Supporting Technical Education Teaching:

**Curriculum Resources**

Teaching Guide

Topic: Modern Methods of Construction

# Version information

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This resource is part of a series of materials to support technical education teaching. The approach to developing the materials draws from research led by Professor Kevin Orr that sets out a model for understanding of technical education pedagogy.

The curriculum development begins with the knowledge that students are working to learn and apply. Teachers draw from their subject and industry expertise, and their knowledge of their students, to make decisions about the core concepts the curriculum will focus on, how they will sequence these concepts, and the activities that are selected to support students’ learning. The decisions behind the resources suggested in this topic are the result of choices made by the curriculum development team, which will be reviewed and improved by teachers’ decision-making and ongoing reflection in their own circumstances.

The materials also seek to support teachers in bringing classroom and industry closer together, by providing assets that draw from authentic industry materials, and using opportunities to capture workplace practice that can be shared with students.

Materials for other topics are available at: [www.technicaleducationnetworks.org.uk](http://www.technicaleducationnetworks.org.uk)

HEALTH AND SAFETY

It is assumed that activities outlined in this Teaching Guide will be undertaken in suitable facilities or work areas and that good practices, appropriate use policies and procedures will be observed. Teachers should consult their employers’ risk assessments before use and consider whether any modification is necessary for the particular circumstances of their own class/institution.

Acknowledgements

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T Level Technical Qualification is a qualification approved and managed by IfATE.

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Introduction

This document for teachers outlines both the topic area covered, and the approach to using the suite of resources and assets for each lesson. Unless otherwise stated, definitions of key terms have been developed by the authoring team and reviewed in the context of the activities. Teachers may choose to revise definitions as necessary.

# Topic purpose

There are eight lessons and each lesson is assumed to be 1.5 hours. Teachers may want to adapt the suggested sequencing of concepts and activities as appropriate for the students and circumstances. The lessons are broken down to provide teacher flexibility on the depth covered in the activities; lessons can also be split over multiple shorter lessons if required.

This topic is an introduction to Modern Methods of Construction (MMC), which has an impact on the way we design, build and maintain the built environment. Digital development and new, more sustainable methods are increasingly being used across the sector that the students will experience in placements and their future careers. It is important to understand the roles, responsibilities and interactions of construction and trade professionals, including the stages where they are involved in the design of a construction project with high levels of professionalism. This topic supports teachers to guide their students through some of the new processes.

There are also opportunities to build several essential skills that are developed during the course and general competencies for maths, English and digital.

The content in the lessons can be reinforced throughout the course to support students’ learning. For example, if a student will be working with the design team or construction manager*:* when discussing a forthcoming industry placement, one objective can be for students to look for these techniques in the workplace, discuss the importance with their supervisor, ask about design software and project management software used and note this learning in their logbook. For example: [support.tlevels.gov.uk/hc/en-gb/articles/360015345420-Industry-placement-logbook-for-students](https://support.tlevels.gov.uk/hc/en-gb/articles/360015345420-Industry-placement-logbook-for-students)

The language and terminology used by the learners will give the tutor an understanding of the depth of their learning and subject confidence. Placement logbooks and feedback from employers can further map how the students are using their new knowledge, as well as grading and progressive feedback throughout the topic.

The resources support delivery of MMC in the core but may also provide some underpinning knowledge for areas of the occupational specialism. They are presented as a full teaching sequence and guidance is given for teachers who want to use the resources in this way. However, the intention is that they can also be used flexibly, and teachers may choose to embed some lessons or individual resources in their own schemes of work, depending on their approach and timetabling. The awarding organisation recommend using real scenarios and contextualisation, which these resources will provide, whether the full teaching sequence is implemented or just parts of lessons.

# Industry importance

With a pressing need to improve productivity, safety and quality, as well as to reduce waste and uncertainty in the cost and programme of construction, there is a drive in the industry to more consciously select the optimal construction technique rather than broadly adopting well-established methods. Some of these techniques borrow ideas from the manufacturing industry, others are enabled by advancement in technology such as Building Information Modelling (BIM), yet some others involve improvement in production techniques. The wide array of approaches is grouped under the term Modern Methods of Construction. Previously, further education has focused on traditional methods but advances in the industry mean that students' knowledge needs to reflect current practice.

*“The development of a truly efficient UK housing strategy to achieve 300,000+ homes per annum (1.5m over the next 5 years) simply cannot be delivered without a significant amount of MMC. MMC not only delivers significant benefits on time, predictability, cost, sustainability, and greater control over zero carbon targets, it is possibly the only way we will develop construction innovation, to reach much higher standards of quality and energy efficiency, without the significant gaps we see today.”*

***Mike Ormesher, Project Manager***

# Industry links

* The UK Government’s Modern Methods of Construction working group report, which outlines the MMC Definition Framework: [www.gov.uk/government/publications/modern-methods-of-construction-working-group-developing-a-definition-framework](http://www.gov.uk/government/publications/modern-methods-of-construction-working-group-developing-a-definition-framework)
* The UK Government’s The Construction Playbook, which includes MMC guidance notes: [www.gov.uk/government/publications/the-construction-playbook](http://www.gov.uk/government/publications/the-construction-playbook)
* The Design for Manufacture and Assembly (DfMA) Report and Overlay provides guidance on implementing seven categories of MMC through each RIBA Plan of Work Stage: [www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work](http://www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work)
* Planning Portal gives guidance on Planning information and Building Regulations via Approved documents: [www.planningportal.co.uk](http://www.planningportal.co.uk/)
* Cast Consulting, for West Midland Combined Authority, provide MMC definitions and examples of different companies that delivery each type of MMC by category: <https://governance.wmca.org.uk/documents/s7945/MMC%20Definitions%20and%20WMCA%20Supply%20Chain%20Appendix.pdf>
* Designing Buildings Wiki is a reliable reference source for UK-based terms approved and updated by Chartered Institute of Builders (CIOB): [www.designingbuildings.co.uk/wiki/Home](http://www.designingbuildings.co.uk/wiki/Home)
* The Institution of Structural Engineers page outlining MMC terms and linking to other MMC-related articles, presentations and case studies: [www.istructe.org/resources/design-and-construction/mmc](http://www.istructe.org/resources/design-and-construction/mmc/)
* Autodesk supply useful industry videos with helpful links to use of CAD and BIM and MMC: [www.autodesk.com/autodesk-university/construction](http://www.autodesk.com/autodesk-university/construction)
* An interactive showing some different aspects of MMC from Balfour Beatty: [www.interactive.balfourbeatty.com/modern-methods-of-construction/p/1](http://www.interactive.balfourbeatty.com/modern-methods-of-construction/p/1)
* Cast consultancy provide outlines of a variety of MMC case studies:

[www.cast-consultancy.com/projects](http://www.cast-consultancy.com/projects/)

* HS2 video showing a tunnel boring machine (TBM): <https://youtu.be/sGEMHn01p4g>
* Balfour Beatty Academy offer some videos related to MMC (free institutional sign up required): [education.balfourbeattyacademy.com/education-level/apprenticeship-or-t-level](https://education.balfourbeattyacademy.com/education-level/apprenticeship-or-t-level/)
* Information regarding wall, floor and roof cassettes from McVeigh Offsite Ltd: <https://www.mcveighoffsite.com/engineered-timber-cassettes/>
* Introduction to steel framing systems (SFS) from FrameCAD: <https://framecad.com/steel-framing>

# Prior learning

Students do not require prior knowledge of MMC before starting the topic. However, it is expected that as part of their current studies, students will have a foundation of understanding of what is involved in traditional methods of construction to be able to understand how MMC methods differ. Some experience of drawing using computer-aided design (CAD) and manual methods would be an advantage.

Experience of and familiarity with MMC will also differ in students depending on their exposure while on placement. If they have not yet had placement experience or have not encountered MMC while on placement then they will not be able to relate the topic to experience. Those who have experiences from placement will be able to contribute their knowledge to discussions and cross-reference their placement into content learning.

# Accessibility

The teaching materials have been designed to provide teachers with a flexible framework, including different approaches to activities, suggested consolidation activities to further embed knowledge, and adaptable study questions to assess learning. As with all resources, teachers will wish to consider the specific needs of their students when using the materials, including Special Educational Needs and Disabilities (SEND). Although content has been reviewed, accessibility in externally linked resources cannot be guaranteed.

