Urban Roads Bridges & Flood Control

城市道桥与防洪

主管：中华人民共和国住房和城乡建设部
主办：上海市政工程设计研究总院(集团)有限公司

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图为上海奉贤建设发展（集团）有限公司施工建设的上海市奉贤区再生能源综合利用中心

因为我们专心，所以我们专业！
——《城市道桥与防洪》

学术联盟：上海市城市科学研究会

● 本期看点

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广告索引

封面工程

本期封面工程为上海市奉贤区再生能源综合利用中心建设工程，由上海奉贤建设发展(集团)有限公司施工建设。

上海市奉贤区再生能源综合利用中心建设工程坐落于柘林镇楚华地块，项目总建筑面积为 33 032 m^2。建设内容主要包括：综合主厂房以及水泵房、冷却塔、消防水池、天然气调压站、附属水处理设施、生产管理和生活服务用房等配套设施；购置垃圾处理、烟气净化处理、余热利用、残渣处理等设备。生活垃圾日处理能力为 1 000 t，全年达 36.5 万 t。厂内配套配置额定容量为 1×30 MW 的汽轮发电机组。

上海市奉贤区再生能源综合利用中心建成后，一、二期两座垃圾焚烧厂可以满足整个奉贤区生活垃圾无害化处理的需求。同时，一、二期两座垃圾焚烧厂在生产运营过程中能够相互统筹兼顾、互为备用，抗风险能力显著增强。此项目的建成标志着上海市奉贤区生活垃圾末端分类处置能力进一步转型升级。

上海市奉贤区再生能源综合利用中心建设工程于 2020 年 2 月开工，计划竣工日期为 2022 年 1 月。

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CONTENTS

ROADS & COMMUNICATION

Abstract: Analysis is conducted on the functional orientation, construction condition, construction form, construction scale and general layout of Xihong Bridge and its connection engineering. The general layout of the bridge and the interchange scheme of Tongtu Road are especially demonstrated. The layout of the main and auxiliary separation of Xihong Bridge is proposed. The full interchange is set up for the upper bridge and the main road of Tongtu Road. The light control is set up for the grade crossing of the lower bridge and the ground auxiliary road of Tongtu Road. The system of sidewalk and bicycle lane is set up to meet the riding demand. The scientific connection of interchange form and bridge span, and the reasonable control of interchange environmental landscape influence and pier flood discharge influence are realized.

Keywords: Xihong Bridge, connection engineering, expressway, interchange, general design

Abstract: In order upgrade the traffic structure in Shuyang, the overall scheme of Shuyang Ring Expressway (Huaihe Avenue – Songjiang Road) is studied. The planning and construction conditions of the project area are introduced. The demand of Shuyang County as a small and medium-sized city for the function of expressway is analyzed. The traffic analysis and scheme selection are carried out from the overall scheme and important node scheme of the project.

Keywords: expressway, overall layout scheme, node design scheme, Shuyang

Abstract: Tongcheng Expressway is one of the important projects in the unblocked expressway network construction planning of Hangzhou for the Asian Games. Its construction will perfect the regional expressway network and completely improve the development level of city in order to provide a strong guarantee for the successful hosting of the 2022 Asian Games. Based on background and functional orientation of the project, the overall scheme layout of Tongcheng Expressway is systematically discussed, and the up and down ramps and the important interchange nodes along the line are specially introduced.

Keywords: urban expressway, overall scheme, up and down ramps, interchange node

Abstract: Taking Ningbo South Huancheng Road West Extension Project as an example, by considering the function demand, construction conditions, short-term and long-term combination, environmental impact and other comprehensive factors, a scientific, reasonable and feasible overall design scheme of expressway is put forward, which can be used as a reference for the design of the similar engineering projects.

