

Modern Methods of Construction



Modern methods of construction

Case studies

Modern Methods of Construction (MMC) are defined as those which provide an efficient product management process to provide more products of better quality in less time. It has been defined in various ways: pre-fabrication, off-site production and off-site manufacturing (OSM). But while all OSM is MMC not all MMC is OSM. It can be classified in various ways and may involve key services (e.g.) plumbing, key items (e.g. foundations) inner shell (walls etc.), external walls, or any combination of these elements. It can also be classified by material (timber, steel, concrete and masonry).

Home Builders Federation

MMC involves a wide range of techniques & materials with the overarching aim to minimise the amount of time required to construct a building on site.

Differing techniques

- Volumetric modular
- Timber frame & steel frame flat packs
- Panel systems
- Hybrid systems (e.g. volumetric & panel)
- Light steel frame (LSF) systems
- Pre-cast structural panels
- Structural Insulated Panels (SIPs)
- Pods

Volumetric modular construction

- Factory based production of modules
 - Shipping container
 - Rigid frame construction
- Fully assembled
- Then transported to site
- Standalone or combined – several storeys high
- Historically used for temporary buildings
- Wide variety of applications



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Panellised system: Timber frame flat pack

- Open-frame systems:
 - Softwood vertical studs & horizontal rails
 - Trussed rafters
 - Wood-based panel sheathing
- Closed panel systems:
 - As per open-frame but with pre-installed insulation , protective membranes, linings, external joinery
- Applications include housing, low-rise commercial & some high-rise apartment



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Panellised system: Steel frame flat pack

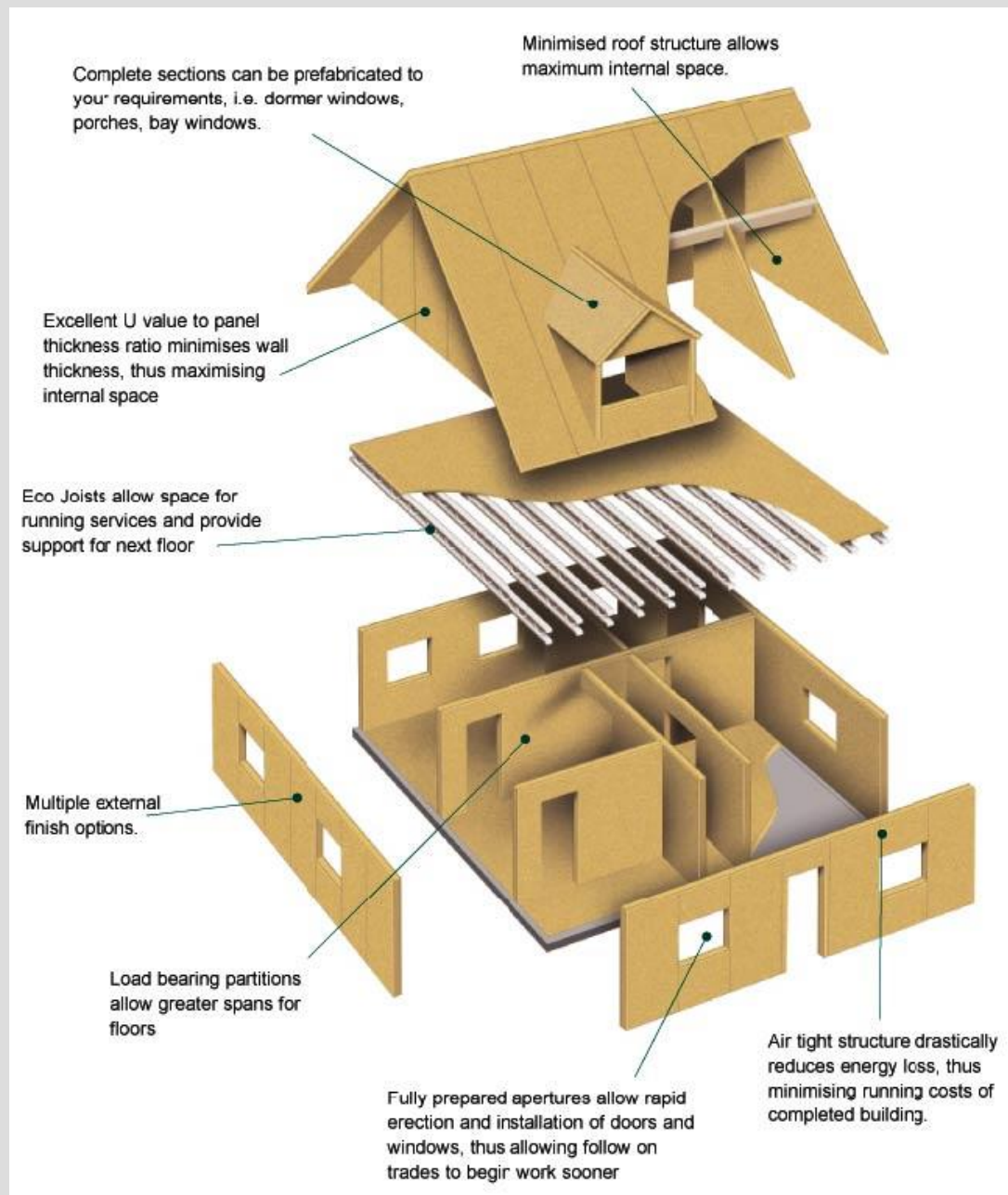
- Warm frame construction panels + insulation
- Typically comprise:
 - Insulated external wall panels
 - Party walls
 - Flooring
 - Some roofing
- Generally applied in housing