Learning outcomes and specification coverage

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| **Lesson** | **Learning outcomes** | **Specification coverage** | **Skills and general competencies** | **Links to other specification content** |
| **1 & 2** | Students will be able to:   * describe what is meant by modern methods of construction (MMC); * explain why MMC is used; * outline the impact that using MMC has on job roles in the industry; * discuss the use of MMC in placements (if applicable). | **4.1** Students must understand construction methods used in residential, commercial and industrial construction contexts, and be able to discriminate between methods and select appropriately  **4.1.2** Off-site construction methods  **9.7** Students must be able to understand the roles, responsibilities and interactions of construction and trade professionals, including the stages where they are involved in the design of a construction project | Skills  **CS1** Participate in group and class discussions to examine concepts and approaches to produce solutions to construction problems  **CS1** Synthesise information from given case studies, construction projects or site visits  General competencies  English:  **E2** Present information and ideas  **E4** Summarise information/ideas  **E6** Take part in/leading discussions  Digital:  **D3** Communicate and collaborate | 8.1 Students must understand the benefits of good design, including delivering within budget, to product performance  8.2 Students must understand the principles of design for a construction project  9.3 Students will understand the principles of the integration of the supply chain through partnering and collaborative practices  10.1 Students will understand the importance of sustainability when planning and delivering a construction project  10.1.2 Designing to use sustainable construction methods and materials  10.1.3 Use of construction site practices that minimise the effect on the natural and physical environment |
| **3** | Students will be able to:   * identify and describe different types of off-site construction methods; * discriminate between off-site methods and select appropriate method for different situations. | **4.1** Students must understand construction methods used in residential, commercial and industrial construction contexts, and be able to discriminate between methods and select appropriately  **4.1.2** Off-site construction methods | Skills  **CS1** Participate in group and class discussions to examine concepts and approaches to produce solutions to construction problems  General competencies  English:  **E3** Create text for different purposes and audiences  **E5** Synthesise information  **E6** Take part in/leading discussions  Digital:  **D1** Use digital technology and media effectively  **D3** Communicate and collaborate | 8.1 Students must understand the benefits of good design, including delivering within budget, to product performance  8.2 Students must understand the principles of design for a construction project  8.3 Students must understand the design process for construction projects, from conception to completion  10.1 Students will understand the importance of sustainability when planning and delivering a construction project |
| **4 & 5** | Students will be able to:   * identify the stages of on-site and off-site construction for a volumetric modular house build; * produce a schedule for the construction of a prefabricated modular house. | **9.4** Students must know how projects are procured within the construction sector  **9.4.1** Documentation and basic information required for procurement and tendering  **13.3** Students must understand approaches to project management throughout the whole life cycle and work stages of a construction project   **13.3.2** Interpretation and production of project management tools and documentation; planning and management tools – Gantt charts, bar charts, critical path analysis, line of balance and suitable planning software. | Skills  **CS1** Produce reports and presentations for construction professionals, clients or for non-technical audiences such as the public  **CS1** Synthesise information from given case studies, construction projects or site visits.  **CS3** Applying a logical approach to solving problems, identifying issues and proposing solutions  General competencies  English:  **E4** Summarise information/ideas  **E5** Synthesise information  Maths:  **M10** Optimise work processes  Digital:  **D1** Use digital technology and media effectively  **D2** Design, create and edit documents and digital media  **D6** Code and program | Supports application of learning and skills in the Employer Set Project and Occupational Specialism  8.1 Students must understand the benefits of good design, including delivering within budget, to product performance  8.2 Students must understand the principles of design for a construction project  8.2.2 Buildability  8.3 Students must understand the design process for construction projects, from conception to completion  9.3 Students will understand the principles of the integration of the supply chain through partnering and collaborative practices  9.7 Students must be able to understand the roles, responsibilities and interactions of construction and trade professionals, including the stages where they are involved in the design of a construction project  9.9 Students must understand how building information modelling (BIM), the Plan of Work (PoW), the Digital Plan of Work (DPoW), Employer’s Information Requirements (EIR) and the Common Data Environment (CDE) are used in construction projects and how the exchange of information can affect project delivery. |
| **6, 7 & 8** | Students will be able to:   * design a house to fulfil a client’s vision and specification using Autodesk® Revit software; * consolidate and test knowledge about MMC. | **8.2** Students must understand the principles of design for a construction project  **8.5** Students must understand applications of manual and computer-aided (CAD) techniques for graphical detailing, and be able to produce construction drawings, charts and diagrams  **8.5.2** CAD techniques to produce 2D and 3D drawings | General competencies **CS1** Produce rendered drawings and illustrations that could be used for marketing a development to the public or similar stakeholders  **CS1** Produce rendered drawings and internal plans in response to design briefs and contexts.  **CS3** Be able to interpret client vision and specification to produce outline design proposals to meet client needs  Skills  English:  **E5** Synthesise information  Maths:  **M2** Estimate, calculate and spot errors  **M3** Work with proportion  **M7** Interpret and represent with mathematical diagrams  Digital:  **D1** Use digital technology and media effectively  **D2** Design, create and edit documents and digital media  **D6** Code and program | Supports application of learning and skills in the Employer Set Project and Occupational Specialism  8.1 Students must understand the benefits of good design, including delivering within budget, to product performance  8.2 Students must understand the principles of design for a construction project  8.2.4 Environmental protection and sustainability  9.9 Students must understand how building information modelling (BIM), the Plan of Work (PoW), the Digital Plan of Work (DPoW), Employer’s Information Requirements (EIR) and the Common Data Environment (CDE) are used in construction projects and how the exchange of information can affect project delivery. |

Lesson guidance

# Lesson 1 & 2: Introduction to Modern Methods of Construction

These lessons introduce students to the concept of MMC and the reasons why the construction industry is increasingly moving from traditional methods towards modern methods. It also outlines how roles within construction are different when using these modern methods, with interviews with an Architect, Project Manager and Registered Building Inspector.

This guidance outlines two lesson’s worth of material, with the suggestion that the first lesson ends in the middle of Activity 1. However, depending on the time available this could be approached differently.

## Preparation

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| **Resources provided** | * L1 & 2 Slide deck * L1 & 2 Activity 2 Worksheet * L1 & 2 Activity 3 Worksheet 1 * L1 & 2 Activity 3 Worksheet 2 * Glossary |
| **Equipment needed** | Whiteboard and pens |
| **Safety factors** | None |
| **Prior learning** | * Students are likely to already understand traditional methods of construction and Environmental and Legal Constraints, as it is anticipated that 4.1.1, covering traditional methods, would be covered before this topic. Their awareness of traditional methods is likely to include: materials used, their site-based construction and the order of the stages of the construction work, for example, site strip, excavate foundations, concrete pour to foundations, brickwork to damp-proof course (DPC). * Some students may be familiar with some MMC from their placements. |
| **Common misconceptions** | * That there is only one (conventional) way to build a property. * Construction of a property always happens on site. * The planning of MMC is the same as with traditional construction. * MMC can only produce temporary buildings. * That buildings made using MMC are of worse quality than those which are traditionally constructed. * That buildings made using MMC are always of a standard size and style. |
| **Accessibility** | * Seek to ensure wide representation for any visiting speakers and case studies used. * Be aware that students may lack confidence in presenting at this stage of the course. Activities in this topic are an opportunity to establish principles of working in a collaborative manner, in a safe space. * For large classes, students could be split into smaller groups for feedback presentations. Alternatively, they could present their findings in different formats, such as short videos or blogs for other students. * Basic animation is used in the slides in this lesson to improve cognitive load, stagger information or present instructions. Teachers may wish to remove this feature if it is unsuitable for students. |

