



GENERAL GUIDELINES FOR CALCULATING TECHNOLOGICAL LINES AND THEIR ARRANGEMENT IN BAYS

Islomova Nufuza Ismatjon qizi

Assistant of the Department of "Building Materials and Structures"

Jizzakh Polytechnic Institute

(+998888695880, islomovanufuza@gmail.com)

<https://doi.org/10.5281/zenodo.16901444>

ARTICLE INFO

Qabul qilindi: 10-Avgust 2025 yil

Ma'qullandi: 15- Avgust 2025 yil

Nashr qilindi: 19- Avgust 2025 yil

KEY WORDS

Aggregate, stand, conveyor, cassette, line, cyclograms, mechanism, coefficient, beams, trusses, arches, double-pitched beams, formwork, reinforcement.

ABSTRACT

This article presents general guidelines for the design and calculation of technological lines. It includes the necessary calculations, technical requirements, and practical approaches to improve the efficiency of production processes and to ensure the optimal placement of equipment within bays. In addition, safety standards and the continuity of technological flows are taken into account in the organization of technological lines

For the product manufactured in the workshop (or products produced at the plant), the following main technological calculations are carried out:

- Calculation of the number of technological lines based on the type of product and the given production capacity of the workshop (plant);
- Determination of the main specifications (number, dimensions) of thermal chambers or autoclaves for heat treatment of the products;
- Determination of the number of equipment (machines and aggregates) required for each technological line;
- Organization within the bays; execution of technological systems operations;
- Optimization of machine and mechanism usage on the lines (cyclograms of the technological system processes);
- Rational organization of product repair, quality control, and shipment to storage.

The main technological equipment is installed in the casting workshop. The production lines must fit into the bays of a standard production building with widths of 18, 24, or 36 meters and lengths ranging from 54 to 144 meters. The height up to the crane rail in the workshop is 8.05 meters, with the distance between columns being 6 meters in the outer rows and 12 meters in the middle rows.

The following stations are located in the concrete casting workshop: mold preparation; concrete pouring; concrete compaction; demolding; repair; cooling; curing; product rework, inspection, and shipment to storage stations; thermal curing chambers; intermediate storage areas for reinforcement materials and assembly parts; and a mold cooling area.

When designing the technological process of the line, special attention should be paid to the concrete pouring and compaction equipment. All other stations must be organized to

ensure the rhythmic operation of the main process.

Selection of Technological Equipment. Technological equipment primarily includes the machines and mechanisms used in the casting workshop, such as concrete dispensers and compactors, cranes, rebar processing machines, and vibrators. When selecting equipment, preference should be given to the most recently manufactured and highly mechanized models, as this enhances production efficiency.

In addition, the choice of equipment depends on the quality and type of raw materials as well as the specifications of the final product. When selecting the machines and mechanisms to be used, their quantity, capacity, and other technological characteristics must be determined, either by calculation or based on special regulatory documents and tables.

The required number of machines and equipment is determined using the following formula:

$$N_M = \frac{R_1}{P_M * K_n}$$

Where:

- R_1 is the hourly productivity of the workshop (or line);
- P_M is the hourly capacity of the selected machine (according to its technical specifications);
- K_n is the equipment utilization coefficient, taken as $K_n = 0.85$.

Organization of the Technological Process in the Workshop Line. The technological processes are divided into main and auxiliary parts. In the main processes, raw materials are used to produce concrete mixtures, meshes, frameworks, and the final products themselves. In the auxiliary processes, raw materials and products are transferred from one location to another and are stacked as needed.

The key characteristic of a technological process is the execution of a distinct cycle, during which the product moves step by step from one workstation to the next.

In the production of reinforced concrete products, the aggregate-flow method is widely used. The overall technological process consists of separate operations. The placement of reinforcement meshes and frames into molds, along with the pouring and compaction of the concrete mix, is performed at a single technological station, while the curing of the products is carried out in special thermal units (steam chambers or autoclaves).

In an aggregate-flow line, the following stations are typically included: mold opening and preparation, concrete pouring and compaction, preliminary holding of products, and thermal curing chambers (usually deep steam chambers are used).

Additional operations such as placing reinforcement into molds, cleaning, oiling, and performing technical inspections are also integrated into the same line. These stations are not technologically dependent on one another, and each operates in a cycle time of approximately 8 to 16 minutes. Products are transferred from one station to another using overhead or bridge cranes.

