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CAUSES OF THE ECCENTRIC COMPRESSION REINFORCED CONCRETE ELEMENTS FIXED JOINT STANCHION AND RAFTER GABLE FRAME OF AGRICULTURAL BUILDINGS

ПРИЧИНЫ ВОЗНИКНОВЕНИЯ ВНЕЦЕНТРЕННОГО СЖАТИЯ ЖЕЛЕЗОБЕТОННЫХ ЭЛЕМЕНТОВ ПРИ ЖЕСТКОМ УЗЛЕ СТОЙКИ И РИГЕЛЯ Г-ПОДОБНОЙ ПОЛУРАМЫ СЕЛЬСКОХОЗЯЙСТВЕННЫХ ЗДАНИЙ

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Abstract. *Eccentric compression in agricultural buildings reinforced concrete elements gable frame reasons describes in the article. Pole and girder fixed joint execution leads to internal forces reduction in specified elements. This, in turn, cross-sections and structure total material content reduces. On other hand, fixed joint arrangement complicates its design and bearing capacity calculation. The authors propose to calculate strength in standard section of eccentric compressed reinforced concrete rectangular cross section L shaped half frame on basis of stress-strain model and extreme strength criterion using concrete nonlinear diagram and reinforcement two-line state diagram.*

Key words: *reinforced concrete element, fixed joint, eccentric compression, standard section, stress-strain behavior, stress-strain model.*

Introduction.

To date, for buildings construction is widely used reinforced concrete structures. Construction lead high rates to decrease their material content, labor intensity and cost at design stages, installation and maintenance while increasing buildings safety. Buildings and structures frameworks reducing cost can be achieved at expense by improving the structures themselves (reducing their mass by light concrete and high-strength reinforcing steel using, etc.) or by changing building bearing construction design scheme [1, 2].

Review the status of the issue.

Special frame type industrial buildings which are equipped with systems of mechanization are required for agriculture. In Ukraine agricultural construction,

houses with no intermediate supports 12, 18 and 21 m (wide) and using three hinge reinforced concrete frames became popular [3] (see fig. 1).

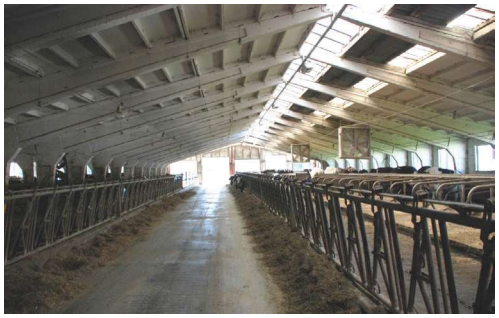
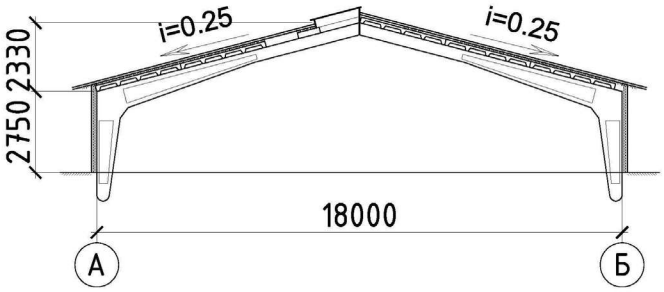
a)  b) 

Figure.1. Three hinge (gable) reinforced concrete frames buildings: a) general view; b) overall dimensions

Therefore, rational solutions and methods calculating frame structures from three hinge reinforced concrete frames agricultural industrial buildings construction, rural public buildings hallways and agricultural aviation airfields structures development tasks are relevant.

The main text.

Three hinge reinforced concrete L-shaped half frames allow to reduce internal forces in cross-section rafter span due to pole and girder fixed joint arrangement and hinge in middle of span between half frames inserting. However, due to such solution, there is pole bending moment, which is equal to girder bending support moment. Thus, the frame stanchion works on eccentric compression. On the figure 2 shows the internal forces distribution in the buildings frame elements are considered which.

