or reconstructed pavement, or the design life asphalt pavement after structural rehabilitation (year);

γ——average annual growth of traffic during the design life of a newly constructed or reconstructed pavement, or the design life of an asphalt pavement after structural rehabilitation;

C.0.3 The design life of a newly constructed or reconstructed pavement shall be determined according to the design documents. Where design documents are not available, the design life of a newly constructed pavement shall be determined according to the highway class, economics, class of vehicular loading and other relevant factors, and shall not be less than the figures specified in Table C.0.3.

Table C.0.3 Design Life of Pavement Structure

Technical Classification	Design Life (year)
Motorway and Class-1 highway	15
Class-2 highway	12
Class-3 highway	10
Class-4 highway	8

C.0.3 The design life of a rehabilitated asphalt pavement shall be determined according to the design documents. In case that design documents are not available, the design life shall be determined by referring to Table C.0.4, in conjunction with necessary adjustment for specific requirements.

表 C.0.4 Design life of a structural repair of an asphalt pavement

Technical Classification	Design Life (year)
Motorway and Class-1 highway	10 ~ 15
Class-2 highway	8 ~ 12
Class-3 highway	6 ~ 10
Class-4 highway	5 ~ 8

Wording Explanation for this Standard

The strictness in execution of this Standard is expressed by using the wording as follows

Must — A strict requirement in any circumstances;

Shall — A mandatory requirement in normal circumstances;

Should — An advisory requirement;

May — A permissive condition. No requirement is intended.

Background to Provisions

1 General Provisions

1.0.1 According to JTG 1001: *Standard System for Highway Engineering*, this Standard is an integral part of the Road Condition Survey Module under the Plate of Highway Maintenance. This Standards are mainly applicable to the highway performance assessment, and the results may be used for the highway assets management, the decision making and the lifecycle design for highway maintenance.

1.0.2 This Standard is applicable to classified highways, including motorways, class-1, -2, -3 and -4 highways. The majority of pavement surface in the highway network are asphalt or cement concrete, whereas highways with gravel surfaced pavement are limited. Therefore, this Standard concentrates on asphalt pavement and cement concrete pavement.

2 Terms and Definitions

2.0.1 Three significant properties of Highway Maintenance Quality Indices (MQI) are that: (1) they are comprehensive technical indicators, in a multi-level hierarchical system of performance indicators used for assessing the maintenance quality of a highway; (2) they are objective descriptions of the maintenance quality of various component parts of a highway asset, and (3) they serve as the baseline for determining the rating of highway performance.

3 Highway Performance Assessment Indicator

3.0.1 In this Edition, the layout of this Standard has been reorganized to conform to a traditional and customary sequence of describing a road, namely subgrade, pavement, structural works and traffic safety devices.

3.0.2 Considering the technical capability of automated highway condition survey, and the real situation of highway performance indicator system, two additional indicators have been introduced in this Edition, namely, Pavement Bumpiness Index (PBI) and Pavement Surface Wear Index (PWI),

4 Rating of Highway Performance

4.0.1 'Excellent, good, average, poor, failed' shown in Table 4.0.1 represent the technical rating of highway performance in a quality descending sequence.

4.0.2 The Excellent, Good, Average, Poor, or Failed listed in Table 4.0.2 is the technical rating of road subgrade, pavement, structures and traffic safety devices. Taking the road pavement as an example. Rating 'Excellent' refers to the pavement that is flat and even with no or only a few fine cracks, no repairs but crack filling are required, preventive maintenance to the wearing course may be conducted depending on the pavement condition. Rating 'Good' refers to the pavement that is quite flat and even with a certain number of cracks, minimal deformation and other types of defects, in addition to crack filling and pothole repairs, and functional repairs may be necessary depending on traffic situations. Rating 'Average' means that the flatness and evenness of the pavement are unsatisfactory, there are a number of cracks and deformation damage in the pavement, and structural and functional repairs are required. Rating 'Poor' or 'failed' means that both functional and structural damage exist with a large number of cracks, deformation defects and other damage, and thus requiring structural repairs. A proposal for structural repair, functional repair or preventive maintenance shall be developed by taking into account the factors such as pavement performance conditions, pavement structure, maintenance history, technical classification, axle loads, tolls, availability of investment funds, and based on the pavement administration system into account, and in accordance with a rational analysis and decision based on life-cycle costs.

