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Creators: Field, M.

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A comparison of off-site manufacture techniques for UK housing construction

Dr Martin Field, Institute for Urban Affairs / Collaborative Centre for the Built Environment, University of Northampton, UK

[martin.field@northampton.ac.uk]

Content of presentation

- ❑ Background to Off-site research project
- ❑ Objectives and method for Off-site comparisons
- ❑ Participating Off-site construction techniques
- ❑ Indicative results and evaluations
- ❑ Observations and concluding remarks

Background to Off-site research project

- ❑ East Midlands RDA / ERDF funds, 2011
- ❑ Can O/S be a means to improve economic sustainability?
- ❑ Can O/S be a driver for improved construction performances?
- ❑ Limited research information on contrasts *between* O/S techniques (panels or volumetric?)
- ❑ Limited detail to compare O/S benefits for clients – encourage evaluation between willing firms
- ❑ Real development site and partner with 'Scheme Brief', as incentive for competitive participation
- ❑ RDA demise left Steering Group's 2011-12 evaluation report unpublished

Off-site research - Terms of Reference

- ❑ Details of technical descriptions to proposed O/S solution(s) and summary of works on & off-site
- ❑ Details of time from project inception to production, delivery and completion
- ❑ Details of the likely performance standards of each proposed O/S technique
- ❑ A summary of all fees and construction costs of each O/S solution to 32 house plots
- ❑ A comparison against an abstract calculation of RICS 'traditional' construction cost data
- ❑ Info on response of residential mortgage market to each proposed O/S process / technique
- ❑ An evaluation on the future housing management / maintenance issues from proposed properties.

Off-site research - General understanding of methods

<u>Key Tasks</u>	Traditional build	Open Panel	Closed Panel	Closed Panel / Pod	Modular / Volumetric
Inner Leaf	Site	Included	Included	Included	Included
Main structure	Site	Site	Option	Option	Included
Electrical	Site	Site	Option	Included	Included
Plumbing	Site	Site	Option	Included	Included
Insulation	Site	Site	Included	Included	Included
Dry lining	Site	Site	Included	Included	Included
Tape & Joint	Site	Site	Site	<i>Part off-site</i>	Included
General Joinery	Site	Site	Site	<i>Part off-site</i>	Included
Decoration	Site	Site	Site	<i>Part off-site</i>	Included
Outer Leaf	Site	Site	Site	Site	Included
Roof finish	Site	Site	Site	Site	Option

Off-site research – project participants

- ❑ *Open invitation to O/S sector : 4 firms accepted*
- ❑ Method A – A prefabricated panelised timber wall and roof system incorporating insulation and supplied in variable sizes flat-packed to site.
- ❑ Method B – Timber based pre-constructed panel units, fully complete except for external cladding and roof construction, fitted to pre-prepared foundations.
- ❑ Method C – A patent structural timber insulated panel system supplied flat-pack by one partner and constructed on site by another.
- ❑ Method D – A panel-based system using factory made brick faced insulated concrete sandwich panels and pre-cast concrete floor screeds, connected and reinforced on-site

Off-site research – submitted solutions

- Free scope to return individual documentation
- On and off-site construction %'s
- Technical performance
- Speed and time
- Indicative costs

Off-site research – construction %'s

- All submissions given a grid against which they should describe construction processes:

List of construction tasks	Where will 'off-site' method undertake this?
Inner Leaf	
Main structure [etc...]	

- Submitted O/S construction techniques varied considerably in how much they carried out works *off-site* : from 20% where pre-made standard panels were proposed to 50% where panels would be bespoke.

Off-site research : proposed performance

- ❑ Code for Sustainable Homes
All submitted proposals could comply with the requirement for CSH Code 4 to all homes.
- ❑ 'U' values for walls
U values varied by type of O/S approach - from 0.1w/M2k to 0.18 w/M2k
- ❑ NHBC approval
Three of the proposals claimed NHBC registration with the fourth being processed.
- ❑ Sound insulation
All proposals claimed to meet Building Regs requirements for airborne sound between semi-detached houses
- ❑ Thermal Comfort
3 responses : SAP calculations; ventilation distribution system; and high thermal mass + mechanical vents.

Off-site research : performance issues

	Method A	Method B	Method C	Method D
Code for sustainable homes	3 -4	4	4	4
'U' values	0.1	0.18	0.1	0.13 – 0.18
NHBC approval	√	√	√	Being processed
Fire resistance	Up to 2 hours	Letters of guarantee	√	Doc B p.A12 Build Regs
IT Futureproof	Capable	√	√	√
Sound insulation	60db	5db above Build Regs	58db	Build Regs Doc E 2-wall

Off-site research : projected speed & time

- ❑ Time from inception to delivery to site per semi-detached plot varied between 4 weeks and 13 weeks.
- ❑ On-site construction per semi-detached plot varied from 11 to 18 weeks.
- ❑ Fastest 'inception to completion' per plot was 19 weeks / longest was 26 weeks.
- ❑ Overall completion period for all 32 units ranged from 31 weeks to 52 weeks.
- ❑ [Comparison : large house building firms consulted suggested an on-site construction time of 15-20 weeks per plot.]

Off-site research : speed of delivery (weeks per semis)

	Inception to delivery	Order to completion on site
Method A	13	24
Method B	8	19
Method C	4	20
Method D	8	26

Off-site research : projected costs

- ❑ Total projected cost of proposal
- ❑ 32 homes, exclusive of foundations but inclusive of site preliminaries, averaged £3,060,000.
- ❑ Site preliminaries ranged from £330,000 to £370,000.
- ❑ One submission reduced bed spaces to 101 - other proposals provided 118 bed spaces.
- ❑ All allowed for an average of 37 car spaces.
- ❑ M₂ costs ranged from £650 to £1200 : relatively high average of £920 compared with RICS 'traditional' costs.

Off-site research : availability of mortgages

Method A	Properties already accepted
Method B	Acceptable by Council of Mortgage Lenders
Method C	Being processed no reason to refuse indicated
Method D	Letters available from mortgage providers

Off-site research – indicative evaluation 1

- Draft Steering Group report made following comments :
 - “Dwellings constructed using submitted off-site manufacturing techniques [referred to as Modern Methods of Construction - MMC] can satisfactorily achieve established performance requirements.”
 - “On average, the use of MMC for multiple dwellings could be significantly faster than traditionally-built housing where construction can progress in an uninterrupted fashion.”
 - “On a cost per square metre basis MMC for housing can seem to be more expensive than traditional construction but significant savings on time-related costs can be achieved for multiple dwellings where construction can progress in an uninterrupted fashion.”
 - “On the basis of the information provided there appears to be little evidence of difficulties obtaining loans or mortgages for properties constructed using the systems examined.”

Off-site research – indicative evaluation 2

- ❑ Project restricted by limited range of O/S methods and techniques – data sets too slim
- ❑ Willing participation, but submitted material very varied and difficult to compare
- ❑ Disparate interests and influences of Steering Group members and participants
- ❑ Indicative sales prices not useful within context of generating 'open' comparisons
- ❑ Terms of Reference only met in part
- ❑ O/S method still being supported by developer, but evaluative approach needs to be repeated

Concluding observations & remarks

- ❑ The “Off-site” term includes very disparate amounts of construction ‘on’ and ‘off’ site
- ❑ UK O/S market not easy for new entrants to enter, either from inside or outside of UK
- ❑ Study did not help add to information for clients / commissioners to compare O/S methods
- ❑ Claims for economic or technical sustainability from O/S methods need assessment against ingrained UK housing market norms
- ❑ Construction challenges to feature within 2013 focus of ESRC “Tensions & Prospects” research