Keywords: urban expressway, overall design, interchange scheme, on-ramp and off-ramp

Abstract: Generally, when rivers pass through cities, the riverside roads are basically laid on both sides of the rivers. With the expansion of cities, in order to support the expansion of urban space and the development of economy, the corresponding traffic goes first. In order to link the urban areas on both sides of the river, it is necessary to build bridges or tunnels across the river. The riverside road is usually close to the flood control wall. A new interchange form of intersecting the river-crossing bridge and riverside road under many restricted conditions is put forward. Therefore, the background technology, problems to be solved for riverside interchange, application conditions, functional orientation, technical standards and detailed scheme of the project are specially expounded.

Keywords: river-crossing bridge, riverside road, separation of embankment, technical standard, new interchange form

Abstract: To meet the development demand of "small block, high density and compact type" in the new urban areas, taking Chongqing Yuelai Eco-city Traffic Planning as an example, emphasizing the planning design concept of "people-oriented, coordinated promotion and implementation, and aiming at the characteristics of mountain city, the planning target, planning strategy and system planning are proposed. And the footpath system, public transportation system, parking system and refined traffic engineering design are specially introduced.

Keywords: small block, mountain city, traffic planning

Abstract: Ningbo is the second batch of national "city double restoration" pilot city. In order to promote the urban renewal and upgrading, taking the compilation of *Guidelines for the Design of Ningbo Streets* as an opportunity, the evolution and current situation of streets in Ningbo are analyzed, and the countermeasures to improve the street design with the goal of "orderly, vitality, greenness and high quality" are put forward. On the basis of classifying the streets in Ningbo, the design essentials of motor vehicle lane, slow traffic area and intersection across street are further discussed.

Keywords: street design, slow traffic, city double restoration, intact street

Abstract: Combined with the new development concept of "innovation, coordination, green, opening and

Abstract: The traffic flow composition of road network in front of high-speed railway station is more complex. The intelligent transportation monitoring system becomes an important means of traffic management and traffic law enforcement. Taking Gaunyin Station of high-speed railway as an example, the structure, traffic flow direction, traffic flow feature and traffic management demand of the station road network are analyzed. Combined with the construction situation and grade crossing type of the road network in the initial stage, the design thought of traffic monitoring facilities for station road network is summarized, and the selection of the main front end facilities and the layout of point location are put forward.

Keywords: Guanyin Station of high-speed railway, station road network, traffic monitoring, front end facilities

BRIDGES & STRUCTURES

Abstract: In recent years, the accidents of bridge collapse happen occasionally. The accidents of bridge collapse cause the economic losses and human casualties, and often have a huge social impact. The time, sites, casualties and causes of bridge collapse accidents in 2017~2019 at home and abroad are statistically analyzed. The results show that the bridge accidents in the construction period in China are more than the accidents in the operation period. The bridge accidents of construction period are mainly caused by the instability in the construction process. The main causes of bridge accidents in operation period are the improper operation maintenance and overload. The accidents of new foreign bridge are less than the bridge accidents in operation period. The most of bridge accidents in operation period are related to the improper maintenance.

Keywords: bridge, collapse accident, collapse cause, lesson

Abstract: Chaohu Bridge is a super large bridge crossing the outlet of Chaohu Lake in Outer Ring Road of Chaohu City. The road is classified as an urban trunk road. The whole bridge is arranged as a double-pylon double-plane composite beam cooperative system cable-stayed bridge with a main span of 460 m. The total length of the bridge is 1 122 m. The bridge pylon is arranged in the shape of "herringbone". The main beam in the cable area is of double I-shaped section with a bridge width of 34.5 m. The non-cable area is a double small side-box section with a bridge width of 32.5 m. The bridge is located in the approach channel area of three-line lock. The channel conditions are complex. The overall design concept, structural design and main technical characteristics of the bridge are introduced.

