The load as a concentrated force P was passed at mid span through the square stamp size 60×60 mm to the compressed zone in the plane of maximum stiffness.

Monitor stresses in these sections was performed using strain sensors mounted on the wall and belts in compressed and stretched zones.

The load was transmitted steps from zero to 32 tons with a constant step 4 tons. Moreover, the research was fulfilled for the load, increasing by stages, it was held for 20 – 25 minutes at each subsequent stage reaches.

Table 1 summarizes the data theoretically, numerical and experimental research.

Table 1 – Summary table of results

Name	Test data		Data of numerical solutions		Theoretical data	
	Deflection, mm	σx, max, MPa	Deflection, mm	σx, max, MPa	Deflection, mm	σx, max, MPa
B-1 (without ribs)	3,09	220,27	3,02	167,81	2,76	191,68
B-2 (2 ribs 90°)	3	220,27	3	167,37	2,76	191,68
B-4 (2 ribs 45°)	2,89	198,14	2,96	169,43	2,63	191,68
B-5 (5 ribs 45°)	3,01	166,73	2,91	168,78	2.62	191,67
B-6 (2 ribs 60°)	2,87	198,45	2,98	168,44	2,67	191,68
B-7 (5 ribs 60°)	3,08	177,75	2,96	167,72	2.69	191,67
B-8 (2 ribs 30°)	3,11	203,96	2,87	173,73	2,58	191,68

Thanks to setting sloping reinforcement rib the stiffness of reinforcement rods is increased. The deflection can be reduced by 1,3 – 14,5%. Normal stress σ_x in dangerous section can be reduced by 4,4 – 24,3 % while increasing the total weight of the structure by 1,8 – 13,3 %.

REFERENCES

1. Аистов, Н.Н. Испытания сооружений / Н.Н. Аистов. – М. : Стройиздат, 1960.
2. Аксельрад, Э.Л. Техническая теория стержней : учеб. пособие / Э.Л. Аксельрад. – Л. : Ленинградский институт инженеров железнодорожного транспорта, 1967.
3. Артемов, П.Я., Расчет тонкостенных стержней открытого профиля / П.Я. Артемов, М.И. Любошин, М.Н. Рудицин. – Минск : Бел. политех. ин-т, 1959.
4. Баклашов, Г.Г. Экспериментальное исследование прочности и устойчивости подкрепленных тонкостенных стержней при плоском изгибе / Г.Г. Баклашов // Изв. вузов, раздел «Строительство и архитектура». – 1973. – № 1.
5. Бейлин, Е.А. Об устойчивости плоской формы изгиба тонкостенных балок, имеющих упругие диафрагмы на торцах / Е.А. Бейлин // Инженерные конструкции, сопротивление материалов, строительная механика : сб. докл. XX науч. конф. ЛИСИ, 1962.
6. Бирюлев, В.В. О работе стальных балок со стенками, усиленными наклонными ребрами жесткости / В.В. Бирюлев, И.И. Крылов // Изв. вузов, раздел «Строительство и архитектура». – 1971. – № 9.
7. Болотин, Б.В. Строительная механика. Современное состояние и перспективы развития / Б.В. Болотин, И.И. Гельденблат, А.Ф. Смирнов. – М. : Изд. лит-ры по строительству, 1972.

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ON THE USE OF TRUSSES WITH LOWER AND UPPER TYPE OF BELT BEARING

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The article deals with trusses of lower and upper type of belt bearing, types of the upper belt and mesh, the calculation of the most effective type. The cross section type of the chosen truss is analyzed as well.

Trusses make the bases of numerous framed structures and vary in their usage. They are applied in ceilings, floors, as profiled walls of covers, shifts, etc. Trusses are applied in various fields of engineering: bridges, frames of industrial buildings, sports objects, halls, stage constructions, tents and runways.

Trusses have various shapes depending on architectural and functional specifications of the design. Geometry of a truss is specified by the belt shape and the mesh type.

