Modelling of framed shear walls for pushover analysis of reinforced concrete buildings

Dear Sir,

This has reference to the paper titled 'Modelling of framed shear walls for pushover analysis of reinforced concrete buildings' by Indu Geevar and Amlan K. Sengupta published in The Indian Concrete Journal (May 2014, Vol. 88, No. 5, pp. 58-68). I have some observations. The authors have carried out static pushover analysis on a shear wall frame. The shear wall was modeled in two manners and the results were compared. These results (Figure 10) show that the maximum lateral roof displacement was about 6 cm in a building height of 14.5 m above GL, that is, 0.41%. If the overall height of the frame is taken as 16 m, then the sway is only 0.375%. The maximum elastic sway under service conditions as per IS 1893 part 1 is 0.4%. Thus it appears that the shear wall was not pushed far enough. It remained essentially elastic. So how do the authors expect to examine the non-linear push over response and compare the two models in the elastic range? I would appreciate if they could elaborate and advise about the validity of their conclusions.

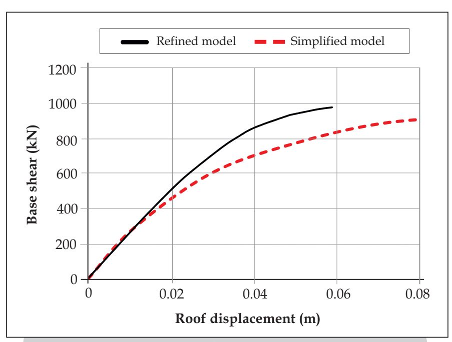

Figure 10. Comparison of pushover curves from the refined and simplified models

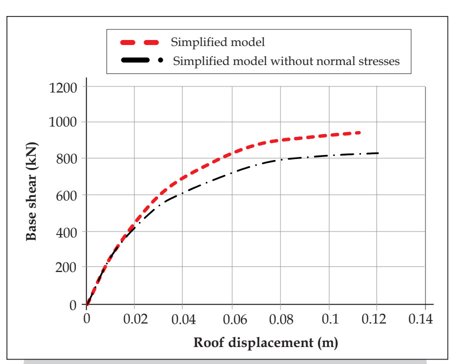

Figure 11. Comparison of pushover curves of the simplified models, with and without considering normal stresses

Thanking you and with regards,

Mandakini Dehuri
Graduate Student,
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THE AUTHORS REPLY

Dear Sir,

I thank the reader for sending the query. The refined analysis based on using the multi-layered membrane elements for modelling the wall panels, terminated at a push of around 0.06 m of roof displacement (Figure 10) due to local failure of the concrete layer near the corner of a wall panel. The model could not be pushed further. The roof displacement of 0.06 m corresponds to a lateral drift ratio of 0.375%. As per Clause 7.11.1, IS 1893 (Part 1): 2002, the limit of storey drift under unfactored lateral forces based on elastic analysis is 0.4%. This does not imply that a structural member will remain linear elastic up to that drift level. In the present model, the behaviours of the lower wall panels and a few frame members had indeed become non-linear.

Compared to the refined analysis, the simplified analysis based on using an equivalent column element for a wall panel, did not consider the local failure of concrete, and continued up to a push of around 0.12 m (Figure 11). The comparison of the results from the two analyses was based on the initial lateral stiffness and ultimate lateral load. The lateral deformability from the simplified model was more. Nevertheless, the simplified model can be used in a high rise building with several framed walls to avoid intensive computation.

With regards,

Dr. Amlan K. Sengupta
IIT Madras,
Chennai 600 036

Pozzolanic industrial waste based geopolymer concretes with low carbon footprint

Dear Sir,

This has reference to the paper titled ‘Pozzolanic industrial waste based geopolymer concretes with low carbon footprint’ by N.P. Rajamane, M.C. Nataraja and R. Jeyalakshmi, published in the The Indian Concrete Journal (July 2014, Vol. 88, No. 7. pp. 49-68).

