

Innovation for terraced homes in Portishead - Lecture by Michael Martin of Crest Homes given at the Design for Homes Joined-up Housing conference, November 2000

This Design for Homes CPD module should take you about half an hour to go through

Ladies and gentlemen, by means of introduction I should say I am coming from a construction point of view. I am not an architect and there is no way I am trying to suggest anything I am discussing today is of an architectural nature.

The shot you can see initially is a typical terraced house, and you can probably see at the top of it a steel frame construction. This is really where I am coming from.

Looking at the construction of a terrace, the actual terrace I am looking at specifically today was designed in traditional construction format. However, obviously we are looking at trying to find ways and means of improving the overall speed of construction and improving the opportunities for the trades within that building to operate effectively, given that we expected to start construction in August 1999 and progress through into the year 2000, right through the winter period.

The prime areas we were looking at was trying to de-skill the operation. We all know generally in construction we have a massive problem of skilled trades and there is a distinct lack. Looking at it in production terms, if you try to analyse over a production programme, one is very reliant on the ability to obtain trades people at particular times in the process and if you cannot obtain them, then the activity of your whole production programme falls behind. Therefore we looked at factory production: how can one use the factory to enable one to construct a building in a more effective manner, given that the overall scheme was to design traditionally?

Build accuracy is another factor. As in general building within housing, I would imagine if you measured the floor span of any particular house, you will find that one house will vary from another by as many as 20 or 30 millimetres. But that is an accepted fact. However, in terms of getting building and factory production, we believe that a genuine factory activity can achieve accuracy.

Quality is high factor. I think every house builder today is wanting to improve quality. You have seen recent tables of activity showing the levels of quality that builds are achieving, and customer satisfaction is incredibly important.

Then there is the supply chain. We hear a lot about partnering. I think it is important to recognise that to get an effective development and operate effectively on a building site, we need to improve the whole supply chain activity and to involve suppliers far more in the whole integration of the production unit. Waste management is very high on the agenda. We

have all seen figures of the waste created on building sites, how dramatic it is, in both timber, hard waste, dry lining board, paper, pallets and the like. If you look at the actual cost of wastage, for every house built, probably the industry is spending four or five hundred pounds per house in getting rid of waste, let alone the cost of materials they are getting rid of. All these add up to the fact that we have to aim to achieve zero defects. Every house builder recognises



that every house they produce will generate defects. We all heard the story about the motor car industry: if you are buying a new car, you expect it to be 100 per cent right, now. Ten years ago, if it was 10 per cent wrong, you might have expected that because you expected things not to be perfect 10 years ago. Now you do. A one per cent deficiency in a motor car means 230 defective items, yet we are quite prepared

to accept a house 75% right. Is that the way to go?

A typical development housing scheme, the scheme we are looking at, comprises a combination of terraced houses and flats, integrated within the total scheme. The whole scheme was designed primarily to achieve – as has been mentioned already by the earlier speakers – the point of location and accessibility. This has to be taken into consideration during the whole building process. That is because, with a terraced scheme, obviously, if you do not complete construction in an orderly manner, the ability to sell those houses to the general public at a sensible rate to achieve your sales targets is very much affected.

Therefore the phasing of construction is important to ensure that we use whatever method we can to achieve a far better process of phased construction. The shots I will show you shortly will give you an indication of how we have achieved that.

The typical three-storey houses we are constructing are essentially in the region of 1500 square feet. Most of them have a garage or an integral garage. There is certainly living space on all three floors. Essentially, being designed from a traditional viewpoint, they rely to a certain extent on internal structure walls. This has an impact again on how one designs the whole project thereafter. This slide shows a scheme which is currently under construction, on a waterfront scheme. These houses on that stretch (indicating) are all identical, these are slightly different and these are a block of flats, or apartments is probably a better term, going through two and three storeys.

