

透水沥青路面改性沥青的选择

Selection of Modified Asphalt for Permeable Asphalt Pavement

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透水沥青路面在上海的应用情况

Application of Permeable Asphalt Pavement in Shanghai

- * 上海是研究、应用和推广透水沥青路面比较早的城市之一。
- * Shanghai is one of the earliest cities to study, apply and popularize permeable asphalt pavement in China.
- * 应用场合：体育场、学校、市政道路、高架道路等
- * Places of use: Stadiums, schools, municipal roads, viaducts, etc.
- * 混合料类型：中底面层采用大粒径，最大粒径35mm；上面层采用细粒径，最小粒径为5mm，常用粒径13mm。
- * Mixture type: Medium and bottom layer with large particle size, maximum particle size of 35 mm; top layer with fine particle size, minimum particle size of 5 mm, commonly used particle size of 13 mm.
- * 沥青类型：成品改性、直投式高粘粒子、复合添加
- * Asphalt type: polymer modified asphalt, high-viscosity particles, compound additives
- * 使用现状：大部分仍保持良好的透水性能。
- * Application situation: most of permeable asphalt pavements maintain good permeability.

- * 采用成品改性沥青（或未改性）的项目
- * Projects of using modified（or unmodified）asphalt

施工时间 Construction time	项目名称 Project Name	透水沥青混合料类型 Type of PA	沥青结合料 Type of Binder
1996.9	上海八万人体育场	L _透 -5	基质沥青70# /base asphalt
1999.10	局门路、延安西路	L _透 -15	EVA改性、EVA+PE
2001.7	上海应用技术学院	L _透 -35, L _透 -25, L _透 -15	基质沥青70#/ base asphalt
2001.8	上海松江九峰中学	L _透 -35, L _透 -25, L _透 -15, L _透 -5	基质沥青70#/ base asphalt
2002.9	复旦附中	L _透 -25, L _透 -15, L _透 -5	基质沥青70# /base asphalt
	松江中山小学		
2003.7	上海交大闵行分校	L _透 -25, L _透 -15, L _透 -5	基质沥青70# /base asphalt
2004.8	上海城市管理学院	L _透 -25, L _透 -15, L _透 -5	基质沥青70# /base asphalt
	上海市北中学		
2005.7	枫泾新镇	OGFC-13	SBS+BMA
2008.12	中环线4.1标	OGFC-13	高粘度/ high viscosity
2010.2	青浦淀山湖大道	OGFC-13	高粘度/ high viscosity
2013.10	崇明东滩启动区道路	OGFC-13 (温拌) /Warm mix	高粘度/ high viscosity
2014.12	嘉闵高架北段	OGFC-13	高粘度 /high viscosity
2016.7	奉贤环城南路	OGFC-13	高粘度/ high viscosity
2016.12	茂名北路	OGFC-13	高粘度/ high viscosity
2017.5~9	虹梅南路高架（180,000m ² ）	OGFC-13	高粘度/ high viscosity
2018.6~9	浦东机场南进场路（100,000m ² ）	OGFC-13	高粘度/ high viscosity



密级配沥青
Dense
grade



透水沥青
PA

延安西路
West Yan'an Road



中环线4.1标
Middle Ring Road



枫泾新镇道路
Road in Fengjing New Town



淀山湖大道
Dianshan Lake Avenue



环城南路
South Ring Road



茂名北路
North Maoming Road



虹梅南路高架
South Hongmei Viadut

- * 采用直投式高粘粒子的项目
- * Projects of using high viscosity additives

年份 Construction Time	项目名称 Project Name	具体道路 Road Name	道路等级 Road Class	工程量 (t) Amount of Asphalt Mixture
2002年	浦东北路大修工程	浦东北路	城市主干道 Urban trunk road	3000
2003年	港城路中修工程	港城路	城市主干道 Urban trunk road	2500
2004年	冬融路中修工程	冬融路	城市次干道 Urban secondary road	1000
2006年	滨洲路新建工程	滨洲路	城市主干道 Urban trunk road	600
2006年	五洲大道新建工程	五洲大道	城市快速路 Urban expressway	700
2006年	A20环南一大道大修工程	A20(杨高南路立交~徐浦大桥)北侧	城市快速路 Urban expressway	5500
2007年	浦东世博园区	园区内试验段	Zone road	200
2009年	张衡路试验段	张衡路	城市次干道 Urban secondary road	200

相关规范对沥青材料的要求

Requirements of Relevant Codes for Asphalt Materials

- * 上海市工程建设规范《道路排水性沥青路面技术规程》DG/TJ 08-2074-2016, J 11695-2016
- * Technical code for drainage asphalt pavement of road, Shanghai
- * 该规程规定，排水性沥青混合料应采用高黏度改性沥青。
- * According to the regulations, high viscosity modified asphalt should be used for drainage asphalt mixture.