The technological line of the aggregate-flow method includes the following components:

- Molding aggregate (together with a concrete dispenser),
- Machines for preparing and tensioning reinforcement meshes and frames,
- Mold positioning units,
- Thermal curing chamber,

- Stations for mold removal, product cooling, and technical inspection,
- Stations for mold cleaning, oiling, and reinforcing,
- Stands for quality control of finished products.

During thermal curing in the chamber, the temperature is maintained at 80–90°C. The annual productivity of the line is calculated based on the type of product being manufactured, the casting regime, and the working time of the casting station, using the following formula:

$$P = \frac{60 \cdot C \cdot V \cdot T}{T_s}$$

Conveyor Method. The conveyor method is an improved version of the aggregate-flow method used in the production of reinforced concrete products. It is characterized by high productivity and allows for full mechanization of all technological processes. In this method, the product moves along with the mold through the technological stations.

The conveyor molds move along a rail track. Both continuous and intermittent thermal units are used in conveyor lines. Continuous thermal units include horizontal slotted and vertically positioned tower-type chambers. These are designed in a horizontal layout parallel to the conveyor line.

Currently, continuous conveyor lines are widely used in reinforced concrete product manufacturing. These lines typically consist of 6 to 15 stations, with a working cycle time of approximately 17 to 22 minutes, and a movement speed of 0.9 to 1.3 m/sec. Conveyor lines are generally designed for the production of products of the same type and shape.

The annual productivity of a continuous conveyor line is calculated based on the type and specifications of the product, the casting regime, and the daily operation time of the casting station, using the following formula:

$$P = \frac{60 \cdot C \cdot V \cdot T}{T_s}$$

Stand Method. In the stand method, products are manufactured in stationary molds and are cured directly within the same mold using heat treatment. All technological operations — such as mold stripping, cleaning, oiling, installation of reinforcement frames, and concreting — are carried out on-site at the stand.

This method is typically used for producing large-sized products (longer than 6 meters), especially prestressed structural elements such as overhead crane beams, trusses, arches, and double-pitched beams.

Depending on the production setup, stands are designed as:

- Linear long stands (150 to 300 meters in length), or
- Short stands, intended to accommodate one product along the length and 2–3 products across the width.

Reinforcement tensioning is performed directly on the stand using built-in tensioning devices. The movement speed of the concrete placing unit (concrete dispenser) is approximately 1 to 2.5 meters per minute, and the complete rotation (or production) cycle of a stand takes about 1 to 1.5 days.

For both long and short stands, the main parameters are:

- The duration of the technological cycle, and
- The time required for one complete production cycle of the stand.

The second key parameter is the number of products that can be molded simultaneously

on the stand.

The annual productivity of a long or short stand is calculated using the following formula:

$$P = \frac{V \cdot n \cdot C \cdot B}{T_s}$$

Calculation of the Productivity of the Cassette Device. The annual productivity of the cassette device is determined by the following formula:

$$P = \dots$$

References:

