Guangdong Highway Academy

Announcement of the Publication of the Institute's Standard Technical Specification for Clean Hot-In-Place Asphalt Recycling

To Whom It May Concern,

In accordance with the requirements outlined in the "Notice of Guangdong Highway Academy on the Issuance of Institute's Standard Formulation and Revision Plan" (Publication No. 34, 2023), we would like to inform you that:

This specification developed by industry participants including Guangdong Huaru Transportation Technology Company Limited, Guangdong Road and Bridge Construction Development Company Limited, Guangdong Transportation Industrial Investment Company Limited, Guangdong Expressway Company Limited, Guangdong Nan Yue Transportation Investment and Construction Company Limited, Guangdong Provincial Transportation Planning and Designing Research Institute Group Company Limited and Jiapeng Infrastructure Technology Co. have successfully completed the "Technical Specification for Clean Hot-In-Place Asphalt Pavement Recycling." This document has been reviewed and approved by the Guangdong Highway Academy and is hereby published.

Addendum: T/GDHS 013-2024《Technical Specification for Clean Hot-In-Place Asphalt Pavement Recycling》

广东省公路学会

2024年10月15日

CHINA HIGHWAY AND TRANSPORTATION SOCIETY (CHTS)

Bulletin regarding the publication of

"Highway Hot-In-Place Ashpalt Recycling Construction Technology Guidelines"

We accounce CHTS Standard# 10137-2024 : “Highway Hot-In-Place Ashpalt Recycling Construction Technology Guidelines” is published today on March 11, 2024 and will be effective from March 25, 2024.

CHTS holds the copyright and interpretation of “Highway Hot-In-Place Ashpalt Recycling Construction Technology Guidelines” and delegate the rights of daily interpretation and management to Jilin Jiapeng Group Ltd Co, who is the editor in chief.

CHINA HIGHWAY AND TRANSPORTATION SOCIETY (CHTS)

March 11, 2024

前 言

INTRODUCTION

本指南是在大量室内外试验研究,对就地热再生设备进一步研发、提出作业环境质量要求的基础 上,结合工程实践编制而成。

This guideline is compiled based on a large number of indoor and outdoor experimental studies, further research and development of Hot-In-Place recycling equipment, and requirements for the quality of the operating environment, and in conjunction with engineering practice.

本指南按照《中国公路学会标准编写规则》(T/CHTS10001—2018)编写,共 8 章和 4 个附录,主要 内容包括:总则、术语、基本规定、材料、配合比设计、设备、施工、质量控制等。

This guideline is complied in accordance with the “China Highway and Transportation Society Standard Writing Rules” (T/CHTS10001-2018), with a total of 8 chapters and 4 appendices, the main contents include: general provisions, terminology, basic provisions, materials, proportion design, equipment, construction, quality control, etc.

本指南的某些内容可能涉及专利,本指南的发布机构不承担识别专利的责任。

Some of the contents of this guideline may be covered by patents, and the publisher of this guideline takes no responsibility for identifying patents.

本指南由吉林省嘉鹏集团有限公司提出,受中国公路学会委托,负责具体解释工作。请有关单位 将实施中发现的问题与建议,反馈至吉林省嘉鹏集团有限公司(地址:吉林省长春市九台区西环路 65- 18 号;联系电话:0431-82322489;电子邮箱:164235884@qq.com),供修订时参考。

This guideline is proposed by Jilin Jiapeng Group Co., Ltd. and entrusted by China Highway and Transportation Society to be responsible for the specific interpretation. For revision purpose, please send the problems and suggestions found in the implementation to Jilin Jiapeng Group Co.,Ltd. (Address: 65-18 Xihuan Road, Jiutai district, Changchun city, Jilin Province; Tel: 0431-82322489;Email:164235884@qq.com)

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公路沥青路面就地热再生清洁化施工技术指南

Technical Guideline for Hot-In-Place Recycling Clean Construction of Asphalt Pavement

1 总则 General Provisions

1.0.1 为指导公路沥青路面就地热再生清洁化施工,减少碳排放,降低环境污染,提高资源循环利用水平和养护工程质量,制定本指南。This guideline is formulated for the purpose of guiding the clean construction of Hot-In-Place recycling of highway asphalt pavement, reducing carbon emission, lowering environmental pollution, and improving the level of resource recycling and the quality of maintenance works.

1.0.2 本指南适用于二级及以上等级公路沥青路面的就地热再生养护工程。城市道路可参照使用。This guideline applies to Hot-In-Place recycling maintenance works for asphalt pavement of second and higher grade highways. It can also be used as a reference for city roads.

1.0.3 就地热再生清洁化施工应积极稳妥地采用新技术、新工艺、新材料、新装备。Hot-In-Place recycling clean construction should actively and steadily adopt new technology, new process, new materials, new equipment.

1.0.4 沥青路面就地热再生清洁化施工,除应符合本指南的规定外,尚应符合有关法律、法规及国 家、行业现行有关标准的规定。Asphalt pavement Hot-In-Place recycling clean construction, in addition to the provisions of this guideline, should also be consistent with the relevant laws, regulations and national and industry standards.

2 术语 Terminology

2.0.1 就地热再生 hot in-place recycling 采用专用设备对原沥青路面就地进行加热、翻松，并掺入一定数量的沥青、集料及再生剂等,经热 态拌和、摊铺、碾压等工序,恢复沥青路面表面功能的技术。Hot In-Place Recycling (HIR) is a technology that utilizes specialized equipment to heat and mill the existing asphalt pavement in situ, and mix a certain amount of asphalt, aggregate, and rejuvenator. Through processes including hot mixing, paving, and compaction, it restores the functional properties of the asphalt pavement surface.

2.0.2 就地热再生清洁化施工 hot in-place recycling clean construction 通过对现场场界温度、大气透光率、温室及有害气体排放浓度等指标的控制，减轻对环境不利影响和作业人员危害的就地热再生作业技术。 Hot in-place recycling clean construction is a process that mitigates un environmental impacts and reduces hazards to work crew through controlling parameters such as on-site field boundary temperature, atmospheric transmittance, greenhouse gas emissions concentration, and other indicators.

2.0.3 场界 field boundary 距就地热再生机组周围最外侧 0.1m，与路面共同形成的虚拟圆滑闭合空间界面，如图 2.0.3 所示。The Field Boundary is a virtual smooth closed space interface with the road surface formed at the outermost 0.1m from the machine perimeter, showing as Figure 2.0.3.

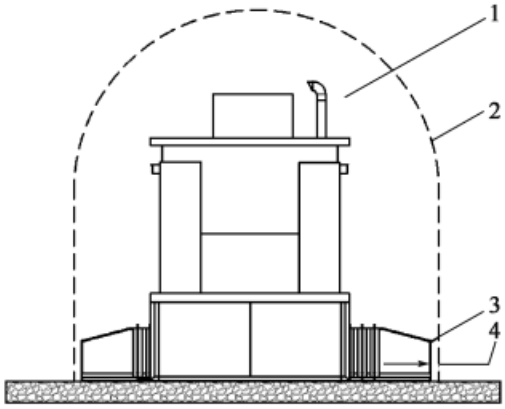

图 2.0.3　场界示意图

Figure 2.0.3 Field Boundary

1-集中排放口 exhaust;2-场界 field boundary;3-机组最外侧 machine outermost;4-距机组最外侧距离(0.1m) the outermost 0.1m from the machine primeter

2.0.4 场界温度 field boundary temperature 就地热再生机组施工过程中,场界处的温度(℃)。 Filed boundary temperature (℃) is the temperature during the equipment under construction.

2.0.5 场界大气透光率 field boundary atmospheric transmittance 就地热再生机组施工过程中,场界外 1m 处,光平行于机组行进方向透过大气的效率(%)。

Field boundary atmospheric transmittance (%) is the efficiency of light transmission through the atmosphere parallel to the direction of travel of the equipment during the construction at 1 m outside the field boundary.

