THE EFECT OF CONSTRUCTION PROCESS – STRESS AND DEFORMATION DEVELOPMENT OF ARCH BRIDGE

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Abstract

Typical character of concrete arch bridges is change of construction stages. The arch bridges are concreting in situ in form which is underpinned of centring. This is classical method of construction of arch bridges. Parts of arch bridge are not the same age in this method. In static analysis we have to calculate with different ages of parts. Creep and shrinkage of concrete, different age of parts affect stress and deformation development of arch bridge. The arch bridge over passing D47 highway will be presented as the example.

Keywords: internal forces; deflections

1 Introduction

Different technologies are used for construction of arch bridges.

For construction of arch bridges are used different technologies. Technology is dependent on the length of the span and configuration of terrain. Classical method of arch bridges construction is concreting in form which is underpinned of centring. The requirements of centring are very strict. Loading capacity is big and deformation of centring is minimal. At this technology are parts of construction different age. It influences behaviour of the structure.

The right static analysis must consider technology and construction stages. Construction process influences static behaviour – first time in construction stages, second time in final stage. Creep and shrinkage of concrete, different ages of parts can influence deformation and distribution of internal forces opposite example without changes of static system. Creation of mathematical models (with and without building stages) and discussion of public effects is the main of this reflection.

2 Construction of arch bridge

The bridge structure is designed as reinforced concrete arch with bridge floor from reinforced concrete and pre-cast elements (Fig.1).

For the time dependent analysis of the arch bridge in construction stages was used software SCIA ESA PT with the module TDA. By this software was also calculated 2D frame model, own history of each part was reflected (Fig.2).

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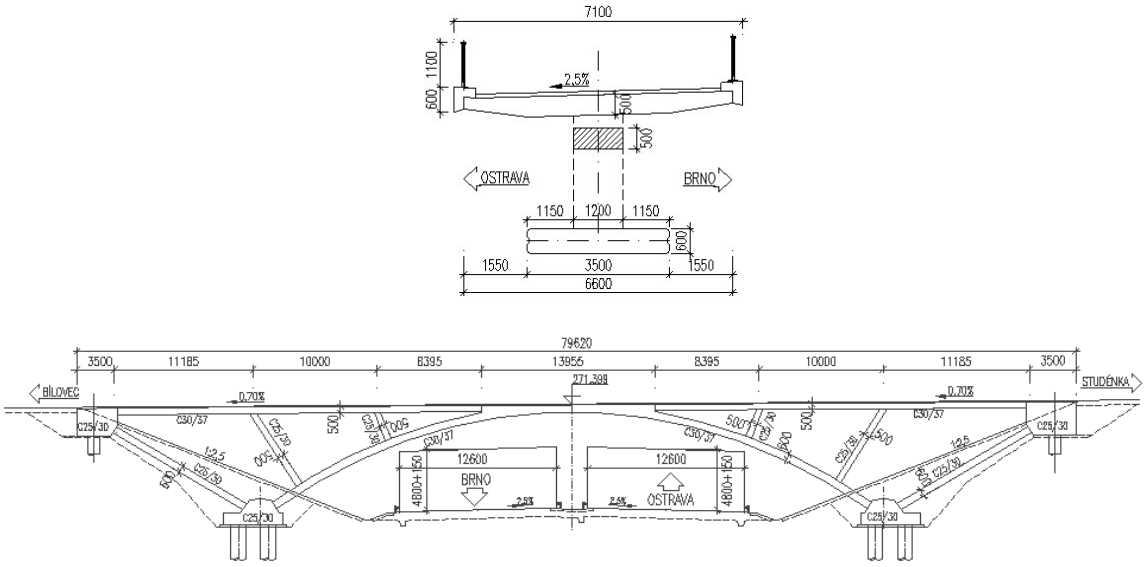

Fig. 1 Bridge over passing D47 highway

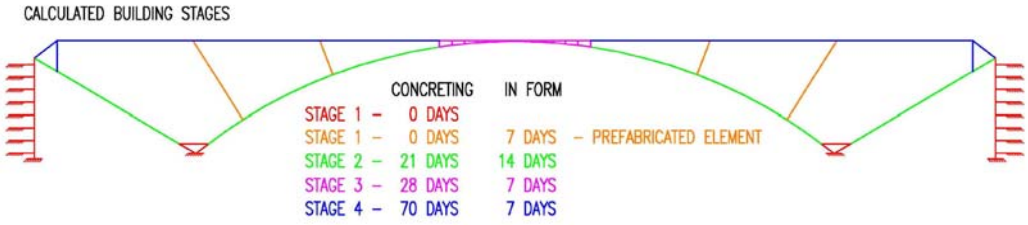

Fig. 2 Construction stages of the structure

3 Conclusion

The effect of frame function is big axial force in bridge floor (it is effect of creep). The confrontation of computational models - the greatest differences between axial forces are in the external parts of bridge floor, differences between bending moments are not so big.

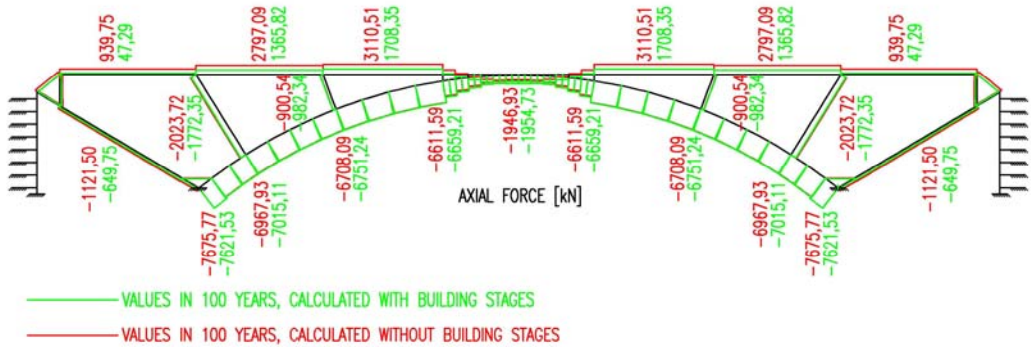

Fig. 3 Axial force

Vertical deformations are two times bigger in model without considering of construction stages than in the model with construction stages.

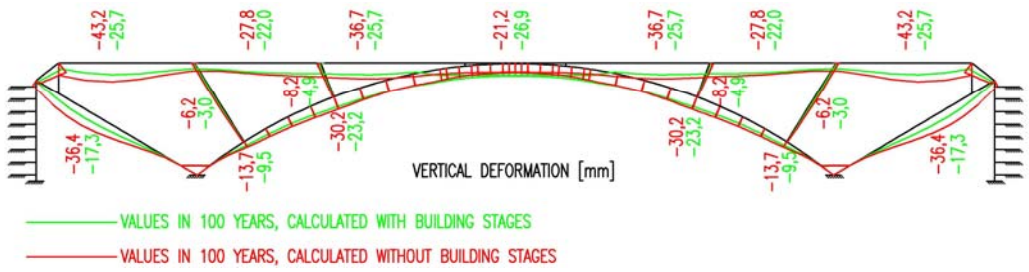

Fig. 4 Vertical deformation

It could be summarized that neglecting of the effect of different ages of structure parts is incorrect. The neglecting of this effect involves wrong and not economical structure design. If computational model for statically analysis without construction stages and changes of structural systems is used, design could be quite far from reality.

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References

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