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Panellised modular systems

- Off-site constructed panels
- Highly insulated
- Differing types
- Can be used in conjunction with other systems (hybrid)



Light Steel Frame (LSF) System

- Typically used for supporting façades
 - Insulation, drylining & external wall cladding
- Systems are either:
 - 'Stick' systems (site-assembled)
 - Frame systems (off-site mfr)
 - Open type (bare light gauge steel panels)
 - Closed type (factory assembled according to client requirements)
- Two basic applications:
 - Infill panels
 - Continuous panels



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15

Pre-cast structural panels

- Concrete panels
- Insulated panels or cross-wall technology
- Key areas of application include external walls, party walls & basement walls
- Come with pre-formed window apertures

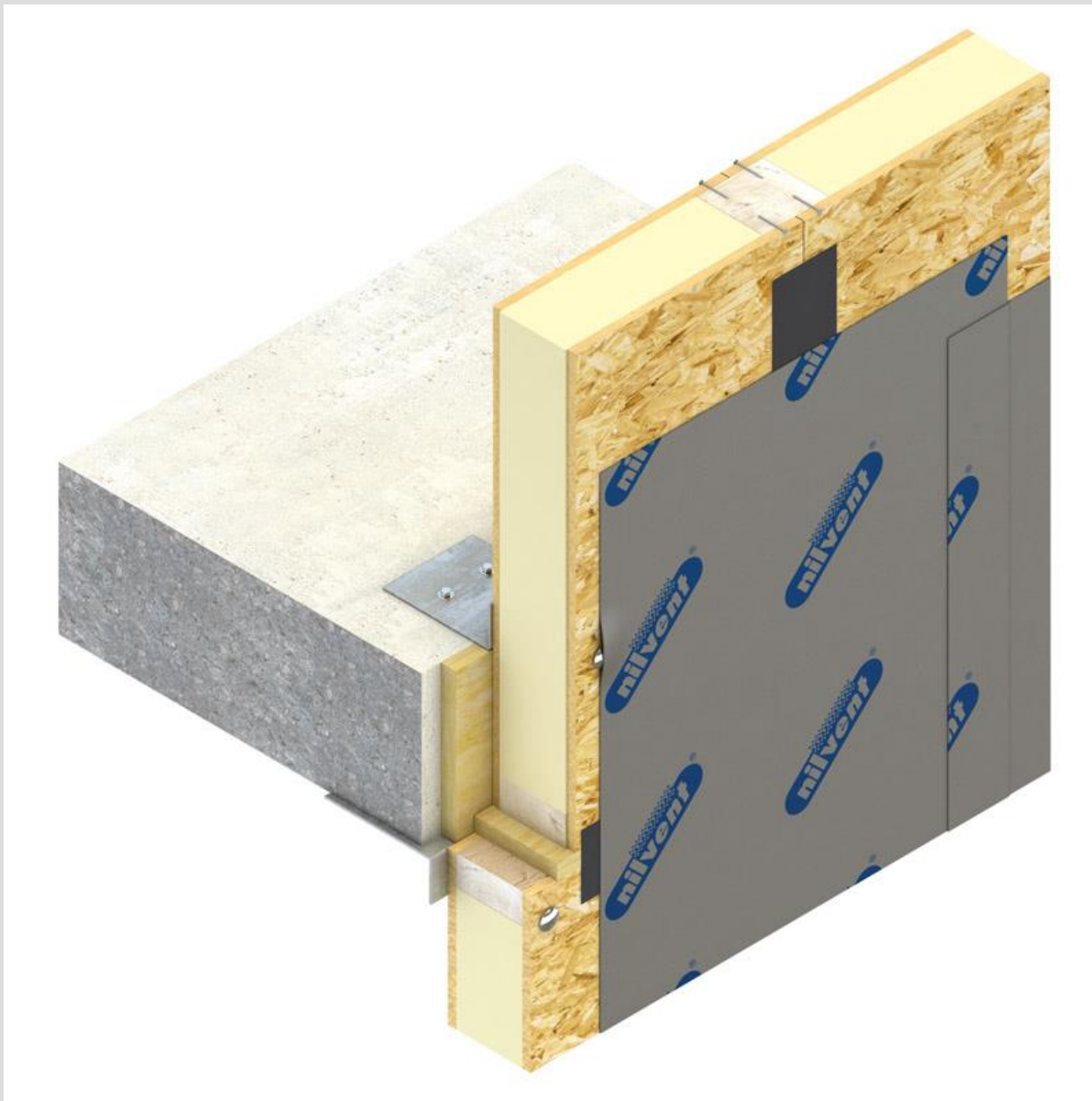


19/04/2016

17

Structural Insulated Panels (SIPs)

- Panels with insulation core
 - Typically OSB with expanded polystyrene core
- Mainly used for external walls, roofs, floors, party walls & roofing
- Also has non-structural applications
 - Infill panels, overcladding
- Applications include social & private housing up to 4 storeys



Pods

- Type of volumetric construction
- Kitchen or bathroom
- Include sanitary ware & tiling
- Ready to be plumbed in
- Successful where are significant repetitions
 - E.g. Hotels, residential, student accommodation



19/04/2016



21

Table 4: Selected Key Types of MMC – Market Size and Construction Applications

Types of MMC	Vol. prod-cap.	UK market £m MSP	Avg growth rates p.a. % 2000 - 2005	Est. % of imports	Main Existing Areas of Construction Application
