

Discussion on Material Testing of Municipal Traffic Engineering

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Abstract

At present, the rapid development of municipal traffic engineering is in line with the high quality development trend and the demand for accurate management. The municipal traffic builders strictly control the quality from the aspects of planning and design, construction management, material testing, measurement and acceptance, among which material testing is an important part. The quality of engineering construction materials directly determines the final quality of engineering construction, so the layout and planning of material control must be done well in the actual implementation process. A preliminary investigation was conducted from the aspects of material classification and detection, material parameter selection, material grading and control, etc., so as to realize the centralized management of the three responsible parties of design, construction and suppliers, further standardize the program and standardization of municipal traffic construction projects, and achieve the goal of excellent construction project quality.

Keywords

Material Testing; Management by Division of Responsibility; Classification and Classification; Divided Policy Implementation.

1. Introduction

The material detection of urban municipal traffic construction project is very important, because the quality of the materials entering the site directly determines the quality of the construction project. However, the material detection of the construction project varies with people, policies and places due to its market limitations, diversified reference standards and uneven quality of practitioners. The purpose of this paper is to classify and summarize experience and practices in accordance with various technical specifications and testing standards, so as to guide practitioners to carry out material testing reasonably and effectively (The picture of detection equipment is as follows: Figure 1).



Figure 1. The picture of detection equipment

2. Current Situation of Construction Engineering Material Testing

Table 1. Actual material testing process

Serial number	Category	Status	Remarks
1	Test item	<p>①The small site of station A is divided into 7 batches of approach, while the large site of station B is divided into 5 batches of approach;</p> <p>② Sample sender A entrusts 5 parameters but sample sender B entrusts 7 parameters;</p> <p>③The third-party testing service unit shall test 10 parameters according to the requirements of the specification. If additional parameters are added, unqualified results appear;</p> <p>④ There are 4 stations in Contractor A's contract but 3 stations in Contractor B's contract.</p>	There are differences in the actual implementation process, in addition, there are also construction testing units and third-party testing units to issue different opinions on the same material.
2	Detecting parameter	<p>① Slow update of drawing reference standard leads to different detection parameters;</p> <p>② Material subdivision types, such as the use of category name will lead to some of the different functions;</p> <p>③ Full parameter test is required for individual materials, but there are different cases because of more material specifications.</p>	In the actual implementation process, there are outdated specifications, referring to different specifications under the same material directory.
3	Testing units	<p>①The market is not open enough and the competition is not strong;</p> <p>②The detection ability of construction detection units is not strong, and the detection parameters can not be covered;</p> <p>③ The division of responsibilities between construction testing units and third-party testing units and the unclear mutual inspection sampling;</p> <p>④ The price of detection is not uniform and the difference of detection parameters.</p>	Price uniformity and testing consistency need to be regulated.

Municipal transportation construction engineering has the characteristics of wide professional fields, many kinds of materials, long implementation period and high technical requirements,

so it is necessary to strictly control the quality of engineering materials and entities, and carry out strict control and standardized management in the construction process. The common practice is to introduce third-party testing service units and construction testing service units [1]. The main responsibility of the construction testing service unit is to test and verify incoming materials according to the design specifications, construction specifications and acceptance specifications, while the third party testing service unit conducts sampling and verification according to the design specifications, construction regulations and acceptance specifications in accordance with 10% of the total amount of incoming materials.

In terms of management control, on behalf of the construction unit, the third-party testing service unit shall establish the work flow, testing frequency and control indicators in advance, carry out process control and strict control during the process, and conduct inspection, analysis and summary, optimization and improvement afterwards. From the perspective of the third party other than construction and supervision, the third-party testing service unit shall be dedicated to check and serve the construction unit. Assist the construction unit to find questions and solve problems to ensure the construction quality and smooth construction. The construction testing service unit shall accept the entrustment of the construction unit to strictly check the relevant testing data and testing parameters of the testing materials, implement the testing task and issue the testing report. In the actual process of material testing, construction staff, material staff and witness sampler cannot effectively master and flexibly use the materials due to the characteristics of multiple types of materials, multiple specification items and multiple project parameters. Parameters of the same material may result in different test parameters due to different consignors, and the same amount of materials may result in different test quantities due to different batches of materials entering the site (see Table 1), which brings certain troubles to the subsequent acceptance of engineering files and measurement of engineering costs.

