

Assessment Of Complex Technological Processes Of Concrete Mixes Preparation With On-Site Automated Concrete Mixing Plants

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Abstract. In the document, one considers the certification methodology of complex technological processes of concrete mixtures preparation at on-site automated concrete mixing plants. It is designed the certification form of technological process for concrete mixes preparation on automated installations with productivity of 100m³/h and more. The work summarizes the results of the local conditions analysis and feasibility studies of choosing basic machines and means of mechanization for production of SMR (civil and erection works), taking into account factors of influence on the performance of technological process, its power consumption, the level of labor mechanization and etc. The technique of equipment selection and factors of influence are given. The technical characteristics of concrete mixer installations (SB-109A, SB-164) are given. It is highlighted the number of workers engaged in concrete works and their distribution by labor categories, the dynamics of changes in the structure of technological processes of concrete mix preparation. It is given detailed bibliography on certification of complex technological processes for the preparation of concrete mixtures on-site automated concrete mixing plants, normative documents used in the certification of processes are also indicated. This article will be useful for specialists who carry out certification of complex technological processes of preparation of concrete mixtures at on-site automated concrete mixing plants.

1. Introduction

Technological processes of monolithic concrete and reinforced concrete structures construction in modern conditions of construction, their organizational preparation are carried out within design of project documentation at the stage of a section POS (project of construction) design. [1, 2, 3, 5, 6]

During the above mentioned one carries out the study (analysis) of the local conditions analysis and feasibility studies of choosing basic machines and means of mechanization for production of SMR (civil and erection works), taking into account factors of influence on the performance of technological process, power consumption and level of labor mechanization and etc.

The range of domestic and foreign concrete mixing equipment, at present, in the construction complex of the Russian Federation and CIS countries is very extensive. In this regard, the selection of the mentioned equipment is associated with a deep study of its technical capabilities in the specific conditions of buildings and structures construction. The standard projects of concrete mixing plants were updated in 2016-2018). [7, 9, 10, 12]

2. Relevance

For the selection of concrete mixing equipment, it is relevant to pre-assess complex technological processes of concrete mixtures preparation in specific conditions on a specific concrete mixing plant.

3. Objective



For example, "The Certificate of technological process of concrete mixes preparation on automated installations with concrete mixer type with productivity of 100 m³/h and more (SB-109A, SB-164)" represents the organizational and technological document the design of which is carried out in the following sequence:

- selection of specific concrete mixing plant from existing range (indicators for a specific production facility);
- feasibility study for specific construction conditions;
- analysis and specification of technical capabilities of concrete mixing plant;
- distribution of technological process on operations with distribution on categories of work (manual, with mechanized tool, machines control).

4. Theoretical section

In this particular case, the certificate is designed for the concrete mixtures production on mobile, automated, high-performance plants of cyclic type (SB-164) designed to operate at positive temperatures. [7]

The plant consists of a number of units: feed boxes with belt conveyors, dosing unit with feed bins and dispensers, warehouse with loading from cement trucks, dispenser, belt conveyor; mixing unit; control unit.

Filling the feed bins is done by a wheeled loader from aggregates open storages. The plant uses three fractions of aggregates, one grade of cement.

Automation of the installation SB-109A does not provide for humidity correction and the use of chemical additives, in such cases the installation with mixer type SB-164 is used. This installation of cyclic action is designed for the preparation of concrete mixtures in the field during the construction of highways, airfields, hydraulic structures and other large construction sites and at positive ambient temperature.

Table 1. Technical characteristics of concrete mixing plant SB-109A.

Indicators	Value
Capacity, m ³ / h	135
Dosing process automation	yes
Metal content, t	156
Humidity correction	no
Number of employees, m	3

Table 2. Number of workers engaged in concrete works and their distribution by categories of labor.

Denomination of technological processes	Number of workers, <u>thous. people</u> %	Including distribution by categories of labor		
		Machinists, machine operators	Working with mechanized tools	Manual workers
1. Preparation of concrete mixture	<u>77,8</u> 12,0	<u>45,7</u> 7,0	<u>28,5</u> 4,4	<u>3,6</u> 0,6

Table 2. Number of workers engaged in concrete works and their distribution by categories of labor.

