More complicated than it looks

The Sherbourne Resource Centre may look ordinary to the casual observer, but a closer look reveals plenty of engineering challenges requiring thoughtful design. David Brown of the SCI comments on the structural solution.

Within the Resource Centre, the Process Hall is 100 m long and initially gives the appearance of a conventional 'hit and miss' portal. The columns support the apex, rather than the usual valley arrangement, and have a longitudinal member supporting the apex of the 'miss' frames. 'Hit and miss' frames always need careful consideration. Firstly, the transverse stability of the structure is affected due to the different structural arrangement on every other bay. Secondly, the two different frame arrangements would naturally take up a different deflected form, which must be prevented to protect the cladding. The solution adopted at Sherborne was to provide bracing in the plane of the roof between every bay to force the frames to deflect identically. SCI publication P399 includes a procedure for assessing the 'hit' and 'miss' frames and iteration to determine the lateral forces. A 3d analysis is an alternative approach.

The Resource Centre is however more complicated that an orthodox 'hit and miss' frame – at one end of the structure all the 'miss' columns are entirely removed and the frames supported on a 52 m-long truss. Under normal loading, the top chord of the truss is in compression and needs lateral restraint – which cannot be provided by the relatively flexible portal frames in the orthogonal direction. The solution here was to provide a truss in the plane of the roof over the full 100 m length of the building. This lateral truss provides restraint to the 52 m length supporting the portal rafters and provides the essential bracing between the remaining 'hit and miss' frames. Vertical bracing in the gables takes the forces in the lateral truss to ground.

Load reversal due to wind uplift puts the lower chord in compression – restraint is provided by diagonal members from the bottom chord to the portal rafters, which are themselves connected into the lateral truss.

The portal rafters are continuous through the 'hit' apex columns, through the longitudinal apex beam, or through the 52 m-long truss, depending on their location. The 52 m-long truss was detailed with vertical internals on the frame locations, which were fabricated such that the connection zone was the same as a 'hit' column profile, meaning the rafters were identical.

One further challenge was the erection method for the 52 m-long truss. This was connected on the ground and then held aloft by two cranes whist certain rafters (and purlins) were erected using a third crane. This temporary case was carefully analysed considering the loading and fixity of the frame at that stage.

The Sherbourne Resource Centre is a good example of something which may look to be a straightforward and utility structure, when in fact the truth is the opposite. There were plenty of design challenges to be addressed resulting in a structure that demonstrates thoughtful best practice.