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VOLUME 5 ISSUE 1
ISSN:2424-8452
UNIVERSE SCIENTIFIC PUBLISHING

URBAN TRANSPORTATION & CONSTRUCTION

UTC

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Volume 5 Issue 1 • 2019

Urban Transportation & Construction

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2019 | Volume 5 | Issue 1

Urban Transportation & Construction

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Original Articles

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ORIGINAL ARTICLE

Application Analysis of Artificial Intelligence in Computer Network Technology

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Abstract: Artificial Intelligence (AI) is a kind of intelligent behavior similar to human being which helps human being to participate in dangerous and complicated work directly. The effective application of computer network technology has changed people's production and life style, and technological innovation has paid more attention to intelligence and humanity, leading to that artificial intelligence has become a development trend. This paper analyzes the general situation of artificial intelligence and its application and future development in computer network technology, hoping to provide help for related work.

Keywords: Artificial Intelligence; Computer Network Technology; Application

Artificial intelligence brings together the knowledge and experience of many subjects, makes the network communication technology more artificial and intelligent, and meets the service demand of network technology. Artificial intelligence has been applied in many fields in the present age, which brings a new development direction for the way of production and life. Therefore, it is an important way to promote the development of productive forces and the reform of economic structure to strengthen the technical research of artificial intelligence and explore the practical application of this technology in computer network technology, since it plays an active role in the development stage of intelligent economy and information technology.

1. Artificial intelligence

Artificial intelligence is a new technology that combines the development, research and popularization of theories, methods, technologies and application systems. Under the comprehensive effect of mathematics, information theory, linguistics, computer science and other disciplines, the machine and equipment has the ability of simulating human's consciousness and behavior, which is similar to human's thinking. It is convenient for human's production and living environment, and can help human to accomplish many high-risk, complex and mechanical high-quality jobs. It already exists in a wide range of industries, as shown in **Figure 1.**

Artificial intelligence belongs to computer science, and its application advantages in computer network technology are shown as follows: First, it has strong information processing ability, and it can quickly obtain reliable information in large amount of information resources according to humanized logic processing mode with its obvious timeliness and rapidity; second, it has strong ability of cooperation, can integrate limited resources, realize the hierarchical management of the computer network, and accomplish the management work together, thus greatly speeding up the work efficiency; third, it has strong memory ability, it can analyze and process the usage information of the browser in the complex network information, and form the database, which plays a certain role of security supervision.

doi: 10.18686/utc.v5i1.73

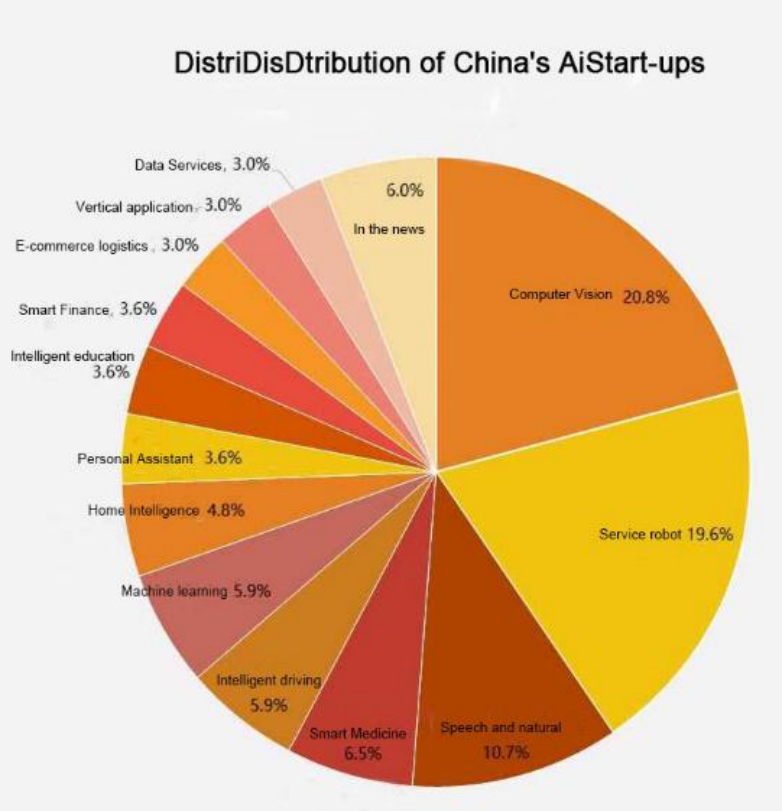

Figure 1. Distribution of China's AI start-ups.

2. Application of artificial intelligence in computer network technology

In the rapid development of social economy, people will put forward more intelligent, human-based service requirements for computer technology, so artificial intelligence reflects a wide range of applicability. The interactive development of computer network technology and artificial intelligence is embodied in:

2.1 Network security management

2.1.1 Smart firewall

The setting of firewall is to protect file information, in case it will be stolen maliciously. The traditional firewall technology has some shortcomings, the program content is fixed, when the new structure appears, it will directly threaten the file information security. The application of artificial intelligence is an evolution of firewall technology, which can resist the new structural firewall problem better, especially the SSL stream data encrypted in the traditional firewall. Based on the characteristics of archives, the relevant monitoring system can be more perfect under the function of artificial intelligence, such as what kind of information, what kind of permission to log on, what kind of permission to open, as well as the outside network access to the archives information can enjoy a wider scope of information access under further strengthening control. From the data link layer to the application layer, it belongs to the monitoring object, and TCP / IP Protocol layer needs to be taken the security monitoring comprehensively, so as to enhance the security performance of the whole archive network.