## Activity guide

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| **Introduction**  SUGGESTED TIME:  10 minutes  RESOURCES:   * L1&2 Slide deck – slides 2–9 | * Start by introducing the lesson objectives using slide 2. * Use slide 3 to prompt a brief discussion around MMC. Ask students to discuss what they know about modern methods of construction, in pairs or small groups, feeding back to the class. * It is likely that most students will know that some building elements can be prefabricated in a factory. * They may have heard of large MMC projects such as: The Shard, London; The Prefabricated Skyscrapers of China: Broad Sustainable Building (BSB); The Cube, Birmingham**;** or projects more locally. * Encourage students to share any knowledge from their placements. * Use slide 4 to briefly outline what is meant by MMC and provide a definition. * Slide 5 gives an overview of some of the main categories of off-site construction. When viewing slide 5, explain that the term ‘modular’ is often used in association with MMC and off-site construction. The use of this term varies in industry, but it is often used to describe construction where aspects are manufactured off-site and put together on-site. Therefore, both 3D volumetric and panelised construction can fall under modular. However, other people use the term interchangeably with volumetric construction. * Use slides 6–8 to go into more detail about volumetric construction, panelised systems, and sub-assemblies and components. * The MMC definition framework could be discussed at this point, as this is used in some industry settings. This categorises types of MMC into seven categories:   + Volumetric systems, shown on slide 6, fall into Category 1 Pre-Manufacturing – 3D primary structural systems.   + Panelised systems, shown on slide 7, fall into Pre-Manufacturing – 2D primary structural systems.   See: <https://www.gov.uk/government/publications/modern-methods-of-construction-working-group-developing-a-definition-framework> for more details on the MMC definition framework.   * Slide 9 encourages students to recognise that MMC extends far beyond domestic construction. The video (<https://youtu.be/sGEMHn01p4g>) shows how MMC has been used in the construction of HS2, the UK’s high-speed rail network. * Note that a lot of terminology is used around MMC and terms vary within the industry. MMC encompasses all modern methods, whereas off-site construction focuses on methods that happen in the factory or away from the construction site itself. The term ‘Construction-integrated manufacturing’ is in the specification, listed as an off-site method; it refers to the integration of building information modelling (BIM) within the manufacturing process. This means that pre-manufactured items will not be required to be adjusted once on site. The process of BIM will help to pre-determine any errors so the design can be adjusted before manufacturing. Some professionals use this term interchangeably with MMC. |
| **Activity 1: Why use MMC?**  SUGGESTED TIME:  30 minutes  RESOURCES:   * L1 & 2 Slide deck – slides 10–11 | * The aim of this activity is to first carry out an initial diagnostic check of the level of understanding around the advantages of MMC. Students then view videos from industry experts to introduce new knowledge that connects to prior knowledge. * Use slide 10 to structure an in-depth class discussion. Depending on class confidence either nominate a whiteboard scribe to record the main points, or a teacher to do this. Once the discussion is complete ask students to copy down the main points from the whiteboard for their notes. Students should not use tech to research answers to the questions during the discussion. * As an alternative to a whole-class discussion, split students into pairs. Give each pair one of the questions on slide 10 to discuss for a couple of minutes (ensure that all four questions are covered). Then ask the pairs to form small groups with others who have discussed the same question and to pool their responses. (This gives four small groups overall, each one covering one of the four questions.) Invite one or two people from each group to feed back their ideas to the whole class. * As well as listening out for the knowledge that the students may already have, assess the terminology they are employing and their confidence when using it. * This is to draw out any current knowledge. But if students have no prior experience of MMC they may be unable to answer these questions. If that is the case, move straight onto the video on slide 11 (<https://vimeo.com/1069603912>), which is an overview of MMC. * If students have MMC experience from their placements, consider asking them to give specific examples and details from that experience. These could be helpful additional prompts:   + For question 1: Have they noticed any difference in site procedures relating to the use of MMC?   + For question 3: Have they seen Building Control Officers visiting placement sites? What do they look for? * Once the discussion is complete, show students the video that outlines why we use MMC using slide 11. This shows an industry expert giving their take on why we use MMC. This covers: using MMC to standardise the quality of construction and reduce defects/risks; recreating weather conditions in the factory to test the energy efficiency of buildings (digital twins); reducing construction time on site; reducing waste because the main components are produced in a factory and then erected on site, and therefore cut-off materials can be re-used/recycled in the factory. * For more information on the University of Salford energy house, see: [https://www.linkedin.com/pulse/energy-house-20-heating-systems-report-summary-richard-fitton-ollde](https://www.linkedin.com/pulse/energy-house-20-heating-systems-report-summary-richard-fitton-ollde/) * Encourage students to make brief notes to detail the main reasons for using MMC. * At the end of the activity, students should understand that MMC:   + is different to traditional methods because most of the construction is off-site;   + is important because it enables us to build more quickly and to maintain quality, and the use of MMC works well with the building information modelling (BIM) process which is an integral part of modern construction;   + can involve having digital twins – interactive, virtual representations of the real construction project – these help construction teams to understand the physical requirements and constraints during the initial design and planning phases, and to determine how the buildings will perform in terms of energy efficiency for example;   + can help us meet building regulations due to factory quality standardisation following the design;   + can help the industry meet construction targets, for example providing social housing quickly to meet demand. |
| **Activity 2: Mind map**  SUGGESTED TIME:  20 minutes  RESOURCES:   * L1 & 2 Slide deck – slides 12–13 * L1 & 2 Activity 2 Worksheet | * This activity aims to help students synthesise and summarise information from Activity 1. * Students complete the mind map shown on slide 12 using the Activity 2 worksheet, giving as many answers as possible under the headings. Students complete this individually. * If students are struggling to synthesise information in this written format, suggest that they try to summarise verbally to a partner before writing. * Once students have completed the worksheet, discuss this together as a class, using slide 13 as a guide. This gives just some examples of answers. (Not all these points will necessarily be explicit in the video they have just watched, but they can be drawn out in discussion. Note that students can add to this mind map during and after watching the videos shown in Activity 3.) |