条文说明 Explanatory note

原路面加热、翻松和原路面材料提温与再生沥青混合料拌和中,会形成包含颗粒物、沥青烟和多环 芳烃在内的混合烟雾。如果未经处理直接排放,这些烟雾会直接恶化作业环境质量,污染大气环境,影 响通行安全和作业安全。

A mixture of particle, asphalt fumes, and polycyclic aromatic hydrocarbons (PAHs) is formed when the original pavement is heated, loosened, and the original pavement material is warmed and mixed with the recycled asphalt mixture. If emitted untreated, these fumes can directly degrade the quality of the operating environment, pollute the atmosphere, and affect traffic and operational safety.

场界大气透光率作为光透过场界范围大气效率的评价指标,用来反映就地热再生施工中场界内大 气中颗粒物、沥青烟和多环芳烃的浓度。

The atmospheric transmittance of the site boundary is used as an evaluation index of the atmospheric efficiency of light transmission through the site boundary area, and is used to reflect the concentration of particulate matter, asphalt fumes, and polycyclic aromatic hydrocarbons (PAHs) in the atmosphere within the boundary of the site during the construction of the in-situ thermal regeneration.

2.0.6 场界温室及有害气体排放浓度 Emission concentration of field boundary greenhouse and harmful gas 排入场界范围内大气单位体积中温室及有害气体的质量(mg/m3)

The concentration (mg/m3) is the mass of greenhouse and hazardous gases per unit volume of atmosphere emitted to the site boundary.

3 基本规定 Basic Provisions

3.0.1 施工单位应具有相应的资质及相应的检测设备和人员。

The construction unit should have appropriate qualifications and appropriate testing equipment and personnel.

3.0.2 根据设计文件和技术交底情况,施工单位应对原路面病害的类型和范围进行复核。

According to the design documents and the technical delivery of the situation, the construction unit should be the original pavement damage type and scope of review.

3.0.3 就地热再生清洁化施工, 除应符合本指南规定外, 其他技术要求还应符合现行《公路沥青路 面再生技术规范》(JTG/T5521)的规定。

Hot-In-Place recycling clean construction in addition to conform to the provisions of this guide, other technical requirements should be consistent with the current “highway asphalt pavement regeneration technical specifications” (JTG/T5521) provisions.

3.0.4 就地热再生清洁化施工应符合下列要求: Requirements on Hot-In-Place recycling clean construction

1 雨天不得作业 Forbidden to work in the rain.

2 现场温度低于 5℃不宜作业 Not suitable for operation when construction site temperature is below 5℃

3 强风及以上风力或路面潮湿条件下不宜作业 Not suitable for operation in strong winds or above or when the road surface is wet.

3.0.5 就地热再生清洁化施工可采用热拌或温拌沥青混合料。当施工现场温度低于 15℃时, 宜选 用温拌沥青混合料。Hot-In-Place recycling clean construction can use hot or warm mix asphalt mixture. When the temperature of the construction site is lower than 15 ℃, it is preferred to use warm mix asphalt mixture.

4 材料 Materials

4.1 一般规定 Ordinary Provision

4.1.1 原材料及混合料应符合现行《公路沥青路面施工技术规范》(JTGF40)的有关规定。Raw materials and mixtures should be in line with the current “Technical Specifications for Highway Asphalt Pavement Construction” (JTGF40).

4.1.2 添加的新材料应记录名称、来源、性质、规格、用途、数量等信息。New materials added should be recorded with information such as name, source, nature, specifications, use, and quantity.

4.1.3 添加的新集料应设置标识,不同规格材料应分开堆放,并采取防雨措施。 Added new aggregates should be labeled, and materials of different sizes should be stacked separately and protected from rain.

4.2 再生剂 Rejuvenator

4.2.1 再生剂应具有良好的浸润扩散能力,与沥青有良好的配伍性和耐老化能力。Rejuvenator should have good infiltration and diffusion ability, good compatibility with asphalt and aging resistance.

4.2.2 石油基再生剂应符合现行《公路沥青路面再生技术规范》(JTG/T5521)的有关规定。Petroleum-based rejuvenator should be in line with the current “Highway Asphalt Pavement Recycling Technical Specification” (JTG/T5521)

4.2.3 非石油基再生剂应对混合料性能进行验证,其结果应符合现行《公路沥青路面再生技术规 范》(JTG/T5521)的规定。 Non-petroleum-based rejuvenator should be verified for the performance of the mixture, and the results should be in accordance with the current “Highway Asphalt Pavement Recycling Technical Specification” (JTG/T5521)

4.2.4 再生剂应储存在密闭的容器中。 Rejuvenator should be stored in airtight containers

4.3 旧沥青层回收料 (RAP) Recycled material from old asphalt layers (RAP)

4.3.1 RAP 的技术要求应符合现行《公路沥青路面再生技术规范》(JTG/T5521)的有关规定。 RAP specification should be in line with the current “Highway Asphalt Pavement Recycling Technical Specification” (JTG/T5521)

4.3.2 RAP 中不得混入杂物。Do not mix debris with RAP.

5 配合比设计 Proportion Design

5.0.1 配合比设计和混合料性能要求应符合现行《公路沥青路面再生技术规范》(JTG/T5521)的有关规定。 The proportion design and mixture’s performance requirements should be in line with the current “Technical Specification for Highway Asphalt Pavement Recycling” (JTG/T5521)

5.0.2 再生沥青混合料的配合比设计,应结合 RAP、新添加材料的性能,设计两组以上混合料配合 比,经试验对比分析择优选取。The proportion design should be combined with the RAP, the performance of the new material. Select the best one among the two designs after the test comparison and analysis.

5.0.3 采用温拌沥青混合料时,温拌剂的种类、添加量等应通过试验确定。When using warm mix asphalt mixtures, the type of warm mixing agent, the amount of additives, etc. should be determined through the test.

6 设备 Equipment

6.0.1 机组应符合下列要求: The equipment should comply with below requirements:

1 具有原沥青路面加热、翻松、提温、新料添加、拌和、摊铺与碾压成型等功能 Functions including original asphalt pavement pre-heating, fluffing, heating, new material adding, mixing, paving, rolling and compacting, etc.

2 作业宽度宜为 3.0m~4.5m 且可调 Construction width is suitable and adjustable in the range of 3.0M to 4.5M

3 作业速度宜为 2m/min~6m/min 且可调 Construction speed is suitable and adjustable in the range of 2m/min~6m/min

4 机组如图 6.0.1 所示。Equipment showing as Figure 6.0.1

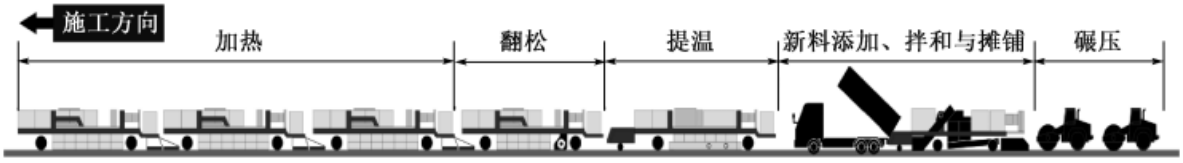

图 6.0.1 施工机组示意图

Direction of construction, Pre-heat, Grind, Heat, New material adding, mixing and paving, Roll and compact.

5 各台机械设备外形尺寸、轴载、作业用燃料与加注方式,应符合国家、行业相关规定。The external dimensions, axle loads, operating fuels and filling methods of each piece of machinery and equipment should be in line with the relevant national and industry regulations.

6.0.2 机组应具有下列功能或装置: The equipment shall have the following functions or devices:

1 机组应具有原沥青路面(或旧沥青混合料)加热温度自动控制、显示、记录和存储功能。 Unit should have the original asphalt pavement (or old asphalt mixture) heating temperature automatic control, display, recording and storage functions.