3. Measures for Material Testing

Material testing of municipal traffic construction engineering is divided into two levels: third-party testing and construction testing. At the same time, there are categories of inspection submitted by construction units and witnessed sampling by supervision units. Moreover, there are not detailed parameter requirements in the design drawings, and many specification references (such as construction specifications, acceptance specifications, material specifications, etc.). Easy to cause cross inspection, personnel ability is different, mutual trust and other situations occur. The author has investigated the rail transit testing in several domestic cities, and at the same time, according to the requirements of local norms, summarized and proposed the control idea of centralized management by division of responsibilities and implementation by classification and classification, which not only controls the effectiveness, efficiency and standardization of contract performance from the source, but also implements the specific requirements of quality control from the implementation, so as to realize the orderliness, reasonability and rigor of material testing. The main purpose of centralized management is to clarify the management responsibility, promote the implementation of the system, focus on the inspection and testing of the ledger, and ensure that the soil is maintained with responsibility and responsibility. The implementation of classification and classification is mainly to clarify the professional categories, the collection of sites and units, and the hierarchical execution and supervision, so as to ensure clear detection parameters and clear material categories.

4. Measures to Divide Responsibility and Centralize Management

1) The establishment unit plans, tracks and adjusts testing regulations and requirements in advance, and works actively with the competent government departments to implement testing categories, types and parameters; According to the professional supervision and management of building structure, municipal garden, mechanical and electrical decoration and track system, establish responsibility list and quality control measures, actively and effectively control the quality of materials and finished products, focus on mechanical and electrical decoration and track system material testing and supervision guidance. Reasonable and effective division of responsibilities and dereliction of duty for third-party testing units, construction testing units, supervision units and construction units, and implementation of centralized management by responsibility.

2) According to the testing specifications and the requirements of the construction unit [2], the three-party testing units shall establish the work flow, detection frequency and control indicators, and conduct process control, strict check, analysis and summary, optimization and improvement; Make sampling inspection plan according to the prescribed frequency and the material entry plan provided by the construction unit; conduct sampling test on raw materials, semi-finished products and finished products in the project together with the supervisor and the construction party, and conduct on-site inspection on the quality of the project entity; At the same time, check the compliance of construction test items of each construction section with design drawings and relevant specifications, complete the arrangement of relevant test and test data as planned, and make a technical summary of the test and test work of the project.

3) According to the testing specifications and the requirements of the construction unit [2], the three-party testing units shall establish the work flow, detection frequency and control indicators, and conduct process control, strict check, analysis and summary, optimization and improvement; Make sampling inspection plan according to the prescribed frequency and the material entry plan provided by the construction unit; conduct sampling test on raw materials, semi-finished products and finished products in the project together with the supervisor and the construction party, and conduct on-site inspection on the quality of the project entity; Before receiving the samples, the construction testing unit must use the face recognition system to verify the identity information of the supervision witnesses who are responsible for witnessing the sampling and monitoring the samples. If the identity information has not been verified by the face recognition system or the verified identity information does not meet the relevant requirements, the detection report of the entrusted test project shall not be stamped with the special seal for witness sampling, and the detection report shall not be used as quality assurance data and completion acceptance data; To test the compacting degree (ring tool method, sand filling method), the testing unit shall send personnel to the site for sampling; The asphalt and water stability inspection shall be carried out on site by the entrusted testing institution in accordance with not less than 30% of the quantity required to be sampled in the relevant technical standards, and the remaining part shall be submitted for inspection by the construction unit. The inspection of pipe, road tile and manhole cover shall be carried out by the construction inspection unit to measure the appearance size on site before sampling on site. At the same time, the corresponding inspection contract unit shall be responsible for the accuracy and authenticity of the report. At the same time, check the compliance of construction test items of each construction section with design drawings and relevant specifications, complete the arrangement of relevant test and test data as planned, and make a technical summary of the test and test work of the project.

