

Key Points of Quality Control in Garden Pavement Construction

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Abstract: Taking the pavement construction of landscape architecture as an example, this paper introduces the key points of quality control in the construction process. Garden pavement construction is mainly divided into surface construction and base construction, occasionally involving foundation treatment and cushion construction, which seems simple, but there are many quality control points. For example, the color difference of surface materials, the smoothness of pavement, the requirements of paving wave lines and closing, the quality, mixture ratio and water content of base materials, the mixing, paving and compaction during base construction, etc. These are the key points of construction quality control of garden pavement engineering. This paper lists in detail the basic structure requirements, surface typesetting requirements and construction technology requirements of pavement engineering, including design requirements and construction requirements, hoping to bring some enlightenment to relevant practitioners. Of course, the ideas and methods of project management will not remain unchanged, and I hope relevant practitioners can gradually supplement and optimize this paper in their future work.

Keywords: Paving Project; Structure; Construction Quality; Control Points

1. Introduction

The garden pavement project, but under the condition of tight construction period and large engineering quantity, how to control the construction quality in an orderly way still needs some skills. The most intuitive effect of pavement is the visual quality of pavement. For example, the color difference of surface materials, the smoothness of pavement, the requirements of paving wave lines and closing are all key points of surface quality control. In addition to the visual quality of the surface layer, the quality of the base layer also determines the

service life of the pavement. The base is the bearing layer of the road, and the quality, mixture ratio and water content of the base materials, as well as the mixing, paving and compaction during the base construction, are the key points of the base quality control. So this paper introduces the quality control points of design and construction involved in the pavement project of garden road and square from top to bottom.

2. Key Points of Visual Quality Control of Stone Surface Layer

2.1 Specifications of Common Stones

The common specifications of ground paving stones in garden construction projects are generally 600*600, 600*300, 600*200, 600*150, 600*100, 300*300, 300*150, 300*100, 200*200, 150*150 and 100*100. (unit: mm) [1].

2.2 Key Points of Drawing Review

Before facing paving, the manhole cover, pattern, line type, etc. should be mainly reviewed, and the pattern position should be accurately centered, the line type should be smooth, and the drainage slope should be accurate. The manhole cover should be parallel to the garden paving and integrated with the garden greening. It is strictly forbidden to cross the garden building and greening, blind road and edge line.

2.3 Pre-Requirement of Sample

Before some important or large-area garden paving construction, we must try to pave according to the pattern, color, size and texture, and determine the quality standard of sample in advance[2]. The paving template has quality control points such as flatness, typesetting, jointing and convergence.

2.4 Laying and Typesetting Requirements

After obtaining the construction drawings, the construction unit should deepen the typesetting before paving, and solve the problems of

material modulus, seam alignment and seam width on the drawing first, and the construction process of "Laying while arranging" is strictly prohibited. Generally speaking, combined with the actual situation on site, the longitudinal center line of the garden road is taken as the benchmark to expand outward to ensure the symmetrical effect. The specifications of large-area paving materials need to be unified, and small boards with a length less than 1/3 of the standard block cannot appear[3].

2.5 Requirements for the Closing of Pavement

When the pavement is closed, it is inevitable to encounter the problem that the size is not square. If the length, width and dimension of the garden road or square are not integral multiples of paving stone, we need to optimize it when closing the pavement. Let's take a standard block plate with a scale of 300*300 (unit: mm) as an example. If nonstandard block plates have to appear in the process of closing, how should we solve it? We need to use the standard block plate adjacent to the non-standard block to weaken the size difference [4]. There are two situations here. If the sum of the lengths of non-standard blocks and adjacent standard blocks is less than 1.2 times that of standard blocks, for example, the sum of the lengths is equal to 1.1 times that of standard blocks, then the small board should be abandoned and a stone with the length of 1.1 times that of standard blocks should be customized directly, so that a joint can be reduced. If the sum of the lengths of non-standard blocks and adjacent standard blocks is greater than or equal to 1.2 times of the standard block length, for example, the sum of the lengths is equal to 1.6 times of the standard block, then two adjacent stones are equally divided into this length, and two plates with the length of 0.8 times of the standard block are customized to weaken the size difference between the non-standard block and the standard block.

2.6 Requirements for the Edge Line

If the closing problem occurs on the edge line of the outermost ring of the pavement, when the paving boundary is rectangular and the edge line stones intersect vertically, at least three stones at four corners should be guaranteed to be complete standard blocks, and the non-standard blocks in the same edge line should be set

adjacent to each other [5], non-standard modules should not exist at both ends; When the paving boundary is an irregular polygon, and the stones of the edge lines do not intersect vertically, the corners of the paving should be connected reasonably according to the principle of corner dividing line, so as to avoid problems such as small broken materials and uneven joints.