This is a typical traditionally built scheme. To achieve that level of finish, we are talking of approximately 42 weeks from DPC level. That was built in every way in the traditional format and designed traditionally. Thus for a construction method we chose light steel frame. There is a lot of debate as to what system we should try but we actually decided to work with Corus framing, try to partner the overall project to ensure that all the design aspects of the building were integrated in the early design phase. One of the problems, obviously, of going from a traditional build to a framing system is with some of the methods of construction, and particularly, as I mentioned earlier, internal structural walls: with a framing system such as the one we are using, those are not required because the system itself enables one to span probably between six and seven metres without any support.

This of course has an impact on the whole design process. Unfortunately, because time moves faster than you like it to, one cannot always encompass the necessary requirements of the design if you are going to change from one method to another. There are three basic stages we have had to go through. First there is the groundwork. In achieving a satisfactory base onto which to build steel frame, it is important that there is a level of accuracy. Again

traditionally, if one does not get the base or the raft absolutely accurately, you can take out those discrepancies with brickwork and blockwork. However, with steel frame you need to be accurate and therefore it is essential that the whole target of achievement and the level of accuracy achieved on the base was critical. In general terms one was working to a tolerance of plus and minus five millimetres. Over that photograph I showed you earlier of 12 houses, the actual base level that was achieved was within plus or minus 10 millimetres, which I think is a reasonable achievement. The build programme, in essence one was trying to achieve a situation where, by concentrating the efforts of the build programme, you are reducing cash flow, improving cash flow to the benefit of the contractor.



With steel frame and any other frame system – although we are talking about steel frame specifically, this probably applies to timber frame as well – with steel frame in particular because of the nature of its construction, we were probably able to save in the region of 10 weeks in build programme on this particular development. Being a shell construction, it does mean that effectively we can programme the whole basis by achieving something like a pair of three storey houses each week.

This shows literally the first frames that went up. You will probably recall the shot I showed you, the left-hand end. This is that left-hand end. It is made up of a number of frames. There are actually six panels which form the ground floor.

When we come to the three storeys, you will have noticed that in the very first shot I showed you, there was a lot of scaffolding around that building. The erection of the steel frame did not require external scaffolding, so that made life much simpler from the point of view of scaffolding and also the cost of scaffolding. The frame itself was erected from inside and effectively, once the ground floor panels are in position, the cassettes which form the first floor are lifted onto that frame and then one constructs thereafter.

Once the external insulation is on, which is the white you can see, then effectively the wall plate is placed on and the roof, which is constructed on the ground, as you can see here, is lifted up in one piece. That is that line of houses, constructed to a stage of 10 weeks. Within that 10 week period we constructed in steel frame approximately eight houses, to the extent that we had the houses totally dry, with the roof on. Those parapets, by the way, are false parapets, they are not real. As part of the traditional design, obviously, the parapets would have formed part of the internal block walls, but effectively because we had no block work, we supported the parapets on the steel within the houses and the parapets were placed on separately, as are the chimneys. The chimneys do not serve any function. The windows were all fitted as soon as the external frame was finished. Therefore within two weeks of each process, we achieved two, possibly three, houses completely dry. That therefore meant that we could get the internal trades into the first house as we started construction of a fourth house. Therefore within a 10 week period we have actually achieved a situation where all the internal first fix electrics and plumbing have been completed. That is a shot taken from the other side of the water to show the state of play at the same time that first photograph was taken. The brickwork, the blockwork on the dockside was being worked on whilst the other side was being prepared. That is the same shot at 12 weeks. Two weeks on, we are in a situation almost of having the external façade on the dockside ready for rendering, some with a certain amount of rendering and a certain amount of brickwork.

The benefits of steel frame I think are important to highlight in terms of the benefits to the contractor. Obviously there are other benefits that I will come on to but first of all I think the important matter is to note the speed to achieve a dry envelope. It is critical, if you are planning the whole steel frame construction, that the follow-on trades are enabled to work alongside the steel frame activity. Once effectively you have actually completed two houses on the terrace, you can effectively get the first trades



into those buildings because they are dry. As a basic principle, one would not dry line until the roof is sealed, but provided the roof is sealed and complete, then effectively all the internal trades can carry on. The important factor is that there is no drying out. Obviously we maintain a dry envelope all the way through, because, as the steel frame goes up, the flooring on each floor maintains a dry envelope on each floor it covers. Therefore as we go up right through the house and once the roof is on, the top floor is completely covered. The roof construction again has been tried many times before, of actually trying to generate a roof construction on the ground. It has been tried and worked reasonably successfully on this particular development and has enabled us to get the roof on to enable us to achieve the dry envelope as fast as possible.