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| **Activity 3: Impact of using MMC on job roles**  SUGGESTED TIME:  60 minutes  RESOURCES:   * L1 & 2 Slide deck – slides 14–20 * L1 & 2 Activity 3 Worksheet 1 * L1 & 2 Activity 3 Worksheet 2 * L1 & 2 Activity 2 Worksheet | * This activity aims to give an insight into the impact of using MMC on job roles, by using real-life interviews with those in the industry. It also helps to tackle the misconception that the impact of MMC in the industry is the same as with traditional construction. * Using slide 14, ask students to write down a list of roles they would expect to see involved in modern methods of construction. Ask students for feedback, which could be written on the board. As a class, they should be able to come up with the following list: designers, quantity surveyors, site management, carpenters, plumbers, electricians, ground workers. * The next part of the activity involves three videos, which students watch, make notes on, then discuss before moving onto the next. There is a lot of detail in these videos and students will need to pull out the relevant information. Before playing the first video talk through the questions that the students need to answer, using slide 15. Students can use Activity 3 worksheet 1 as a reference to these questions during the videos. They can plan how they take notes, using the format that works best for them. Scaffold this by using Activity 3 worksheet 2 to help those learners who could feel overwhelmed by this task. * Slide 16: This video (<https://vimeo.com/1069605995>) is an interview with an architect. Once the video has finished give students time to finish their notes before starting a whole-class discussion. The students should have drawn out the following points:   + MMC encourages collaboration across the whole design team with strong focus on the initial stages;   + creativity and identity of buildings can be limited;   + architects need to understand the limitations MMC can place on design;   + must understand details supplied by MMC contractors and manufacturers to cover liability;   + use of digital modelling such as BIM, VR and AI;   + good communication with manufacturers essential to ensure the right fit on site;   + potential for future use of BIM to allow for more bespoke and flexible designs, and efficient and cost-effective solutions for customers. * If some students are struggling to participate in a whole-class discussion to examine these concepts, consider splitting the class into smaller groups and prompting the student(s) to take part by asking them a direct question in this less pressured environment. * Depending on the time available, this may be a suitable place to end this session. When resuming for Lesson 2, ask students to familiarise themselves again with the questions from slide 15 before starting the video on slide 17. * Slide 17: This video (<https://vimeo.com/1069604569>) is an interview with a Project Manager (PM). Once the video has finished, give students time to finish their notes before leading a whole-class discussion. The students may draw out the following points:   + Most of the construction happens off-site, so the PM must be aware of what’s happening both in the factory and on-site.   + A PM’s role is more complicated, with a need to understand each MMC product and how it is manufactured, and how all the products come together on-site.   + MMC means liaising with newer professions, including DfMA and MEP engineers, and QA managers; increased involvement with inspection and test plans, QA assurance and compliance checks.   + PM must capture inspections at every stage; tolerances are critical – with rigorous checks that the manufacturer is working very closely with ground workers on-site. * After watching the video, ensure students understand the terms DfMA engineers and MEP engineers:   + **DfMA: Design for Manufacture and Assembly** – the use of methods to optimise the design process of a building. The end goal of DfMA is to simplify a design to such a level that there are fewer (or more standardised) components and therefore will take less time and work to complete. Note that MMC and DfMA are both methods of optimising construction projects but MMC is a much broader term, which covers more than just the design phase – it is a range of construction techniques that improve productivity and efficiency throughout the full construction process.   + **MEP: Mechanical, Electrical and Plumbing** professionals who work together to ensure buildings are functional and fit for purpose. * Slide 18: This video (<https://vimeo.com/1069604879>) is an interview with a Registered Building Inspector (RBI). Once the video has finished give students time to finish their notes before starting a whole-class discussion. The students should have drawn out the following points   + Buildings still need to pass the same checks, but approach to inspecting MMC buildings differs, with more quality control off-site   + Different inspectors off- and on-site due to different locations   + Fire safety and water resilience are key issues that RBIs look for   + Challenge to make sure that the building is protected during transportation and storage * After watching all the videos, ask students to consider and discuss as a group the disadvantages of using MMC. This reinforces that the advantages they have identified don't automatically apply to all MMC and will depend on the factors involved. For example: it is not always the case that MMC is quicker, cheaper and easier – in some cases, it can cost more money; sustainability principles are not always upheld – some approaches may result in higher amounts of waste; there are many different types of software, e.g. for BIM, and not everyone on a project will have access to, or use, the same types; there can be a limited amount of creativity, leading to standardisation and unoriginal buildings suffering from a loss of identity. * Following the discussion, the students can return to the mind map they completed for the Activity 2 worksheet, adding any extra advantages and disadvantages they have gleaned from the videos. * Show students the DfMA Overlay to the RIBA Plan of Work on slide 19. This slide shows that there is provision for MMC already available by RIBA in the Plan of Work. Remind the students that RIBA produced the original Plan of Work to help organise the various roles at different stages of construction. With MMC changing individual roles’ participation, RIBA have provided the Overlay to bridge the gap and assist with the organisation of roles for new methods. This also highlights that MMC use is becoming more popular. For more information see the DfMA Overlay to the RIBA Plan of Work: <https://www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work#available-resources>. The image on the slide can be found on page 63 of the downloadable pdf. * By the end of this activity, students should understand that the MMC is a collaboration between parties and is moving construction methods forward in line with the demands of the industry. * Slide 20: If time allows, consider asking students to plan and film a one-minute video that synthesises and summarises the information – answering the question, ‘How are construction roles different when MMC is involved?’ They could do this in small groups, collaborating to decide on the script, any images they would like to show and presenting this information. Students could use their video software of choice to record this. * As well as checking the students’ understanding of information, the presentation gives an opportunity to check their use of language, and their confidence in using it, to assess their depth of learning over the lesson. |
| **Plenary**  SUGGESTED TIME:  60 minutes  RESOURCES:   * L1 & 2 Slide deck – slides 21–22 | * To bring placement experiences into this learning, students produce a slide show to communicate their experiences of MMC, including photos if possible (see slide 21). They should cover any use of MMC, any impact on job roles they experienced and any advantages of MMC they saw first-hand. They should reflect on whether any of their placement experiences differed from that covered in this lesson. Producing a slide show with images will help them to build on their digital communication skills. Encourage students to create simple slides, placing speaker notes in the notes section below each slide, or on a Word document. This will help them to avoid adding too much information on each slide. * Alternatively, they could write a blog post or simply supply photos from their placement to discuss with the class. * If students have not had placement experience of MMC, they could research a local project and summarise their findings, covering why MMC was used for that project, what the advantages and disadvantages were and any information about what job roles were involved. * If time allows, ask students to present their slide shows to the class or to small groups. * Students could be encouraged to use open AI responsibly here to help develop their presentations. * Revisit the learning objectives on slide 22 to close the lesson. |
| **Follow-up/consolidation** (to be completed outside of lesson)  SUGGESTED TIME:  20 minutes  RESOURCES:   * L1 & 2 Slide deck – slide 23 * Glossary | * To help to consolidate learning, ask students to write definitions for the glossary terms on slide 23. Definitions can be found in the glossary provided if clarification is needed. * Students could email their definitions for addition to a class glossary that is added to over time. * If using a learning platform, add the best definitions to a class glossary for students to access. You could also use this glossary to generate revision games. |

# Lesson 3: Types of Modern Methods of Construction

This lesson introduces the forms of MMC currently being used on UK sites, covering materials and processes used; it is in the form of a structured research task in which students learn about these methods before drawing together their knowledge. They then apply this knowledge of MMC to review the benefits and drawbacks of MMC in different scenarios.

## Preparation

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| **Resources provided** | * L3 Slide deck * L3 Workbook * L3 Plenary Worksheet * L3 Plenary Answers * Glossary |
| **Equipment needed** | Computers with internet access |
| **Safety factors** | None |
| **Prior learning** | * Students would benefit from an understanding of what MMC is and why it is used. This is provided in Lesson 1 & 2 where they will have been introduced to some types of MMC and their basic concepts. * Students are likely to already understand traditional methods of construction and building technology, as it is anticipated that 4.1.1 would be covered before this topic. * Some students may be familiar with some MMC from their placements. |
| **Common misconceptions** | * There may be some confusion among students about what is categorised as MMC. Systems which have previously been labelled as modern methods, such as the ‘thin joint system’, where blocks are laid with thinner joints to enhance thermal performance, would not now be categorised as a modern method. |
| **Accessibility** | * Seek to ensure wide representation for any visiting speakers and case studies used. * Be aware that students may lack confidence in presenting at this stage of the course. Activities in this topic are an opportunity to establish principles of working in a collaborative manner, in a safe space. * Basic animation is used in the slides in this lesson to improve cognitive load, stagger information or present instructions. Teachers may wish to remove this feature if it is unsuitable for students. |