2.1.2 Intelligent intrusion detection system

The intelligent intrusion detection system (ids) is a web page which can detect, visit and retrieve the information of archives. Some web pages are simply information filtering, but some web pages contain viruses or other procedures to facilitate the malicious theft of post-archive information. And the application of artificial intelligence can visit the page of hidden procedures to check, some intrusion type of procedures can be issued in a timely security warning, or even the implementation of timely blocking procedures. Artificial intelligence (AI) has the ability of self-learning. After

receiving the data and technology of intrusion retrieval, the system will evolve and defend itself better.

2.1.3 Intelligent anti-spam software system

Intelligent anti-spam software system can maintain the user's mailbox security by scanning the mailbox. Moreover, searching out the spam, and identifying the virus mail will use artificial intelligence. With its ability of unforeseeable problems and the processing technology of learning reasoning function, it can supervise the content of mail comprehensively and efficiently, and classify many kinds of mail information. So the spam, harmful e-mails can be clearly divided with targeted warning, which significantly reduces the security risk of spam and has played an important role in the network security.

2.2 Integrated management and systems evaluation

The effective application of artificial intelligence is helpful to enhance the computer network security, and make comprehensive management and evaluation. The sharing, high efficiency and dynamic of computer network objectively increase the difficulty of Network Integrated Management, and manpower is only a part of resources to optimize network management. Artificial intelligence brings together expert skills and professional experience and provides users with the required data and information through the programming form to facilitate users to solve problems. Artificial intelligence has the ability to calculate and process big data. With the help of the management and guidance of computer network technology, it makes decisions for the work of the system and greatly enhances the management efficiency and security performance of the whole network, it is an important guarantee for comprehensive management and systematic evaluation.

3. Advances in artificial intelligence

3.1 Accelerating breakthroughs in core technologies

In the development of information technology, from information to intelligence, the era of mobile interconnection has gradually been transferring to the era of all things interconnection, and artificial intelligence as the most cutting-edge technology, widely exists in all industries to promote its optimization and upgrading. The application of artificial intelligence in enterprises can enhance the comprehensive competitiveness of enterprises while more resources and more research energy will be invested in the research and development of artificial intelligence, and broaden the application scope of artificial intelligence.

3.2 Entering the industry booster phase

At present, artificial intelligence has risen to the national strategic planning, issued a number of rights and interests protection policies. In this environment, the Internet technology giants actively absorb artificial intelligence, capital investment and the specific number of R & D institutions is increasing, market size data shown as **Figure 2**.

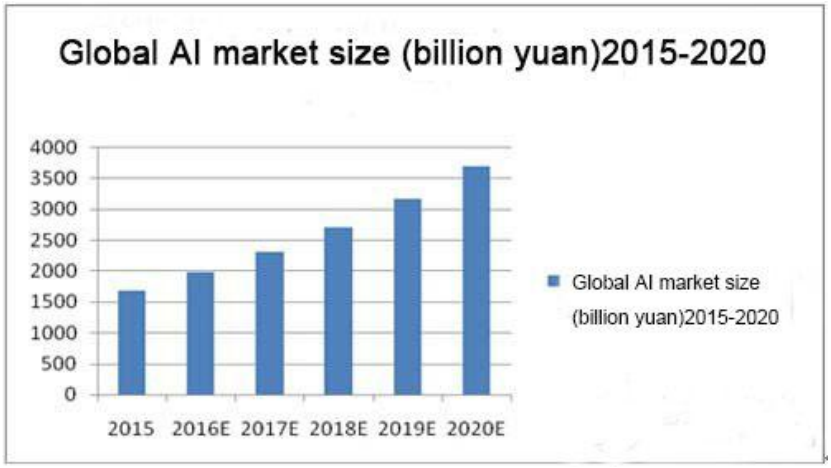

Figure 2. Global AI market size.

3.3 Technology is more mature and the industrial chain is getting better

Artificial intelligence (AI) has gone through three development stages: Computational Intelligence (CI) , Perceptual Intelligence (PI) and Cognitive Intelligence (CI) . Specifically, computational intelligence is the storage, calculation and transmission of data information that improves the processing efficiency of a large number of information resources; perceptual intelligence is the faster way to complete the "see" and "hear" work and it has successfully developed technologies such as a face recognition camera platform and a voice recognition assistant. Artificial intelligence is more humanized and works in a way similar to human thinking, and has developed advanced devices such as self driving cars. Artificial intelligence technology has been witnessing the development of mature, and related production chain is also in the continuous development.

4. Conclusion

To sum up, the popularization of computer network technology brings security risks such as viruses and hackers that threaten the security of network system and user information. Artificial intelligence is produced and developed with computer network technology, which has obvious advantage in information protection and positive effect on other aspects, and promotes the innovation and application of Internet information technology.

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ORIGINAL ARTICLE

Development Status and Application Research of Rare Earth Permanent Magnet Motor

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Abstract: Since entering the new century, the efficient use of energy has become the key to the development of every country in the world, so it is an inevitable trend to create a resource-saving society. So many fields are also actively exploring new environmental protection technology, and in the development process of China's industrial industry, the further use of rare earth permanent magnet motor can better realize the full use of energy. Therefore, this paper will analyze the development of rare earth permanent magnet motor and the overall application trend.

Keywords: Rare Earth Permanent Magnet Motor; Development Status; Application Research

China is very rich in rare earth resources, especially the annual output of rare earth resources is the first in the world. Rare-earth permanent magnet motors are characterized by high efficiency, compact appearance and stable operation. They cover almost all kinds of motors in the market. Therefore, the comprehensive development of rare earth permanent magnet motor will do good to our country's resources protection and development of many industries.