Keywords: cable-stayed bridge, composite beam, "herringbone" bridge pylon, double I-shaped composite beam, welding

Abstract: The development project of Hengqin Port and Comprehensive Transportation Hub is the dedication project for the 20 th anniversary of Macao's Return, and is significant and far-reaching. The reconstruction of Lotus Bridge is the key to realize the customs clearance at the new port. To make sure that the port does not interrupt traffic during the reconstruction, the demolition and new construction projects need to be implemented in stages. Considering the complex construction conditions of the project, the overall layout, structural form and landscape modeling of the bridge have been carefully designed. In order to ensure the operation and structural safety of the temporarily retained bridge, the incremental launching construction of the world's small-radius curved bridge is implemented. The permanent use of the old bridge pier is designed for reinforcement. The strict monitoring scheme is adopted during the reconstruction period. The successful reconstruction of Lotus Bridge lays a solid foundation for the smooth customs clearance of the port, and also provides a reference for the design and construction of similar projects.

Keywords: Hengqin Port, reconstruction scheme, overall layout, incremental launching construction, reinforcement design

Abstract: The Xiping Avenue Bridge in Xining is a (135 m+57 m+33 m=225 m) spatial curved steel pylon semi-floating system steel girder cable-stayed bridge. The pylon girder separation is adopted for this bridge. The vertical supports, and the longitudinal and lateral blocks are installed between the girder and the pier to strengthen the anti-seismic performance of the bridge. The main girder is a 3.5 m high flat steel box girder structure. The main span is a double-side box structure. In order to meet the anchorage demand, the single-box four-cell structure is adopted for the side span. And UHPC paving system is adopted for the bridge deck. The bridge pylon is a spatial curved steel structural pylon welded of three box sections. The pylon column below the deck is 10.613 2 m high. In order to ensure the stability of the bridge pylon and transfer the horizontal component, the connecting rods are arranged between the middle pylon and the side pylon as well as the side pylons. Three base slabs of side and middle pylons are connected with the straining beam (straining beam is prestressed) with ϕ2.0-m cast-in-situ piles below. The auxiliary piers are the columned piers and the base slab is a rectangular section with ϕ1.5-m cast-in-situ piles below. The abutment is a thin-wall abutment with ϕ1.5-m cast-in-situ piles below. The stayed cables consists of the ϕ7 mm galvanized zinc-aluminium high-strength parallel steel tendons. MIDAS Civil and ANSYS finite element programs are used to carry out the static calculation. The result shows that the static performance of the bridge meets the code requirements.

Keywords: cable-stayed bridge, steel pylon, steel box girder, stayed cable, pier, abutment, foundation, structural design, finite element method

Abstract: The superstructure of the bridge spanning Beijing-Hangzhou Canal in an urban expressway is a (85 + 100 + 70 + 65)-m unequal-span variable-height steel structural continuous girder. The single-box double-cell layout is adopted. Its substructure is a plate-type main pier and a counterfort abutment. While ensuring the using function and saving resources of the bridge, the harmony of the bridge landscape is also

Abstract: The long cantilever through continuous girder arch composite bridge is a bridge with characteristic structural form. Through the rational and clever combination of girder and arch, the advantages of the combined system are fully played so that the stress of the whole structure is more reasonable. The arch and girder joints are the design key of continuous girder arch composite bridge. The arch ribs of the whole zone are intersected with the main girder. The joint of arch and girder is the intersection of arch thrust, girder internal force and support reaction. The local stress distribution of the arch and girder joints is complex, and is a key stress position of arch bridge structure. In order to study the stress distribution of arch and beam joints, prevent the stress concentration and improve the stress of arch foot, the stress of arch and girder joints is studied by numerical simulation.

Keywords: girder arch composite bridge, arch and girder node, finite element, local analysis

Abstract: Combined with the advantages of traditional corrugated steel web composite box girder and steel truss, the concrete bottom plate of the traditional corrugated steel web composite box girder is improved into a steel pipe truss structure. A new structural form of corrugated steel web – steel pipe composite box girder is proposed. This structure gives full play to the advantage of materials and has the advantages of light dead weight, good seismic performance, excellent structural crack resistance and overall performance. At the same time, the construction is convenient and the construction process is flexible. It is more suitable for use in urban mid– and small–span beam bridges. The composite structure is applied to a practical project, and its flexural performance and structural modal are analyzed by finite element software. The influence of the steel pipe filled with concrete on the mechanical performance of the structure is compared and studied. The result shows that the steel pipe filled with concrete can effectively increase the overall stiffness of the structure and improve the structural stress. The analysis results applied to the engineering design and construction have achieved the good economic and social benefits of the project, which can be referred for the similar projects.