## Activity guide

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| **Introduction**  SUGGESTED TIME:  10 minutes  RESOURCES:   * L3 Slide deck – slides 2–3 | * Start by introducing the lesson objectives on slide 2 and explain that by the end the students will be able to identify several types of MMC and understand what is involved. Avoid giving students the list of types at this stage. * Ask students to take part in a small-group discussion. Referring to slide 3, students should discuss any types MMC they already know and whether they have seen any MMC used locally or on placement. If they have seen MMC used, push them to think about why the contractor might have chosen to use MMC in that situation. * One representative from each group should summarise what was discussed and feed back to the class. If they struggle to synthesise and present the information, ask their group to support. * If teachers have any local MMC projects to share with students, this may be a good opportunity to do so, outlining what type of MMC is used and any images of the project in progress. |
| **Activity 1: Research task**  SUGGESTED TIME:  60 minutes  RESOURCES:   * L3 Slide deck – slides 4–13 * L3 Workbook | * This activity is a structured research task involving videos and use of the internet. Students are asked to plan and carry out guided research into several MMC methods (slide 4), and write up their findings in a guide for a client who has no construction experience. They will need to explain what materials are used in each method, and link in how emerging technologies can be used to enhance the process – robotics, CNC, BIM and 3D concrete printing. Teachers could suggest that the students aim for 2000 words for their guides. * The following activities can be completed using the slide deck. Alternatively, students can work through them independently by using the Workbook which accompanies this lesson. Both resources provide the same information. * If more guidance is needed, set specific durations for each part and remind students when to move on and/or initiate class discussions to make sure each stage is understood before moving on. This activity could also be completed in front of the class rather than on individual computers. * Warm-up (slide 5): firstly, students are asked to complete a simple warm-up task, where they write a short definition of MMC and list five different types of MMC, which they should remember from the introductory class discussion. The aim of this warm-up is to give them confidence in their baseline knowledge. * Step 1 (slide 6): next, students are asked to plan what they need to find out. They are prompted to draw a table or write a list of questions to answer. This is designed to get students thinking about how they can scaffold their own work. For those students who might find this task demanding, scaffolding grids are provided on pages 3 to 5 of the Workbook. This is a good place to pause and make sure all students understand the expectations. * Step 2 (slides 7–9): there are three videos to watch; each is approximately 3–4 minutes long. Encourage students to watch at their own pace, pausing when they need to in order to make notes. (For those students who need support, remind them to use the grids in their workbooks.) * Notes on the terminology used in the videos and corresponding terms in the specification:   + Video 1 <https://vimeo.com/1069606578> (3D volumetric construction): the term ‘complete or modular units’ is used in the specification. Industry terminology varies but this is usually used to refer to complete units such as, for example, kitchens and bathrooms, which are fully fitted, then can be lifted into place, then fixed in before the main services are connected up.   + Video 2 <https://vimeo.com/1070001660> (SIPs): the term ‘sandwich panel systems’ is listed in the specification. Sandwich panels consist of two layers of rigid material bonded to either side of a lightweight core. SIP panels are a type of sandwich panel system.   + Video 3 <https://vimeo.com/1070001877> (pre-manufactured components): these are smaller elements of off-site construction. This video focusses on structural steelwork and timber frames. * Step 3 (slide 10): once they have watched the videos, students are asked to check their plan and to revisit any videos where they are missing information. They are encouraged to do any further research to clarify their knowledge. * Step 4 (slide 11): the task then prompts students to investigate other methods of MMC. They need to write a brief description of each one. As an alternative to individual work, place students into small groups of four or five. Each member researches one of the listed types of MMC, and then reports back to the group to share their findings. In this way, research can be spread out amongst the group. * To help students to build their digital skills, students could be encouraged to use open AI responsibly here, to aid the research process. Encourage students to use prompts such as ‘How are steel framing systems different from steel framed panels?’ in order to understand these different methods. Students should be encouraged to fact check information from AI and should summarise any information used in their own words. * Alternatively, students might find the links provided in the ‘Industry links’ section of this document a good starting point. * The phrase ‘concrete panels/sections (including flatpack)’ is also mentioned in the spec. However, in industry, this is used interchangeably with ‘precast concrete section’. Therefore it has not been included as a separate method for research. * Step 5 (slide 12): the information students have gathered should be summarised in a guide for a client with no construction experience, with a focus on one of the modern methods covered. The grid on page 7 of the Workbook will help students to scaffold their writing. Alternatively, students could produce a blog for other T-level students, a webpage or an infographic. * Remind the students that, as well as assessing their knowledge of the facts, they will also be assessed on the language they are using – are they using the correct terminology? * Step 6 (slide 13): this stage encourages students to reflect on how the research task went and think about how they might improve their research and writing skills in the future. * If applicable, completed guides could be uploaded to the centre’s learning platform. If there is time they could be discussed as a class, introduced by the authors. |
| **Plenary**  SUGGESTED TIME:  20 minutes  RESOURCES:   * L3 Slide deck – slide 14 * L3 Plenary Worksheet * L3 Plenary Answers | * Hand out the plenary worksheet, which details four different scenarios – a one-off building design, a collection of 22 houses for social housing, a high-rise office block and an outdoor pursuits centre – with specified restrictions. Students need to consider the benefits and drawbacks of using the different types of MMC for the different scenarios. These are focused on traditional, volumetric and panelised construction, but for an additional challenge ask students to consider other forms of MMC such as steel framing systems. * Answer suggestions are given in the Plenary answer sheet. Teachers might decide to give these out to students to peer mark or self-mark. The depth and breadth of answers should give an indication of how well the students have understood the different types of MMC and how they are best used in different situations. If time is tight for the work involved in this activity, teachers could suggest groups focus on one each and then share answers with the class or set as a follow-up. * Revisit the learning objectives on slide 15 to close the lesson. |
| **Follow-up/consolidation** (to be completed outside of lesson)  SUGGESTED TIME:  30 minutes  RESOURCES:   * L3 Slide deck 15 * L3 Workbook * Glossary | * Students could use the prompts on slide 16 (step 7 in Workbook of the research task) to look into types of MMC further. If they are left with any questions from step 6 of the research task or the plenary questions encourage them to spend some time looking into this independently. * Alternatively, allocate students a glossary term to write a definition to add to the class glossary. This could include the different types of MMC covered in this lesson, which have not already had a definition added, e.g. steel framing systems, 3D printing, etc. Definitions can be found in the glossary provided if clarification is needed. |

# Lesson 4 & 5: Scheduling on-site and off-site activities for a modular house

These lessons aim to discuss the differences between scheduling traditional construction (all on-site) and volumetric modular construction. In volumetric modular construction, most of the construction is off-site in a factory, while on-site works are mainly preparation (foundations) and positioning, fixing, connecting of services and weatherproofing in place. The lessons will consist of the students watching a video of the on-site and off-site tasks co-ordinated to construct a volumetric modular house. The students will record the tasks in order on a sheet and then use this list to schedule the works using project software.

Students will need to understand how work is scheduled and adjusted to suit labour availability and deadlines. They will produce schedules if they progress to work in site management and need to understand scheduling for the purpose of tender and tracking material and labour requirements as the works proceed.

This guidance outlines two lessons' worth of material, with the suggestion that Lesson 4 ends when Activity 2 is completed. However, depending on the time available, this could be approached differently.

Note that the lessons have a slightly slower pace than previous ones because the activities are quite involved practically and require the students to pay attention to a lot of small details and translate these into a schedule. The time given reflects the level of detail needed and allows opportunity for the teacher to support those who need additional help, while giving suggestions for additional challenges for those students who work at a faster pace.

Note that Pearson provides a Modular Building case study, which is similar to Lessons 4 and 5 but focuses on different areas of the specification. These lessons are designed to be used individually, but could be used alongside the case study if preferred.

## Preparation

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| **Resources provided** | * L4 & 5 Slide deck * L4 & 5 Worksheet * Glossary |
| **Equipment needed** | Access to computer with Microsoft Project software or similar installed – one per student.  Excel may be used as an alternative but will not have scheduling features such as a precedent feature for aligning tasks, calendar views, network analysis, resource charts, etc.  Project Libre™ software could also be used. |

Microsoft Project and Excel are trademarks of the Microsoft group of companies.

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| **Safety factors** | None |
| **Prior learning** | * Students should be aware of the construction phases of traditional construction and where these take place in order to appreciate how modular construction differs. * Students need to understand construction technology in terms of the process and tasks that combine to achieve a finished building. They will have covered this in 4.1 Construction Technology and have extended their learning through watching processes in Lesson 3. * Students may have used software such as Microsoft Project before, but this is not essential. |
| **Common misconceptions** | * Scheduling for prefabricated building is the same as traditional construction. |
| **Accessibility** | * Seek to ensure wide representation for any visiting speakers and case studies used. * Be aware that students may lack confidence in presenting at this stage of the course. Activities in this topic are an opportunity to establish principles of working in a collaborative manner, in a safe space. * Basic animation is used in the slides in this lesson to improve cognitive load, stagger information or present instructions. Teachers may wish to remove this feature if it is unsuitable for students. |