1. Analysis of operation principle of rare earth permanent magnet motor

1.1 Introduction of the whole structure of rare earth permanent magnet motor

In view of the current development of China's industry, the rare earth permanent magnet motor (REPM) is a newly developed and deeply applied specialized facility in the new century. Therefore, the understanding of the structure of REPM motor should be strengthened, which is the important foundation for the development direction of rare earth permanent magnet motor. The core of the rare earth permanent magnet motor is to operate with the magnetic field as the core. The rare earth permanent magnet motor can realize the effective conversion of mechanical energy and electrical energy, rare earth permanent magnet motor (REPM) is an advanced electromagnetic device in modern industrial facilities. The general type of rare earth permanent magnet motor is shown in **Figure 1** below.

There are some differences between the rare earth permanent magnet motor and other facilities. As shown in **Figure 2** below, it is the rare earth permanent magnet motor internal structure profile. The rare earth permanent magnet motor first converts the air gap magnetic field related to industry into the air gap magnetic field which needs permanent magnet to produce, and then enters the motor's winding current from the inner layer. The core function of the device is to provide energy to effectively maintain the normal movement of the current, so the whole motor is often composed of two independent modules which are stator and rotor respectively. In this case, the stator is the fixed part of the operation process of the motor. The stator is formed by the symmetrical arrangement of two modules.

doi: 10.18686/utc.v5i1.74

Figure 1. Appearance display of rare earth permanent magnet motor.

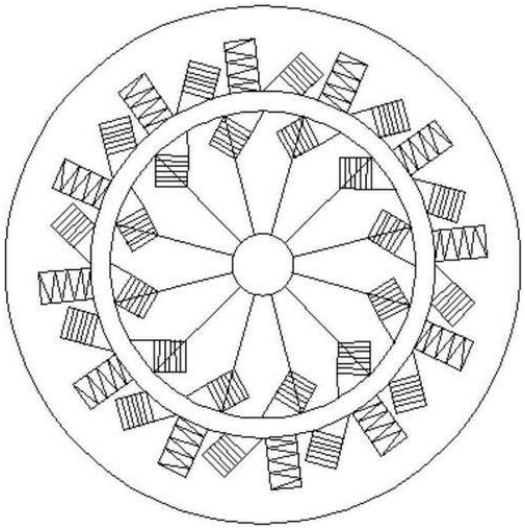

Figure 2. Internal structure profile of rare earth permanent magnet motor.

1.2 Introduction of operation principle of rare earth permanent magnet motor

Compared with the traditional industrial facilities, rare earth permanent magnet motor is a relatively new facility, and it can provide very excellent energy, The biggest difference from the traditional motor is that the core of the operation of the rare earth permanent magnet motor is a kind of electromagnetic force which is perpendicular to each other. This kind of electromagnetic force is produced by the interaction between the magnetic field of the stator and the rotor. This kind of electromagnetic force core is the vertical function which unfolds in the plane, and the function unfolds may maintain the normal operation of the motor better. The electromagnetic force is formed by the interaction of the magnetic field and the electric current in the magnetic array. Especially when the electromagnetic torque suppresses the inertia of the rotor itself and the permanent magnet rotor also produces damping torque, the motor will start to operate.

2. Development status of rare earth permanent magnet motor

2.1 Characteristics of high efficiency, environment friendly and energy saving

China's rapid economic development brings about the biggest negative effect is the serious loss of energy, and China's industry needs to further comprehensive development, so rare earth permanent magnet motor is born. The emergence of rare earth permanent magnet motor and its deep application have laid a solid foundation for the green development of China's industry. Compared with other traditional motors, rare-earth permanent magnet motors are endowed with unique advantages. The overall operating efficiency of the rare earth permanent magnet motor is higher than that of the motor of the same level, and the operation of the rare earth permanent magnet motor is more environmentally friendly. The core of rare-earth permanent magnet motor is to operate by electricity, so it can be said to be the more efficient green product at this stage.

2.2 Relatively high performance

As for the rare earth permanent magnet motor, compared with the similar motor, it not only has the advantages of energy saving and high efficiency, but also has the characteristics of high efficiency. High efficiency can be said to be an advantage that can never be ignored in the development of rare earth permanent magnet motors, especially for some traditional motors with older technology whose overall operation can not fully meet the basic needs of China's current industrial production. If large-scale production is carried out, it will often cause great energy consumption, and also

invisibly trigger the related enterprise's input cost to further increase. When rare earth permanent magnet motors are used in some fields, their speed regulation is nearly 10,000 times higher than that of traditional motors. Meanwhile, the precision of operation is well guaranteed, and the total error is usually not less than 0.1% .

2.3 Architectural diversity

The performance of rare earth permanent magnet motor is not only very good in the efficiency link. Because of its diversified overall structure, rare earth permanent magnet motor can be used in different fields of industrial production. Compared with the traditional motor, the rare earth permanent magnet motor is more widely used due to its multiple structure characteristics.

3. Research on the application of rare earth permanent magnet motor

3.1 Use of household appliances

It is well known that rare earth permanent magnet motors have been widely used in the field of aerospace in China. Besides, rare earth permanent magnet motor has been fully applied in the daily use of the most frequent household appliances. It can be said that the use of rare earth permanent magnet motor has gradually entered into people's daily life. For example, the brushless DC motor of rare earth permanent magnet motor can be used as a new generation of variable speed refrigeration technology. Now many countries at home and abroad use rare earth permanent magnet motor as an important basic refrigeration component that is used in household appliances such as refrigerators and air conditioners.

3.2 Application in the shipping area

Besides the in-depth use in the daily household appliances, rare earth permanent magnet motor has also played a better role in the ship field at the same time. At present, the worldwide shipping industry also uses rare earth permanent magnet motors to carry out its daily operation. This is because rare earth permanent magnet motors are a kind of ship propulsion system with high efficiency. Most of the usual ship propulsion systems are driven by full-speed power, and with the appearance and further development of rare earth permanent magnet motors, however, the ship propulsion mode of rare earth permanent magnet motors is more efficient and energy-saving, at the same time, the overall technology is also increasingly mature.