There are various other methods of roofing, which we are looking at but, as you have probably noticed from the shots I have shown you, the roofs have been constructed in a standard format.

Accuracy again features quite highly but, given the overall design of the steel frame, one can overlay into that design the layouts for plumbing and electrics. Because of the advantages of the steel frame itself, where all the service holes are provided, one can run these electrics and plumbing services very easily.

Coming back to the whole point of de-skilling, that by planning the introduction of plastic push-fit plumbing and by training the on-site operatives, one does not necessarily need a plumber to do that plumbing insulation. If you have a trained operative who

understands the plumbing pipework system and can understand a drawing, you can actually de-skill that away from a plumbing activity. Okay, you need a plumber to do the final test, but the arrangements we have with the supplier of plumbing fittings is such that they will monitor the actual installation, they will check that all the fittings have been installed correctly and witness the pressure test on the plumbing. The same applies to electrics. I mean traditionally we have always allowed an electrician to go into a building and wire it as he thinks fit, provided he can supply all the various connections to power points and sockets.



But why not go for loom electrics? Why not look at the way motorcars are wired up? Why not have a perimeter wiring system, which you can just have spares off, which are controlled from a central box? That is another way of speeding up and de-skilling the operation because you can go down that route, you can de-skill the need for electrical installations. That is another area to be looked at.



The build rate can be monitored very accurately. Given the weather we have had, certainly during the latter part of September and virtually the whole of October – and I think in October we averaged on that site something like 20 millimetres of rain per day and suffered gale force winds for at least 50 per cent of the time – under normal circumstances traditional build would probably have been stopped for most of October. The only days that steel frame was not actually erected was when we had two days of gale force winds when the crane could not operate. For the remainder of the time the steel was erected, and therefore no time was lost for erection purposes.



Another factor which I think is becoming increasingly important, going back to waste management, is this. Because we are going for an accurate system and a programmed system, we are achieving a far better site appearance. The site looks much more professional, tidier and when people are looking at the site, and might be looking from a potential purchasing point of view, it does look more professional and more likely to service what they are requiring. That shows the position after four days. This is just a close-up shot to show that the panels themselves, that particular wall there is one panel and you can see the covering, and that is the joists with the floor covering on, and the second lift being put up. All you have to install in scaffolding terms is a handrail just to protect the operatives on that floor.



This is the underside of a floor. The joists are constructed in a lattice format which therefore means obviously, as I said earlier, that all services can be passed through easily. There are service holes in the cross members and those holes there are purely for lifting purposes, in other words the crane can actually be used to lift the cassettes in place and those holes are sealed when the house is finished.

In terms of sales benefit, I think one has to look at it from the point of view that it is all very well my talking about how to build it but one has to provide



benefits in terms of the houses themselves. We can achieve a rapid construction programme, as I mentioned earlier. Therefore to some extent one can predict to a potential purchaser when the house is going to be ready. Not only that, one can predict when the whole development will be completed because of achieving a site appearance, and a tidy site can be achieved, then obviously groundwork is going to be finished earlier, which means the whole concept of the development can be improved. There is no drying out to worry about. When the house owner moves in, they have moved into a house which has not been subjected to severe weather conditions like we had in October. There is the early completion of groundwork, as I mentioned. All these factors lead to a load defect problem. We all know those house builders allow a lot of money for defects. It is often a hidden amount of money but probably something in the region of £500,000 per unit being built is allowed for defects. If you can save that money by going for accurate build method, as I have suggested, you can cut out all these problems.

Having achieved that, then one can go for early occupation because effectively, if you have achieved a dry environment, you have achieved a building without any defects, you have the groundwork sorted out, you have the appearance of the site cleared, you can actually get people into those houses very quickly.