## Activity guide

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| **Introduction**  SUGGESTED TIME:  30 minutes  RESOURCES:   * L4 & 5 Slide deck – slides 2–5 | * Introduce the lesson objectives using slide 2. * Ask students whether they have used Microsoft Project or similar before. If there are some students who are not confident using this software or who need a quick refresh of knowledge, consider using slides 3–5. This activity involves students quickly listing the stages involved in forming a raft foundation using the diagram provided. (A completed list can be found on slide 4. Students can use this to check their answers.) * The next stage uses Microsoft Project software. However, if this is not available, consider other programs such as Excel or Project Libre™, which work in a very similar way. * Once students have identified the stages needed, they then use the software to add these stages into a schedule. Depending on the level of experience, leave students to do this themselves. If they need guidance, show the instructions on slide 5. Reassure students that exact timings of each activity are not important: they can guess if they are not sure how long things might take. * Make sure students only assign a date to the first activity. Point out to students that the dates for the following activities appear automatically when they assign predecessors. * Give students a chance to make changes and observe the results, so they can see how this software works in practice. For example, ask them to change the initial date and see what happens. Suggest students change the timings for a couple of tasks and observe the results. * Consider checking students' knowledge of traditional methods of construction by asking them to then list on the board a list of general tasks for the construction of a typical cavity wall construction house. This will help them understand how the construction of modular houses differs from traditional processes. |
| **Activity 1: Construction of a modular house**  SUGGESTED TIME:  40 minutes  RESOURCES:   * L4 & 5 Slide deck – slide 6 * L4 & 5 Worksheet | * The aim of this activity is to look at the stages involved in the construction of a volumetric/modular construction, before inputting them into a schedule in Activity 2. * Students watch a video (<https://vimeo.com/1073169748>) about the on-site and off-site tasks co-ordinated to construct a modular house. The video (slide 6) can be shown to the whole class, or students could access it independently and work through at their own pace. * The students record the tasks they watched in the video in order on the worksheet. * The students can then estimate timings and justify these if possible. For example, they might have an idea of the gang size for concreting – they should record the time needed and validate their response by writing why they chose that time. However, justifying timings is not essential and they do not need to be exact. The main outcome is that they assign a time, even if this is a guess, in order to use this time when scheduling. * Students do not need to fill in the ‘simultaneous’ and ‘predecessor’ columns at this stage. * A useful point to add is that, when putting together a schedule, many aspects must be ordered at the start of the project to ensure they’re available when needed. For example, ‘special attention packages’, such as bathroom pods and cladding cassettes, will need to be ordered at the outset to allow time for their design and construction prior to delivery. (Stress that the students don’t necessarily need to add this to the schedules – this is just real-world context.) * In addition, there are on-site considerations that could be discussed as an extension to the video. For example, once on-site it is important that consideration is given to using the correct lifting equipment for the modules, appropriate lifting points are provided and the modules are delivered in the correct order. * Once students have completed the worksheet, ask them to summarise the information they have been given to state how this modular construction project differs from traditional construction. |
| **Activity 2: Understanding activities**  SUGGESTED TIME:  20 minutes  RESOURCES:   * L4 & 5 Slide deck – slides 7–8 * L4 & 5 Worksheet | * The purpose of Activity 2 is to get students thinking more widely about the tasks they have recorded in the worksheet – how tasks might occur simultaneously, which tasks rely on others being complete and what resources might be required for each one. Note that students do not need in-depth knowledge at this point – the activity simply aims to provide a bridge between the students' understanding of the tasks and then putting them in an order that works in the software. * Show a completed list of tasks on slide 7 for students to check against to make sure they have noted everything, and whether each task is completed on-site or off-site. * The video shows the tasks in a specific order, but students need to think about how they might be happening simultaneously, especially when some are occurring on-site and others off-site. * Students can note the simultaneous stages, and which stages need to be complete before another, using the ‘simultaneous’ and ‘predecessor’ columns in the worksheet. Alternatively, students might find that producing a flow chart helps them visualise the different tasks occurring. Students could do this by writing the tasks on sticky notes which they then place in order on their desk or on a piece of paper. In this way, they can ‘play with’ the order of the tasks and rearrange it quickly and easily. An example flowchart is shown on slide 8. * Students could work in pairs to collaboratively consider the resources required for each task and record these on the worksheet. * Encourage students to compare their flow charts, and the example could be shown. Students can discuss where and why theirs may vary. There are many correct ways of organising the tasks. Some students may have seen parts of the process done differently on placement. Encourage them to add to the discussion. * Explain that there are different ways of achieving the same goal, even when using MMC and that this is why we schedule – no two projects are the same. * This is also a good opportunity to check students’ understanding of just-in-time (JIT) delivery. As touched on in videos in previous lessons, suppliers must carefully balance delivery dates to avoid either getting items to site too early (where they take up storage space and are exposed to the weather) or delivering too late and holding up the process. * Depending on time available, this may be a suitable place to end Lesson 4. When resuming for Lesson 5, ask students to familiarise themselves again with their list of activities and flow chart before starting Activity 3. |
| **Activity 3: Scheduling**  SUGGESTED TIME:  60 minutes  RESOURCES:   * L4 & 5 Worksheet (completed) * L4 & 5 Slide deck – slides 9–10 * Computer with Microsoft Project software or similar | * The purpose of this activity is for students to learn how to schedule the tasks involved in a modular house building project using digital technology. This builds on their confidence using scheduling software, helping them to use digital technology and media effectively. This helps students to produce reports and presentations for construction professionals, clients or for non-technical audiences such as the public. * This is using Microsoft Project software. However, if this is not available, consider other programs such as Project Libre™ that work in a very similar way. * They will use their completed worksheet for the information needed to input into the schedule, so it is essential that all students have completed this and feel confident in how this process fits together. * Students should ideally do this individually, but if students are lacking confidence they could be paired up with a more confident student for support. * Slide 9 reinforces why we need to produce schedules and keep a close eye on how the programme of works is running. Stress that delays should always be anticipated and, wherever possible, mitigated against. Delays can arise because of issues with planning and building control, and even because of archaeological finds (with an associated knock-on effect on costs). Late or non-payment can also lead to a delay, or even a complete cessation of works. * Show students the instructions on slide 10. If they did not complete the raft foundation ordering activity in the introduction, make sure they understand that they only need to assign a date to the first activity. Point out to students that the dates for the following activities appear automatically when they assign predecessors. * Students will need to consider the fact that some tasks might be running concurrently, as they identified in Activity 2. They will need to set the predecessors accordingly and might want to group some parts of the process together to make this clearer. * As students are working through this activity, consider checking in with each student to assess their progress. There are a lot of stages to add to this schedule, so consider prompting students to stop occasionally and check their work. This is also an opportunity to assess their understanding and use of correct terminology. * Show students that once set, the schedule is not locked but can still be flexible. For example, show how if the start date is delayed, the dates for the rest of the tasks move on automatically. |
| **Activity 4: Use of data**  SUGGESTED TIME:  20 minutes  RESOURCES:   * Computer with Microsoft Project software * L4 & 5 Slide deck – slide 11 | * The purpose of this activity is to guide students to look at other formats of schedules within the Microsoft Project software, available with the inputted data. It also aims to cover what these formats might be used for in real-world projects. Give an example to students by explaining that, while spreadsheet software can be used to create a Gantt chart (by inputting data), Microsoft Project software uses the data for a range of construction documentation which could not be produced from a spreadsheet alone. * To access these formats in Microsoft Project, students will need to click on ‘Gantt chart’ on the command bar and select another format such as resource list, network analysis, calendar, etc. * Using the prompts (slide 11), ask students to view network analysis, resource sheets, calendars and the Gantt chart created in the activity. This shows the schedule information they added to the software in different ways. * Ask students to discuss in pairs what they think these different formats are used for. They may have experience of these from placement. Students note down their ideas and then feed back to the class. * The network analysis is like the flow chart they created in Activity 2 and shows how the stages fit together. Make sure that students use the network analysis for finding the project’s critical path **–** the path that sets the project duration and the tasks in the critical path which cannot happen in any other order. * Outline that the resource sheets are used for tracking when site resources, for example excavators/cranes, are to be used and for what activity. * Calendar function could be used for displaying the schedule on a site office wall. Students may have seen something similar on placement. Consider asking them to discuss whether and how this was used in practice. * The Gantt chart view that they saw originally will be helpful to visualise overlapping and scheduling of tasks in one view, also start and finish dates of tasks and the project as a whole. * This activity helps students to understand how to produce documentation for use during construction activities. * To assess understanding, ask students to think about why we chose a Gantt chart for the schedule. They should be able to deduce that as well as for functional reasons listed above, it is also the best format to produce – as it is possible to insert predecessors and task lengths that the other formats will show. |
| **Plenary**  SUGGESTED TIME:  10 minutes  RESOURCES:   * L4 & 5 Slide deck – slide 12 | * Ask students to provide verbal responses or write down three things they have learned in this lesson. Ask students to feed back to the class and assess their understanding and correct use of terminology. * Revisit the learning objectives on slide 12 to close the lesson. |
| **Follow-up/consolidation** (to be completed outside of lesson)  SUGGESTED TIME:  30 minutes | * Ask students to return to their schedules. Give students a specific date for the build to be complete. Ask students to tweak their time estimates to accommodate this, and check whether there are some other tasks that can occur simultaneously in order to reduce the overall build time. This helps students build on problem solving skills, to produce a solution to a construction problem as well as understanding how to edit data in digital media. * Alternatively, ask students to think about the importance of logistics. Challenge the students to think about what happens if one of the steps doesn’t happen when it should. Can they predict the knock-on effects? For more information regarding logistics see: <https://interactive.balfourbeatty.com/modern-methods-of-construction/p/4>, including material on digital rehearsal. (Note that Balfour Beatty use MMC in civil projects and digital twins are useful in this instance, but they are unlikely to be used in domestic prefabricated buildings.) |

# Lesson 6, 7 & 8: Modelling a modular house using Autodesk® Revit software

These lessons aim to consolidate the knowledge gained in the previous lessons and to give real-world design experience using Autodesk® Revit software and producing 2D and 3D drawings.