4. Conclusion

Although rare earth permanent magnet motor is the product of scientific development in the new century, its overall technology has been very perfect and mature, and still has a very high room for improvement. It can be said that rare earth permanent magnet motor is a landmark product. So in the future development process of rare earth permanent magnet motor, we need to further effectively integrate it into more industry areas, so as to better achieve the dual effects of efficient operation and environmental protection.

Acknowledgement

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ORIGINAL ARTICLE

Discussion on Applicability and Train of Thought of Urban Small Capacity Rail Transit Development

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Abstract: In recent years, small and medium-sized cities have built rail transit to meet the growing travel needs of residents that gain popularity. Among them, small capacity rail transit has been widely used in many cities across the country due to its short construction period, low cost and strong adaptability. This article introduces the classification and characteristics of urban small capacity rail transit. Moreover, it discusses the applicability of small capacity rail transit development based on the current development of urban rail. This article claims that the direction of its development ideas in the future is more strengths, more smart, more standardized and coordination development with multiple types.

Keywords: Small and Medium Cities; Small Traffic Capacity; Rail Transit; Applicability

1. Introduction

With the development of China's economy and society, urban rail transit construction has become a trend. As the skeleton of urban public transportation, rail transit has the advantages of high arrival rate, high punctuality rate, clean and comfortable riding environment, and therefore driving urban economic development. However, the construction of large-capacity rail transit has high cost and long construction period. In some small and medium-sized cities, due to population aggregation, travel capacity, and economic constraints, the construction of large capacity rail transit has obviously caused the city's economic burden and resource waste. Therefore, for small and medium-sized cities, the proper construction of small capacity rail transit has become a reasonable choice.

2. Rail transit system

2.1 Rail transit system classification

Due to the rapid development of urban rail transit, rail transit in various cities has different characteristics to adapt to various local conditions. There are many types, and the technical indicators are quite different. At present, there is no clear division standard. Urban rail transit can be classified according to one aspect, for example, according to capacity, line erection method, guidance method, line isolation degree, etc. Presently, urban rail transit can be divided into 7 types according to national standards, including subway, light rail, monorail, modern tram, maglev train, urban fast rail, and automatic guided rail system, each with its own adaptability and characteristics.

doi: 10.18686/utc.v5i1.76

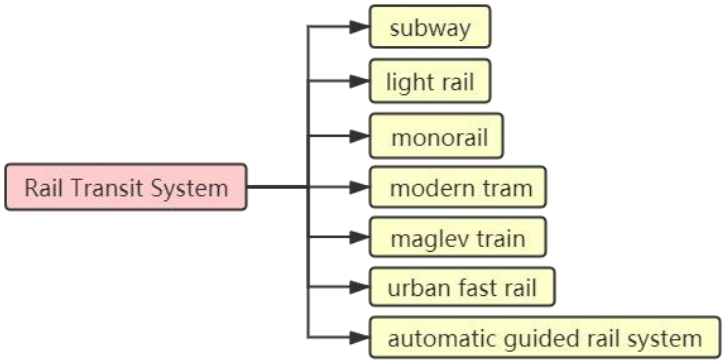

Figure 1. Urban rail transit system.

Classification Index	Type of Division
Capacity（per hour）	large capacity, medium capacity, small capacity
Guidance Method	wheel rail guide, guide rail guide
Line Erection Method	underground, elevated, ground
Line Isolation Degree	fully isolated, semi-isolated, not isolated
Towing Method	rotating DC, AC motor traction, linear motor traction
Operational Organization	traditional urban rail transit, regional rapid rail transit, city (suburban) railway
Right of Way	exclusive right of way, mixed right of way
Control Method	signal control, visible distance operation

Table 1. Other types of rail transit system

2.2 Small capacity rail transit classification

According to the classification of one-way traffic capacity per hour during peak hours, urban rail transit is divided into large capacity, medium capacity and small capacity. The transport capacity standards and common types are shown in the **Table 2**.

Classification	Capacity（per hour）	Common Types
Large Capacity	more than 30,000 people	heavy metro, light metro
Medium Capacity	15,000 ~ 30,000 people	miniature subway, high-tech light rail, monorail
Small Capacity	5000 ~ 15,000 people	low-tech standard light rail, automatic guided new transportation system, modern tram

Table 2. The rail transit system is divided by capacity

The urban small-capacity rail transit system includes many types. Common light rails with low technical standards, automatic guided new transit systems, and modern trams are briefly introduced in following contents.

2.2.1 Light rail

Light rail mainly belongs to the type of small and medium-sized rail transit, also known as light rail rapid transit and light rail railway, referred to as light rail. The difference between it and the subway lies in the traffic capacity, the width of the cars and the number of cars. The traffic capacity, the width and the number of carriages in the light rail are all smaller than that of the subway. The maximum train grouping of light rail is 4 carriages.

2.2.2 Automatically guided new traffic system

The automatic guided new traffic system contains a dual-track railway and a single-track railway that are introduced into a computer and a fully automatic control system. Its transportation capacity is between buses and suburban railways.

2.2.3 Modern tram

Modern tram is a kind of rail transportation that uses electric power as the starting force on the ground-laying tracks. The number of carriages of a tram is usually one, and the maximum is generally not more than three, so the transportation capacity is small. Among them, Skyshuttle (named Yunba in Chinese), a small capacity rubber wheel system, uses a rubber wheel system, which is similar to a ground bus and can carry concentrated traffic in a small area.

Light Rail

Automatically Guided New Traffic System

Modern Tram

Yunba

Figure 3. Schematic diagram of small capacity rail transit (Source: 360 pictures).

