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Comparisons for the protected steel column UC203×203×71.

Comparisons for the RC beams.

The results show that when T_e is below 150 min the C/VM2 method predicts eleaaesu 8olts lor

lar analysis for RC beams uses a design FRR of 60 min. The comparison employs the MLC method to predict T_e associated with the different glazing fallout ratios and the results are illustrated in Figs. 6 and 7. The C/VM2 method’s prediction is still conservative if the glazing fallout ratio is no less than 70% for the protected steel beam and is no less than 65% for the (th)7(e)] TJETBT1 0 0 1 17e6stee-12(fl)-127con62(a[(t)-10(h4S00480-3( )] T6 2(fl)-127co12(fl)-127co)] TJETBT

spaces, a travelling fire may be observed instead of a fully involved compartment fire [22].

6 Conclusions

This article has identified a number of parameters previously overlooked in the maximum temperature-based TE methods. The parameters are related to the mechanical response of structural members at elevated temperatures, which directly influence failure, and hence their T_e predictions. The effect of load ratio, member size and reinforcement size of RC members have been investigated. The study also looks at the impact of varying ventilation conditions on the prediction of T_e. It is found that all these parameters have considerable influence in either the prediction of T_e or the confidence in relying on existing design methods. The results show that:

- for protected steel beams, the C/VM2 method tends to predict lower T_e values than the MLC method beyond 150 min.
- glazing fallout ratios of 70%, 65% and 95% should be expected when using the C/VM2 method for protected steel beams and columns, and RC beams respectively.
- for both protected steel beams and columns, the C/VM2 method tends to predict lower values than the MLC method when α_V is lower than 7.5%.
- when the steel member section factor H_p/A is greater than 140 m^{-1}, the C/VM2 method may predict lower T_e than the MLC method.
- a lower reinforcement size for RC beams may lead to an earlier failure than expected.

It is observed that the MLC method provides a more fundamental way of assessing structural failure. To ensure that the current methods provide adequate design solutions, a large number of uncertainties will need to be investigated. It is also found that some parameters that affect the prediction of T_e need to be represented statistically rather than the conventional pre-defined values. It is recommended that a risk-based statistical approach should be investigated for future design.

References

[1] Buchanan A.H., 2001, Structural design for fire safety, John Wiley and Sons Ltd., Chichester, England.

[2] MBIE, 2014, C/AS5 Acceptable Solution for buildings used for business, commerical and low level storage (Risk Group WB), Ministry of Business, Innovation and Employment, New Zealand.

[3] MBIE, 2012, Extract from the New Zealand Building Code: Clauses C1-C6 Protection from fire & clauses A3 building importance levels, Ministry of Business, Innovation and Employment, New Zealand.

[4] MBIE, 2014, C/VM2 Verification Method: Framework for fire safety design for New Zealand Building Code clauses C1-C6 protection from fire, Ministry of Business, Innovation and Employment, New Zealand.

[5] Wade CA, Gerlich JT, Abu A, 2014, The relationship between fire severity and time-equivalence, BRANZ Study Report, SR 314, New Zealand

[6] Kirby BR, Wainman DE, Tomlinson LN, Kay RT, Peacock BN, .81 736. dp .0270K18(o)[([)] Ta aineis57(.81 736.)-4(d)-p .027-3(t)-3(y)21( )-524

0776 Tm.98(J)-411ap o7(B)35-4(d)9my-10T(a)-6(l)-i45ymh4(d)-m(a)-6(l)-3(a)-6(n)7(d)] TJ0.822ti0[/F1Tm[(h)7(en16.14 Tm[(,)] TJETBT1 0Tm05/F1o(16.14c)-)4(3)7(p)7(