Keywords: composite structure, corrugated steel web, steel pipe, steel pipe filled with concrete, analysis of mechanical performance

Abstract: In accordance with the design method of the bearing capacity of reinforced UHPC plate stipulated in Swiss SLA2052 specification, the bearing capacity of the reinforced UHPC plate under the limit state of bending bearing capacity and the calculation method of deformation capacity are discussed. Based on a 12–cm thick reinforced UHPC plate, the main influence factors on the bearing capacity and ductility of the reinforced UHPC plate under the limit state are analyzed. The influences of various variation factors on the limit states of reinforced UHPC plate are studied separately. The bearing capacity under limit state is compared with the design values specified by the specification. The conclusion shows that the limit state bearing capacity of UHPC plate with too low reinforcement ratio will be lower than the design value recommended in Swiss SLA2052 and the structure is unsafe by considering the influence of

FLOOD CONTROL & DRAINAGE

MANAGEMENT & CONSTRUCITON

Abstract: The trenchless technology is gradually applied in the restoration of town drainage pipe. The in-site solidifying method in the overall restoration, the stainless steel double-tensioner ring method in the local restoration and the local in-site solidifying method are the most commonly used restoration methods now. The above methods are compared and analyzed in depth and in all directions. The relative experience can be referred for the related specialized persons.

Keywords: trenchless restoration, in-site solidifying method, stainless steel double-tensioner ring method, local in-site solidifying method

Abstract: The general situation of Lianjiang River Bridge Project is introduced. The steel tube brackets are required to erect for the construction of 0# and 1# blocks of 3# pier, 4# pier and 5# pier of the main pier. 0# and 1# blocks are constructed on the brackets. The construction technology of 0# and 1# blocks are further discussed. The experience can be provided for the relative constructions.

Keywords: bridge, rigid frame, 0# block, 1# block, construction technology

Abstract: In order to study the compaction characteristics and the proposed compaction method of construction machinery, an airport expansion project Phase III of China is experimentally analyzed and studied. The treatment and analysis are carried out for the settlement monitoring under the different sections. 2 # and 3 # underpass test stations of this airport are selected to carry out the testing and research work of static and dynamic stresses of the airport pavement and structure. The characteristics of static and dynamic earth pressures in the side walls and subgrades of the underpass under the action of the fill and pavement dead load, and the vibration compaction of the vibratory roller are studied to obtain the scientific measured data. The field test data are analyzed and processed. The depth and range of vibration impact of the vibratory roller are summarized. The empirical research on the interaction is carried out according to the theoretical research results of the earth pressure around the underpass.

Keywords: coarse-grained soil, settlement detection, compaction of high filling earthwork

Abstract: The field construction is a key link in the engineering project, and is also the important content in the management work of enterprise. Compared with the traditional construction management mode, the application of informatization technology in the construction management has the advantages of ensuring the construction period, strictly controlling the investment cost and guaranteeing the construction quality. The application of informatization technology in construction management is studied. Its application status and significance of construction management informatization are summarized. Its application in airport construction management based on BIM integrated management platform is briefly introduced.

Keywords: informatization, construction management, integrated management platform

Abstract: At present, there is more and more contract money determined by financial evaluation after winning the bid of EPC project. The mode of design, construction and financial evaluation at the same time not only shortens the construction period of project, but also makes for the owner to control the cost and quality. But there is a certain risk for the construction units. Aiming at the mode of contract money determined by financial evaluation after winning the bid of EPC project, the advantages and disadvantages of each participant in the project are expounded, analyzed and discussed.