2.6 Requirements for Joining Different Surfaces

When joining stones with different materials, the ground should be kept flat, the lines at the joint should be smooth and the gaps should be even. For example, when connecting stone with wood or metal materials, ensure that the plane and the joint are flat and aligned; When stone and pebble are connected, the pebble surface is slightly lower than the stone surface; Setting-out is particularly important in the connection of pattern paving between stones and pebbles, and attention should be paid to the paving of special-shaped stones, pebble size, gap scale, flatness and so on.

3. Quality Control Points of Pavement Surface Construction Technology

Construction process: base treatment → elastic line → elevation control point → paving cement mortar bonding layer → trial paving → watering mud or scraping cement paste → paving and adjustment of surface layer → jointing → clean water → finished product protection [6].

3.1 Base Treatment

The paved base is mostly cement stabilized gravel, cement stabilized macadam or plain concrete base. Before the surface course is formally paved, all sundries on the base should be cleaned up, the mortar on the base should be brushed off, and ensure that there are no impurities on the surface of the base.

3.2 Elastic Line

pull the cross control line to check and control the plane position of stone paving.

3.3 Elevation Control Point

control the elevation with a level gauge, and then pull up the elevation control line.

3.4 Cement Mortar Bonding Layer

30mm thick 1:3 hard cement mortar is laid. The dry hardness should be "kneaded into a ball by

hand and scattered when landing".

3.5 Trial Paving

Before the formal paving, try to spell the paving stones in each part according to the pattern, color and texture, and then arrange them in two directions and put them neatly.

3.6 Grouting Method or Scraping Cement Paste Method

There are two ways to bond the stone and the bonding layer. The first is the grouting method. After laying the bonding layer, a plain cement slurry (water cement ratio is 0.4-0.5) is poured on the bonding layer. When pouring the slurry, it is necessary to pay attention to the uniform thickness of the bonding layer, and pave it while pouring. After pouring the slurry, the bonding layer should be scraped several times with a trowel to facilitate the rapid infiltration of the cement slurry. The second method is scraping cement paste. In which 3-5mm thick plain cement plaster must be scraped on the back of the stone. Comparatively speaking, the grouting method has low construction cost and fast construction speed, but the risk of stone hollowing is also greater. The Scraping cement paste method has the advantages of high construction cost, slow construction speed and better quality [7].

3.7 Laying and Adjustment of Surface Layer

Before paving the stone, check the surface material itself to ensure that the specifications are consistent, the periphery is straight, the arrangement meets the design requirements, the plate has no defects such as cracks and corners, and the surface is smooth; When placing plates, the four corners shall be put down at the same time, and tapped with a rubber hammer or a wooden hammer, and leveled according to the horizontal line; Ensure that the surface layer is firmly combined with the base layer, without empty drum and looseness; The finished surface must be neat, free from color difference, pollution and water accumulation; At least 2mm expansion joints should be reserved between paving blocks. The joints between pavements and between pavements and edge lines should be smooth and the gap spacing should be uniform. The joint height difference should not be greater than 1mm. It is forbidden to polish.

3.8 Fill Joints

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After the slabs are paved for 24h, professional jointing grout will be used for high-end projects, and ordinary cement mortar will be used for middle-end projects. Tickle should be straight, full and consistent in depth. The jointing process can also be omitted when the construction period of ordinary projects is urgent.

3.9 Clean with Clean Water

After jointing is completed for 1-2h, clean the cement stains on the stone surface with a brush and a wet sponge to ensure the stone is bright and clean.

3.10 Finished Product Protection

After the paving is completed, the surface of the finished surface should be covered and protected. In principle, pedestrians are forbidden to pass within 24 hours, and pedestrians are forbidden to pass in cold and cold areas for 2-3 days in winter.

4. Quality Control Points of Pavement Base Structure

4.1 Roadway Foundation Structure

Because the load of passing vehicles needs to be considered, and the base is the main bearing layer of the road, two levels of base and sub-base can generally be set under the surface. If the bearing capacity of the foundation in the project area is insufficient, a cushion layer needs to be added under the base [8]. (This paper only discusses the road base structure with stone surface, excluding asphalt concrete roads.)

4.2 Base Layer

Base material: C15 plain concrete is generally selected.

Thickness of base course: The thickness of base course can be determined according to the road width. The road width is less than 5m, and the base thickness should be 18cm; If the road width is between 5m and 7m, the thickness of base course should be 18cm; If the road width is before 7m and 12m, the thickness of base course should be 20cm; If the road width exceeds 12m, it can be set according to the municipal road standard, which is not discussed in this paper. No matter how wide the road is, the thickness of the base of the fire-fighting climbing surface and the commercial plaza with trucks shall be treated as 20cm.

4.3 Sub-Base Layer

Sub-base material: Lime fly ash stabilized, cement stabilized or lime stabilized granular materials can be selected.