3. Characteristics and applicability of small capacity rail transit

3.1 Characteristics of small capacity rail transit

The small capacity rail transit system has the characteristics of high punctuality rate, high arrival rate, high service quality, fast driving speed, safe and stable operation of large capacity rail transit. It can also become the link and "capillary" of the city like ordinary public transportation systems, connecting all walks of life, reaching into remote areas of cities, and helping to build a complete and reasonable public transportation system network. The characteristics of small capacity rail transit are mainly reflected in the following four aspects.

3.1.1 Low construction and operation costs and short construction period

Due to different geographical and geological environments, the cost of subways is usually 500-1000 million yuan per kilometer. The cost of light rail is 100-200 million yuan per kilometer, and modern trams are about 100 million yuan per kilometer. However, a city's rail transportation forms a network, which requires the construction of hundreds of kilometers. Moreover, the operation costs are much greater than the construction costs. Compared with large and medium capacity rail transit, the operation and construction cost of small capacity rail transit is lower, which is conducive to reasonable fiscal expenditures of small and medium-sized cities and reduces the urban economic burden. In addition, the short construction time can not only reduce the impact on the ground traffic and the surrounding environment, but also win valuable time costs in the fast-paced development era.

3.1.2 The line is adaptable and flexible

The turning radius required for small capacity rail transit is small, and the climbing ability is strong. It can be adapted to a variety of terrains and has a wide range of applications. Most of the routes use networked operation and organization methods, which can reduce rail transit transfers and improve travel efficiency.

3.1.3 Environmentally friendly

Small capacity rail transit occupies less land resources, and uses more ground or above-ground framing methods to rationally use the ground or above-ground space, reducing damage to the underground environment. In addition, small capacity rail transit is an urban public transport, which can effectively guide residents to use public transport to reduce carbon emissions, and is a green way of travel.

3.1.4 Low external negative effects

The construction of small-capacity rail transit has the functions of improving the urban transportation system, alleviating traffic congestion, and guiding green travel modes. The positive effect on economic and social development is greater than the negative effect, and the negative impact on the outside is small.

3.2 Applicability of small capacity rail transit

Based on the characteristics and advantages of the small capacity rail transit mentioned above, the small capacity rail transit can be applied to the following four aspects:

3.2.1 Suitable for large or medium-sized urban rail transit branch or encryption line

Large or medium-sized cities often choose large capacity rail transit as the backbone of rail transit, and areas with less traffic than mainline stations can choose small-transit rail transit as a supplement to form a reasonable rail transit network, which can meet both the demand for traffic and reduced the waste of funds and resources for the construction of large capacity rail transit.

3.2.2 Suitable for the backbone of small and medium-sized cities

The economic strength of small and medium-sized cities is limited, the number of people and the volume of transportation are relatively small, and the construction of large capacity rail transit is unreasonable. At this time, the strategy of "adapt to local conditions" is adopted. When the amount of travel is within the appropriate range, small capacity rail transit can be used as the main line to form a skeleton of urban public transport, ease the pressure of urban traffic, and improve the structure of urban resident's travel.

3.2.3 Suitable for connecting lines in the periphery of cities or integrated rail transit hubs

With the city's population gathering and industrial development, the city continues to expand, and satellite cities or groups will also be built. Under suitable conditions, the connection between the outer areas of the city and the satellite city and the main urban area can be achieved by the construction of small capacity rail transit. In addition, an expansive city often builds a comprehensive rail hub to achieve the organic combination of multiple modes of transportation, while radiating the surrounding areas, and small capacity rail transit can expand its radiation range and serve more people.

3.2.4 Suitable for tourism and sightseeing lines or internal loops in large areas

In some wider tourist attractions, large-scale places, such as university campuses, buildings, and so on, the

construction of small capacity rail transit can facilitate local residents to commute, and can also realize the function of tourists taking a cable car or coach and effective use of tourism resources.

4. Ideas for the future development of small capacity rail transit

With the development of modern science and technology and the need to "adapt to local conditions" in the planning and construction of urban rail transit, small capacity rail transit will become the focus of development in the future. It may have the following four trends.

4.1 Diverse advantages

Under the various advantages of the small capacity rail transit, it is necessary to find more advantages and increase the advantages. For example, in compliance with construction standards and operation requirements, continue to reduce construction costs, reduce manpower input, and shorten the construction period. Besides, based on the existing advantages, more other advantages can be explored and created.

4.2 Intelligent operation management

Autonomous and intelligent small capacity rail transit is an important aspect of the development of smart cities, further promoting the application of new technologies such as the Internet, cloud computing and IBM, improving operational efficiency, providing people with travel convenience, and greatly saving operations manpower in management.

4.3 Standardized construction and operation

With the arrival of a new wave of small capacity rail transit construction, more standardized construction and operation indicators and specifications are needed to further improve the rail transit construction and operation system.

4.4 Coordinated development of multiple rail transit

At present, there are many types of small capacity rail transit in China, which have different characteristics and are irreplaceable. The construction of small capacity rail transit should be "adapted to local conditions" and "selected according to needs", and the same city can also be developed in a coordinated manner.

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ORIGINAL ARTICLE

Development and Prospect of Chinese Tunnel and Underground Engineering

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Abstract: In recent years, with the rapid development of China's economy and the continuous expansion of the scale of urban construction, the urban population has grown rapidly, and the phenomenon of urban traffic congestion has become increasingly serious. The construction of urban rail transit is an important measure to alleviate urban traffic congestion. Highway tunnels and subways have the advantages of improving routes and shortening travel time in transportation and ultimately improving operational efficiency. Therefore, in recent years, China has increasingly invested in tunnels. Underground engineering has become an important symbol of a country's overall national strength, urban economic strength, people's living standards and modernization.