2 机组应有废气、废热与粉尘收集处理装置,其收集的混合气体在大于或等于 650℃空间环境中 滞留的时间应大于或等于 0.5s。 The unit shall have exhaust gas, waste heat and dust collection and treatment devices, and the collected gas mixture shall

be retained in the space environment at or above 650℃ for a period of time greater than or equal to 0.5 s. The unit shall be equipped with an exhaust gas, heat and dust collection and treatment device.

3 拌和机应具有对接缝与下承层的补温功能。 The mixing machine shall have the function of warming up the joints and the sub-bearing layer.

4 设备四周与路面之间宜加装保温装置。It is desirable to add insulation between the perimeter of the equipment and the road surface

6.0.3 清洁化要求如下:

1 场界温度应小于或等于 50℃,检测按本指南附录 A 进行。The field boundary temperature should be less than or equal to 50℃, and testing should be conducted in accordance with Appendix A of this Guide.

2 场界大气透光率应大于或等于 90%,检测按本指南附录 B 进行。Atmospheric light transmission at the field boundary should be greater than or equal to 90%, and testing should be conducted in accordance with Appendix B of this Guide.

3 场界温室及有害气体排放浓度应符合表 6.0.3 的要求。 Greenhouse and hazardous gas emission concentrations at the field boundary shall comply with the requirements of Table 6.0.3.

表 6.0.3 场界温室及有害气体排放浓度场界控制要求

项目	碳化物	氮化物	硫化物	检测方法
浓度(mg/m³),≤	240	200	1000	按本指南附录 C

Concentration (mg/m3), Carbide, Nitride, Sulfide, Detection Methods: As per Appendix C of this guideline

7 施工 Construction

7.1 施工准备 Construction Preparation

7.1.1 施工组织方案和交通组织方案,应符合设计要求及现行《道路交通标志和标线 第 4 部分: 作业区》(GB5768.4)和《公路养护安全作业规程》(JTGH30)的要求编制。 Construction organization plan and traffic organization plan, should be in line with the design requirements and the current “road traffic signs and markings Part 4: work area” (GB5768.4) and “highway maintenance safety regulations” (JTGH30)

7.1.2 根据现行《公路沥青路面再生技术规范》(JTG/T5521)的有关规定,应对原路面特殊部位及 原路面的局部病害进行处治。 According to the current “highway asphalt pavement regeneration technical specifications” (JTG/T5521) , the special parts and the disease parts of the original pavement should be treated.

7.1.3 进场设备应提供作业环境质量性能检测报告。必要时,可请第三方检测机构进行现场检测。 The incoming equipment should be provided with a test report on the quality and performance of the operating environment. If necessary, a third-party testing organization may be requested to conduct on-site testing.

7.1.4 设备作业前应进行调试、标定,并应处于正常工作状态。 The equipment should be debugged and calibrated before operation, and should be in normal working condition.

7.1.5 各单机之间间距应控制在 2m 以内。 The distance between individual machines should be controlled within 2m

7.1.6 铺筑试验段长度不宜小于 500m。应通过试铺确定下列参数和工艺: The length of the paving test section should not be less than 500 m. The following parameters and processes should be determined by trial paving.

1 检验就地热再生设备的性能是否满足施工需要。 Test the performance of HIR equipment to meet construction needs

2 确定设备加热时间、加热温度及施工速度、碾压组合等参数和工艺。 Determine the equipment heating time, heating temperature and construction speed, rolling combination and other parameters and processes

3 验证混合料配合比设计。 Verify mix ratio design

4 检验压实度、渗水系数等。 Test compaction, seepage coefficient, etc.

5 检验作业环境质量控制措施是否可行。 Test the feasibility of quality control measures for the operating environment

6 验证施工组织和交通组织方案是否可行。 Verify that the construction organization and traffic organization plan is feasible

7 检验材料供应和其他配套设备的配置是否满足生产需求。 Verify that material supplies and other ancillary equipment are configured to meet production requirements

7.1.7 对施工路段还应做好下列工作: The following shall also be done for the construction section

1 对植物隔离带、树木、加油(气)站、桥梁伸缩装置等采取必要的防护措施。 Necessary protective measures are taken for vegetation barrier, trees, gasoline (gas) stations, bridge expansion joints, etc.

2 清除环氧树脂等热固型材料铺装层,清除原路面上的突起路标、灌封胶等。 Remove epoxy resin and other thermosetting materials from the paving layer, and remove protruding road markings and potting adhesive from the original pavement.

3 清扫路面杂物,设置机组行走导向线。 Sweeping debris from the road surface and setting up guide lines for the crews.

7.1.8 应根据施工进度,按照再生沥青混合料配合比设计要求,拌制新沥青混合料保温备用,也可 准备新添加集料或 RAP 备用。 According to the construction progress, in accordance with the recycled asphalt mix ratio design requirements, mixing new asphalt mixture insulation spare, can also be prepared to add new aggregates or RAP spare.

7.2 再生作业 HIR construction

7.2.1 沥青路面就地热再生清洁化作业流程如图 7.2.1 所示。 HIR operation process is shown in Figure 7.2.1

7.2.2 路面加热应符合下列要求: Heating on road surface should comply with below requirements:

1 各台加热机应按照 2m/min~6m/min 的作业速度与摊铺机作业速度匀速行进,并尽可能缩短 各台设备之间的间距。 Each heating machine should be in accordance with the operating speed of 2m/min~6m/min and the paver operating speed, and shorten the distance between the equipment as much as possible.

2 加热宽度应符合现行《公路沥青路面再生技术规范》(JTG/T5521)的有关规定。 Heating width should be in line with the current “highway asphalt pavement regeneration technical specifications” (JTG/T5521)

3 原路面温度及最高加热温度应符合表 7.2.2 的规定。The original pavement temperature and maximum heating temperature shall be in accordance with Table 7.2.2

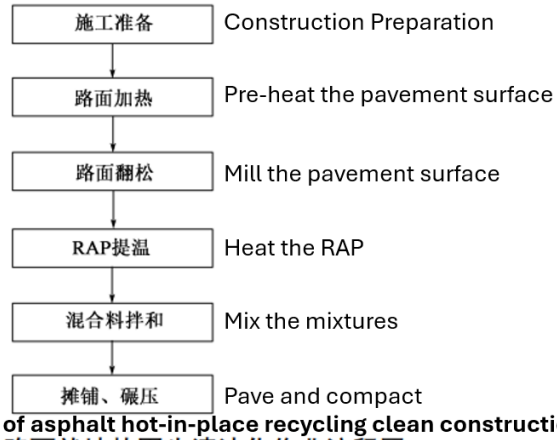

Figure 7.2.1 Process map of asphalt hot-in-place recycling clean construction

图 7.2.1　沥青路面就地热再生清洁化作业流程图

Figure 7.2.2 Original pavement temperature and maximum heating temperature

表 7.2.2　原路面温度及最高加热温度

项目 ITEM		温度要求 Temperature requirement		Detection frequency 检测频率	Testing method 试验方法
		普通沥青	改性沥青		
原路面温度(℃) Original pavement surface temp		Ordinary asphalt ⩾5	Modified asphalt	Before each shift 每班作业前 检测一次 Test once	infrared thermometer 红外测温枪 或温度计 Or thermometer
路面加热最高温度(℃) Maximum temperature for road heating	热拌沥青混合料 Hot mixed asphalt mixtures	⩽180	⩽190	每 300m 检测一次 Test once every 300m	按本指南附录 D As per Appendix D of this guide
	温拌沥青混合料 Warm mixed asphalt mixtures	⩽170	⩽180		

7.2.3 路面翻松应符合下列规定: Grinding should comply with below requirements:

1 原路面翻松的宽度应满足再生宽度设计要求。 The width of the original pavement shall meet the design requirements of the regeneration width.