4) The supervision unit shall set up full-time test and detection engineers, establish a perfect test management system, review and verify the testing process and test results of the construction unit, have a perfect and accurate testing ledger and records, timely and accurately

complete the testing work, and do a good job in the classification, sorting and filing of test results; Review the application form and quality certificate of engineering materials, components and equipment submitted by the construction unit, and check the account of materials submitted by the construction unit; Inspect and spot test the engineering entity in accordance with the prescribed frequency: in the process of detection, on-site test testing and witness sampling shall be conducted in accordance with the supervision contract or the provisions of the relevant engineering quality management documents in the whole process to ensure the authenticity of the test and sent samples[3]; The video image data of the whole process should be kept, which can reflect the operators and the operation process. If there is any objection to the inspection of the quality of the project entity, it can be reported to the construction testing unit for on-site inspection.

5) The construction unit is the main body responsible for the construction quality of the project. It shall strictly fulfill the contract and standard requirements, and take full and final responsibility for the quality of the raw materials and the project entity. Include complete and detailed design requirements and technical quality assurance requirements into the supply agreement and report to the supervisor for review; Establish a sound and perfect inspection system, do a good job of inspection and supervision of incoming materials, at the same time, under the witness of the on-site supervisor in accordance with the standard requirements of sampling and inspection; Conduct sampling and testing of various raw materials and auxiliary materials provided by the material supplier according to the regulations, and the unit shall conduct sampling and testing according to the regulations, and timely submit the test ledger and materials approach plan to the third party testing unit according to the requirements; Materials that do not meet the specifications and design requirements are not allowed to enter the site, and materials that do not meet the specifications and design requirements are cleared after testing.

5. Steps of Classification and Grading Implementation

1) Municipal transportation construction projects involve architectural structure, municipal garden, mechanical and electrical decoration, track system and vehicle signals, etc., with more than 200 material categories, more than 5 000 detection parameters and more than 100 reference specifications. Any one testing unit can not achieve full testing capacity; Any construction unit can not grasp and understand all the test parameters required by the code; No one can use reference codes and engineering materials flexibly. In view of this, it is more necessary to implement the control measures and methods and steps of material testing by classification and classification, so as to achieve the standardization, efficiency and rigor of construction engineering material testing[4].

2) The third-party testing unit shall make comprehensive comments on the testing behaviors of construction testing units, supervision units and construction units every month, and rectify and improve the deficiencies in the testing behaviors in time; The authenticity and fairness of random inspection, the randomness of inspection materials, the comprehensiveness of parameter selection, and the rationality of standard reference.

3) According to the characteristics of materials of municipal transportation construction engineering and the limitation of testing market, relevant materials of building structure and municipal landscape should be taken as one testing subject (hereinafter referred to as "testing subject of Building structure and Municipal Landscape"), and relevant materials of mechanical and electrical decoration and track system should be taken as one testing subject (hereinafter referred to as "Testing subject of mechanical and electrical decoration and track system")[5]. The testing unit shall be equipped with professional testing professionals to conduct supervision, inspection and test testing, so as to achieve the specialization and special use of

professional and technical personnel and avoid cross-professional operations and supervision in a large field.

4) The testing subjects of building structure and municipal landscape mainly involve building materials and municipal road materials, all of which have a relatively mature testing market and reference basis, and relevant standards have been formed in the collection and arrangement of archival data. For mechanical and electrical decoration and track system testing subjects, the construction unit shall cooperate with industry competent authorities, testing units and industry experts to implement testing items and testing frequency (see Table 2), so as to ensure the compliance and orderfulness of later archival data collection.

Table 2. Test item parameters and frequency

Category	Serial number	Detection item		• Detection cycle/day	Examination requirement	
		Project	Parameter		Construction inspection	Third party detection
Decoration/ Fitment/ Equipment	1	Aluminium alloy profile for building	Coating thickness	3	√	√
	2		Mechanical property	5	√	√
	3		Dimensional deviation	3	√	/

Electromechanical systems	1	Electric wire	Conductor resistance	5	√	√
	2		Insulation resistance	5	√	√
	3		High-voltage test	5	√	√

For the test items with key materials and important functions but single and special test parameters (such as the fatigue test of damping pads and rubber and plastic pads), the mode of random sampling and sample sealing witnessed by the third party testing unit and supervision unit shall be adopted, and the third party testing unit, supervision unit and construction unit shall jointly sign the order. The construction unit shall entrust the "fatigue test" for inspection, so as to achieve the dual purposes of construction detection and third-party sampling inspection; The construction unit shall be equipped with at least 3 sampling personnel for each project, and the supervision unit shall be equipped with at least 2 witnesses, and shall hold the entry certificate issued by the competent construction[6].