5 Types of Road Defects

5.1 Subgrade

5.1.4 Depending on the impact, this Standard modifies the classification of the subgrade structural damage.

5.3 Cement concrete pavement

5.3.2 According to JTG D40: Specifications for Design of Highway Cement Concrete Pavement, for continuously reinforced cement concrete pavement, the continuous transverse cracks, with average spacing less than 1.8m, shall not be regarded as surface distress.

Neither contraction joints nor construction joints shall be regarded as surface distresses.

6 Highway Condition Survey and Inspection

6.1 General

6.1.2 The typical unit for highway condition survey is a 1000m long road section. However, the length of a survey (or inspection) unit may be affected by the changes in terms of highway administration classification, technical classification, type of pavement, width of pavement, and maintenance zone, or by an intersection, exit or entrance. In such a case, the unit length shall not be exactly 1000m long, but of a length usually between 100m to 1900m.

6.1.4 The frequencies of survey and inspection given in this Standard is minimum values. Local authorities are encouraged to increase the frequencies of survey and inspection of all or some of these indicators.

With the current technology extensive and frequent surveys on pavement structural strength is not feasible. Highway administrations and Motorway operators shall plan and schedule the survey frequency and routes based on the needs of pavement maintenance and the characteristics of pavement performance, to ensure that the annual survey shall not cover less than 20% of scheduled maintenance kilometers, and a full-scale survey can be fulfilled progressively once in every 2 to 5 years.

6.1.5 Portable equipment refers to equipment that is easy to carry and use on site, and which is capable of recording on site for wireless data transmission, and including mobile terminals.

6.2 Survey and inspection of subgrade condition

6.2.1 In the light of the development of inspection technology, subgrade defects such as those in shoulders, broken or missing curbs and embankment settlement may be detected rapidly by

automated equipment.

6.3 Automated survey of pavement condition

6.3.1 The relationship of automated survey indicators and assessment indicators are given in Table 6-1.

Table 6-1 Automated survey measurements and assessment indicators

No.	Survey parameter	Assessment index
1	Pavement distress ratio, DR	Pavement surface condition index, PCI
2	International Roughness Index, IRI	Pavement riding quality index, RQI
3	Rut depth, RD	Pavement rut depth index, RDI
4	Pavement bumpiness, PB	Pavement bumpiness, PBI
5	Pavement Mean Profile depth, MPD	Pavement wear index, PWI
6	Sideways force coefficient, SFC	Pavement skid resistance index, SRI
7	Pavement deflection, l	Pavement structural strength index PSSI

6.3.2 The current GBT/T 26764: Multifunctional high-speed highway condition monitoring, and the current JTG/T E61: Specifications of Automated Pavement Condition Survey provide detailed provisions on automated survey of pavement conditions, some of which have been quoted in this Standard.

6.3.3 A major lane refers to the full width of pavement of either a one-way, single lane road or an undivided two-way road, the traveled way in either direction of a divided two-way, two-lane road, the outer lane of a divided two-way, four-lane road, or the middle lane of a divided two-way, 6-lane road, or either middle lanes of a divided two-way, 8-lane or more than 8-lane road.

6.3.5 Compared with the provisions in *JTG/T E*61: *Specifications for Automated Pavement Condition Survey*, this Edition adjusted the statistical length and specifies that a value for IRI shall be calculated over every 10m.

6.3.7 In order to be consistent with the other road survey measurements, the length over which bumpiness is calculated is 10 m.

6.3.8 Compared with JTG/T E61: *Specifications for Automated Pavement Condition Survey*, this Standard specifies that the positions of automated survey of pavement wear are left wheel path, right wheel path and an unworn point either at midpoint of the lane or on the homogenous shoulder, and the statistical value is calculated over a length of 10 meters.

6.3.9 In the former edition, JTG H20—2007 of this Standard, the reporting length for SFC was 20m. To remain consistent with the other survey indicators and pavement surface structural strength, which is one of the either/or alternatives, this edition specifies that the interval for reporting sideways force coefficient, SFC, is 10 meters.

6.4 Manual inspection of pavement condition

6.4.1 This Standard specifies that where there are two or more than two types of defects in one location, only the type of defect with the largest weighting shall be taken into account to avoid the double counting the deduction.

6.5 Survey and inspection of the condition of structural work

6.5.1 In the light of technical development in survey and inspection equipment, some types of the damage to bridges and tunnels, such as the depth and width of a crack, the position of reinforcing steel and concrete cover, can be surveyed and detected by automated survey equipment.