1. Berdiyev, O. B., Kurbanov, Z. H., Tilavov, E., Rasulova, N., Boboqulova, S., Jumanov, I., ... & Botirov, B. (2024). The calculation of reinforced concrete conical dome shells considering concrete creep. In E3S Web of Conferences (Vol. 587, p. 03001). EDP Sciences.
2. Hamidduloyevich, K. Z., Ezoza, S., & Jamshid, R. (2024). DEVELOPMENT OF COMPOSITE MIXTURES USING WATER-SOLUBLE POLYMERS FOR CERAMIC TILES. Бюллетень педагогов нового Узбекистана, 2(11), 127-130.
3. Mustafaqulov, J., & Kurbanov, Z. (2024). COMPOSITE GYPSUM MATERIALS FOR THE PRODUCTION OF THERMAL INSULATION PRODUCTS: DEVELOPMENT, PROPERTIES, AND APPLICATIONS. Журнал академических исследований нового Узбекистана, 1(10), 124-127.
4. Javohir, M., Zavkiddinjon, K., & Mirzokhid, O. (2024). COMPOSITION AND PHYSICAL AND TECHNICAL PROPERTIES OF CERAMIC CONCRETE WITH INDUSTRIAL WASTE AND CHEMICAL ADDITIVES. Central Asian Journal of Education and Innovation, 4(1), 38-41.
5. Курбанов, З. Х., Шукруллаева, Д., & Турсунбоева, С. (2024). РАЗРАБОТКА КОМПОЗИЦИОННЫХ КЛЕЕВЫХ СМЕСЕЙ НА ОСНОВЕ ВОДОРАСТВОРИМЫХ ПОЛИМЕРОВ ДЛЯ КРЕПЛЕНИЯ МРАМОРНОЙ И ГРАНИТНОЙ ПЛИТКИ. Central Asian Journal of Education and Innovation, 3(12), 158-162.
6. Курбанов, З. Х., Мамадуллаев, Д., & Ибрагимова, К. (2024). РАЗРАБОТКА КЛЕЕВЫХ СМЕСЕЙ ДЛЯ УКЛАДКИ КЕРАМИЧЕСКИХ ПЛИТ НА ОСНОВЕ ЦЕМЕНТА С ИСПОЛЬЗОВАНИЕМ ВОДОРАСТВОРИМЫХ ПОЛИМЕРОВ. Бюллетень педагогов нового Узбекистана, 2(11), 80-83.
7. Hamidduloyevich, K. Z., Vohid, X., & Gulchehra, R. (2024). DEVELOPMENT OF COMPOSITE MIXTURES USING WATER-SOLUBLE POLYMERS BASED ON CEMENT. Central Asian Journal of Education and Innovation, 3(12), 97-100.
8. Kurbanov, Z., & Noryigitov, N. (2024). DEVELOPMENT OF COMPOSITE MIXTURES FOR CERAMIC TILE INSTALLATION USING WATER-SOLUBLE POLYMERS BASED ON CEMENT. Central Asian Journal of Academic Research, 2(12), 79-82.
9. Hamidduloyevich, K. Z., & Laziz, S. (2024). DEVELOPMENT OF COMPOSITE ADHESIVE MIXTURES FOR CERAMIC TILE INSTALLATION USING WATER-SOLUBLE POLYMERS. Бюллетень студентов нового Узбекистана, 2(12), 22-25.
10. Hamidduloyevich, K. Z., & Sitara, Y. (2024). DEVELOPMENT OF COMPOSITION AND TECHNOLOGY FOR PRODUCING COMPOSITE WATER-RESISTANT FOAM GYPSUM MATERIALS BASED ON SULFATE-CONTAINING MINERAL BINDERS. Бюллетень педагогов нового Узбекистана, 2(11), 76-79.
11. Hamidduloyevich, K. Z., & Bekzod, Q. (2024). DEVELOPMENT OF COMPOSITE ADHESIVE MIXTURES FOR LAYING

CERAMIC TILES USING WATER-SOLUBLE POLYMER. Central Asian Journal of Education and Innovation, 3(12), 92-96.

12. Абдусаматов, К. Б., Турсунов, Б. А., Курбонов, З. Х., Расулова, Н. Б., Убайдуллаев, Ж. А., Бахронов, Ж. Т., ... & Каримов, Л. Ш. (2021). ИСПОЛЬЗОВАНИЕ ОТХОДОВ АСБЕСТОЦЕМЕНТОВ ПРИ ПРОИЗВОДСТВЕ ГАЗОБЕТОННЫХ БЛОКОВ В СТРОИТЕЛЬНОЙ ПРОМЫШЛЕННОСТИ.

13. Khamidulloevich, K. Z., Botirkulovna, R. N., Narzullayeva, K., & Davron, O. (2023). Study of the Mechanical Properties of High Strength Concrete Obtained With the Help of Chemical Additives. AMERICAN JOURNAL OF SCIENCE AND LEARNING FOR DEVELOPMENT, 2(2), 64-68.

14. Талипов, Н., Курбанов, З., & Артыккулов, Д. (2023). ЭФФЕКТИВНЫЕ СУХИЕ СМЕСИ С ПОЛИМЕРНЫМИ ДОБАВКАМИ. Центральноеазиатский журнал образования и инноваций, 2(5), 43-48.

15. Kurbanov, Z., & Artiqqulov, D. (2023). DETERMINATION OF THE CONTENT OF DRY CONSTRUCTION MIXED ON THE BASIS OF LOCAL MARBLE WASTE POWDER. Центральноеазиатский журнал образования и инноваций, 2(9), 104-106.