技术指标/Technical index	单位/Unit	技术要求/Technical requirement	试验方法/Test method	
零剪切粘度 (60°C) / zero-shear rate viscosity	Pa·s	≥40000	附录A	
针入度 (25°C) /Penetration	0.1mm	≥40	T 0604	
软化点 (环球法) /Softening point	°C	≥85	T 0606	
延度 (5°C) /Ductility	cm	≥20	T 0605	
闪点 (COC) /Flash point	°C	≥260	T 0611	
黏韧性/Toughness	N·m	≥20	T0624	
韧性/Tenacity	N·m	≥15	T0624	
薄膜烘箱试验 (163°C, 5h) 残留 物/TFOT	质量变化/Mass difference	%	±0.6	T 0609
	针入度比/ ratio of penetration	%	≥70	T 0604

- * 当采用直投方法生产排水性沥青混合料时，基质沥青应采用70A道路石油沥青，所采用的高粘度改性沥青改性剂品种和掺量应经过试验确认，所配制的高粘度改性沥青的技术要求应符合规范要求。
- * When using direct casting method to produce drainage asphalt mixture, the base asphalt should adopt 70A road petroleum asphalt. The varieties and dosage of high viscosity modified asphalt modifier should be confirmed by test, and the technical requirements of high viscosity modified asphalt should meet the specification requirements.

- * 排水沥青混合料的配合比设计采用马歇尔方法进行。
- * The mix design of drainage asphalt mixture is carried out by Marshall method.

	技术指标/Technical index	单位/Unit	技术要求/Technical requirement	试验方法/Test method
配合比设计指标/ Mix design index	马歇尔试件击实次数/ Compaction number of Marshall specimen	次	两面各50	T0702
	马歇尔试件尺寸/Specimen size	mm	Φ101.6×63.5	T0702
	空隙率/Air voids	%	18~23	T0708
	连通空隙率/Connected air voids	%	≥14	CJJ/T 190附录A
	马歇尔稳定度/Marshall stability	kN	≥5.0	T0709
	流值/Flow value	mm	2~4	T0709
配合比验证指标/ Mix validation index	沥青膜厚度/Asphalt film thickness	μm	≥13	计算
	谢伦堡沥青析漏量/Schellenberg binder drainage	%	≤0.3	T 0732
	肯塔堡飞散损失/Cantabro quality loss	%	≤15	T 0733
	动稳定度(60℃)/Dynamic stability	次/mm	≥4000	T 0719
	残留稳定度/Residual stability	%	≥85	T0709
	冻融劈裂强度比/TSR	%	≥85	T 0729

- * 其他相关标准：

- * Other relevant standards

- * 《透水沥青路面技术规程》 CJJ/T 190-2012（住建部行业标准）
- * Technical specification for permeable asphalt pavement
- * 《排水沥青路面设计与施工技术细则》（交通部行业推荐性标准）
- * Technical rules for design and construction of drainage asphalt pavement
- * 《公路沥青路面施工技术规范》 JTG F40-2004
- * Technical specification for construction of highway asphalt pavements
- * 上海市工程建设规范《道路、排水管道成品与半成品施工及验收规程》
- * The specification for construction and acceptance of road's and drainage pipe's product and semi-product, Shanghai
- * 重庆、杭州等地方标准
- * Local standards in Chongqing, Huangzhou, etc.

* 不同规范共同特点

* Common features of different specifications

- * 在沥青选择方面，强调应采用高黏度改性沥青或高粘粒子。
- * For asphalt binder, it is emphasized that high viscosity modified asphalt or high viscosity particles should be used.
- * 主要针对上面层，因较早的规范大多为排水沥青路面，对透水沥青混合料的要求较高。
- * As the early permeable asphalt is mainly used in the upper layer, the technical requirements for permeable asphalt mixture are higher.
- * 在沥青选择上只规定了技术指标，以“高粘”为特征，而对改性剂的品种没有规定，造成在使用过程中只注重指标，而未综合考虑材料是否真正符合项目的特点，如交通量、气候、当地石材、经济能力等。
- * Only technical indexes are specified in the selection of asphalt, which is characterized by "high viscosity", while there is no regulation on the variety of modifier. As a result, only indexes are paid attention to in the process of use, and no comprehensive consideration is given to whether the materials truly conform to the characteristics of the project, such as traffic volume, climate, local stone and economic capacity.