I appreciate the authors work related to this field. They must develop this work with cost effective manner for our society.

In this paper, the authors mention that geopolymer concrete under ambient curing condition has high compressive strength at 28th day. So my question is, can geopolymer concrete be directly used at site or not ? If not, what is the reason for that?

Thank you,

With regards,

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THE AUTHORS REPLY

The authors thank the discusser for showing interest in our paper. We can state clearly that there is no actual bar on use of geopolymer concretes in field. They are even cost effective when advantages of these new materials are considered. However, following points may also be noted in this regard:

- The chemistry aspects of geopolymers (GPs) discussed in various published articles indicate that GPs can be tailor made after thorough systematic study/research using particular set of materials for any given application.

- In GP reactions, there is a need for silicate anions which obviously depends on polymerised or unpolymeric material, the rate of reaction between source and activator, and also on silica/alumina ratio. Therefore, GP technology needs optimisation of various parameters such as: Molar ratio of SiO_2/Na_2O of activator solutions; SiO_2 and Al_2O_3 contents in geopolymeric source material, aqueous alkali or Na_2O contents, etc.

- With present knowledge, the identification of presence or absence of residual source material in final cured GP product is a very challenging task. This is a major concern. Rate of reaction of GP (for total conversion of source to GP product - which is a complex and rapid continuous process) in general depends on activator type. Duration of curing, its nature and condition do affect GP reactions. Even the sequence of additions of components of activator solution has been reported to be sometimes a parameter; in this regard, it was mentioned in one paper that addition of alkali first and then addition of silicate had resulted in higher dissolution of source materials leading to faster rate of geopolymerisation. Well known scientist in the field of Geopolymer, Dr Palomo had observed once that by adding alkaline hydroxide solution first, the Al–Si bonds of Geopolymeric source materials are broken up thereby causing a higher degree of the Al–Si disorder which influences the step of formation of alumino-silicate gel due to sodium silicate (Palomo, 2011)[1].

- Because of possible wider choice of geopolymeric source materials, activators, and reaction conditions, the attainable strengths of GPs would also differ significantly. However, this also shows that tailor making of various parameters is possible to achieve desired performance of GPs.

- The main reason for lack of large scale field applications of GPs is due to very limited research conducted to generate rational data on comparative behaviour of these new binders as technical alternatives to conventional Portland cement. GP is mainly a kind of (Si+Al) cement needing silica and alumina rich materials (such as fly ash, metakaolin, rice husk ash, GGBS etc.,) as source materials (Provis, 2009)[2]. GPs are characterised by a highly polymerised alumino-silicate structure composed mainly of three-dimensional cross linked units. Normal Portland cement hydration or pozzolanic reaction processes cannot be used to describe the GP reactions since the actual mechanism of formation of GP gel is complex. However, under optimised conditions, GP technology is a promising technology that offers attractive possibilities for commercial applications with advantages such as, fast hardening, high early strength, optimal acid resistance, lower chloride and sulphate diffusion, enhanced protection to steel and long term durability.

- The simplified tips for engineers to use GP technology on site are still under development and hence, only well informed and technical personnel should get involved in production and usage of GPs in order to get desired level of performances of structures built with GPs.

- Many of the above points are with reference to Indian context. However, many site applications of GP concrete are already seen in several countries such as Australia and NZ (CAI, 2011)[3].

References

1. Palomo Angel, and Ana Fernández-Jiménez, (2011), Alkaline activation, procedure for transforming fly ash into new materials. Part I: Applications, World of Coal Ash (WOCA) Conference - May 9-12, 2011, in Denver, USA, 14 p

2. Provis J.L. and J.S.J. van Deventer (Ed). (2009), "Geopolymers: Structures, processing, properties and industrial applications", Cambridge: Woodhead Publishing Limited, ISBN-13: 978 1 84569 449 4, June, 464 page

3. CAI (2011), CIA Z16-2011, Geopolymer Recommended Practice Handbook, Concrete Institute of Australia, Committee: DD-001, ISBN: 1 921093 56,

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