Discussion on Winter Construction Technology of Field Road Engineering in Civil Airport Flying area

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Abstract: In this paper, the winter construction characteristics of field road engineering is discussed, mix proportion design of frost-resistant concrete and winter construction sites such as earth and stone works, the construction measures of cement stabilized macadam engineering, concrete engineering, drainage engineering and ancillary engineering are analyzed and studied. The feasibility of the system is verified by field test, quality meeting design requirements, it has certain social effects. It has certain reference significance for future winter operation of airport runway engineering under specific conditions in northern China.

Project overview

DaoBen Project is the FXQSG-01 tender section for the construction of the flying area of the second phase expansion project of an international airport. A second runway with a length of 3600 meters and a width of 60 meters is located 2050 meters north of the current runway. The index of flight area is 4F. A new second parallel taxiway is built on the north side of the existing parallel taxiway in the South Flight Zone. Two new contact taxiways are built between the two long-distance runways. The width of the taxiway is 23 meters, the shoulder width is 10.5 meters and the distance between the taxiways is 80 meters, which meets the operation requirements of Class E aircraft.

Technical specifications for pavement design of civil airport: the measured flexural strength is greater than 7.5 Mpa in 28 days, and the freeze-thaw index is F300, the texture depth is more than 4 mm, and the wear resistance is less than 3.6 kg/m2.

Climate characteristics of winter construction

The starting and ending dates of winter construction are as follows: when the average daily temperature of outdoor air is stable for 5 consecutive days below 5 C, the construction will enter winter construction. The observation site is 1.5m above the ground and away from the heat source. After entering the winter construction, listen to the local weather forecast at any time, begin to measure the temperature every day, and do a good job in preventing the sudden drop of temperature from freezing. From November 15 to March 15 the following year, it is a total of 120 days. The extremely low temperature stage is in December of each year. From late January to late January of the next year, especially January, the coldest month of temperature in the region, the lowest temperature reached.

Airport pavement concrete mix proportion

In winter construction, concrete mix design is the primary link to ensure quality. Concrete suffers frost damage. It is caused by the freezing of the mixed water in the mixture. If the water content in the concrete is less, the freezing damage will be serious. The degree can be reduced.
We design the concrete mix proportion according to this principle. In mix proportion design, on the premise of satisfying construction and according to the standard of "super-dry and hard" concrete, try to reduce the single concrete as far as possible. The water-cement ratio is only 0.38, and the trial strength is not less than 1.15 times of the design strength. Among them, "Huaxin" fortress brand 42.5 grade ordinary road low alkali Portland cement is selected, the dosage is 325 kg/m²; The crude aggregate is composed of 520m and 2040m crushed stone, and the proportion of crude aggregate is 35%:65%. The amount of crude aggregate is increased, and the amount of crude aggregate is 1449kg per cubic meter. The natural coarse sand whose fineness modulus is more than 3.13.3 is selected for sand. The sand rate of 29% reduces the sand rate of 29% and the sand amount of 29%. At the same time, Beijing Keningfeng A D D-7 compound admixture with high water reducing, early strength, air entrainment and anti-freezing was added to the mixture, and the amount of admixture was 4% of the cement content.

<table>
<thead>
<tr>
<th>Material name</th>
<th>consumption(kg)</th>
<th>Gravel(5-20mm)(kg)</th>
<th>Gravel(20-40mm)(kg)</th>
<th>Sand(kg)</th>
<th>water(kg)</th>
<th>Admixture(kg)</th>
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<tbody>
<tr>
<td>cement</td>
<td>325</td>
<td>505</td>
<td>944</td>
<td>593</td>
<td>122</td>
<td>13</td>
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<tr>
<td>Weight ratio</td>
<td>1</td>
<td>1.56</td>
<td>2.90</td>
<td>1.81</td>
<td>0.39</td>
<td>0.04</td>
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</tbody>
</table>

**Technical measures of intestinal tract construction in civil airport during winter period**

According to the construction schedule, the main parts of this project in winter construction are as follows: Earth and stone works, cement stabilized gravel works, concrete works, drainage works, ancillary works (steel mesh enclosure and retaining wall).

**Winter Construction Scheme of Earthwork**

1. The use of snow insulation. The melting parts of the initial snowfall should be removed, and the later snowfall can be retained and utilized when it does not melt.

