PORTAL FRAME NODES UNDER HORIZONTAL LOADS

[1] Luis Carrillo Alonso

[1] PhD. Ingeniero de Caminos Canales y Puertos. Prof. Asociado UPM.
luis.alonso@upm.es

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Nowadays, more common building structures are formed by means of a sequence of rigid concrete portal frames, with several floor levels and spans.

Usually, in conventional buildings, the structural behaviour is governed by vertical loads. Only in case of large height towers horizontal forces are the main concern in the design [1-2].

This is not the case of structures in seismic areas, where the horizontal inertial forces generated by the ground motion cause very large bending moments and shear forces. Thus, in this type of structures the design is governed by their seismic behavior [3].

Although the best way to withstand very large horizontal seismic forces is to design structures with restrained horizontal displacement (in order to have as much as possible little displacements by means of shear walls or cross frames), there could be special designs without this capability. So, horizontal stiffness mainly could be concentrated in the columns of the portal frames [4].

Portal frames withstand horizontal forces due to rigid connection between beams and columns. In case of concrete rigid frames, the amount, the shape and the dimensions of the reinforcement need to be design with special care at nodes that connects beams and columns in order to guarantee an adequate behavior [5].

Related to previous comments, an analysis has been carried out in this paper for different types of portal frame geometries under horizontal forces. This study has been focused on developing structural models that could led to a better understanding of the structural scheme and so an specific reinforcement could be stated on each case studied.

Finit element models and strut and ties model has been proposed for each case studied. So based on those structural models reinforcement to be placed on the connection area has been calculated.

REFERENCES

[1] ACHE, Monografía M-6 “Método de bielas y tirantes”. Ed ACHE. 2003.

[2] P.F. Sosa, M.A. Fdez, J.L. Bonet, J.R. Martí, J. Navarro, M.C. Castro, “Método de las bielas y tirantes” Ed. VJ, 2006.

[3] CEB-FIP, Bulletin 54, “Textbook on behavior, design and performance” Vol 4, 2º Ed, 2010.

[4] CEB-FIP, Bulletin 61, “Design examples for strut-and-ties models”, 2011.

[5] K:H:Reineck, ACI SP-208 “Examples for the design of structural concrete with strut and tie models”, American Concrete Institute, 2002.