Keywords: Underground Engineering; Open Cut Construction Method; Cover Excavation Construction Method; Shallow Buried Excavation Method

1. Current status of highway tunnels and underground projects in China

In the 21st century, as China accelerates the process of urbanization, the development and utilization of underground space becomes increasingly important. The construction of tunnels and underground projects is both an opportunity and a challenge. Since 2018, China's National Development and Reform Commission has opened the door for the approval of the urban rail transit project. In particular, at the end of 2018, in just two months, a total of 10 rail transit construction projects were approved, with an investment of 1,088.942 billion yuan. Up to now, China's rail transit construction plans in 43 cities have been approved by the state, with a total mileage of 8,600 kilometers. According to the provisions of Article 19.1.22 of "Metro Code Design" (GB50157-2003): "between two single-line interval tunnels, when the continuous length of the tunnel is greater than 600m, a communication channel shall be set up". Therefore, the number of communication channels to be built is extremely large.

2. Commonly used construction methods in China

2.1 Open cut construction method

Open cut construction method refers to the operation on the ground surface, digging the earth and stone from the ground to the bottom. When it reaches a certain design elevation, the base will be constructed in succession. When the main structure of the tunnel is completed, the ground backfill foundation pit will be restored. This method is the most basic construction method for underground engineering. Its safety and convenience in construction have advantages that other construction methods do not have. However, this method is only suitable for uninhabited people,

doi: 10.18686/utc.v5i1.77

inconvenient transportation and relatively few buried pipelines. Local application, because of the restrictions on the construction environment and the noise and vibration caused by the construction, has a great impact on the surrounding environment. Open-cut is the most widely used method to construct subway stations, and can be divided into single-layer open-cut station, one-layer open-cut station, double-layer open-cut station, and three-layer open-cut station based on different buried depths.

2.2 Cover excavation construction method

The cover excavation construction method is to dig down from the ground to a certain depth, then close the top, and the rest of the lower part of the project will be constructed under the closed roof. It is mainly suitable for areas with loose geological conditions and tunnels above groundwater level. This method is a commonly used construction technology including: cover and excavation along the way, cover and excavation reverse operation, cover and excavation semi-reverse operation, compared with open excavation method. On the one hand, it has little impact on the construction of other projects. Underground pipelines can use cover. The board is used as protection, thereby reducing the workload of pipeline relocation and correspondingly reducing the investment of the construction unit. Even if the pipeline and structural location conflict and the pipeline needs to be relocated, the relocation can be carried out simultaneously with the construction of the project. The cost is low, and the required time is shortened, and the impact of the pipeline demolition on the project construction is minimized. On the other hand, the cover excavation method is less affected by other factors. The cover excavation method is conducive to the comprehensive construction of the underground structure of urban municipal engineering that can not be implemented by side construction or complex pipelines without affecting normal traffic conditions and maintaining traffic flow. In addition, the cover excavation method is used in underground construction, and the noise vibration is small, which effectively reduces the noise pollution during the construction process. It is more flexible, which can not only ensure the construction period, but also ensure smooth traffic, which is extremely important for the construction of subway stations in the city.

2.3 Shallow buried excavation method

Shallow buried excavation method refers to a method of underground excavation construction of various types of underground caves near the ground surface. Shallow buried mining method is a new method developed in recent years. According to the basic principles of New Austrian law, shallow buried mining method is based on "pipe ahead, strict grouting, short footage, strong support, early closure, diligence" "Measurement" is the main point of construction control. The underground caverns constructed by shallow burying and underground excavation have shallow burial depth (minimum cover span ratio can reach 0.2), poor stratum lithology (usually Quaternary weak stratum), presence of groundwater (need to lower groundwater level), and complicated surrounding environment (adjacent Existing buildings, structures) and other characteristics. The core of the method is to use the surrounding rock support tunnel to form the supporting ring of the surrounding rock itself, and use a variety of auxiliary construction methods to implement advanced support, so as to mobilize the self-supporting capacity of part of the surrounding rock to ensure that the construction process and completion. After operation, the amount of subsidence in the ground and in the ground is less than the limits specified by adjacent building structures and pipelines. Due to the characteristics of low cost, less demolition, flexibility, no need for too much special equipment, and no interference with ground traffic and surrounding environment, the shallow buried excavation method is widely used in similar stratums and various underground projects across the country. However, there are problems such as inconvenient mechanized operations, high labor intensity, poor working conditions, and high risks. This method has been widely used in urban underground engineering.

2.4 Shield construction method

The shield construction method is a fully mechanized construction method in the construction of the dark excavation method. It is to advance the shield machinery in the ground, and support the surrounding rock through the shield shell and the segment to prevent the collapse into the tunnel. At the same time, a cutting device is used to

excavate the soil in front of the excavation surface, and it is transported out of the hole through the excavation machinery, jacked up at the rear by jacking, and prefabricated concrete segments are assembled to form a mechanized construction method of the tunnel structure. At present, the shield method construction has been widely used because it has: (1) excavation and lining operations under the cover of the shield, with sufficient construction safety; (2) underground construction does not affect ground traffic, and construction under the river is not affects the navigation of the river; (3) construction operations are not affected by climatic conditions; () the resulting vibration, noise and other environmental hazards are less harmful; (5) the impact on ground buildings and underground pipelines is less obvious advantages.

2.5 Pipe jacking construction method

Pipe jacking construction method is an underground pipeline construction method developed after shield construction. With the help of the jacking force generated by jacking equipment in the working well, the friction between the pipe and the surrounding soil is overcome, and the pipe is jacked up according to the designed slope go into the soil and transport the earth away. After one pipe section has been jacked into the soil layer, the next pipe section will continue to jack in. The principle is to push the tool pipe or the boring machine from the working pit through the soil layer to the receiving well by using the thrust of the main top oil cylinder, the pipeline and the relay room. The pipeline is buried between the two shafts immediately after the tool pipe or the boring machine. The main problem of pipe jacking technology in China is that the mechanical equipment technology is relatively backward, the regional differences are obvious, the level is uneven, the lack of standardization, and the shortage of talents are yet to be further publicized. China mainly relies on imports for pipe jacking machinery and equipment. Although there are also domestic production enterprises, the technology is still lagging behind the international advanced level. The type of roadheader is not enough to meet the needs of the project. There is no rock disk for China above medium strength rock formation. The machine is not suitable for the range of soil quality, and the durability, mechanization and automation are not enough.