2. Use the toppling soil for heat preservation. The depth of loosening can be determined according to the local temperature, generally not less than 30CM.

3. Straw bags, wheat straw, saw foam and other materials can be used to cover the working surface for heat preservation.

4. The excavation method of frozen soil should be determined according to soil quality, winter depth, machine performance and construction conditions. When the thickness of frozen soil is less than 25CM, excavators, bulldozers or excavators can be directly excavated. When the frozen soil is thicker, the looser can be used to cooperate with the plough to break the winter soil, or the winter soil can be broken and transported by means of heavy hammer impact and blasting.

5. The working surface should not be too large, the excavation should not reach the design elevation at one time, and the slope should not be excavated at one time. 30-40 cm should be reserved for excavation and repair after spring melting.

6. Before winter, the compacted soil foundation should be covered with virtual soil layer to keep warm. Coverage thickness is determined by local temperature, generally not less than 30 cm.

**Winter Construction Scheme of Water Stabilization Project**

1. Construction shall be organized according to weather conditions and shall not be carried out when the lowest temperature is below 5 degrees Celsius.

2. The following measures should be taken when the temperature is less than 10 C.
(1) No water stabilization shall be laid on frozen or snow-covered basement, nor shall frozen sand or stone be used in water stabilization.

(2) The paving temperature of mixing water-stabilized mixture should not be less than 10 °C. When the paving temperature of mixing material is lower than 10 °C, the water should be heated beforehand or both water and stone should be heated according to the situation.

3. According to the temperature, appropriate amount of early strength agent or aerator can be added to improve the early strength and frost resistance of water stability.

4. In order to reduce heat loss, the mixing, transportation and paving processes of water-stabilized mixtures should be closely linked, and the interval time should be shortened as far as possible. The water-stabilized mixtures should be covered and insulated during the transportation process.

5. Geotextiles are quickly used to cover the paved water-stable products.

**Low temperature construction technology scheme of cement concrete pavement surface**

1. Cement concrete pavement should not be constructed at low temperature except for a few tailing works. When the average temperature of day and night is below 5 °C for 5 consecutive days, concrete mixtures should be constructed according to the low temperature regulations. When the average temperature of day and night is lower than 0 °C, construction shall not be carried out.

2. In low-temperature construction, adequate materials and appliances for cold protection should be prepared beforehand. Concrete mixing stations should be equipped with warm shed or other windshield equipment. Sand and stone materials should be covered with warm materials when necessary.

3. No concrete mixture shall be laid on the frozen or snow-covered base, nor shall frozen sand or stone be used in concrete mixture.

4. According to the temperature, appropriate amount of early strength agent or air entraining agent can be added to improve the early strength and frost resistance of concrete.

5. When mixing concrete mixture is laid into the formwork, the temperature should not be less than 10 °C. When the temperature is 2 °C or below, or when the temperature of mixing material is lower than 10 °C, water or sand and stone should be heated beforehand according to the situation.

6. The mixing time of concrete mixtures increases by 50% compared with conventional construction.

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8. In order to reduce heat loss, the mixing, transportation and paving processes of concrete mixtures should be closely linked, and the interval time should be shortened as far as possible. If the transportation distance is long, the mixtures should be covered and insulated during the transportation process.

9. The concrete mixture should be compacted and made as soon as possible after paving. When there is bleeding on the surface, it should be removed in time. The concrete temperature should not be lower than 5 °C when finishing the surface process.

10. When the concrete surface is finished, when there is no trace on the surface, it should be covered and maintained with plastic cloth, non-woven cloth, sacks and other thermal insulation materials immediately. Covering thickness should be determined according to temperature and concrete temperature, so as to ensure that the lowest temperature of concrete in early hardening...
period can not be lower than 5 C, and that concrete pavement will not be frozen before the strength of concrete reaches 50% of the design strength.

**Technical scheme for winter construction of drainage works**

1. Excavation of foundation groove

   (1) During the construction of drainage ditches in winter, it is necessary to complete a section of excavation so as to avoid freezing the foundation. The excavation will be mainly carried out by machinery and supplemented by manual work. The drainage measures of the foundation ditches should be well done in the excavation project to ensure that there is no water and ice in the foundation ditches.

   (2) When excavating, the excavation method and suitable tools should be studied beforehand, and safety measures should be formulated.

   (3) If the cushion cannot be constructed in time after foundation trench excavation, thermal insulation measures such as covering straw bales or temporarily retaining a certain thickness of loose soil cover should be taken.