Volumetric modular	Med	200	10 - 15	10 - 15	Cellular single living accommodation: MoD, prisons, KWL, budget hotels; out-of-town retail back offices; forecourt stores; stand-alone fast food outlets; hospital wards & operating theatres; primary schools & nurseries; university tutorial blocks; school classroom extensions; 3-4 star hotel extensions; sports pavilions; shower blocks; airport terminal buildings; social housing apartment blocks
Panellised modular		565			
Timber frame	High	475	40 - 45	5 - 10	Up to 4 storeys - private and social housing
Pre-cast	Med	80	10 - 20	5 - 10	Up to 6 storeys - cellular single living accommodation: student accommodation, KWL, hotels; private housing; apartment blocks; school buildings; industrial buildings; prisons
Steel frame	Low	25 - 35	5 - 10	0	Mostly 2 storeys - private and social housing
SIPS/SIRPs	Low	30 - 35	5 - 10	30 - 40	Up to 6 storeys - private and social housing
Building envelope		545			
Composite panels	High	325	4 - 6	10 - 20	Mostly industrial buildings, warehousing, out-of-town retail, business park offices
Pre-cast cladding	High	120	5 - 8	5 - 10	Mostly bespoke/prestigious architect-designed buildings
LSF systems	Med	50	20 - 30	5 - 10	Large facades/high-rise – apartments, SLA, hospitals, hotels, airport buildings, retail
Pods	High	125	40 - 50	50 - 55	Cellular single living accommodation: MoD, prisons, hotels rooms, student halls of res.; apartment blocks
Pre-cast structural	Med	110	Mixed	Low	Varied & wide-ranging depending on the type of products
Insulating concrete formwork	Low	20	N/a	Low	Mainly housing
Tunnel form	Med	130 *	Strong	Low	Large-scale cellular construction developments