Keywords: PEC project, mode of contract money, financial evaluation

Abstract: The urbanization highway projects can adopt the pricing and construction management modes of municipal engineering or highway engineering. But the cost management document, bidding document and bill of quantities directly related to the engineering cost are different from the forms to contents. Due to the difference of the pricing quota and pricing procedure of municipal engineering or highway engineering, even if adopting the same labor, material and mechanical unit price, the result of its engineering cost will be also different. By comparison and analysis of the partial subprojects adopting the municipal and highway pricing quotas in urbanization highway project, the pricing difference between two quotas is analyzed in order to provide some ideas for mutual complementation and reference to build an unified pricing mode or two pricing modes.

Keywords: urbanization highway engineering, municipal quota, highway quota, unit price

Abstract: In the bridge engineering construction, the level of engineering management has a huge decision impact on the final quality and benefits of a project. In the current bridge engineering construction, especially in the engineering management in China, the general and prominent problems are more concentrated and obvious. The development and leap of bridge engineering construction are seriously hindered by these problems in China, and are disjointed with the overall level of economic development in China, which are urgently required to improve and solve. According to the study subject of bridge engineering management and taking the bridges under construction in Fengxian District of Shanghai as the examples, the main contents of bridge engineering management are briefly introduced. Several constraints on the current bridge engineering management of China are analyzed, and at the same time, the thought and suggestions are put forward to intensify the bridge engineering management. The aim is to provide the beneficial reference and help for the promotion of bridge engineering management.

Keywords: urban construction, bridge engineering, management member, level, thought and suggestion

STUDY ON SCIENCE & TECHNOLOGY

Abstract: Based on the study of arch rib stability of bowstring arch bridge in the research literature, the influence of connecting system on the arch rib stability is studied. The frame type of longitudinal connecting system is commonly used as a study object. According to the calculation of composite columns concerned in the elastic system stability theory, the approximate formula of stiffness combination effect coefficient of frame composite columns is proposed. The current connecting system is checked and calculated. An example of the out-of-plane stability of arch rib is given. The optimization suggestion for setting the lateral straining beam is proposed. Meanwhile, the out-of-plane stability of arch rib of basket-shaped bowstring arch bridge is analyzed by the examples.

Keywords: frame-type connecting system, composite column, stiffness combination coefficient, basket-shaped bowstring arch bridge, out-of-plane stability

Abstract: Fabricated concrete culverts have a certain degree of weakened structural rigidity due to the presence of connecting joints. When designing and calculating, the influence of joints on the overall structure stress and deformation must be considered. The pipe segments cannot be simply regarded as homogeneous structures. Based on the fabricated tubular culverts in Zhejiang Province, the finite element method is used to establish the analysis models of the tubular culverts with and without joints. The modified routine theory in shield tunnel is introduced into the fabricated tubular channel structure. The reasonable values of bending rigidity efficiency η and the stress calculation correction coefficient ξ of the fabricated tubular channel are analyzed and proposed to simplify the calculation.

Keywords: fabricated concrete culvert, rigidity efficiency, finite element analysis

Abstract: With the development of road transportation industry, it is a trend to maintain some roads with weakened surface function. Thin overlay is a reasonable and effective maintenance scheme. In order to improve the bonding performance between the thin overlays and further improve the maintenance life of thin overlays, four different interlayer bonding materials of SBS modified asphalt, ESSO70# matrix asphalt, rubberized asphalt and TB modified asphalt are studied and tested. The test method is a self-developed simple method for detecting the bond strength of materials, that is, a lever drawing method. The drawing force and bonding strength of four different bonding materials with the different spraying amounts are used to evaluate the bonding performances as interlayer materials. The test results show that the four materials can all meet the more stringently required value of bond strength not less than 0.48 MPa, in which SBS modified asphalt is the best bonding material. The best recommended spraying amount is 0.6 kg/m^2.

Keywords: thin overlay, interlayer bonding, asphalt material, drawing strength

Abstract: In the early stage, the drainage pavement was mainly damaged by water. Once damage occurs, a great impact on the normal performance of the pavement is large. In order to improve the water stability of drainage asphalt mixture, the influence of SBS content on the water stability of asphalt mixture is studied.