Autodesk® Revit is a software used for building information modelling (BIM) design; if your centre uses other software, the instructions for these lessons will not be applicable.

This guidance outlines three lessons' worth of material, with the suggestion that Lesson 6 ends either part way through or at the end of Activity 2, and that Lesson 7 ends either part way through or at the end of Activity 4. However, depending on the time available this could be approached differently.

## Preparation

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| **Resources provided** | * L6, 7 & 8 Slide deck * L6, 7 & 8 Autodesk® Revit support instructions * L6, 7 & 8 End-of-unit assessment * L6, 7 & 8 End-of-unit assessment Answers * Glossary |
| **Equipment needed** | * Computers with Autodesk® Revit software * Printer – A3 colour printer would be an advantage * Isometric paper |
| **Safety factors** | None |
| **Prior learning** | * Experience using manual and computer-aided design (CAD) drawing techniques is an advantage in this lesson, but not a requirement. If students have no experience of drawing using Autodesk® Revit or similar software, this will be a useful introduction. * Drawing with isometric paper may not have been covered prior to the lesson; if so, the teacher should explain about using the dots on the 30- and 60-degree planes as unit measurements to match the elevation and that the two elevations are drawn on these planes to form a 3-dimensional shape. |
| **Common misconceptions** | * Building information modelling is only possible with pre-loaded wall types and using traditional construction methods. |
| **Accessibility** | * Seek to ensure wide representation for any visiting speakers and case studies used. * Be aware that students may lack confidence in presenting at this stage of the course. Activities in this topic are an opportunity to establish principles of working in a collaborative manner, in a safe space. * Basic animation is used in the slides in this lesson to improve cognitive load, stagger information or present instructions. Teachers may wish to remove this feature if it is unsuitable for students. |

## Activity guide

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| **Introduction**  SUGGESTED TIME:  15 minutes  RESOURCES:   * L6, 7 & 8 Slide deck – slides 2–3 | * Start the lesson by introducing the lesson objectives using slide 2. * Tell students that they are going to be designing a modular home for a client using SIPs panels in this lesson, and that they will be using digital skills to produce a design for this project. * Using Slide 3, ask students to write down what they remember about SIPs – what they are made of, and the advantages and disadvantages of their use. If students have not yet covered SIPs, consider showing the video on slide 8 of Lesson 3. * Students could think about how they might summarise this information for a client looking to use this type of MMC in their new home and how they might convey this technical information to a non-expert audience. They could write an email using suitable clear language to the client. If students completed the workbook during Lesson 3 they can use this to help them. |
| **Activity 1: Research**  SUGGESTED TIME:  30 minutes  RESOURCES:   * L6, 7 & 8 Slide deck – slide 4 | * The purpose of this task is for students to find properties of SIPs panels which they will then use later to inform their building design. * Ask students to individually research the properties of a SIPs panel. They need to find the thicknesses for the following as they will be drawing them on Autodesk® Revit and specifying a thickness of the material which will produce a calculated U-value for the panel (to meet Building Regulation Approved Document L research): timber ply outer skin, a breather membrane layer, insulation, and internal skin of ply, with or without a plaster finish (at their discretion). These are listed on slide 4. * These need to meet building regulations Approved Document L U-value as stated in: <https://www.planningportal.co.uk/applications/building-control-applications/building-control/approved-documents/part-l-conservation-of-fuel-and-power/approved-document-l-conservation-of-fuel-and-power-volume-1-dwellings> * Ask the students to individually research the available sizes of modules for modular building. * Once they have found the different modules available, let them know that for the next activity they will be using modules of length × width × height = 3 m × 6 m × 2.8 m. |

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| **Activity 2: Designing a modular house using Autodesk® Revit**  SUGGESTED TIME:  60 minutes  RESOURCES:   * L6, 7 & 8 Slide deck – slides 5–6 * L6, 7 & 8 Autodesk® Revit support instructions, if needed – pages 2–25 | * In this activity, students will use Autodesk® Revit software to make the shell of a modular home for a client. This helps to build on the students’ digital and design skills, as well as their understanding of how to interpret a client’s vision and specification. * This is a good opportunity to discuss with students when Autodesk® Revit is used in the workplace. The architectural technologist (with a degree) or architectural technician (without a degree) is likely to design the main structure of a building using Autodesk® Revit. The design manager then co-ordinates information between the various design disciplines and the contractor carrying out the project. They use the building information management (BIM) protocols and give access to parts of the 3D model created on Autodesk® Revit to various parties, e.g. the building services design team, so that they can design their systems to fit the actual structure – walls, floors, stairs, etc. The contractor will also use the model to check against the ‘as built’ project. Building Control will see plans and sections produced from the model and check them for compliance with the Approved documents. * Make students aware that Bentley® and SYNCHRO software are also used in the construction industry. Note that the software differs so skills learned with one type of software may not be easily transferable. If students get the opportunity, they should use different types of software to gain a broad range of experience. * Ascertain students’ starting points of using Autodesk® Revit software and arrange the class so that those with less experience/confidence sit by someone who can peer support positively. * Note that most students will need to be supported during the process; complete independence will take more practice. However, some students with prior knowledge (usually from placement) could potentially complete this activity independently. * If teachers are less confident with Autodesk® Revit, they can use the Autodesk® Revit support instruction sheet to understand the steps involved. This support sheet is not designed as a general class tool, but should be used to support teaching. If a student has missed teaching on the basics of Autodesk® Revit, they could access this tool to help them to catch up. The main teaching slides assume that teachers have prior experience of drawing using Autodesk® Revit for traditional construction. * Show students the client information on slide 5. Discuss with students whether there are any needs within this client brief that are perhaps implied and not stated, for example, if this is designed with young children in mind there might be other things to consider. For example, it might be practical to have both bedrooms on the same floor. The bathroom may need to be big enough for a bath. They might like to think about a separate play area. They may need to consider safety and practicality throughout. This could help students interpret a client’s vision beyond what is specified to meet their needs. * Show students slide 6 and the step-by-step instructions on how to design the basics of a modular house for Amira and Claire. This is a good opportunity to check students' understanding. Once they have read through the steps, answer any questions they might have. Ask students how confident they feel in doing this task independently. * If they are lacking in confidence, consider opening Autodesk® Revit and showing the steps. Ask what they think should be done next at each point to draw out the information they already know about how to use this. * Students may get stuck when trying to draw stairs, floors and roofs – the stairs/roof/floor command opens ‘modify mode’ which is sometimes hidden and requires a tick or cross to accept or not accept the changes before moving on. Check in the ‘Properties’ dialog box that the element is drawn on the correct level. Roof cannot be drawn on Level 2 so will need drawing on Level 1 by setting the ‘base level’ to Level 2 in ‘Properties’. Support them by showing on their monitor or the whole class on the board if there is a wider class issue. * Some students may work through this faster than others. If students wish to move onto the next stage – making your modular house a home – then ask them to check that their home so far meets the brief. Consider looking over their work before they move on and assessing their understanding. * Depending on the time available, this may be a suitable place to end this session. Teachers may find they need to end the session part way through Activity 2. If so, resume at the start of Lesson 7. |
| **Activity 3: Making your modular house a home**  SUGGESTED TIME:  60 minutes  RESOURCES:   * L6, 7 & 8 Slide deck – slide 7 * L6, 7 & 8 Autodesk® Revit support instructions, if needed – pages 26–55 | * The purpose of this activity is to add features onto the modular house that students have already created. Before starting, make sure that students have completed all the stages in the previous activity and are confident in their designs. * Remind students that they are designing for a client and should make sure they go back to the client vision and specification for any essential details regarding the interiors. * Show students the instructions on slide 7. Students need to add features to create a modular house and furnish to demonstrate room allocation and service requirements. * Walk around the room and observe progress. Ask the whole group and individuals if they have any problems. This is another good opportunity to assess understanding and correct use of terminology. |
| **Activity 4: Generating drawings**  SUGGESTED TIME:  60 minutes  RESOURCES:   * L6, 7 & 8 Slide deck – slides 8–9 * L6, 7 & 8 Autodesk® Revit support instructions, if needed – page 56–77 * Printer access | * Ask students to produce three drawings from their model of Amira and Claire’s house for the clients. The details are listed on slide 8. * This covers the communication skills ‘Produce rendered drawings and illustrations that could be used for marketing a development to the public or similar stakeholders andproduce rendered drawings and internal plans in response to design briefs and contexts’. * There is additional support on how to produce these in the Autodesk® Revit support instruction sheet. * First, they should produce a rendered 3D front and east view of the building. Students might struggle with knowing which views to include. Support them in this by helping them use the navigation cube in the top right-hand corner. * Secondly, they will need to produce a 3D floor plan. Students might struggle with duplicating the 3D view. Support them in this by showing them to right-click in the view menu to duplicate the view; if further problems refer to the instructions in the Autodesk® Revit guide. * Lastly, they will need to produce 2D floorplan to scale 1:50. Students might struggle with dragging and dropping views. Support them in this by telling them to click once, then click drag and show them where to change the scale. This covers the maths skill ‘Work with proportion’. * Remind students that for these to meet industry standards, they need to make sure they complete the title blocks with the project information. * Students should print these drawings. Printing will vary depending on your provider’s network of printers; there is also a ‘Print to PDF’ function which can be used if not printing from the same classroom and using a computer without Autodesk® Revit installed. * Depending on the time available, this may be a suitable place to end this session. If so, resume at the start of Lesson 8. * Show students the questions on slide 9 and encourage reflection. Students could write down their answers to these questions. If appropriate, discuss the students' answers as a class. * Take this opportunity to discuss different uses of drawing and modelling information. For example, for planning and building regulation approval, for client visualisation and for builders’/panel manufacturers’ instructions. * Ask students to carry out a peer assessment. This can be done by collecting all work in and redistributing randomly. Teachers may want to produce a mark sheet or use their centre’s peer assessment sheet for the students to complete and return as feedback. The Pearson Autumn 2023 ESP mark scheme shows the framework of how students are likely to be marked on live assessments, see page 17 (Task 2: Technical content of presentation). * Remind students that to give constructive feedback, they need to have a balance of positive and negative in their discussions of other people’s work and that the aim is to help others to improve. |
| **Plenary**  SUGGESTED TIME:  45 minutes  RESOURCES:   * L6, 7 & 8 Slide deck – slides 10–12 * L6, 7 & 8 End-of-unit assessment * Isometric paper | * Using slide 10, recap what has been learned in these lessons. * Slide 11: Students complete the end-of-unit assessment individually to assess their understanding of MMC covered in Lessons 1–8. * Distribute the end-of-unit assessment sheet and isometric paper. They should complete this under assessment conditions. * If students need support with isometric drawing in question 4, consider showing them an example of this before they answer the question. * Students need to understand that when using isometric paper they should first draw the adjoining wall of the two sides. They need to make sure they count in enough triangles so that the drawing fits on the paper. Next, they draw the base lines to the correct length (squares on the elevations = triangles on isometric) and the roof line, connect the remaining base and roof lines. In the same way (counting squares) complete the drawing with windows and doors, and roof. * Students might also benefit from using a 60/30 degree set square with a drawing board and straight edge. * Encourage students to check their work to spot any errors and emphasise how important it is to measure with precision. * If time allows, show students the questions on slide 12 and encourage reflection around this series of lessons about MMC. Students could write down their answers to these questions. If appropriate, discuss the students' answers to these as a class. This gives an opportunity to assess their learning and how far they feel they have consolidated their knowledge. |
| **Follow-up/consolidation**  (to be completed outside of lesson)  SUGGESTED TIME:  20 minutes  RESOURCES:   * L6, 7 & 8 Slide deck – slide 13 * L6, 7 & 8 End-of-unit assessment answers | * Give students the end-of-unit assessment answers sheet and ask them to mark their own work. * Alternatively, students could swap assessments and carry out a peer assessment. * Encourage students to reflect on their strengths and weaknesses from this assessment and ask for support for any particular questions. * Ask students to watch the short video (<https://vimeo.com/1069604418>) (less than two minutes) on slide 13, which draws together advice from industry professionals who have featured in videos in earlier lessons. It covers some key skills students need for a variety of careers in the field, and what the future of the sector might look like. |