2 原路面翻松深度应控制在设计值±3mm 的范围内。翻松作业应均匀,当翻松深度变化时应缓 慢渐变。The depth of original road surface should be controlled within the range of ±3mm of the design value. Turning operation should be uniform, when the turning depth changes should be slow and gradual change.

3 原路面翻松后裸露面温度应在原路面沥青软化点的基础上提升 15℃,并按本指南附录 D 的要 求每 300m 检测一次,保持纵向翻松边沿顺直。The temperature of the exposed surface of the original pavement should be increased by 15℃ on the basis of the softening point of the asphalt of the original pavement, and should be tested every 300m according to the requirements of Appendix D of this guideline, and the longitudinal loosening edges should be kept straight.

4 原路面翻松后旧沥青混合料的温度要求:对于普通沥青混合料宜控制在 110℃~130℃;对于改 性沥青混合料宜控制在 120℃~150℃。The temperature of the old asphalt mixture after the original pavement loosening requirements: for ordinary asphalt mixture should be controlled at 110 ℃ ~ 130 ℃; for modified asphalt mixture should be controlled at 120 ℃ ~ 150 ℃.

7.2.4 应对翻松后的旧沥青混合料进行提温,其温度要求宜符合表 7.2.4 的规定。The old asphalt mixture shall be warmed up after turning, and its temperature requirements shall be in accordance with the provisions of Table 7.2.4.

Figure 7.2.4 After heating, old asphalt mixtures' temperature

表 7. 2. 4　提温后旧沥青混合料的温度

项目 ITEM	After heating, RAP temperature 提温后 RAP 温度(℃)		检测频率 Detection frequency	试验方法 Testing method
	Ordinary asphalt 普通沥青	Modified asphalt 改性沥青		
热拌沥青混合料 Hot mixed asphalt mixtures	145～155	155～165	每 300m 检测一次 Test once every 300m	按本指南附录 D As per Appendix D of this guide
	Temperature difference between internal measurement points less than 10 内部各测点温差小于 10			
温拌沥青混合料 Warm mixed asphalt mixtures	125～135	135～145		
	Temperature difference between internal measurement points less than 10 内部各测点温差小于 10			

7.2.5 混合料拌和应符合下列规定: Mixing should comply with below requirements:

1 按照配合比设计的比例,将提温后的旧沥青混合料计量投入拌缸内拌和。 According to the proportion of the mixing ratio design, the old asphalt mixture after warming up and measured are mixed in the mixing pots.

2 再生剂、沥青等新添加材料应按配合比设计要求计量添加,并根据旧沥青混合料的变化情况, 动态调整再生剂、沥青的用量。 Rejuvenator, asphalt and other new materials should be added according to the design requirements of the measurement ratio, and according to the changes in the old asphalt mixture. Dynamically adjust the dosage of rejuvenator and asphalt.

3 拌和宜采用强制间歇式搅拌,也可采取其他拌和方式。 Mixing should be forced intermittent mixing, can also take other mixing methods

4 拌和均匀后的混合料宜直接卸于摊铺机料斗中。 The homogenized mix should be discharged directly into the paver's hopper.

5 混合料的拌和温度宜符合表 7.2.5 的规定。The mixing temperature of the mixture shall be in accordance with Table 7.2.5.

Figure 7.2.5 Mixing temperature for recycled asphalt mixtures

表 7.2.5 再生沥青混合料拌和温度

项目 ITEM	拌和温度(℃) Mixing temperature		检测频率 Detection frequency	试验方法 Testing method
	普通沥青 Ordinary asphalt	改性沥青 Modified asphalt		
热拌沥青混合料 Hot mixed asphalt mixtures	140～155	150～165	每 300m 检测一次 Test once every 300m	按本指南附录 D As per Appendix D of this guide
温拌沥青混合料 Warm mixed asphalt mixtures	120～135	130～145		

7.2.6 摊铺应符合下列规定: Paving should comply with below requirements:

1 摊铺前,应将摊铺机熨平板预热到 110℃以上。 Before paving, the paver screed should be preheated to 110℃ or above.

2 摊铺前裸露面、所有边缘接缝处的温度,应在旧沥青混合料沥青软化点的基础上至少提 高 15℃。 The temperature of the exposed surfaces and all edge joints before paving shall be increased by at least 15°C above the softening point of the asphalt of the old mix.

3 再生沥青混合料的摊铺温度宜符合表 7.2.6 的规定。The paving temperature of recycled asphalt mixtures shall be in accordance with Table 7.2.6.

Figure 7.2.6 Paving temperature for recycled asphalt mixtures

表 7.2.6 再生沥青混合料摊铺温度

项目 ITEM	再生沥青混合料摊铺温度(熨平板后)(℃) Paving temperature for recycled asphalt mixtures (after screed)		检测频率 Detection frequency	试验方法 Testing method
	普通沥青 Ordinary asphalt	改性沥青 Modified asphalt		
热拌沥青混合料 Hot mixed asphalt mixtures	≥135	≥145	每 300m 检测一次 Test once every 300m	按本指南附录 D As per Appendix D of this guide
温拌沥青混合料 Warm mixed asphalt mixtures	≥115	≥125		

4 沥青混合料的摊铺速度宜为 2m/min~6m/min。 The paving speed of asphalt mixture should be 2m/min~6m/min.

5 再生沥青混合料铺层应均匀,无裂纹、无油团、无硬块、无离析等现象。Recycled asphalt mixture paving layer should be uniform, no cracks, no oil, no hard lumps, no segregation and other phenomena

6 接缝应连接紧密、纵横平顺,无明显离析。Joints should be tightly connected, smooth lengthwise and crosswise, without obvious segregation.

7.2.7 碾压应符合下列规定: Compaction should comply with below requirements

1 应采用试验段确定的设备组合和碾压工艺进行碾压。 The combination of equipment and rolling process determined for the test section should be used for rolling

2 初压机械应紧跟摊铺机进行碾压。 The initial pressing machine should follow the paver closely for rolling

3 对大型机具无法压实的部位,应选用小型振动压路机配合碾压。 For the parts that cannot be compacted by large machines, small vibratory rollers should be used with the roller.

4 碾压温度宜符合表 7.2.7 的规定。The rolling temperature should be in accordance with Table 7.2.7.

Figure 7.2.7 Rolling and Compaction temperature

表 7.2.7 碾压温度

项目ITEM	First compaction temperature 初压开始温度(℃)		Last compaction temperature 终压结束温度(℃)		检测频率 Detection frequency	试验方法 Testing method
	Ordinary asphalt 普通沥青	Modified asphalt 改性沥青	Ordinary asphalt 普通沥青	Modified asphalt 改性沥青		
Hot mixed asphalt mixtures 热拌沥青混合料	≥130	≥140	≥80	≥90	每 300m 检测一次 Test once every 300m	按本指南附录 D As per Appendix D of this guide
Warm mixed asphalt mixtures 温拌沥青混合料	≥110	≥120	≥70	≥80		

5 其他要求应符合现行《公路沥青路面施工技术规范》(JTGF40)的有关规定。 Other requirements should be in line with the current Technical Specification for Highway Asphalt Pavement Construction (JTGF40).

7.2.8 开放交通应符合下列规定: Open to traffic should comply with below requirements

1 开放交通时路面温度低于 50℃。 Pavement temperature below 50°C when open to traffic

2 清理路面杂物。 Clearing of road debris

3 其他要求符合现行《公路沥青路面施工技术规范》(JTGF40)的有关规定。 Other requirements are in line with the current Technical Specification for Highway Asphalt Pavement Construction (JTGF40).

8 质量控制 Quality Control

8.1 施工质量控制 Quality control on construction

8.1.1 所有材料质量检验应符合现行《公路沥青路面施工技术规范》(JTGF40)和《公路沥青路面再 生技术规范》(JTG/T5521)的有关规定。The quality inspection of all materials should be in accordance with the current Technical Specification for “Highway Asphalt Pavement Construction “(JTGF40) and Technical Specification for “Highway Asphalt Pavement Regeneration” (JTG/T5521).