   (4) When backfilling the foundation trough, it should check whether there is ice and snow in the trough. If there is ice and snow in the trough, it should be handled in time and assigned special person to take charge of it. When backfilling, it should be backfilled in layers, vibrated and compacted, and frozen soil should not be included in the upper backfilling soil.

2. Reinforced concrete construction

   (1) During the use of reinforcing bars, inspection should be strengthened to ensure that there are no cracks on the surface of reinforcing bars and that the welded joints are not easily attacked by ice and snow immediately.

   (2) After the construction of formwork and reinforcing steel bar in winter, ice and snow should be prevented at any time. Covering should be carried out when necessary to prevent water accumulation in formwork and rusting of reinforcing steel bar.

   (3) In the process of concrete mixing, a certain amount of antifreeze agent will be added according to the specific weather conditions.

   (4) Before concreting, the rubbish, ice and snow in the formwork and oil stain on the steel bar should be cleaned up. In the course of concrete transportation, measures of covering and insulation should be taken.

   (5) After concreting, the concrete should be maintained in time, usually covered with plastic film, covered with straw bales and hemp bags.

3. Masonry construction

   (1) Ice, snow and mud blocks on flakes and precast concrete blocks must be cleaned before they can be used.

   (2) The ice and snow on the stubble site can be cleaned up before the upper layer of masonry can be built.

   (3) In the process of mixing mortar, a certain amount of antifreeze agent will be added according to the specific weather conditions.

   (4) In the course of transportation, mortar will be covered and insulated.

   (5) After each shift is completed, the stubble area is covered with plastic film, covered with straw bales and sacks.
(6) Backfilling of groove after mortar strength meets design requirements

Technical plan for winter construction of boundary engineering

1. Foundation trench excavation

(1) During the construction of drainage ditches in winter, it is necessary to complete a section of excavation in order to avoid freezing the foundation. The excavation will be mainly mechanical and supplemented by manual work. The drainage measures of the foundation ditches should be taken in the excavation project to ensure that there is no water and ice in the foundation ditches.

(2) When excavating, the excavation method and the suitable tools should be studied beforehand, and safety measures should be formulated.

(3) If the cushion cannot be constructed in time after excavation of foundation trench, thermal insulation measures such as covering straw bale or temporarily retaining a certain thickness of loose soil cover should be taken.

(4) When backfilling the foundation trough, it should check whether there is ice and snow in the trough. If there is ice and snow in the trough, it should be handled in time and assigned to a special person to be responsible for it. When backfilling, it should be backfilled by layers, vibrated and compacted, and frozen soil should not be included in the upper backfill.


(1) After the construction of formwork and reinforcing steel bar in winter, ice and snow should be prevented at any time. Covering should be carried out when necessary to prevent water accumulation in formwork and rusting of reinforcing steel bar.

(2) In the process of concrete mixing, a certain amount of antifreeze agent will be added according to the specific weather conditions.

(3) Before concreting, the rubbish, ice and snow in the formwork should be cleaned up. In the course of concrete transportation, covering and insulation measures should be taken.

(4) After concreting, the concrete should be maintained in time, usually covered with plastic film, covered with straw bales and hemp bags.

(5) After the strength of concrete meets the design requirements, the groove can be backfilled.

3. Retaining wall construction

(1) Ice, snow and mud blocks on flake stones and precast concrete blocks must be cleaned up before they can be used.

(2) The ice and snow on the stubble site can be cleaned up before the upper layer of masonry can be built.

(3) In the process of mixing mortar, a certain amount of antifreeze agent will be added according to the specific weather conditions.

(4) Mortar will be covered and insulated during transportation.

(5) After each shift has been built, the stubble area shall be covered with plastic film, covered with straw bales and sacks.

(6) After the strength of mortar meets the design requirements, the groove can be backfilled.

Concluding remarks

Taking the winter construction of second phase airport express extension project of some international airport as an example, this paper briefly expounds the characteristics of cement concrete construction in winter, and introduces the mix proportion of concrete construction in winter. This paper describes some winter construction measures of intestinal stone works, cement...
stabilized gravel works, concrete works, drainage works and ancillary works of civil airports, in order to meet the corresponding standards, ensure the quality of airport runway works, prolong the service life of runway, and provide reference for similar projects.

Reference


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