6.5.2 Detailed requirements for survey and inspection of bridges, tunnels and culverts are contained in three technical specifications, namely, *JTG/T H*21: *Standards for technical condition evaluation of highway bridges*, *JTG H*12: *Technical Specifications of Maintenance for Highway Tunnel*, *and JTG H*11: *Code for Maintenance of Bridges and Culverts.* Some of requirements have been directly quoted in this Standard.

6.6 Survey and inspection of the condition of traffic safety devices

6.6.1 As a result of the developments in survey and inspection techniques, some types of the defects in traffic safety devices, such as the deteriorated or missing protective devices, traffic signs and road markings, can be quickly surveyed and detected by automated survey equipment.

7 Highway Performance Assessment

7.1 General

7.1.1 The typical unit for highway maintenance quality assessment is an 1000m long road section. However, the length of an assessment unit may be affected by the changes in terms of highway administration classification, technical classification, type of pavement, width of pavement, and maintenance zone, or by an intersection, exit or entrance. In such a case, the unit length shall not be exactly 1000m long, but of a length usually between 100m to 1900m.

7.1.2 The ratio of excellent condition is the percentage of the length of excellent road segments to the total length of the road under assessment; the ratio of good condition is the percentage of the length of good road segments to the total length of road under assessment, and the ratio of poor condition is the percentage of the length of poor road sections to the total length of road under assessment.

7.2 Assessment of Highway Maintenance Quality (MQI)

7.2.5 To cater for the needs of the highway network MQI, this edition introduces the statistical methods for highway network maintenance quality assessment.

7.2.6 In order to regulate the assessment activities of MQI and its subsidiary indices, this Standard specifies that the accuracy of assessment results shall be two decimals, except for the integers ending with 0s, such as 0, 10, 100.

7.3 Assessment of Subgrade Condition (SCI)

7.3.1 A serious side slope collapse may have serious consequences, particularly on traffic safety.

This Standard specifies that MQI shall be 0 for any serious side slope collapse which may negatively affect traffic safety.

7.4 Assessment of Pavement Maintenance Quality (PQI)

7.4.2 Surface grooves of a cement concrete pavement may affect surveyed MPD data, and therefore PWI assessment is not required for surface grooved cement concrete pavement in this Standard.

7.4.3 Either PWI or SRI shall be used for the PQI calculation, while the weighting shall be 0.10.

7.4.4 Pavement Structural Strength Index, PSSI, is not part of the PQI calculation. Therefore, the weighting of PSSI for calculating PQI shall be 0.

7.4.5 The assessment model of Pavement Surface Condition Indicator (PCI) is consistent with JTG H20—2007 of this Standard. The correlation of PCI and DR is shown in Table 7-2.

Table 7-2 Correlation of PCI and DR

PCI	90	80	70	60
DR (asphalt pavement)	0.4	2.0	5.5	11.0
DR (cement concrete pavement)	0.8	4.0	9.5	18.0

The conversion factors of asphalt pavement distresses and cement concrete pavement distresses are to be used as the weighting of various types of pavement distresses identified by an automated survey.

Strip patching refers to the filling up of longitudinal and transversal cracks, which shall be measured in length (m). Block patch refers to the repair of ruts, potholes (or popouts), which shall be measured as an area (m^2).

7.4.6 As specified in *T* 0974: *Automated Survey for Pavement Cracking of JTG/T E*61: *Specifications of Automated Pavement Condition Survey*, the standard size of a grid for measuring pavement cracking is 0.1m × 0.1m. For other types of pavement distresses this provision shall be referred to.

7.4.8 The rutting factors in Table 7.4.5-1 are applicable to manual inspection. For Motorways

and Class-1 highways, pavement rutting shall be detected by automated survey, and the Pavement Rut Depth Index (RDI) shall be assessed separately and independently. Thus pavement rutting in Table 7.4.5-1 shall not be considered to avoid duplication.

7.4.9 The factors influencing pavement bumpiness include faulting of cement concrete pavement, potholes, shoving, depression, corrugation, raised or sunk manhole covers on an asphalt pavement, and the poor approaches at bridge ends and tunnel portals. The pavement bumpiness mentioned in this Standard concentrates on pavement bumpiness due to poor pavement approaches or connections at bridge ends and tunnel portals.

Pavement Bumpiness Index (PBI) is a function of the number of bumps and the bump severity (slight, moderate or serious). The bump severity relates to the elevation difference along the longitudinal profile.