8.1.2 施工过程中的检测项目、频率和要求应符合表 8.1.2-1、表 8.1.2-2 的规定。Testing items, frequency and requirements during construction shall be in accordance with Table 8.1.2-1 and Table 8.1.2-2

Figure 8.1.2-1 Quality requirement on recycled asphalt mixture

表 8.1.2-1 再生沥青混合料质量要求

项目ITEM		要求或偏差 Requirement or tolerance	检测频率 Detection frequency	试验方法 Testing method
混合料外观 Mixture exterior appearance		应均匀、无离析、无花白料、无团团 Uniform, insoluble, no grizzled material, no pellet	随时 Any time	目测 Visual assessment
新沥青混合料、再生剂、沥青用量 New asphalt mixture, rejuvenator, asphalt		适时调整，总量控制 Timely adjust, Overall control	随时 Any time	统计计算 Statistical calculation
再生混合料级配(%) Recycled mixture gradation %	0.075mm	设计值±2 designed value	每个工作日 1 次～2 次 Once or twice every working day	JTG E20—2011 的 T 0725 或 T 0735
	≤2.36mm	设计值±5(高速公路、一级公路)；设计值±6(二级公路) designed value (HWY, Class I roads designed value (HWY, Class II roads		
	≥4.75mm	设计值±6(高速公路、一级公路)；设计值±7(二级公路) designed value (HWY, Class I roads designed value (HWY, Class II roads		
再生混合料沥青含量(%) Asphalt ration in recycled mixture		设计值±0.3 designed value	每个工作日 1 次～2 次 Once or twice every working day	JTG E20—2011 的 T 0722 或 T 0735
马歇尔试验：空隙率、稳定度、流值 Marshall test, void ratio, stability degree, stream vale		符合《公路沥青路面再生技术规范》(JTG/T 5521—2019)的要求 Meet JTG/T5521-2019	每个工作日 1 次 Once every working day	JTG E20—2011 的 T 0702、T 0709，JTG/T 5521—2019 的附录 E
浸水马歇尔试验 Marshall soak test		符合《公路沥青路面再生技术规范》(JTG/T 5521—2019)的要求 Meet JTG/T5521-2019	必要时 When necessary	JTG E20—2011 的 T 0702、T 0709
车辙动稳定度试验 Rutting dynamic stability test		符合《公路沥青路面再生技术规范》(JTG/T 5521—2019)的要求 Meet JTG/T5521-2019	每周 1 次～2 次 Once or twice every week	JTG E20—2011 的 T 0719

注：试验方法中的标准为《公路工程沥青及沥青混合料试验规程》(JTG E20—2011)、《公路沥青路面再生技术规范》(JTG/T 5521—2019)。

Figure 8.1.2-2 Quality requirement on payment

表 8.1.2-2 路面质量要求

项目 ITEM	Requirement or tolerance 要求或偏差	Detection frequency 检测频率	Testing method 试验方法
外观 Exterior appearance	表面平整密实，无明显轮迹、裂痕、推挤、油包、离析等缺陷 Surface flat and dense, no visible wheel marks, cracks, extrusion, pellet and segregation	随时 Any time	目测 Visual assessment
纵、横接缝高差(mm) Longitudinal and transverse joint height difference	≤3	每 200m 测 1 处 1 measurement per 200m	3m 直尺间隙 3m straightedge clearance
翻松裸露面温度 Temperature of exposed surface after milling	符合本指南要求 Comply with this guide	随时Any time	按本指南附录 D As per Appendix D of this guide
再生混合料摊铺温度 Recycled mixture paving temperature	符合本指南要求 Comply with this guide	随时Any time	按本指南附录 D As per Appendix D of this guide
再生厚度(mm) Regeneration thickness	−1，+5(基于设计厚度) Based on design thickness	每 1500m² 检验 1 处 1 measurement per 1500m2	JTG 3450—2019 的 T 0912
加铺厚度(mm) Thickness of additional paving	−1，+5(基于设计厚度) Based on design thickness	每 1500m² 检验 1 处 1 measurement per 1500m2	JTG 3450—2019 的 T 0912
宽度 Width	≥设计宽度 designed width	每 100m² 检验 1 次 1 measurement per 100m2	JTG 3450—2019 的 T 0911
压实度(%) degree of compaction	≥93(基于理论最大相对密度) Based on theoretical maximum relative density	每 1500m² 检验 1 组 1 group measurement per 1500m2	JTG 3450—2019 的 T 0924，JTG F40—2004 的附录 E
平整度(标准差)(mm) Flatness (standard deviation)	(HWY, Class I roads) ≤1.5(高速公路、一级公路)；≤2.5(二级公路) (Class II roads)	full-line 全线连续 continuous	JTG 3450—2019 的 T 0932，全程每车道施工段连续，按每 100m 施工段计算标准差 Throughout continuous on Each lane of the construction section, standard deviation per 100 m construction section
渗水系数(mL/min) Seepage parameters	符合设计要求 Comply with design	每 1500m² 检验 1 处 1 measurement per 1500m2	JTG 3450—2019 的 T 0971

注：试验方法中的标准为《公路路基路面现场测试规程》(JTG 3450—2019)、《公路沥青路面施工技术规范》(JTG F40—2004)。

8.2 作业环境质量检查 Quality control on construction environment

8.2.1 再生作业环境场界温度、大气透光率、温室及有害气体排放浓度,应符合表 8.2.1 的规定。Recycling operation environment boundary temperature, atmospheric transmittance, greenhouse and harmful gas emission concentration, shall comply with Table 8.2.1.

Figure 8.2.1 Environmental quality requirement at construction site

表 8. 2. 1　作业环境质量要求

项目 ITEM	要求或偏差 Requirement or tolerance	检验频率 Detection frequency	试验方法 Testing method
场界温度 Field boundary temperature	符合本指南要求 Comply with this guide	每 300m 测 1 次 1 measurement per 300m	按本指南附录 A As per Appendix A
场界大气透光率 field boundary atmospheric transmittance	符合本指南要求 Comply with this guide	每台班测 1 次 1 measurement per shift	按本指南附录 B As per Appendix B
温室及有害气体排放浓度 Field boundary Emission concentration of field boundary greenhouse and harmful gas	符合本指南要求 Comply with this guide	施工期内不少于 1 次 Not less than once during construction	按本指南附录 C As per Appendix C

8.2.2 再生作业时,如出现可见蓝烟、粉尘等外溢现象,应增加检测频率。During regeneration operations, the frequency of inspection should be increased if there is visible blue smoke, dust or other spillage.

附录 A 场界温度测试

Appendix A Field boundary temperature test

A.0.1 本方法适用于就地热再生清洁化施工过程中机组场界温度的测试。 This method is applicable to the testing of field boundary temperatures during Hot in-place recycling clean construction processes.

A.0.2 仪具与材料技术要求如下: The technical requirements for instruments and materials are as follows:

1 热电偶温度计:分度值为 1℃,宜采用数字式的热电偶温度计,测杆长度不小于 100mm,并具有 温度测值及最大值读数留置功能。 Thermocouple thermometer: graduation value of 1 ℃, it is appropriate to use digital thermocouple thermometer, the length of the measuring rod is not less than 100mm, and has a temperature measurement value and the maximum value of the readings retained function

2 测温支架长度不应小于 2.1m。 The length of the temperature measurement bracket should not be less than 2.1m.

3 卷尺和记号笔等。 Tape measure, marker, etc

A.0.3 方法与步骤: Methodology and steps

1 使用卷尺从测温支架底部进行测量,并使用记号笔分别在距地面 0.1m、1m、2m 处做好标记。 Use a tape measure to measure from the bottom of the temperature measurement bracket, and use a marker to mark 0.1m, 1m, 2m from the ground.