Source: AMA Research/trade estimates

Table 7: MMC & Estimates of Waste Reduction through Substitution for Traditional Building Methods

MMC	Est. % reduction	Level of confidence
Volumetric building systems	70 - 90	Reasonable
Timber frame systems	20 - 40	Broad estimate – depends upon the level of pre-fabrication
Concrete panel systems	20 - 30	Broad estimate
Steel frame housing systems	40 - 50	Broad estimate
OSB SIPS	50 - 60	Reasonable – depends on the level of prefabrication
Composite panels	20 - 30	Broad estimate
Pre-cast cladding	40 - 50	Broad estimate
LSF systems	40 - 70	Reasonable – depends on the level of prefabrication
Bathroom/shower & kitchen pods	40 - 50	Broad estimate
Pre-cast flooring	30 - 40	Broad estimate
Thin joint masonry	30 - 40	Broad estimate
Insulating concrete formwork	40 - 50	Broad estimate
Tunnel form construction	50 - 60	Broad estimate

Source: AMA Research/trade estimates

Table 8: Main MMC & End of Life Disassembly for Recycling

MMC Products	Comment
Volumetric building systems	Fastening systems enable ease of disassembly. Main components for recovering for recycling include: light steel frames, cladding, drylining, membranes
Timber frame systems	Easy to disassemble. Most components suitable for chipping but wood treatments make post-use timber unsuitable for some recycling applications
Pre-cast panel systems	Easy to disassemble. Suitable for crushing for use as recycled aggregate
Steel frame housing systems	Fastening systems enable ease of disassembly. Main components for recovering for recycling include: steel frames, cladding, drylining, membranes & insulation
OSB SIPS	Fastening systems enables ease of disassembly. OSB panels can be chipped and urethane insulation core can be powderised.
Composite panels	More difficult to disassemble and recycle where urethane insulation core bonds to panels. Where insulation core is mineral wool, fastening system makes disassembly easy
Pre-cast cladding	Suitable for crushing for use as recycled aggregate
LSF systems	Fastening systems enable ease of disassembly. Main components for recovering for recycling include: light steel frames plus cladding, drylining, membranes & insulation on closed systems
Bathroom/shower & kitchen pods	Easy to disassemble. Steel frames can be recovered for recycling but not the ceramic ware and plastic shells
Pre-cast structural panels, flooring	Not easy to separate insulation from pre-cast leaves

Source: AMA Research

Benefits of MMC

- Quicker construction time
- Cost-effective construction
- Better resource use
 - Products with recycled content / sustainable sources
- Less waste
 - Less to do on-site
 - Ability to 'lean' manufacturing processes
- Differing skills requirements
- Links to sustainability...

Case studies

Oxley Woods, Milton Keynes; Low Carbon housing





Flat Pack

Richard Rogers Partnership/George Wimpey





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29

Sixth Avenue Apartments, York; Modular apartments



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31

Ladies Walk Health Centre, Sedgley; First PFI project using off-site construction



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32



Corefast, Tata Steel



Trinity Buoy Wharf, East London

- Urban Space Management





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Barling Court housing, London, PCKO Architects



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38



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39



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40

Exeter Trust House, University of Exeter



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Higher Broughton redevelopment, Salford





Nick Everton House,
Manchester
Volumetric high rise
construction

Travelodge Hotel
construction using off-
site container modules,
Hemel Hempstead