Keywords: Wushao Mountain, high and cold tunnel, frost heave, insulation and anti-freezing measures

Abstract: The influence on the operation of urban traffic during the construction of urban rail traffic is mainly manifested in the temporary relief road and surrounding road network. At present, the focus of traffic relief design is on the rail transit stations. There is no unified consideration of the situation along the line and road network. From the system point of view, the traffic relief can not only solve the problem of smooth traffic of the occupied road, but also evaluate the influence of relief scheme on the road network. Therefore, by analyzing the characters of traffic composition, traffic volume carried by temporary relief road, traffic allocation of local road network and influence range of road network, the viewpoint and method of traffic relief systematic design are proposed.

Keywords: traffic relief, systematic design, non-transfer traffic, shunt traffic, road resistance

Abstract: Combined with the potential safety hazard treatment projects of urban elevated single-column pier curved beam in Shanghai, the applicability of reinforcement scheme is studied by full scale test. The stress mode and load-transferring mechanism after reinforcement are explored and studied in order to provide the powerful support for accurate optimization and implementation of reinforcement scheme. The test shows that the maximum bearing capacity of the steel bent cap added in this test is 280 t, which meets the design (160 t) requirement. When the load is less than 150 t, no bond failure occurs between the ultrahigh performance concrete (UHPC) and the component. When the design load is 0.93 times, the studs begin to participate in the stress. An optimization direction is provided through this test for the reinforcement scheme, which can be referred for the implementation of the similar projects.

Keywords: single-column pier, anti-dumping, steel bent cap, ultrahigh performance concrete (UHPC)

Abstract: According to *Code for Design of Highway Reinforced Concrete and Prestressed Concrete Bridges and Culverts* (JTG 3362—2018), the midspan hemline normal stress of 40m-span post-tensioned prestressed concrete small box girder is calculated by hand and professional software respectively, and the difference between the two calculation results is compared. The causes of the difference are found out through analysis, and the solutions are put forward, which have certain reference value for engineering design.

Keywords: bridge engineering, small box girder, post tensioning method, stress

Abstract: *Technical Specifications of Urban Pedestrian Overpass and Underpass* (CJJ 69-95) of China requires the first-order natural frequency of pedestrian overpass greater than 3 Hz. But the large-span pedestrian bridge cannot meet the requirements of this code. Therefore, it is necessary to analyze and control its comfort. After the research and analysis of the corresponding foreign codes, the German codes

Abstract: The supporting structure of foundation pit in the foundation pit engineering close to water is subjected to the different water and soil pressures. When the foundation pit is under the asymmetrical load, the whole structure will deform and tilt to the side with less water and soil pressure. Therefore, the relevant formula in the code cannot be completely used for calculation. Based on the characteristics of the unbalanced water and soil pressures at both sides of foundation pit close to the water, the design of this kind of foundation pit is assumed and discussed. From the formula in the code, the iteration recursive method is adopted to establish a set of system to calculate the deformation of supporting structure in the foundation pit engineering close to water. Its calculation and analysis are carried out by the engineering examples.

Keywords: foundation pit close to water, internal support stiffness, iteration recursion, deformation impact analysis

Abstract: Based on the internal prefabricated structural system of "slab-beam-column" double-layer tunnel, the connecting mode between lane slabs is studied including four modes of straight joint, hinge joint, rigid joint and equal rigidity joint. The results show that the longitudinal moment transmitted by the straight joint is limited, and the hinge joint is equivalent to the rigid joint. The longitudinal shearing force of straight joint is basically not transferred, and the longitudinal bending moment of hinge joint and rigid joint is relatively continuous, almost 100% transfer. The transfer of rigid joint width to bending moment decreases with the increase of the width, but has little effect. From the perspective of construction convenience, a larger joint width can be selected. The transfer of rigid joint thickness to bending moment decreases with the increase of thickness. But when the thickness of rigid joint is equal to the thickness of lane slab (equal rigidity connection), the stress is the most continuous. The near equal rigidity connection recommended in this paper has large joint stiffness and reasonable stress.