2 将插入式温度计的测温探头分别固定在测温支架标记处,测温探头应悬浮于空气中,不得与测 温支架或其他物体触碰。 Fix the temperature probe of the insertion thermometer at the mark of the temperature measurement bracket, the temperature probe should be suspended in the air, and should not touch the temperature measurement bracket or other objects.

3 提前将测温支架与地面垂直地放在机组作业的下风侧,其位置应与机组场界的侧面重合。 Place the temperature measurement bracket perpendicular to the ground on the downwind side of the unit in advance of operation, and its position should coincide with the side of the unit's field boundary.

4 当机组行驶至测温支架时,开启测温仪,并调整至显示最大值模式,数据采集间隔时间不大于 5s,注视温度计变化,直至机组全部通过测温支架,读记最大温度,准确至 1℃。 When the unit is traveling to the temperature measurement bracket, turn on the thermometer and adjust it to the mode of displaying the maximum value, with the interval time of data acquisition not more than 5s, watch the thermometer change until the unit passes through the temperature measurement bracket, and then read and record the maximum temperature accurately up to 1℃.

5 重复上述过程,依次测试机组中每台设备的场界温度。 Repeat the above process to test the field temperature of each piece of equipment in the unit in turn.

A.0.4 数据处理:对测试的数据进行整理分析,取测试最高温度中的最大值作为机组场界温度。 Data processing: the data of the test is organized and analyzed, and the maximum value of the highest temperature of the test is taken as the field temperature of the unit.

A.0.5 报告应包括下列内容: The report should include the following

1 测试路段信息(桩号、车道位置、施工方向、环境温度、风力、风向等)。 Test section information (pile number, lane location, construction direction, ambient temperature, wind, wind direction, etc.)

2 施工参数。Construction parameters

3 测试方法。Test Methods

4 测试结果。 Test results

5 观察到的异常情况 Observed abnormalities

6 测试日期。Test date

附录 B 场界大气透光率测试

Appendix B Field boundary atmospheric light transmission test

B.0.1 本方法适用于就地热再生清洁化施工场界大气透光率的测试,包括路面加热、翻松、旧沥青 混合料提温、拌和与摊铺的大气透光率。 This method is applicable to the testing of atmospheric transmittance at the field boundary of Hot in-place recycling clean construction, including the pre-heating the pavement surface, grinding, warming of old asphalt mixture, mixing and paving.

B.0.2 仪具与材料技术要求如下: The technical requirements for instruments and materials are as follows:

1 透光率检测仪宜采用分体便携式大气透光率仪,透光率测试范围为 0%~100%,测试误差不超 过±2%,分度值为 0.01%,并具有数据记录、存储、导出功能,数据记录间隔不大于 1s。 Transmittance detector should be used split portable atmospheric transmittance meter, transmittance test range of 0% ~ 100%, the test error does not exceed ± 2%, the graduation value of 0.01%, and has a data logging, storage, export function, the data recording interval is not greater than 1s.

2 笔记本电脑、仪器固定支架等。 Laptop computers, instrument mounting bracket, etc.

B.0.3 方法与步骤: Methodology and steps

1 将大气透光率仪的发射器与接收器安装到仪器固定支架上,并摆放在机组一侧下风口的检测 位置上。 Attach the transmitter and receiver of the atmospheric transmittance meter to the instrument mounting bracket and place it in the detection position at the downdraft port on the side of the unit.

2 发射器与接收器间的距离应根据机组单个设备的长度进行调整,使测试间距覆盖单个设备的 长度,如各单机长度不同,则按机组中单个设备最大长度作为测试距离。 The distance between the transmitter and receiver should be adjusted according to the length of individual equipment in the set, so that the test spacing covers the length of individual equipment, or if the length of each unit is different, the maximum length of individual equipment in the set will be taken as the test distance.

3 调整仪器固定支架,使发射器和接收器处于距地面高度 1m、距场界侧面 0.5m 的位置。 Adjust the instrument mounting bracket so that the transmitter and receiver are at a height of 1 m above the ground and 0.5 m from the side of the field boundary.

4 仪器连接电脑后,调整参数处于工作状态,记录大气透光率检测值。当机组进入测试位置时,开 始记录初始时间。当机组尾部驶出测试范围时,记录结束时间。After the instrument is connected to the computer, the parameters are adjusted to the working state, and the atmospheric transmittance test value is recorded. When the unit enters the test position, the initial time is recorded. When the rear part of the unit leaves the test range, the end time is recorded.

5 初始时间与结束时间段内的测试数据为机组的场界大气透光率,准确至 0.01%。Test data for the initial and final time periods are the unit's atmospheric transmittance at the field boundary, accurate to 0.01%.

B.0.4 数据处理:整理初始时间至结束时间内所测得的数据,取测试值中的最小值,作为机组场界 大气透光率。 Data processing: Collate the data measured from the start time to the end time, and take the smallest value among the test values as the unit boundary Atmospheric transmittance

B.0.5 报告应包括下列内容: The report should include the following

1 测试路段信息(桩号、车道位置、施工方向、环境温度、风力、风向等)。 Test section information (pile number, lane location, construction direction, ambient temperature, wind, wind direction, etc.)

2 施工参数。Construction parameters

3 测试方法。Test Methods

4 测试结果。 Test results

5 观察到的异常情况 Observed abnormalities

6 测试日期。Test date

附录 C 温室及有害气体排放浓度测试

Appendix C Field boundary greenhouse and hazardous gas emission concentration test

C.0.1 本方法适用于测试就地热再生清洁化施工时的温室及有害气体排放浓度,包括场界温度和 集中排放口温室及有害气体排放浓度。 This method is applicable to the testing of greenhouse and hazardous gas emission concentrations, including site boundary temperature and centralized vent greenhouse and hazardous gas emission concentrations, during the Hot in-place recycling clean construction.

C.0.2 仪具与材料技术要求如下: The technical requirements for instruments and materials are as follows:

烟气分析仪宜采用便携式气体检测仪,能以 mg/m3 为单位显示结果。测试探针长度不低于 500mm,测量精度不低于±5%,分辨率不低于 1mg/m3,并有读数留置功能。 Flue gas analyzer should be used portable gas detector, can be mg/m3 as the unit of display results. Test probe length of not less than 500mm, measurement accuracy of not less than ± 5%, resolution of not less than 1mg/m3, and readings retained function

条文说明 Explanatory note

基于就地热再生环保和保障车辆通行等要求,本指南通过现场研究,采用便携式气体检测仪,提出 了快速检测温室及有害气体排放浓度的方法,以满足施工作业的需要。This guideline proposes a method through on-site research for rapid detection of greenhouse and hazardous gas emissions using portable gas detectors to meet the needs of construction operations, based on the HIR environmental requirement and requirement of maintaining vehicular traffic, etc.

C.0.3 方法与步骤: Methodology and steps

1 场界温室及有害气体排放浓度测试方法为: The test methods for greenhouse and hazardous gas emission concentrations at the field boundary are:

1) 每台设备测点数不少于 3 个。 Not less than 3 measurement points per piece of equipment

2) 在就地热再生清洁化施工现场无烟处,开启便携式气体检测仪,测试自然环境数据后将仪器 处于待机状态。 The portable gas detector is switched on in

a smokeless area of the CRE construction site, tested for natural ambient data, and then placed in standby mode.

3) 在机组场界下风口一侧,将便携式气体检测仪的探头置于高于加热装置 1m 处的场界处。 On the downwind side of the unit boundary, place the probe of the portable gas detector at the boundary 1 m above the heating unit.

4) 开启仪器测试,注视测值直至不再继续变化为止,读记烟气浓度,准确至 1mg/m3。 Turn the instrument on, watch the measurement until it does not continue to change, and read the flue gas concentration to the nearest 1mg/m3.