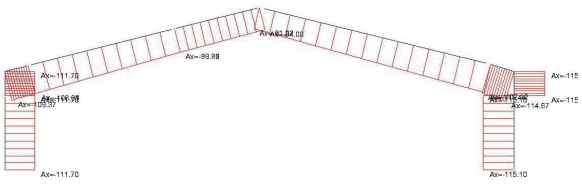
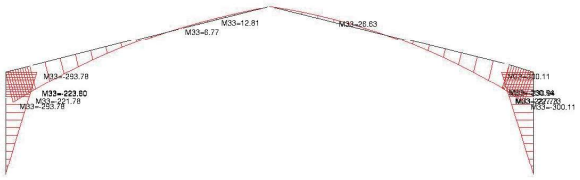
a)  b) 

Figure.2. Diagrams of internal forces in frame's elements: a) axial force diagram; b) bending moment diagram

The authors propose to calculate strength in standard section of eccentric compressed reinforced concrete rectangular cross section pole on basis of stress-strain model and extreme strength criterion using concrete nonlinear diagram and reinforcement two-line state diagram [4]. The proposed calculation method during experimental studies and computer finite element modeling of a samples series [5] is tested by the authors, shown on the figure 3.

Summary and Conclusions.

Eccentric compressed reinforced concrete elements experimental and numerical investigations confirm theoretical calculations accuracy which based on the stress-strain model and the extreme strength criterion.

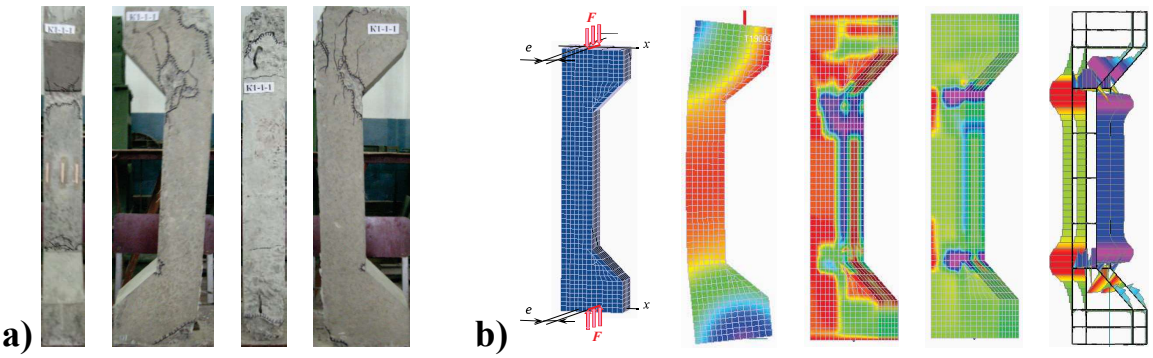


Figure.3. Eccentric compressed reinforced concrete elements experimental samples: a) experimentally tested; b) numerical models

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Аннотация. *Выполнение жесткого узла стойки и ригеля Г-образных полурам сельскохозяйственных зданий приводит к уменьшению внутренних усилий в указанных элементах. Это в свою очередь позволяет уменьшить их сечения и общую материалоемкость конструкции. С другой стороны, устройство жесткого узла усложняет его конструкцию и расчет несущей способности, так как элементы Г-образных полурам работают на сложный вид сопротивления, а именно внецентренное сжатие. Авторами статьи предлагается проводить расчет прочности в нормальном сечении внецентренно*

сжатых железобетонных элементов прямоугольного сечения на основе деформационной модели и экстремального критерия прочности с использованием нелинейной диаграммы бетона и двухлинейные диаграммы состояния арматуры.

Ключевые слова: *железобетонный элемент, жесткий узел, внецентренное сжатие, нормальное сечение, напряженно-деформированное состояние, деформационная модель.*

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