2.	Supply of concrete mixture	<u>35,7</u> 5,6	<u>33,6</u> 5,1	-	<u>2,1</u> 0,5
3.	Distribution and laying of mixture	<u>190,1</u> 29,3	<u>69,7</u> 10,7	<u>25,4</u> 3,9	<u>95,0</u> 14,7
4.	Maintenance of concrete	<u>28,4</u> 4,5	<u>0,2</u> 0,1	-	<u>28,2</u> 4,4
5.	Manufacture of reinforcement products	<u>100,0</u> 15,4	<u>51,7</u> 8,0	<u>23,0</u> 3,5	<u>25,3</u> 3,9
6.	Installation of reinforcement products	<u>70,7</u> 10,9	<u>6,0</u> 1,0	<u>8,1</u> 1,3	<u>56,6</u> 8,6
7.	Formwork installation and disassembly	<u>144,9</u> 22,3	<u>12,0</u> 1,9	<u>15,8</u> 2,5	<u>117,1</u> 17,9
8	Total on concrete works	<u>647,6</u> 100	<u>218,9</u> 33,8	<u>100,8</u> 15,6	<u>327,9</u> 50,6

Table 3. Technical and economic indicators per 1000 m3 of prepared concrete mixture.

Indicators		Unit	Value
1	Energy consumption	kW/h	2440
2	Standard labor consumption	man-hour	850
3	Cost of preparation	RUR	1960
4	Machine time	machine-hour	72
5	Manual labor consumption	man-hour	1234

Table 4. Technological process distribution by operations and by category of labor.

Operations		Distribution by category of labor, %		
		manual	with mechanized tool	machines control
1	Getting components	3	3	21
2	Dosing components	3	-	27
3	Mixing	-	-	20
4	Unloading	-	-	10
5	Maintenance	9	1	-

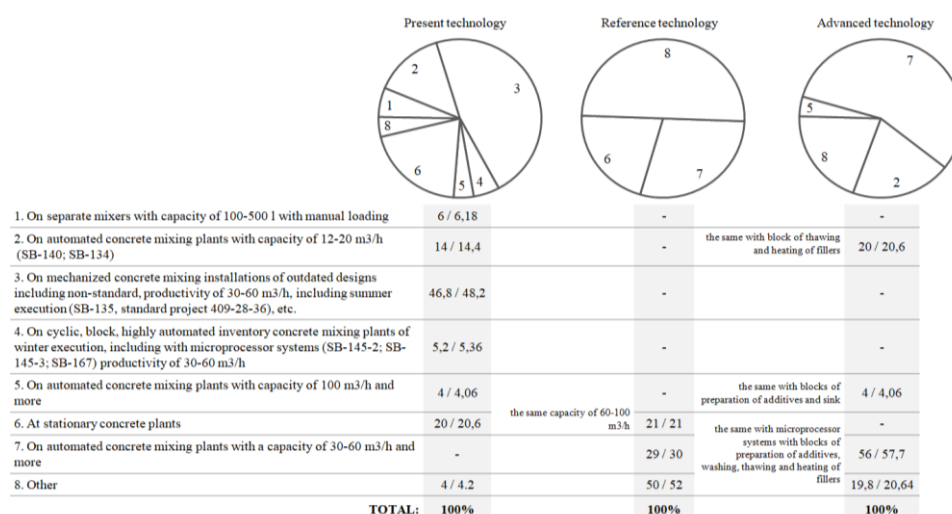


Figure 1. Dynamics of changes in the structure of technological processes of concrete mixture preparation (% / million m³)

5. Summary

The algorithm of assessment of technological processes for concrete mixtures preparation on the automated concrete mixing plants is an actual task for the perspective period of construction in the Russian Federation. The assessment methodology can be successfully applied to mobile concrete mixing plants.

6. References

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