**Module 6 Speakers Notes: Maximising Material Reuse – Urban mining and designing for deconstruction**

Please refer to the [how-to guide](https://www.circuit-project.eu/academy) which explains how to use these speakers notes.

Total: 95mins

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**Time:** 10 **Total time:** 0 (not part of full time)

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| Facilitation / Alterations | Script |
| If in person, get everyone settled into the room. If possible, provide the group with refreshments etc. Review any housekeeping required of the space – fire exits etc. If online, wait a few minutes for everyone to arrive. Run through how you will use the technology, when/how to use the chat box, explain how they should get your attention if they would like to speak or ask a question.  |  |

1. **Introductions and CIRCuIT Background**

**Time:** 10 **Total time:** 10

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| Facilitation / Alterations | Script |
| Introduce yourself, tell the group how you have worked with circular building issues in the past / why you are the one delivering training. Provide a brief background to the CIRCuIT project (see script) for those who may not be familiar. Invite everyone in the room to briefly introduce themselves. Ask them to share how they have previously worked with circular construction. This is a good way to get to know everyone, but also allows you as the facilitator to get an insight into who has experience with which areas of learning.Thank everyone for attending.  | [CIRCuIT](https://www.circuit-project.eu/) is a four-year Horizon 2020 project, this means it is funded by the EU’s Research and Innovation arm. The main purpose of the project is to mainstream circular construction in European cities. The project has run across four cities, Copenhagen Hamburg Helsinki and London with over 31 partners. With this many people taking part, you can imagine the range of work that has been completed. We work across three themes: urban mining and material reuse, transformation and life cycle extension, and design for disassembly and adaptability. The consortium has developed pilots and assessed best practice across these themes. The findings and results of these are what we want to share with you via training.  |

1. **Introducing Module 6 – Learning Objectives**

**Time:** 5 **Total time:** 15

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| Facilitation / Alterations | Script |
| Introduce the purpose of the session. Connect the learning objectives of the module with the job descriptions and previous experiences learners shared in their introductions. Highlight how some of the learnings might be particularly relevant for some attendees. The full set of CIRCuIT training sessions can be given as stand-alone sessions or as a series to the same group of learners. Contextualise the module accordingly. Highlight any city policies or initiatives that are related to the learning outcomes of the module. Emphasise how these learning outcomes may be able to help further work on these areas.  | In this module you will learn about maximising material reuse through deconstruction and a design for disassembly approach.By the end of this module, you will understand:* Name the steps involved in completing Pre-Demolition Audits (PDA) using the CIRCuIT template
* Learn ways to integrate their use into city policy
* Understand the benefits designing for disassembly (DfD) and adaptability
* Learn ways to incorporate design for disassembly and adaptability this into city policy
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1. **Urban mining and material reuse cycle – identifying drivers in a short introduction activity**

**Time:** 15 **Total time: 30**

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| Before jumping into the pre-demolition audit Template that the CIRCuIT team has created, we want to encourage discussion about the economic and cultural environment that must be in place for a PDA policy to take root.   As you work through the script and before breaking into discussion draw a representative building on one side and some building materials on the opposite side as illustrated on the slide.   Split the group into groups of 2 or 3. Ask half the groups to list what factors would drive and/or enable them to sell their demolition materials. Ask the other half to consider what would drive and/or enable them to use reused materials in their new project.   Fill in responses at relevant points between the materials and the building – drawing lines if materials need to take detours to remanufacturing facilities etc.    Share the list of examples you have prepared if they have not been mentioned.    When introducing the PDA, highlight which of the drivers identified that PDAs. When used at scale, could facilitate.   | Let’s briefly recap the thought process policy should be guiding the construction sector along:* **Building nothing:** Rethinking the design brief, do we need to build anything at all?
* **Build for long term use:** Designing for future adaptability and demountability
* **Build Efficiently:** Transforming already existing assets, retaining major elements, reduce unnecessary components.
* **Build with the right materials:** Using reused and low carbon materials, deconstructing and reusing materials in a new design