如何选择合适的改性沥青

How to Select Suitable Modified Asphalt

- * 先根据项目的交通荷载、气候、结构层次来确定透水沥青混合料的技术要求，建议把动稳定度、飞散损失、冻融劈裂强度比作为控制指标，马歇尔稳定度作为参考指标。

Firstly, the technical requirements of permeable asphalt mixture were determined according to the traffic load, climate and structure levels of the project. It was suggested to take dynamic stability, dispersion loss, freeze-thaw splitting strength ratio as the control index, and Marshall stability as the reference index.
- * 然后根据透水沥青混合料的性能要求，来选择沥青品种，不局限于高粘度改性沥青，应结合项目的经济条件、生产条件、石材情况等。

Then, according to the performance requirements of permeable asphalt mixture, asphalt varieties should be selected, not limited to high-viscosity modified asphalt, and the economic conditions, production conditions and mineral conditions of the project should be considered comprehensively.

* 沥青指标的选定

* Selection of asphalt index

- * 对于高粘度改性沥青可采用规范指标，其中零剪切粘度比毛细管粘度更合理。
- * For high viscosity modified asphalt, standard index can be used, in which zero-shear rate viscosity is more reasonable than capillary viscosity.
- * 对于其他改性沥青，应注重黏韧性、韧性
- * For other modified asphalt, attention should be paid to toughness and tenacity.

- * 沥青混合料性能的验证

- * Verification of asphalt mixture performance

- * 除了规范中的几个性能参数外，建议对铺筑在路口、公交停靠站等受力比较复杂路段，引入混合料抗扭剪试验。

- * In addition to several performance parameters in the specification, it is recommended to test the torsional shear performance of permeable asphalt mixtures at road intersections, bus stops and other sections with relatively complex forces.

- * 考虑实际路面饱水受压状况，可采用模拟动水压力的水敏感试验，来评价混合料的水稳定性。

- * In order to simulate the water-saturated and compressive condition of permeable asphalt pavement, the MIST (Moisture Induced Sensitivity Test) can be used to evaluate the water sensitivity of the asphalt mixture.

- * 可选的其他改性沥青

- * Alternative modified asphalt

- * 橡胶沥青

- * Rubber asphalt

- * 复合改性沥青：SBS+SBR，SBS+EVA，SBR+PE等

- * Composite modified asphalt, such as SBS+SBR,SBS+EVA,SBR+PE,etc.

- * 添加天然沥青：SBS（SBR）+湖沥青或岩沥青

- * Adding natural asphalt: SBS(SBR)+Lake asphalt or Rock asphalt

- * 在保证设计空隙率和渗透系数的前提下，也可采用SBS添加纤维，但木质素纤维慎用。

- * On the premise of guaranteeing the design porosity and permeability coefficient, the combination of fiber and SBS can be used to improve the viscosity of asphalt, but the cellulose fiber should be used cautiously.

透水沥青路面结合料的选择

Selection of asphalt binder for permeable asphalt pavement

结构层位/ Structure layer		混合料类型/ Mixture type	推荐沥青类型 /Recommended asphalt type
透水沥青面 层 /Permeable asphalt surface course	轻交通/light traffic	OGFC-5, OGFC-10, OGFC-13	高粘度改性沥青, 复合改性 沥青, SBS+天然沥青/High viscosity asphalt, composite modified asphalt, SBS+natural asphalt
	重交通 /heavy traffic	OGFC-13, OGFC-16	高粘度改性沥青/High viscosity asphalt
透水沥青基层/Permeable asphalt base		ATPB-25	基质沥青, 基质沥青+天然 沥青, SBS改性沥青/Base asphalt, base asphalt+natural asphalt, SBS modified asphalt

结论/conclusions

- * 透水沥青路面应根据实际工程情况确定混合料性能参数，从而提出沥青的技术要求。
- * Permeable asphalt pavement should be based on the actual engineering situation to determine the performance parameters of the mixture, so as to put forward the technical requirements of asphalt.
- * 在保守情况下可参考相关规范选择高粘度改性沥青或高粘粒子，但必须满足生产施工要求。
- * In the conservative case, high viscosity modified asphalt or high viscosity particles can be selected according to relevant specifications, but must meet the production and construction requirements.
- * 对于技术基础比较好的项目，可进行优化设计，对改性沥青方案进行比选，选择经济实用、耐久性好、绿色可循环的沥青结合料。
- * For projects with good technical foundation, optimization design can be carried out, and different modified asphalt can be compared and selected to determine the economic, practical, durable, green and recyclable asphalt binder.

谢谢！
Thank you!

A decorative fan-shaped background with a traditional Chinese ink wash landscape painting. The painting depicts a mountainous landscape with trees and a small structure, rendered in a classic style. The fan is centered on the page and has a light beige color.