2 集中排放口温室及有害气体排放浓度测试方法为: The test methods for greenhouse and hazardous gas emission concentrations at centralized outfalls are as follows:

1) 将便携式气体检测仪的探头置于被检测单机烟气集中排放口外排放方向约 50cm 处。 Place the probe of the portable gas detector about 50cm in the direction of discharge outside the centralized flue gas discharge port of the single machine under test.

2) 开启仪器测试,注视测值直至不再继续变化为止,读记烟气浓度,准确至 1mg/m3。 Turn the instrument on, watch the measurement until it does not continue to change, and read the flue gas concentration to the nearest 1mg/m3.

C.0.4 数据处理:整理初始时间至结束时间内所测得的数据,取测试值中的最大值作为测试结果。 Data processing: Organize the data measured from the initial time to the end time, and take the maximum of the test values as the test results.

C.0.5 报告应包括下列内容: The report should include the following

1 测试路段信息(桩号、车道位置、施工方向、环境温度、风力、风向等)。 Test section information (pile number, lane location, construction direction, ambient temperature, wind, wind direction, etc.)

2 施工参数。Construction parameters

3 测试方法。Test Methods

4 测试结果。 Test results

5 观察到的异常情况 Observed abnormalities

6 测试日期。Test date

附录 D 就地热再生清洁化作业温度测试方法

Appendix D Hot in-place recycling clean construction temperature test

D.1 适用范围 Scope of application

D.1.1 本方法适用于测试就地热再生清洁化施工时的作业温度,包括原路面、路面加热、提温后旧 沥青混合料、混合料拌和、摊铺和碾压时等的温度。 This method is applicable to test the working temperature of Hot in-place recycling clean construction, including the temperature of the original pavement, the pavement heating, the old asphalt mixture after warming, the mixture mixing, paving and rolling, etc.

D.2 仪具与材料技术要求 The technical requirements for instruments and materials are as follows:

D.2.1 插入式温度计:量程为 300℃,分度值为 1℃,采用数字式的插入式热电偶温度计,测杆长度 不小于 300mm,并有读数留置功能。Insertion thermometer: range of 300 ℃, graduation value of 1 ℃, the use of digital insertion thermocouple thermometer, the length of the measuring rod is not less than 300mm, and and readings retained function

D.2.2 非插入式温度计:红外温度计,分辨力为 1℃。Non-insertion thermometers: infrared thermometers with a resolution of 1℃

D.2.3 其他:棉丝、软布、螺丝刀、铲子等。 Others: Cotton thread, soft cloth, screwdriver, spatula, etc.

D.3 方法与步骤 Methodology and steps

D.3.1 路面加热温度测试: Temperature test on pre-heating

1 原路面温度测试: Original Pavement Temperature Test

1) 在紧邻加热机前原路面的横断面上,测点数量应不少于 5 个。测试时应使插入式温度计与原 路面接触,使用棉丝压紧,注视温度计变化至不再继续上升为止,读记温度,准确至 1℃; In the cross section of the original pavement immediately in front of the heating machine, the number of measurement points should be not less than five. Test should make the insertion thermometer and the original road surface

contact, use the cotton wool pressure, watch the thermometer changes until it does not continue to rise, read the temperature, accurate to 1 ℃.

2) 当使用非插入式温度计测试原路面温度时,测点数量应不少于 5 个。测试应直接对准测量的 位置连续测试 3 次以上,直至最后 3 次温度差值不大于 1℃,读记最后一次测试温度,并作为该测点的 测试温度,准确至 1℃。 When the use of non-insert thermometer test the original pavement temperature, the number of measurement points should be not less than five. The test should be directly aligned with the position of the measurement of more than three consecutive tests, until the last three temperature difference is not greater than 1 ℃, read the last test temperature, and as the test point of the test temperature, accurate to 1 ℃.

2 路面加热温度测试: Temperature test on pre-heating

1) 插入式温度计测试 Insertion thermometer test

a) 测点数量应不少于 5 个。 The number of measurement points should be not less than 5

b) 在紧邻加热机后路面的横断面上,将插入式温度计仔细插入加热后的路面混合料层约 1cm 深 度处,使用棉丝轻轻压紧温度计旁被扰动的混合料,注视温度计变化至不再继续上升为止,读记温度, 准确至 1℃。 In the cross section of the original pavement immediately in front of the heating machine, the number of measurement points should be not less than five. Test should make the insertion thermometer and the original road surface contact, use the cotton wool pressure, watch the thermometer changes until it does not continue to rise, read the temperature, accurate to 1 ℃.

c) 温度计完成读数后,立即拔出并插入下一个测点处。 As soon as the thermometer has completed its reading, pull it out and insert it at the next measurement point.

d) 当温度计插入路面混合料较困难时,可用螺丝刀先插一孔后再插入温度计。 When it is difficult to insert the thermometer into the pavement mixture, a screwdriver can be used to insert a hole before inserting the thermometer.

e) 当温度较低且混合料较硬时,不宜用玻璃温度计或玻璃触头的半导体点温计测试。 When the temperature is low and the mixture is hard, it is not advisable to test with a glass thermometer or a semiconductor spot thermometer with glass contacts.

2) 非插入式温度计测试 Non-insertion thermometer testing

a) 测点数量应不少于 5 个。 The number of measurement points should be not less than 5

b) 测温时应直接对准测量的位置连续测试 3 次以上,直至最后 3 次温度差值不大于 1℃,读记最后一次测试温度,并作为该测点的测试温度,准确至 1℃。Temperature measurement should be directly aligned with the location of the measurement of more than three consecutive tests, until the last three temperature difference is not greater than 1 ℃, read the last test temperature, and as the test point of the test temperature, accurate to 1 ℃.

条文说明 explanatory note

采用非插入式温度计时,测试距离、环境等因素对测试结果有一定影响,造成测试数据不稳定,数 值显示存在误差。所以,非插入式温度计法主要用于施工过程中的控制,不作为仲裁试验使用。 When the non-insert thermometer is used, factors such as testing distance and environment have certain influence on the test results, resulting in unstable test data and errors in the display of values. Therefore, the non-insertion thermometer method is mainly used for control during the construction process, not as an arbitration test.

插入式温度计选用多通道热电偶温度计,同时测试多点温度,既保证测试数据的稳定性,又提高温 度测试速度。 Insert thermometer using multi-channel thermocouple

thermometer, simultaneous testing of multi-point temperature, both to ensure the stability of the test data, but also to improve the speed of temperature testing.

D.3.2 路面翻松温度测试: Temperature test on grinding

1 翻松后裸露面温度测试: Temperature test of exposed surface after grinding

1) 插入式温度计测试: Insertion thermometer test

a) 测点数量应不少于 4 个。 The number of measurement points should be not less than 4

b) 在紧邻翻松机翻松装置后的横断面上,紧跟翻松刀头位置,将插入式温度计与翻松后底面接 触并用棉丝压紧,注视温度计变化至不再继续上升为止,读记温度,准确至 1℃。 In the cross-section immediately after the fluffing device of the fluffing machine, following the position of the fluffing cutter head, contact the inserted thermometer with the bottom surface of the fluffing machine and press it tightly with cotton threads, watch the thermometer until it does not continue to rise, and then read and record the temperature, accurately to 1℃.

2) 非插入式温度计测试: Non-insertion thermometer testing

a) 测点数量应不少于 4 个。 The number of measurement points should be not less than 4

b) 测温时需要紧跟翻松刀头,直接对准翻松后裸露面连续测试 3 次以上,直至最后 3 次温度差 值不大于 1℃,读记最后一次测试温度,并作为该测点的测试温度,准确至 1℃。 Temperature measurement needs to follow the loosening of the cutter head, directly aligned with the exposed surface of the loosening of more than three consecutive tests, until the last three temperature difference is not greater than 1 ℃, read the last test temperature, and as the test temperature of the test point, accurate to 1 ℃.