Sub-base thickness: The thickness of sub-base can be determined according to the road width. The road width is less than 5m, and the thickness of sub-base can be set to 15cm. If the cushion below sub-base contains a certain strength of aggregate, sub-base can also be cancelled and directly used as base. If the road width is between 5m and 7m, the thickness of sub-base should be 18cm; If the road width is between 7m and 12m, the thickness of sub-base should be 20cm; If the road width exceeds 12m, it can be set according to the municipal road standard, which is not discussed in this paper.

Compaction degree requirements: Sub-base compaction degree requirements shall be $\geq 96\%$, and seven-day compressive strength shall be $\geq 1.5\text{MPa}$.

4.4 Cushion Layer

Cushion layer is generally not set, but in case of high groundwater level and high frozen layer thickness, the thickness of cushion layer should be determined according to calculation. Cushion layer mainly plays the role of dewatering, temperature insulation and frost resistance and strengthening foundation support.

4.5 Pedestrian Road Foundation Structure: Stone Pavement

Base layer: 10cm thick C15 plain concrete.

Sub-base layer: This paper divides major cities in China into four regions. According to the location of the project, the materials selected are different [9]:

Region 1: Heilongjiang and Jilin. Sub-base materials can choose 10cm thick pseudo-ginseng lime soil;

Region 2: Xinjiang, Qinghai, Shaanxi, Gansu, Ningxia, Inner Mongolia, Beijing, Tianjin, Henan, Hebei, Shanxi, Shandong, Jiangsu, Anhui, Zhejiang and Liaoning. Sub-base materials can choose 10cm thick pseudo-ginseng lime soil or 5% cement graded macadam;

Region 3: Shanghai, Hubei, Sichuan and Chongqing. Sub-base materials can be the same as area 2, and 10cm thick pseudo-ginseng lime soil or 5% cement graded macadam can be selected;

Region 4: Yunnan, Guizhou, Hunan, Jiangxi,

Fujian, Guangdong, Guangxi and Hainan. Sub-base materials can choose 10cm thick 5% cement graded macadam.

Subgrade requirements: the compaction coefficient of plain soil on the top surface of soil foundation should be $\geq 93\%$, and the fuzzy amount of compressive strength should reach 25MPa. If the groundwater level is high and the water content of the base is high, sand cushion should be added.

4.6 Brick Pavement

The base layer should be set in different areas. The type and thickness of base material and the form of regional division are completely consistent with the sub-base structure of stone pavement, and there is no need to add concrete base, so no more details here.

5. Key Points for Acceptance of Different Pavement Surfaces

After the surface layer is laid, timely check whether the surface smoothness, joint height difference, etc. meet the allowable deviation. The pattern position of the invisible manhole cover and the surrounding area should be stitched and connected smoothly, and the decorative surface of the tree pool should be stitched and connected smoothly with the ground [10].

5.1 Stone

The finished surface must be neat, free of color difference, pollution and water accumulation. Adjacent parts are connected smoothly and the gap spacing is uniform.

5.2 Brick

The finished surface shall be smooth, the seam shall be fine, the edges shall be clear and beautiful, and the arrangement pattern and slope ratio shall meet the requirements. The pavement shall be filled with fine sand. After finishing one day, it shall be sprinkled with fine sand, swept with a broom and watered with water pipes for joint filling, and then cleaned.

5.3 Pebble

After paving a section, use bakelite board to flatten pebbles according to the elevation control line, ensuring that the surface flatness error is $\leq 4\text{mm}$, the joint height difference is $\leq 4\text{mm}$, and the gap width is $\leq 5\text{mm}$. Cover the finished product with striped cloth. Pedestrians

are strictly prohibited within 24 hours. After paving, it must be watered and maintained for 7 days, 2-3 times a day.

5.4 Tingbu

The surface of tingbu in water should not be smooth, with an area of 0.25-0.35 m², the spacing between tingbu $\leq 0.3\text{m}$, and the height difference between adjacent tingbu $\leq 25\text{mm}$. The spacing of ordinary tingbu should be about 65mm according to the pedestrian step. If the tingbu width is 50cm, the width of grass gap should be adjusted to 15cm, and so on. Tingbu installation should be convenient for people to walk, and the paving arc should be natural and beautiful.

5.5 Steps

The materials of steps shall be uniform in thickness and the chamfering radius shall be the same. The step construction should be adapted to local conditions, and the landscape effect should be taken into account while meeting the design requirements. Some materials with special specifications can be customized according to the actual situation, so the construction is simple and the effect is beautiful. Arc steps should be installed in a radial shape to maintain the landscape effect.

6. Conclusion

The pavement works of the Garden Road and Square look simple, but it is not so easy to pave beautifully. There are many details to be considered, such as the common specifications of the pavement, the connection mode of the edge line, the closing requirements of the pavement, the structural thickness of the base and other quality control points. This paper only provides a train of thought. Facing the specific situation, how to properly handle it, relevant practitioners need to be flexible.

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