Keywords: shield tunnel, double-layer prefabricated structure, joint form, numerical simulation

Abstract: For the study of the characteristics of soil pressure within the underpass wall and roadbed under the dead load of filling and pavement, and the load of construction vehicles, the side wall soil pressure of the underpass of a high fill airport in Guizhou of China is tested. After comparison, the pressure values measured on the earth pressure cell and the values calculated on the filling thickness are processed and analyzed. The experimental results show that the higher the backfill height is, the higher the earth pressure is without the load, and the increase range is approximately proportional to the filling thickness. With the increase of backfill thickness, the distribution of the value α along the backfill direction turns into a line going to be approximately stable from the initial approximately linear increasing trend due to the increase of filling thickness. The higher the fill thickness is, the closer the value α is to 0.1~0.15. Under the action of load, the buried shallow earth pressure cell is more sensitive to the change of pressure value. The depth affected by load is about 1.52~2.81 m. The driving direction of vehicle has no obvious influence on the earth pressure.

APPLICATION OF ACHIEVEMENTS

THE RELATIVE SPECIALITIES

Abstract: The development and utilization of low hill gentle slope are the important measures for the land reform in China, and are the important starting point of priority strategy for land resource conservation. Taking a typical project built in Zhejiang Province as an example, the important matters of development intensity, site leveling mode, slope direction control, vertical design, entrance and exit design, earthwork deploy and earthwork balance for attention in the planning and design of development and utilization of low hill gentle slope are summarized, and the relative suggestions are put forward, which can be referred for the related professionals.

Keywords: low hill gentle slope, development intensity, site leveling, coefficient of loosened soil

Abstract: With the continuous development of engineering digitization and BIM design, the application of 3D measurement in project is indispensable. In 3D laser scanner point cloud processing, taking the normal vector and principal curvatures of a regular surface (plane, cylindrical surface and spherical surface) as the parameters, the mathematical model of regular geometric surface automatic extraction is established. The distance of surface namesake point and the ranging result of precision total station extracted by this model are compared and analyzed for model precision. The noise reduction, downsampling and regular geometric surface automatic extraction are carried out through point cloud data. Combined with the operation of 3d chartlet and rendering, taking the spatial simulation of a building as an example, an application method of centimeter-level point cloud data regular surface extraction spatial simulation is obtained.

Keywords: 3D laser scanner, pre-processing, regular surface, automatic extraction, spatial simulation

Abstract: The utility tunnel built in the place with large hypsographical undulation is often located in the high fill subgrade. At this time, the retaining walls are often required to ensure the safety of road slopes and utility tunnel. In order to ensure the safety of the utility tunnel, the requirements for the design of retaining wall outside the utility tunnel are generally higher. To illustrate the design process of such retaining walls, taking a pile foundation counterfort wall outside the underground utility tunnel in Qingbao Road of Bashan City in Yunnan Province as an example, its design method is briefly analyzed.

Keywords: utility tunnel, counterfort wall, pile foundation, analysis

Abstract: The design budget estimate is the main basis and the maximum limit of construction project investment control, and is also one of the result documents in the preliminary design stage. At the same time, it can be used as the basis for the preparation and control of construction drawing budget, bidding control price, tender quote and contract price. Therefore, it is very important to master the accuracy (quality) of design budge estimate. The quality problems leading to "no" of design budget estimate, i.e. the preparation contents inconsistent with the design documents and drawings in the preparation of design

budget estimate are analyzed. On the basis of the arithmetic error in the calculation of engineering quantity, and the calculation rules inconsistent with stipulations, taking the projects of road, bridge, drainage and tunnel in Shanghai as the examples, the preparation members are guided how to apply the "exclusive method" and "empirical method" for the self-check (self-correction) in order to evade the arithmetic errors and "stupid mistakes", and improve the preparation accuracy and precision of design budget estimate.

Keywords: design budget estimate, quality, self-correction

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