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Note: The following letter was issued by our former department, the Office of the Deputy Prime Minister (ODPM). ODPM became Communities and Local Government on 5 May 2006 - all references in the text to ODPM now refer to Communities and Local Government.

Building Act 1984 - Section 16(10)(a)

Determination of compliance with Regulation 7 (Materials and Workmanship) and Requirement A1 (Loading) of the Building Regulations 2000 (as amended) in respect of two plywood web beams, forming part of a roof space conversion

The proposed work

4. The building work to which this determination relates is a proposed roof space conversion at a new second floor level to a four bedroom, two storey, semi-detached house. The ground floor plan area, including a single storey extension to the rear, is approximately 12m x 14m in depth. The roof is of traditional tile construction with a roof ridge running between the party wall and a hip to the flank wall.

5. The proposed loft conversion will comprise two bedrooms and a separate bathroom - the overall dimensions of the area being approximately 8m x 5.25m. Ceiling height for this new floor area will be created by breaking open approximately 6.5m or 50 per cent of the length of the rear roof slope at sill height and the construction of a dormer section containing two separate windows - one to each of the bedrooms - spaced 1.7m apart. The roof slope to the front elevation is to remain unchanged.

6. The breaking out of the rear slope of the roof will be achieved by severing the relevant roof rafters and securing the upper severed sections to new horizontal roof joists which will form the new ceiling; and securing the upper ends of the lower severed rafters on to a plywood web beam running horizontally under the new windows at sill height. The new ceiling joists will bear on to a storey height plywood web beam towards the front of the property and, via timber framing, on to a 700mm deep plywood web beam to the rear. The plywood web beams also support the new timber floor joists to the roof space extension. Your proposals are based on the assumption that the plywood web beams will be manufactured at site.

7. These proposals were the subject of a full plans application which was rejected on the basis of non-compliance with regulation 14 (ie provision of details) of the Building Regulations and other specified items. Of particular concern to the Borough Council was the stability of the two plywood web beams proposed, together with the fact that they were to be manufactured at site. However you take the view that these proposals comply with the Building Regulations and that the use of these beams is preferable in cost-effective terms to the use of steel beams as suggested by the Council. You therefore applied for a determination in respect of the question of compliance to the Secretary of State.

The applicant's case

8. You point out that the design calculations for the plywood web beams have been carried out step-by-step in accordance with recognised approved publications by specialised bodies - namely *BS 5268: Part 2: 1984 (Structural use of timber - Part 2: Code of practice for permissible stress design, materials and workmanship)* and the Timber Research and Development Association. You have also questioned the Borough Council's position on a number of other points.

9. In response to the Borough Council's criticism that submitted calculations for the plywood web beams do not adequately represent the load cases, you argue that the structural arrangement is relatively simple and that the additional calculation check confirms that the structure is satisfactory for carrying the combined gravitational and lateral forces. Furthermore you have emphasised that your calculations and computer analysis have demonstrated that *"there are no induced moments nor any out of balance forces present in the proposed structure"*.

10. You also dismiss the Borough Council's concern regarding your proposed method of supporting the new floor joists on the bottom flange of the plywood web beams and the reliance on the gluelines between the bottom flange and the ply web.

11. With regard to the Borough Council's view that adequate quality controlled conditions cannot be provided at site for the manufacture of the plywood web beams, you argue that current technology and use of modern tools and materials does facilitate high precision manufacture of the plywood web beams at site.

The Borough Council's case

12. The Borough Council has raised its concerns relating to the design and manufacture of the plywood web beams and that the worked examples, upon which the design was based, are not representative of the proposed construction. Particular concern is raised regarding the means of loading the plywood web beam via the bottom flange and the implications this has on the web/flange glueline.

13. More generally, the Borough Council was originally concerned that the calculations submitted did not demonstrate that there was no risk of buckling under design load. The Council also identified an error in the evaluation of the bending moment resulting in the tension stress in the flange being above that permissible in Table 8 of BS 5268: Part 2: 2002 (ie the latest version). This was subsequently resolved by you.

14. The Borough Council has also expressed concern regarding the proposed manufacture of the plywood web beams at site. The Council contends that the quality control provisions given in the relevant British Standards cannot be achieved at site and that the site manufacture of these elements is not consistent with recommendations published by BSI and the timber industry.

15. In elaborating its argument concerning appropriate fabrication, the Borough Council refers to the fact that manufacture should be carried out in accordance with *BS 6446: 1997 (Specification for Manufacture of glued structural components of timber and wood based panels)* which sets out the minimum requirements to achieve sound glued joints and consequential adequate performance in service. The Council also points out that the British Standard highlights the importance of quality control in the construction of the components and covers aspects such as moisture and temperature control, adhesives, measuring equipment, documentation, and cleanliness of the production area.

16. In the context of quality control the Borough Council also goes on to cite quotes from *BRE Information Paper IP 7/88 (The design and manufacture of ply-web beams)*. In particular the Council quotes the following from the paper: "*Manufacture should be carried out in accordance with BS 6446. The apparent simplicity and ease of assembly belies the care and attention actually required. During manufacture, workmanship has been identified as the single most important factor affecting beam performance and the need for adequate staff training and supervision cannot be overstated.*"

17. The Borough Council concludes that the Method Statement you have submitted omits many of the critical elements required to ensure adequate quality control and satisfactory beam performance. As a consequence the Council considers that the proposals do not demonstrate compliance with Requirement A1 or regulation 7 of the Building Regulations.

The Secretary of State's consideration

18. From the papers submitted it is apparent that the disparate views between yourself and the Borough Council on the design of the plywood web beams appear to have been subsequently addressed by you and that they have been reconciled. The issues which remain unresolved are the loading on the bottom flange of both beams and the intention to fabricate these beams at site.

19. The Secretary of State accepts the Borough Council's main concern which centres on the dependency of the structure on the glueline strength between the bottom flange timber and the ply-web. In the Secretary of State's view if this critical connection failed, then the remaining structure would not remain stable and would be unable to carry the dead and imposed loading via alternative loadpaths.

20. Given the critical dependency on the glueline strength the Secretary of State is therefore very concerned with your proposal to manufacture the two plywood web beams at site. Both BS 5268 and BS 6446 recommend that such glued components are manufactured in controlled factory conditions and are subjected to third party quality control procedures. With such critical connections, as mentioned above, the quality of manufacture is paramount. Moreover, your drawing MAC/NM/07 indicates finger joints are proposed in the top and bottom flanges at about the mid-span position. BS 5268 specifically advises against the provision of finger joints in principal members acting alone unless such joints have been manufactured under a third-party quality control scheme.

The determination

21. The Secretary of State has given careful consideration to the particular circumstances of this case and to the arguments presented by both parties. He has concluded and hereby determines that your proposals, which incorporate the design and manufacture at site of two plywood web beams, do not comply with Regulation 7 (Materials and workmanship) or with Requirement A1 (Loading) of the Building Regulations 2000 (as amended).