According to the belt shape trusses are divided into trapezoid, triangular, parabolic or segment, polygonal, flat-chord trusses (Fig. 1).

a) b) c) d)

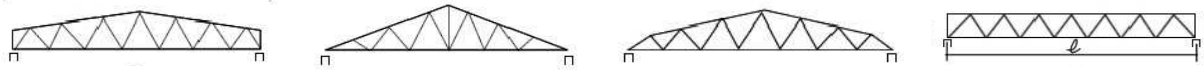


Fig. 1. Trusses according to the belt shape: a) trapezoid; b) triangular; c) polygonal; d) flat-cross

According to the mesh type trusses are divided into braced diagonal, triangular, triangular with additional poles, triangular with truss poles, rhombic, cross (Fig. 2).

a) b) c) d)

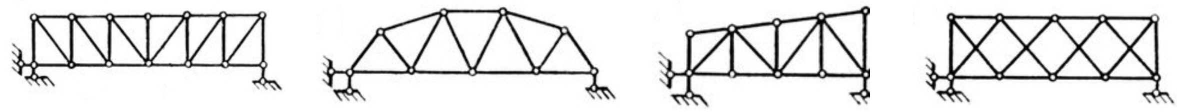


Fig. 2. Trusses according to the mesh type:
a) diagonal; b) triangular; c) triangular with additional poles; d) cross

Flat-chord and trapezoid belt trusses are used more often. Lenticular and former trapezoid trusses, applied in the construction of the entry zones of buildings, have recently become rather widespread as well. There are only two types of bearings among all the types of the truss constructions: the lower and the upper belt. The lower belt bearing type was typical of the XX-century buildings. The upper belt bearing type construction has recently found its industrial application in Vitebsk region, Belarus. Nowadays closed profiles are used for cross-section manufacturing: double angles, channels. The choice of the bearing type and the most effective cross-section shape of the belt are the issues to be clarified.

To find the most effective type of bearing the building of the rehabilitation water centre was chosen as a diploma project as well.

The building designed consists of a two-storeyed part – administrative and economic room, and a one-storeyed part – a swimming pool. General characteristics are 27,38 × 39,4 × 12,2m.

The space of the swimming pool was examined for the possible usage of trusses (Fig. 2).

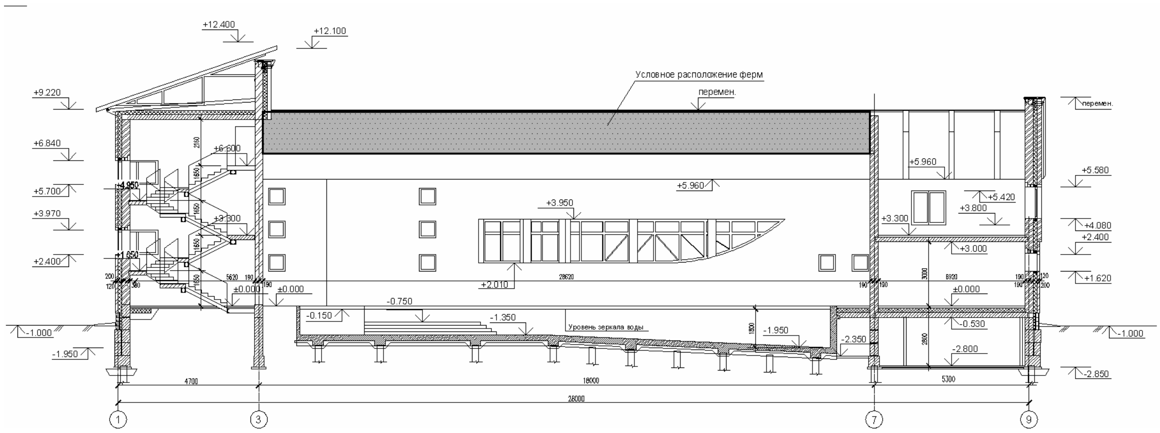


Fig.1. Section of the building

Two trusses of trapezoid belt and diagonal mesh type have been chosen for the experiment, as the most widely used types in the Republic of Belarus. The trusses are of 18 meters span each (Fig. 3).