2 翻松后料垄温度测试: Temperature test of ridges after fluffing

1) 测点数量应不少于 4 个。The number of measurement points should be not less than 4

2) 在紧跟翻松机形成的料垄横断面上,将插入式温度计插入料垄深度 100mm 以上,注视温度计 变化至不再继续上升为止,读记温度,准确至 1℃。 In the cross-section of the material ridges formed by following the fluffing machine, insert a thermometer into the ridges to a depth of 100mm or more, and watch the thermometer change until it does not continue to rise, and then read the temperature, accurate to 1 ℃.

3) 温度计完成读数后,立即拔出并再次插入下一个测点处的料垄中。As soon as the thermometer has completed its reading, it is withdrawn and re-inserted into the mound at the next measurement point.

D.3.3 提温后旧沥青混合料温度测试: Temperature test of old asphalt mixture after warming up

1 测点数量应不少于 4 个。The number of measurement points should be not less than 4

2 在紧跟提温机形成的料垄横断面上,将插入式温度计插入料垄深度 100mm 以上,注视温度注 视温度计变化至不再继续上升为止,读记温度,准确至 1℃。In close proximity to the temperature machine formed on the cross-section of the material ridge, the insertion of thermometers into the material ridge depth of more than 100mm, watching the temperature watching the thermometer changes until it no longer continues to rise until, read the temperature, accurate to 1 ℃.

3 温度计完成读数后,立即拔出并再次插入下一个测点处的料垄中。 As soon as the thermometer has completed its reading, it is withdrawn and re-inserted into the mound at the next measurement point.

D.3.4 混合料拌和温度测试: Temperature test of mixtures

1 测点数量应不少于 5 个。 The number of measurement points should be not less than 5

2 宜在拌和机向摊铺机卸料时,将插入式温度计插入摊铺机料斗中的混合料内,插入深度应在 100mm 以上,注视温度计变化至不再继续上升为止,读记温度,准确至 1℃。 When unloading the material from the mixer to the paver, insert a thermometer into the mix in the paver hopper to a depth of 100mm or more, watch the thermometer until it no longer rises, and then read the temperature, which is accurate to 1°C. The thermometer should be used to measure the temperature in the paver hopper, and then to measure the temperature in the paver hopper.

3 温度计完成读数后,立即拔出并插入下一个测点处的混合料中。 As soon as the thermometer has completed its reading, it is withdrawn and inserted into the mix at the next measurement point.

D.3.5 混合料摊铺温度测试: Temperature test of mixtures paving

1 测点数量应不少于 4 个,测点应距离作业边界至少 20cm。The number of measurement points shall be not less than 4, and the measurement points shall be at least 20 cm away from the operation boundary.

2 在紧邻摊铺装置后路面铺层的横断面上,将插入式温度计插入测试位置混合料层一半深度处, 使用棉丝轻轻压紧温度计旁被扰动的混合料,注视温度计变化至不再继续上升为止,读记温度,准确 至 1℃。 On the cross-section of the pavement layer immediately behind the paving unit, insert an insertion thermometer at half the depth of the mix layer at the test location, gently press the disturbed mix next to the thermometer with a cotton thread, watch the thermometer until it does not continue to rise, and read the temperature to an accuracy of 1°C. The thermometer should be used to measure the temperature at the same time as the paving unit, but should not be used for the same purpose.

3 当温度计插入路面混合料困难时,可用螺丝刀先插一孔后再插入温度计。 When it is difficult to insert the thermometer into the pavement mixture, use a screwdriver to insert a hole first and then insert the thermometer.

D.3.6 混合料碾压温度测试: Temperature test of mixtures compaction

1 插入式温度计测试: Insertion thermometer test

1) 测点数量应不少于 4 个。 The number of measurement points shall be not less than 4

2) 在初压开始时选择一横断面做为测试位置,在此位置依次测试初压、复压和终压温度。将插 入式温度计插入路面混合料压实层一半深度处,轻轻压紧温度计旁被扰动的混合料,注视温度计变化 至不再继续上升为止,读记温度,准确至 1℃。 At the beginning of the initial compaction, choose a cross-section as the test position, and test the initial compaction, re-compaction and final compaction temperatures sequentially at this position. Insert the insertion thermometer into the half depth of the compacted layer of the pavement mixture, gently press the disturbed mixture next to the thermometer, watch the thermometer change until it does not continue to rise, read and record the temperature accurately to 1℃.

3) 温度计完成读数后,立即拔出并插入下一个测点处的混合料中。As soon as the thermometer has completed its reading, it is withdrawn and inserted into the mix at the next measurement point.

4) 当温度计插入路面混合料较困难时,可用螺丝刀先插一孔后再插入温度计。 When it is difficult to insert the thermometer into the pavement mixture, a screwdriver can be used to insert a hole before inserting the thermometer.

2 非插入式温度计测试: Non-insertion thermometer testing

1) 测点数量应不少于 4 个。 The number of measurement points shall be not less than 4

2) 测温时,需要直接对准测量的沥青混合料表面连续测试 3 次以上,直至最后 3 次温度差值不 大于 1℃,读记最后一次测试温度,准确至 1℃。 Temperature measurement, need to be directly aligned with the measurement of the asphalt mixture surface for more than three consecutive tests, until the last three temperature difference is not greater than 1 ℃, read the last test temperature, accurate to 1 ℃.

D.4 数据处理 data processing

D.4.1 取平均值作为测试温度。 Take the average value as the test temperature

D.5 报告 report

D.5.1 报告应包括下列内容: The report should include the following

1 测试路段信息(桩号、车道位置、施工方向、环境温度、风力、风向等)。 Test section information (pile number, lane location, construction direction, ambient temperature, wind, wind direction, etc.)

2 施工参数。Construction parameters

3 测试方法。Test Methods

4 测试结果。 Test results

5 观察到的异常情况 Observed abnormalities

6 测试日期。Test date

用 词 说 明

Glossary

1 本指南执行严格程度的用词,采用以下写法: The Guide implements the terminology of strictness by using the following formulation.

1) 表示极其严格,在正常情况下必须这样做的用词,正面词采用“须”、反面词采用“杜绝”或 “不得”。 Words indicating extreme strictness and the necessity of doing so under normal circumstances are used in the positive sense as “shall” and in the negative sense as “refrain from” or “must not”.

2) 表示严格,在正常情况下均应这样做的用词,正面词采用“应”、反面词采用“不应”或“不得”。 Words indicating strictness, which should be done under normal circumstances, are used in the positive sense as “shall” and in the negative sense as “shall not” or “shall not”.

3) 表示允许稍有选择,在条件许可时首先应这样做的用词,正面词采用“宜”,反面词采用 “不宜”。 Words indicating that a slight choice is permissible and should be the first thing to be done when conditions permit are used in the positive sense as “desirable” and in the negative sense as “undesirable”.

4) 表示有选择,在一定条件下可以这样做的用词,采用“可”。 The word “may” is used to indicate that there is an option to do so under certain conditions.

2 引用标准的用语采用下列写法: The terminology used to cite the standard is written in the following way

1) 当引用的标准为国家标准或行业标准时,表述为“应符合《×××××》(×××)的有关 规定”。 When the quoted standard is a national or industrial standard, it is expressed as “shall conform to the relevant provisions of ××××× (xxxxx)”.

2) 当引用本指南中的其他规定时,表述为“应符合本指南第×章的有关规定”“应符合本指南 第×.×节的有关规定”“应按本指南第×.×.×条的有关规定执行”。When other provisions of this Guide are cited, they are expressed as “shall be in accordance with the relevant provisions of chapter x of this Guide” “shall be in accordance with the relevant provisions of section x. x of this Guide” “shall be in accordance with the relevant provisions of section x. x of this Guide”. ×X.” ‘shall be in accordance with the relevant provisions of Chapter X of this Guide’ ‘shall be in accordance with the

relevant provisions of Section X.’ of this Guide. ×X. ×The relevant provisions of article x. x. of this Guide shall be implemented.”