7.4.10 Pavement Wear Index (PWI) is a function of maximum elevation difference of pavement profile depths along three lines (left wheel path, right wheel path and centerline) of a traffic lane, to describe the pavement surface wear condition. The reference values are the pavement profile depths measured along the unworn centerline of a traffic lane. Where the pavement surface along centerline has been significantly worn off, the measured profile depths of a homogeneous shoulder on the same transverse profile may be taken as reference values. The profile depths measured for project handing-over may also be used as the reference values of pavement profile depths.

APPENDIX B
CALCULATION OF PAVEMENT BUMPINESS

B. 0. 1 This Standard takes the elevations along a 10m long segment of the longitudinal profile on a pavement to measure pavement bumpiness. These elevation data points on the longitudinal profile shall be pre-processed to remove possible abnormal elevation values such as those at bridge expansion joints, and eliminate the effects of pavement grades on the calculation of elevation difference along the longitudinal profile on a pavement.

C. 0. 3 The design life of a newly constructed or reconstructed highway pavement shall conform to the current JTG D50: Specifications for Design of Highway Asphalt Pavement.

C. 0. 4 The design life of a highway pavement after structural rehabilitation shall conform to the current JTG 5421: Specifications for Maintenance Design of Highway Asphalt Pavement.

Technical Terms in Chinese and English

Terms	中 文 词 条
alligator cracking Interconnected cracks forming a series of small polygons in the pavement surface that resemble an alligator's skin or chicken wire.	龟裂(路面)
automated survey surveys to provide a consistent method of measuring the surface condition of road traveled-ways, using automated road condition survey machines.	自动化检测
bleeding The flow of asphalt cement to the top of the mix surface under the action of traffic loading.	泛油(沥青路面)
block cracking A pattern of cracks that divide the pavement into approximately rectangular pieces, ranging in size from approximately 0.1 to 10 m^2.	块状裂缝
blowup Localized upward movement of the pavement surface at transverse joints or cracks, often accompanied by shattering of the concrete in that area.	拱起
clogging (drainage) drainage pipes are blocked by something that prevent water from being drained off.	堵塞(排水设施)
concrete and masonry works structures built by concrete or masonry materials.	圬工体
construction Joint 1) A joint made necessary by a prolonged interruption in the placing of concrete. 2) A temporary joint used to permit sequential construction.	施工缝

continued

Terms	中 文 词 条
contraction Joint 1）A joint at the ends of a rigid slab to control the location of transverse cracks. 2）A joint that controls the cracking effect of concrete shrinking as it cures. It generally has a water stop incorporated into it and is typically found in wing walls and retaining walls where seeping water needs to be controlled.	干缩缝
corner breaking A portion ofthe slab separated by a crack that intersects the adjacent transverse and longitudinal joints, describing approximately a 45-degree angle with the direction of traffic, where the length of the sides is from 0.3 m to one half the width of the slab. A portion of the slab separated by a crack, which intersects the adjacent transverse and longitudinal joints, describing approximately a 45-degree angle with the direction of traffic. The length of the sides is from 0.3 m to one-half the width of the slab on each side of the corner.	板角断裂
defect fault or deviation from the intended condition of an assembly, component or material.［BS6100-1］	损坏
defective concrete pavements Concrete pavements deteriorate over time due to exposure to severe weather conditions and excessive traffic loading of the concrete.	混凝土路面损坏
defective joint filler Defective or inadequate joint filler material should also be removed and replaced.【AA Manual of Maintenance】	接缝料损坏
depression Depressions are localized pavement surface areas with slightly lower elevations than the surrounding pavement. Depressions are very noticeable after a rain when they fill with water.	沉陷(路面)
earthworks 1 All operations involved in loosening, removing, depositing, shaping and compacting soil or rock. 2 The structure resulting from the above operations.	路基(广义)
embankment settlement A downward movement of the soil or of the structure it supports.	路基沉降
equivalent single axle loads（ESAL） The number ofdesign axle loads that are equivalent in damaging effect on a pavement to a given vehicle or axle loading.	当量轴次
faulting 1）The difference in elevation across a transverse joint or crack. 2）Differential vertical displacement of rigid slabs at a joint or crack.	错台