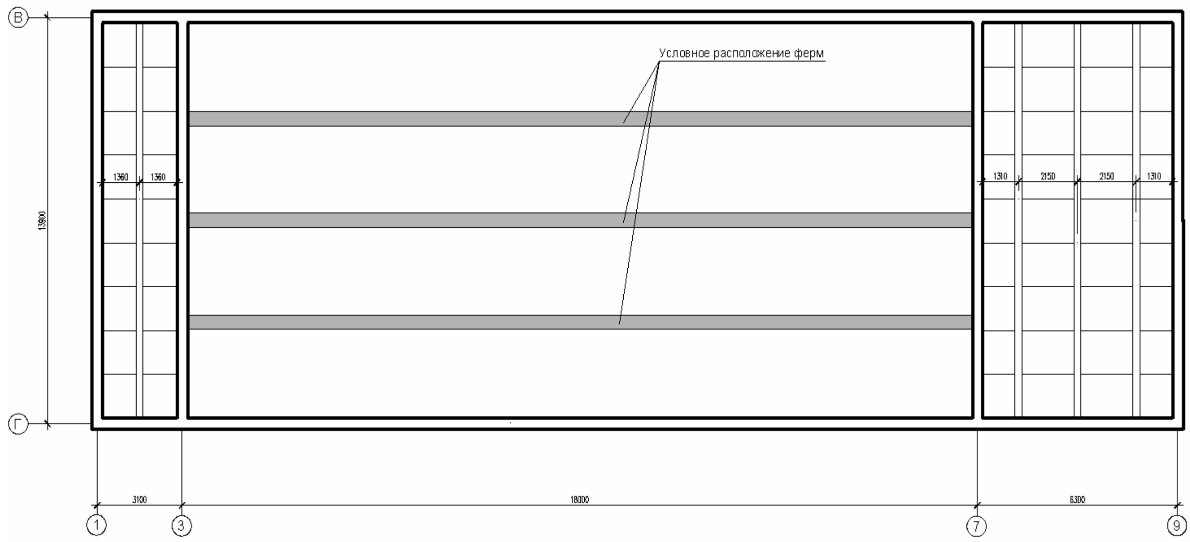


Fig. 2. Allocation of the trusses

a) b)

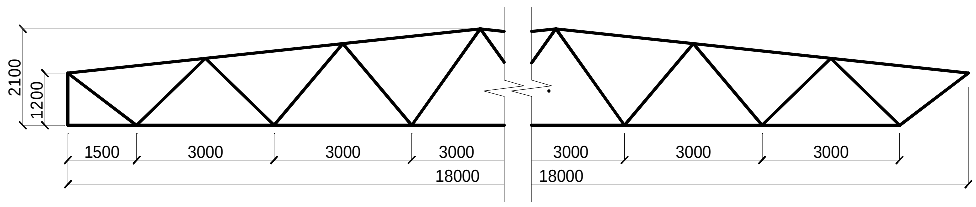


Fig. 3. The studied trusses: a) the lower bearing type; b) the upper bearing type

Sizes, belt shapes and diagonals are assumed as equal. Equal unit load is applied to find the internal forces. Forces of the poles are shown in Figure 4.

a) b)

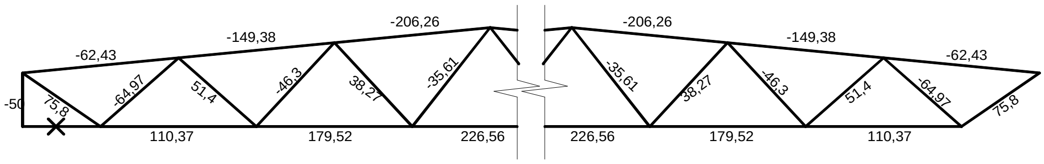
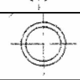


Fig. 4. Forces of the poles of the trusses: a) forces of the lower bearing type trusses;
b) forces of the upper bearing type trusses

According to the calculations the forces of the poles are identical. The upper bearing belt truss is more economically sound as the material consumption for a truss is 10 per cent less, when the span is 18 meters. So the upper bearing type truss is relevant for further research.

