

Design Of Portal Frame

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this book provides in si units an integrated design approach to various reinforced concrete and steel structures with particular emphasis on the logical presentation of steps conforming to indian standard codes detailed drawings along with carefully chosen examples many of them from examination papers greatly facilitate the understanding of the subject

practicing engineers can confidently design hot rolled steel portal frame structure if it is kept at ambient temperature however as they are not aware of the potential collapse behaviour of such frames in fire they tend to use heavy foundations with expensive fire protection materials applied to all the columns rafters and column bases to ensure the structural integrity and prevent premature collapse the research presented in this thesis aims to provide computational techniques and solutions for studying the possible behaviour of different hot rolled steel portal frames in fire considering the partial strength of column bases with partial insulations applied to the columns before tackling the effect of partial strength of column bases a comparative study between two different dynamic methods for solving such problems the implicit dynamic method and the explicit dynamic method has been undertaken considering fire large deformations complex geometry boundary conditions and degradation of material stiffness for such analyses the cost of computation is important as well as the accuracy robustness and stability of the analysis it is found that obtaining similar results are possible by using both of the dynamic methods however the analyses time differ significantly it has been established that if the applied artificial inertia forces in terms of residual forces can be magnified and if the automatic time incrementation scheme is activated in the implicit dynamic method then this method shows significant superiority over the explicit dynamic method both in terms of cost of computation and accuracy of results for analysing such structure once the proper dynamic method has been selected all of the analyses of portal frame structure in fire have been conducted by using this particular dynamic method the developed model using the implicit dynamic method has been used for studying the effect of partial strength of column bases a non linear elasto plastic implicit dynamic finite element model of a single span pitched roof steel portal frame building in fire is set up and used to assess the adequacy of the design method provided by the steel construction institute the sci design method both 2 d and 3 d models are used to analyze a building similar to the exemplar frame described in the sci design guide using the 2 d model a series of parametric study on different frames is conducted it is shown that the value of the overturning moment M_{OTM} calculated in accordance with the sci design method is not sufficient to prevent collapse of the frame before 890 c it is established that if M_{OTM} is increased the eaves rotations are reduced significantly and reach close to 1 of the original shape the limit specified by the sci design method the developed model has been extended for analyzing three other portalised frames such as multi span portal frames portalised truss frames and asymmetric portal frames it is found that apart from the multi span frame the model can be readily applied to the portalised truss frames and asymmetric portal frames without any computational overhead and loss of accuracy however for the multispan frame the cost of computation is increased significantly the computational cost is reduced by relaxing some tight tolerance parameters without losing any accuracy for all of the frames it has been observed that all the frames collapses when the column bases are perfectly pinned however when a partial strength is introduced at the column bases the behaviour of the frames changed considerably it is found that though the snap through buckling temperatures remain

almost same the collapse temperatures vary and the eaves rotations differ significantly similar to the single span pitched roof portal frame it has been found that when μ_{tm} is increased the eaves rotations are reduced significantly and reached close to 1 of the original shape based on the studies on different frames it is suggested that the μ_{tm} given by the sci method should be increased and considered within the region of 1.5msci to 2.0msci key words steel portal frames stability snap through buckling quasi static and dynamic analysis partial strength semi rigidity

this project and thesis undertakes the design of a light industrial portal frame structure in two different mediums timber and wood the initial design of the structure is based on an existing structure that was built in ballarat in 1994 and designed by gibcus mcgrath and o neill pty ltd a local engineering constancy firm at the time the structure was designed in steel for bendix mintex s for their new rail brake division which is now located on sutton street ballarat a cost comparison was undertaken on both of the structures to determine which design would be more economically efficient while still meeting all of the design requirements the recommendations of this cost comparison along with the various advantages and disadvantages of each method can be found in section 5 abstract synopsis

an economic comparison between two types of portal frame construction was undertaken the two types were the conventional portal frame and a hinged portal frame this involved the design of both types of portal frames a comprehensive costing of each and a sensitivity analysis on the most significant items

this book gathers the proceedings of the 7th international conference on architecture materials and construction icamc held in lisbon portugal on october 27 29 2021 icamc serves as an international forum for the presentation of the latest technological advances and research results in the fields of architecture and urban planning civil and structural engineering and materials manufacturing and processing as such it explores highly diverse topics including innovative construction technologies computer and digital manufacturing and materials polymers composites etc traditional materials glass wood steel concrete stone brick etc and its harmonic combination which can be achieved by evaluating their structural and non structural properties the key concepts of efficiency and sustainability related to the architectural design and engineering of new buildings analysis rehabilitation and restoration of buildings the contributions which were selected by means of a rigorous international peer review process highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaborations

this investigation was into the computized design and analysis of portal frame type structures which may include members of varying section by both elastic and plastic methods of analysis the objectives were to produce suitable design guide lines for the sizing of the frame members to produce an interactive plastic analysis program for use on micro computers and to expand the capability of the existing elasto plastic analysis program at the university of bradford to cope with haunched members and to incorporate any applicable time and space saving

devices the design guide lines were to be an extension of d i blockley s paper the design of single storey pitched roof portal frames published in 1970 repeated analysis and geometrically similar frames with varying sections were performed and the results combined with the recommendations from blockley s paper to produce design guides for the sizing and position of the individual members of the frame to produce a suitable plastic analysis program for use on a micro computer computer the reactant bending moment or graphical method analysis was chosen the advantages of this method are that it is commonly used in the design office it allows checking at intermediate stages in the analysis and the free bending moment distribution aids the selection of appropriate hinge positions the existing program at the university of bradford was to be extended by introduction of routines which would allow haunched members and multiply loading to any member this would reduce computer storage and solution time but a special solution routine was required to determine the formation position of a hinge along a member the three objectives were completed and where possible compared with other proven methods of analysis

structural mechanics in australasia is the focus of the some 100 papers but among them are also contributions from north america japan britain asia and southeast asia

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