continued

Terms	中 文 词 条
gully 1）a small, narrow channel, usually formed by a stream or by rain; 2）a deepditch	冲沟
gully erosion theremoval of soil along drainage lines by surface water runoff.	水毁冲沟
International Roughness Indes（IRI） An index computed from a longitudinal profile measurement using a quarter-car simulation at a simulation speed of 80 km/h（50 mph）.	国际平整度指数 IRI
joint spalling Joint spalling is the breakdown of the slab near edge of the joint. Normally it occurs within 0.5 m of the joints.	边角剥落
longitudinal cracking Cracks in the pavement predominantly parallel to the direction of traffic.	纵向裂缝
manual inspection Manual inspection may be adopted for surveys on routes where automated survey is not suitable or not available, and where portable equipment should be used.	人工调查
patching The filling up or repair of depressions, holes, or other defective places in a carriageway to restore the surface.	修补(路面)
pavement distress External indications of pavement defects or deterioration.	路面损坏
pavement skid resistance The ability of the traveled surface to prevent the loss of tire traction, quantified by the frictional force between a locked tire and a pavement, which force resists motion.	路面抗滑性能
pavement structural strength Pavement Structural Strength Ratio, which is the ratio of the standard value to the measured representative value of a pavement.	路面结构强度
pavement surface condition A quantitative representation of pavement distress at a given point in time.	路面损坏状况
pitting development of relatively small cavities in a surface; in concrete, localized disintegration, such as a popout; in steel, localized corrosion evident as minute cavities on the surface.	麻面
polishing A condition whereby the surface of an aggregate becomes smooth under the action of traffic, which tends to reduce tyre/road friction.	露骨(骨料磨光)

continued

Terms	中 文 词 条
popouts the breaking away of small portions of a concrete surface due to localized internal pressure that leaves a shallow, typically conical, depression; small popouts leave holes up to 10 mm in diameter; medium popouts leave holes 10 to 50 mm in diameter; and large popouts leave holes greater than 50 mm in diameter.	坑洞(混凝土表面)
pothole A hole in a pavement, frequently rounded in shape, resulting from the loss of pavement material under traffic.	坑槽(沥青路面)
pumping pumping (of pavements)—the ejection of water, or water and solid materials, such as clay or silt, along transverse or longitudinal joints and cracks, and along pavement edges caused by downward slab movement activated by the passage of loads over the pavement after the accumulation of free water on or in the base course, subgrade, or subbase.	唧泥
ravelling 1) Loss of pavement surface material involving the dislodging of aggregate particles and degradation of the bituminous binder. 2) The gradual disintegration from the surface downward by losing the surface aggregate particles. Larger-sized aggregates are more likely to be dislodged.	松散(路面)
roughness The consequence of irregularities in the longitudinal profile of a road with respect to the intended profile.	平整度
rut 1) A contiguous longitudinal depression deviating from a surface plane defined by transverse cross slope and longitudinal profile. 2) A longitudinal surface depression in the wheel path(s) of a pavement surface.	车辙
rut Depth The maximum measured perpendicular distance between the bottom surface of the straight edge and the contact area of the gauge with the pavement surface at a specific location.	车辙深度
rutting The formation of longitudinal depressions in the roadway surface from traffic wear in the wheel path.	形成车辙
scaling (of cement concrete) 1) The deterioration of the upper concrete slab surface, normally 3 mm to 13 mm in depth, resulting in the loss of surface mortar.	脱皮(砼)

continued

Terms	中 文 词 条
shoving 1） The displacement of a localized area of the pavement surface generally associated with turning, braking, or accelerating vehicles. 2） The displacement of the HMA mixture in a longitudinal direction.	波浪拥包(沥青路面)
sideways force coefficient The ratio of the resistance to sideways motion to the normal component of the force between the tyres of the vehicle and the pavement.	横向力系数
slab breaking Slab breaking shall be measured as the whole area of the slab broken.	破碎板
structural works Mainly refer to bridges and tunnels.	桥隧构造物
subgrade Upper part of the soil, natural or constructed, that supports the loads transmitted by the overlying road structure	路基
traffic safety device A sign, signal, marking, median, guardrail or other device placed on or adjacent to the roadway of a highway by authority of a public body to regulate, warn, or guide traffic.	沿线设施
transverse cracking 1)Cracks in the pavement that are predominantly perpendicular to the direction of traffic. 2） Any transverse crack that is longer than 2 m, excluding sawcuts, that projects within 45 degrees of perpendicular to the pavement centerline.	横向裂缝
upheaval Upheaval is a localized upward movement in a pavement due to swelling of the subgrade. This can be due to expansive soils that swell due to moisture or frost heave (ice under the pavement).	突起(路面)