6. Summary and Suggestions

1)As the cornerstone of the construction project, the design unit has the role of normative guidance and demonstration, the right to decide the use of technical parameters, and the right to make suggestions on test items and test parameters. The parameters of test items mainly

refer to the requirements of design drawings and related technical specifications, so the design unit must give full play to its professionalism, orientation and enthusiasm.

2) As the direct unit of construction engineering material testing, the professionalism, standardization and coverage of construction testing units have a direct impact on the quality of the project. Therefore, they should give full play to their professional ability to verify the rationality, standardization and comprehensiveness of the material inspection parameters, so as to realize the normalization and rationalization of sample testing parameters[7]; As the responsible party for supervision of construction engineering material testing, the third-party testing unit must strictly regulate its operation behavior and sampling inspection frequency, and ensure compliance, reasonable cost and effective supervision.

3) Due to the variety of materials used in municipal traffic construction engineering, the number of applicable specification items, and the number of test item parameters, it is suggested to divide the material test items into building structure and municipal landscape, mechanical and electrical decoration, and track system, so as to facilitate the contract implementation unit to select targeted talents, and facilitate the market professionals to engage in the testing of relevant contract requirements and specifications. More convenient material testing market preliminary research and professional team formation.

4) Material testing of municipal traffic construction projects involves third-party testing units, construction testing units, supervision units and construction units, as well as standards and specifications and design drawings. Therefore, it is necessary for builders to creatively carry out centralized management by division of responsibilities to achieve centralized and unified leadership. Moreover, it is also necessary for builders to carry out expanded classification and classification control to achieve orderly and compliance in accordance with the law. It is not only necessary to control the effectiveness, efficiency and regularity of contract performance from the source, but also to implement the standardization, procedure and information of quality control from the implementation, so as to realize the orderliness, rationality and rigor of material testing.

5) The layout, planning, implementation and supervision of material control of municipal traffic construction engineering materials testing must be done well in advance. Comprehensive consideration should be given to environmental factors, market mechanism and contract benefits, so as to achieve marketization of material classification testing, randomness of material sample selection and rationality of material project parameters, so as to realize the trinity of design, construction and testing. To further standardize the procedure and standardization of material testing of municipal traffic construction engineering, so as to achieve the goal of excellent overall quality of construction engineering.

6) For testing items involving key materials but with special testing parameters, only a few dozen or even a few domestic testing institutions are capable of testing, it is necessary to adopt the mode of accurate testing and implementation of different policies, develop targeted and feasible testing modes, and achieve the tripartite responsibility implementation under the witness of third-party testing, construction testing and supervision.

7. Conclusion

In this paper, according to the relevant status and characteristics of municipal traffic construction engineering materials, such as multiple testing types, applicable specification items, testing project parameters, etc., based on years of practice exploration and summary improvement, it is appropriate to divide material testing items into building structure and municipal landscape, mechanical and electrical decoration and track system. Among them, the testing subjects of building structure and municipal garden can refer to the existing norms,

while the testing subjects of mechanical and electrical decoration and track system need to be explored and established by the construction unit according to the standards and norms, requirements of the local supervision unit and its own needs. When it comes to the formulation of testing subjects and parameters for mechanical and electrical decoration and track system materials, the construction unit should lead relevant practitioners to formulate and implement the testing name list, and treat universal testing items and special testing items differently according to the mode of precise testing and implementation of different policies, so as to effectively implement the tripartite responsibilities witnessed by third-party testing, construction testing and supervision. In order to achieve the efficient implementation of material testing standards and methods. However, in the investigation and formulation of the test list, it is difficult to evaluate the normative rationality of the test list items and parameter Settings due to the many professional fields involved and heavy coordination tasks. In addition, it still needs to be improved in the stage of responsibility division of all parties involved.

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