In terms of the customer benefits, number one has to be quality. The rooms are square; nothing shrinks, the seal is stable, you do not have any cracks in any walls, the staircases do not creak, the baths and showers do not move because we have a rigid floor. The floors do not creak because we have a stable platform and a steel structure. We are achieving a much higher quality finish which will be far more acceptable. Certainly the purchaser today is far more discerning than in the past and is looking for such quality.

We are achieving excellent sound insulation. I think the systems we used and designed, working with Corus, is to achieve a sound performance within the buildings which will exceed the new regulations coming into force.

Equally permanent performance is good. There is always a big debate, when one is selling a property: do you try to convince the new purchaser that they will save money because their heating bills will be lower and therefore the house has been designed to suit that? Is that a selling point? Maybe not, but it might be.

Then there is the overall stability of frame construction, which again goes back to the fact I mentioned earlier, of having a stable platform, no shrinkage and therefore no defects. All that really can be summarised within innovation. What one is trying to do is to meet the Egan



principles. We are trying to cut construction costs, we are trying to make improvements in production and boost profits.

Certainly in terms of construction costs, there is a big argument for partnering with the supply chain, there is a big argument for looking at early design implications: why design it in a traditional build, why not think about building it in a frame system when you actually design the property and therefore reap the benefits of that, in terms of that you can get more floor area using a steel frame system? One looks at the costs. We are always coming back to costs because a quantity surveyor in every situation will look at the cost comparison between traditional build and frame build and say, well, frame build is more expensive than putting up a block or brick wall. But you have to argue that if you are looking at a system, then there is an opportunity for fixing costs at a very early stage. You do not have these sudden extras because the bricklayer needs extra money because of the details required to achieve certain situations.

Improving production really comes out of the output of the system, that we can actually step up production. If Corus can meet demand, we can build houses faster and quicker and therefore become more effective in our overheads and our prelims. All these can be achievable by good management and management themselves are having to look at the improvement of methods of construction and look forward to how they can best utilise factory methods and factory design methods to improve the whole output.

These all end with giving us more profit because we actually can produce houses, sell them quicker, get them right first time. Then we achieve no defects, we get our money in quickly: on time, on quality, zero defects. Those have to be prime drivers.

Then of course we have the changes to parts E & L, which we will hear about later on, but again steel frame does have the ability to meet these requirements. Again there will be lots of questions asked as to cost implications of applying different layers of insulation and the like. However, in reality steel frame and probably timber frame can achieve the requirements of both parts E and L rapidly. Acceptance of innovation is important too.

Purchasers, in general term, based upon the market research that has been done, indicate that purchasers are very happy with a steel frame or even timber frame construction. There is no resistance to that forms of building so why not use it? We all believe that maybe, as said earlier by the Minister, that timber frame in 1982/83 was ostracised because of the World in Action programme but that is a long time ago now and people buying houses actually want to buy a house which has no defects, is a high quality product and is in the right location. Method of construction does not feature very highly in their thought process, they want something that will be effective.

The lenders, in general I do not know of any lender who is not prepared to finance or mortgage a house built in steel frame or timber frame. We have no problems in that respect.

Architects and consultants, that is probably where we have the biggest drawback, with respect to everybody here. In many respects the change or innovation that one wants to see in construction is somewhat hindered by the continued traditional approach of architects to building. No consultants have actually come to me – and I am responsible for research and development for Crest Construction – no architect has come to me and said: "We're thinking of introducing a particular build method or construction method into this particular phase. What do you think of it?" It is always the other way round: they have designed something, we say: "Can you actually build it in a different way?" "Well, no, it is traditional." I do really pose the question: is it not about time that more architects gave more thought to innovation in construction?

We can always achieve an aesthetic appearance, whatever method we use, whether it is a steel frame or a timber frame. If you want to have nice detail on the external façade, that can be achieved, but in terms of actual construction, we need to innovate more, we need to think through more carefully how we can speed up production and achieve a higher quality and no defects.

I think that is my closing point, really, and thank you for listening.