Three types of belt sections are compared and the most effective type of the section is found for the chosen type of the truss. The results are arranged in the table (Table 1).

Table 1 – Belts characteristics

Section	Size, mm	Area *A*, cm^2	Radius of inertia *i*, cm	Mass 1m, kg
	75x75x5	14,78	3,35	11,6
	102x4,5	13,8	3,5	10,82
	100x100x3,5	13,19	3,91	10,36

The results prove that a bent-weld-and-closed profile is the most effective one according to its characteristics.

In conclusion it is important to say that the upper bearing type truss is the most economically sound type due to 10 per cent lower material consumption for each truss, when the span is 18 meters. Bend-weld-and-closed profile is the most effective, among the studied, due to its lower mass and section area.

REFERENCE

1. Типовая документация на конструкции, изделия и узлы зданий и сооружений. Сер. 1.460.3-23.98. Стальные конструкции покрытий производственных зданий пролётами 18, 24 и 30 м из замкнутых гнутосварных профилей прямоугольного сечения с уклоном кровли 10 %. – Вып. 1.
2. Металлические конструкции. Общий курс : учеб. для вузов / Е.И. Беленя [и др.] ; под общ. ред. Е.И. Белени. – 6-е изд., перераб. и доп. – М. : Стройиздат, 1986. – 560 с., ил.
3. Вариантное проектирование и оптимизация стальных конструкций. – М. : Стройиздат, 1979. – 319 с., ил.
4. Лебедева, Н.В.Фермы, арки, тонкостенные пространственные конструкции : учеб. пособие / Н.В. Лебедева. – М. : «Архитектура-С». 2006. – 120 с., ил.

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MIXTURES AND THEIR CHARACTERISTICS

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Here the mixture, which used for filling up the pores of macadam basis and promoting receiving the monolithic basis with the minimum of shrink deformations and with the help of a vibrodelivery method and penetration viscometer are considered.

The aim of our research is cement dough, the methods of its best arrangement between macadam base, as the aim of our research – to create a monolith, which will be strong, rigid, and non-shrink. It is an important characteristic of the highway.

We can determine viscosity of a raw mix by the penetration viscometer. The principle of operation of the PM-3 penetration viscometer (Fig. 1) is the following:

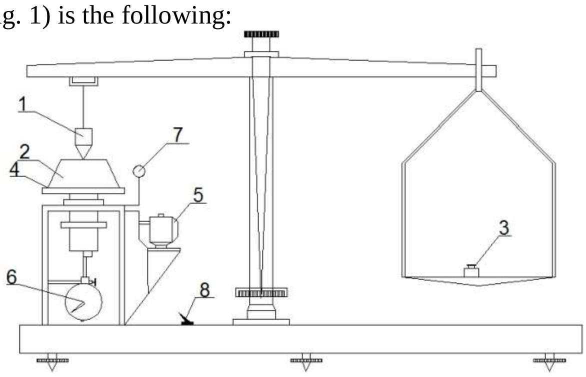

Fig. 1. Penetration viscometer PM-3 (1 – cone; 2 – model; 3 – scale with weightes; 4 – little table; 5 – electric motor; 6 – indicator; 7 – lamp; 8 – switch)

The principle of operation of the penetration viscometer shows that by results of measurements on the penetration viscometer the limit tension of shift τ_0, and the operating tension of shift τ which part, except τ_0, is the dynamic component depending on viscosity and a gradient of speed in a shifted layer is defined not. Thus, for definition of rheological characteristics by results of measurements on the penetration PM-3 viscometer it is necessary to know the character and the sizes of the shift area of the studied environment at movement in it the conic indicator, and also the size of a gradient of speed of shift [1, p. 9].

Let's consider the deformation scheme which is of great importance as it is the characteristic for the majority of the raw mixes applied in production of construction materials. Figure 2 shows that the particles of the environment adjacent to a surface of a cone, move together with the last, and at a certain distance from a cone surface where a trajectory of movement of particles pass to horizontals, they aren't mobile. Therefore, in all deformable volume there is a shift. Thus the sliding surface I-I, dividing deformable and not deformable volumes