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| Teaching Guide page 3 | <https://qualifications.pearson.com/en/qualifications/t-levels/design-surveying-and-planning.html> | Pearson\* | March 2025 |
| Teaching Guide page 3 | [www.technicaleducationnetworks.org.uk](http://www.technicaleducationnetworks.org.uk/) | Technical Education Networks | March 2025 |
| Teaching Guide page 6 | support.tlevels.gov.uk/hc/en-gb/articles/360015345420-Industry-placement-logbook-for-students | GOV.UK | March 2025 |
| Teaching Guide page 7 & 14 | [www.gov.uk/government/publications/modern-methods-of-construction-working-group-developing-a-definition-framework](http://www.gov.uk/government/publications/modern-methods-of-construction-working-group-developing-a-definition-framework) | GOV.UK | March 2025 |
| Teaching Guide page 7 | [www.gov.uk/government/publications/the-construction-playbook](http://www.gov.uk/government/publications/the-construction-playbook) | GOV.UK | March 2025 |
| Teaching Guide page 7 | [www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work](http://www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work) (with permission) | RIBA Architecture | March 2025 |
| Teaching Guide page 7 | [www.planningportal.co.uk](http://www.planningportal.co.uk/) | Planning Portal | March 2025 |
| Teaching Guide page 7 | <https://governance.wmca.org.uk/documents/s7945/MMC%20Definitions%20and%20WMCA%20Supply%20Chain%20Appendix.pdf>  (with permission) | Cast Consult Ltd | March 2025 |
| Teaching Guide page 7 | [www.designingbuildings.co.uk/wiki/Home](http://www.designingbuildings.co.uk/wiki/Home)  (with permission) | Designing Buildings: The Construction Wiki | March 2025 |
| Teaching Guide page 7 | [www.istructe.org/resources/design-and-construction/mmc](http://www.istructe.org/resources/design-and-construction/mmc) (with permission) | The Institution of Structural Engineers | March 2025 |
| Teaching Guide page 8 | [www.autodesk.com/autodesk-university/construction](http://www.autodesk.com/autodesk-university/construction) | Autodesk, Inc | March 2025 |
| Teaching Guide page 8 | [www.interactive.balfourbeatty.com/modern-methods-of-construction/p/1](http://www.interactive.balfourbeatty.com/modern-methods-of-construction/p/1) (with permission) | Balfour Beatty | March 2025 |
| Teaching Guide page 8 | [www.cast-consultancy.com/projects](http://www.cast-consultancy.com/projects)  (with permission) | Cast Consult Ltd | March 2025 |
| Teaching Guide page 8 & 15  Lesson 1&2 Slide deck, slide 9 | <https://youtu.be/sGEMHn01p4g> (with permission) | HS2 Ltd / YouTube | March 2025 |
| Teaching Guide page 8 | education.balfourbeattyacademy.com/education-level/apprenticeship-or-t-level (with permission) | Balfour Beatty | March 2025 |
| Teaching Guide page 8 | <https://www.mcveighoffsite.com/engineered-timber-cassettes/> (with permission) | McVeigh Offsite Ltd | March 2025 |
| Teaching Guide page 8 | <https://framecad.com/steel-framing>  (with permission) | FRAMECAD | March 2025 |
| Teaching Guide page 16 | <https://www.linkedin.com/pulse/energy-house-20-heating-systems-report-summary-richard-fitton-ollde> (with permission) | Richard Fitton | March 2025 |
| Teaching Guide page 19  Lesson 1&2 Slide deck, slide 19 | <https://www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work#available-resources>  (with permission) | RIBA Architecture | March 2025 |
| Teaching Guide page 30 | <https://interactive.balfourbeatty.com/modern-methods-of-construction/p/4>  (with permission) | Balfour Beatty | March 2025 |
| Teaching Guide page 32  Lesson 6,7,8 Slide deck, slide 4 | <https://www.planningportal.co.uk/applications/building-control-applications/building-control/approved-documents/part-l-conservation-of-fuel-and-power/approved-document-l-conservation-of-fuel-and-power-volume-1-dwellings> | Planning Portal | March 2025 |

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