3. Outlook

Academician Mengshu Wang pointed out that the 21st century is a century of great development of tunnels and underground spaces. With the continuous advancement of technical level and the need for operational development, the tunnel will inevitably become longer and wider, making the construction more difficult. Moreover, the various problems faced are becoming more and more complicated. China is a big country in the construction of tunnels and underground projects, but it is not a theoretical power. Many modern design theories are still based on the situation in the West. The design models and methods still have many shortcomings. There is still a big gap.

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ORIGINAL ARTICLE

Research on the Application of Precast T-beam Construction Technology in Bridge Construction

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Abstract: Prefabricated T-beams are widely used in bridge engineering in China. In this article, the construction technology of prefabricated T-beams is clarified. The characteristics of current prefabricated T-beam technology in bridge construction and construction are discussed and explained based on the actual situation of bridge engineering.. Problems and countermeasures that may arise when erecting T beams are also analyzed.. Precast T-beams are of great significance to the basic construction and development of modern road bridges in China.

Keywords: Prefabricated T-beams; Bridge Engineering; Basic Construction

1. Application of precast T-beam construction technology

Many technologies have been used in the fabrication and construction of prefabricated T-beams. For example, the installation of prefabricated T-beams needs to be regulated when laying T-beams, the pre-archedness of prefabricated T-beams is controlled, and the value of the reverse arch of the support is strictly controlled. Controlling the erection time of prefabricated T-beams not only has higher requirements on the technical level, but also can improve the engineering efficiency and speed up the progress.

In the concrete pouring project after the T-beam being laid, it is necessary to standardize the concrete construction technology, do a good job of raw material review and control, and standard mixing and processing. Control the pouring link when pouring, and strictly control the concrete raw materials and accurately position the corrugated pipe when pouring the concrete to prevent damage to the corrugated pipe during the operation of the reinforcing steel skeleton. After pouring, maintenance control should also be done. Other technologies used in prestressed construction operations, one should strictly control equipment and facilities, tensile prestressing, and the standardization of anchoring operations and support sill construction.

2. Main operating methods of beams

Girder construction is generally divided into prefabricated T-beam operations, concrete pouring and formwork dismantling and maintenance after reaching final setting. The engineering sequence and application of the technology shall comply with the specifications and shall not be changed at will.

2.1 Precast T-beam construction

The construction sequence begins with the construction of the T-beam prefabrication yard. The steel is cut and bound to the vertical formwork, and the concrete is poured to the final setting and the mold is dismantled. The pre-

doi: 10.18686/utc.v5i1.75

stressed steel beams are tensioned, and the mortar is finally sealed after anchoring.

The binding of the reinforcing steel skeleton is used as a pre-engineering project to make the prestressed T beam. The cross points of the reinforcing steel are tied with thin wires to make the reinforcing beam of the T beam stable and strong. Unless specified in the design, the main reinforcement and the stirrup in the T beam should be connected to each other vertically. When binding the reinforcing steel frame, the ends of the stirrups should be bent inward appropriately, and the junctions of the corners of the stirrups with the reinforcing bars should be tied with thin iron wires. In the beam, the joints for the stirrups (hook joints) should be inserted in the longitudinal direction. At the same time, bend the iron wire that binds the reinforcement inward, so that the thin iron wire is not inside the protective layer. The binding arrangement of all reinforcing steel frames must be carried out strictly in accordance with the dimensions specified in the drawings, and it must not be altered without authorization.

The bundling of reinforcing steel joints generally requires the connection point of the bent corners of the reinforcing steel bars and the longitudinal distribution rods. When the large and small stirrups on the lower edge of the bridge are connected, interlacing and bundling should be used to make the bundling and binding points firm. If the wire is broken, it must be re-bundled and each banding point shall be banded according to the "figure" to ensure that the shape of the steel frame skeleton does not change after the banding. Reinforced skeleton at the junction point.

After the inspection of banded steel bars is completed and qualified, install corrugated pipes and steel strands. Double-sided electric welding is used when the steel bars are connected to the steel plates. When welding steel bars by arc welding, the length, width and thickness of the weld seam should be in accordance with the drawings and then welded to ensure its shape. After installing the prestressed tendons, the installation needs to be installed strictly according to the designed position. Improper installation of the position will cause structural quality problems. Finally, after the installation of the prestressed tendons, a transverse bulkhead is added. In this process, the stability of the reinforcement is controlled appropriately, and then the stability detection and the binding of the roof reinforcement are performed.

2.2 Pouring of concrete

Check separately the acceptance of concrete pouring in response to the bracket, formwork, steel and embedded parts, in order to meet the requirements before pouring concrete. The accumulated debris, water and stains on the steel bars on the T-beam formwork should be cleaned in time and coated with a release agent on the inside and outside of the formwork. The concrete should maintain a free height of no more than 2 meters. If it reaches a dumping height of more than 2 meters, it should be lowered through pipe strings, slides and other facilities. When the dropping height is 10 meters, the speed reducer should be installed.

When pouring concrete, it should be layered according to a certain thickness, order and purpose. For layered pouring, the upper layer should be poured first and then the lower layer should be poured. When pouring the upper and lower concrete at the same time, the distance between the upper and lower layers should be kept as high as 1.5 meters or more.

2.3 Formwork removal

When installing and removing the T-beam formwork, care must be taken when installing the T-beam formwork to prevent the ribs of the beam from colliding with the diaphragm reinforcement. The first eccentric gantry crane spreader template transfer position is fixed to the place where the pull-up penetrates by adjusting the adjustment screw. A template is used to fix the bolts well to assemble the adjacent sections. After the T-beam concrete reaches 2.5Mpa, the t-beam formwork is removed symmetrically in sections, and each formwork is immediately supported at the same time. When the template is removed, hook the upper ring of the template with a gantry crane, remove the connecting bolts and the bottom adjustment block, and pull the lower edge of the template by hand.

3. Construction common problems and treatment countermeasures

3.1 Pre-stressed engineering (tension) pre-stressed steel strand breaks and slips

The reason for this phenomenon is that the jack, anchor ring and hole edge are misaligned when tensioning the pre-stressed steel strands, the deeds are loose and tight during the construction, and the diameter difference between the laid steel strands is large or partial damage. The hardness of the anchor ring is not satisfactory, the poor tolerance of the taper tolerance of the anchor ring and the plug and the anchor pad plate is not perpendicular to the hole edge cause the pre-stressed stranded wires to break and slip.

When handling stranded wire breakage and slippage, if the stranded wire exceeds the requirements of the specification, it should be replaced in principle. If it cannot be replaced for some reasons, it can be remedied under the allowable conditions. Increasing his prestress value, such as adding a prestressed beam, must meet the requirements of each stage of the limit state design. Broken wire or slip wire per share does not exceed 1 strand of steel wire refers to a single strand of broken wire, and the total number of broken wires per share does not exceed 1% of the total number of broken wires.

When the prestressed tendons are tensioned, it is necessary to accurately install the anchors and jacks. When the prestressed tensions are found, the oil pressure decreases when it reaches a certain tonnage, and then it drops after refueling, which may cause fracture. When the wire breaks, the prestressed steel bundle should be replaced immediately, and the prestress is re-applied to make it stretch. Meanwhile, the pretensioned tendon must be cleaned before tensioning.

3.2 Blockage of holes during concrete pouring

During the concrete pouring process, the plasma generates pre-stressed pores that leak, leading to more severe blockage of air holes. The leakage of slurry during the pouring of concrete changes the friction between the channels and can cause blockage of the channels. The clogging of the channels changes the pre-tensioned tensile length, so the pre-stressed tendons cannot penetrate the channels blocked by the mortar.

In order to prevent the channel from being blocked during construction, the concrete vibration should prevent direct contact with the corrugated pipe. During the welding of steel bars, the intermediate pipe joint of the bellows wall should be prevented from being damaged by welding sparks. The bell mouth of the pipe joint and the anchor plate and the seal must be solid and not easy to detach and the leakage of mud. Before the poured concrete reaches the final setting state, the pipeline can be flushed with high-pressure water, and the pipe can be checked to ensure that the pipeline is unobstructed.

3.3 Insufficient thickness of the protective layer of the steel bar

When the concrete is poured, the concrete pads are displaced or the pads are barely exposed, which will cause the reinforcing bars to fall or move outwards, bringing the reinforcing bars closer to the formwork. Segregation that occurs when the concrete protective layer is too small or the mixing ratio is not appropriate.

The method to deal with such phenomena is to correctly determine the position of the reinforcement and the thickness of the protective layer when pouring concrete, strengthen real-time detection, and correct in time when deviations are found, and the concrete should ensure that the mix ratio is accurate and easy.

3.4 Bubbles in the honeycomb hemp surface on the surface of the poured concrete with water ripples

When concrete is poured, because of poor concrete workability or improper vibrating method, which results in incompactness, it is difficult to exhaust the cross section of the T-beam web. phenomenon.

The coping method is mainly to adopt the correct pouring measures of the attached vibrator to vibrate, adopt the layered pouring method to the bottom of the beam, and the thickness of the concrete in each layer should not be greater than 30cm. The pouring sequence should be pushed from the tail to the middle and the original concrete. Collapse to ensure that the mortar is spread evenly with crushed stone.

To ensure a good connection between the layers, the corrugated pipe should be inserted into the lower concrete surface 5 to 10 cm away from the concrete when vibrating. Finally, use a spatula to smooth the two bottom surfaces. When the concrete is finally set, it should be sprinkled and maintained until the concrete stays wet every day before being stretched.

4. Conclusion

With the rapid promotion of urbanization and rapid economic development, the country has set up bridges in relatively complicated geographical locations during the process of moving westward. The bridges represented by prestressed T beams are summarized and discussed in actual construction. Strengthening the management during the construction process using prestressed T-beam bridges to improve the overall structural level of the bridge and the quality of construction technology directly affect the safety and stability of the entire bridge structure.

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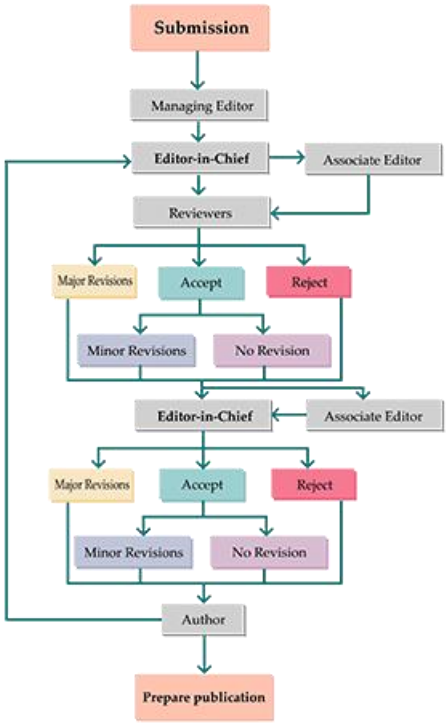

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