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| Split into groups of 2 or 3. Half of you are responsible for the demolition of a site. The other half of you are responsible for the development of a new project a 20 minute drive away. Please name what would drive and/or enable you to either sell or use reused/recycled materials from the other project.   When you are ready please share with the group.   In addition to the shared examples some examples of drivers could include:  **Economic** * Economically advantageous to reuse – my new project works out cheaper
* Materials are certified – no one is taking on risk using them
* Supply matches demand, there is always someone buying or selling when needed
* Storage is available, easing timing issues
* There need to be organisations to process the materials

 **Cultural** * It is considered acceptable to build with reused materials in this context culturally
* Process is integrated into existing processes along the supply chain – no special work needed to gain support
* Projects communication is easy
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 Today we will focus on one aspect of this cycle that the CIRCuIT project has done a lot of work on that facilitates this cycle. This is the pre-demolition Audit (PDA).    |

1. **What is a PDA and how to use it**

**Time:** 5 **Total time: 35**

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| Facilitation / Alterations | Script |
| Pull up the PDA by CIRCuIT on a screen, or if online, share a copy of it in the chat so people can access it themselves and review the sections as they are described.   The purpose of this section is to articulate how cities can drive the use of PDAs, not how to complete a PDA, so this review is simply to ensure understanding of the process.   If the group you are working with is familiar with PDAs or has used a similar material passports before ask them how the PDA compares and how they would change it/what they would take away from PDA.   | A pre-demolition audit is a survey of the materials in a building before it is demolished. Depending on how early in the process the demolition audit would be carried out by the developer or the demolition contractor.  Pre-demolition audits are relevant to the circular economy as they allow the identification of building components, fixtures and fittings that can be reuse or recycled to avoid the existing linear disposal routes.Selective demolition techniques – also known as deconstruction - can preserve building elements and materials for reuse and recycling, and Pre-Demolition Audit reporting helps the recovery of components from demolitions. It is an essential first step towards recycling and appropriate waste management from construction as it collects information about elements, quantities, and treatment paths of building materials.The auditing process should serve to identify and prompt opportunities for circular project decision making and planning, tailored to the constraints of the site and the materials available. Furthermore, on a city scale the PDA contributes to a material-knowledge database (or as input to local material exchange portals) about relevant material flows in the city or for potential use in other planned construction projects. This process should inspire future design of buildings tailored in accordance with the typical CDW generated in a respective city.This is the PDA developed by CIRCuIT.  The CIRCuIT pre-demolition audit template was created and refined with input from four partner cities and tested using the eight demolition demonstrators.   The template itself has the following components: * Project Details
* Desk study
* Field survey
* Inventory of hazardous elements
* Inventory of non-hazardous reusable elements
* Inventory of non-hazardous non reusable materials

 The following steps are needed to complete the PDA on a building.   **Desk Study** * The desk study involves analysing existing building documentation. The aim is to collect information about the history of the “target” building (technical drawings, maintenance, and renovation documents), as well as information about the type of materials and construction techniques used, the location etc. The age of building and/or past refurbishment activities are essential information, also related to the presence or not of hazardous materials.

**Field Survey** * The field survey involves the visual inspection of the site to be demolished. The experience of the auditors is essential to collect data useful for the inventory. Sampling and laboratory analyses are requested for suspected hazardous materials. This will help quantify the products and furniture, to evaluate their condition and possibility of reuse and to estimate the amount of waste streams arising from the building demolition. During the site visit, it is necessary to evaluate the nature and amount of materials through non-destructive and destructive techniques. It is also good practice to take photos and/or measurements of materials that will be considered in the final inventory.

**Inventory** * The inventory is based on the desk study and field survey and concerns the material and element assessment, in order to decide the best waste management operation. It includes the type and quantification of waste arising from demolition, the European waste code and description. This information should be supplemented by photos and comments that allow an easier interpretation of the audit.

**Waste Recommendations** * The waste audit can be completed with recommendations on how to perform waste management on site.

**Management Report** * The final report must summarize the information collected during the desk study and the site visit, and must present: (1) the scope and characteristics of project, site location and history, (2) the list of available documents, and the summary of recommendations, (3) the summary of waste audit and the explanation of techniques, the sampling and laboratory analysis used during the site visit, (4) the inventory of materials, the waste fraction arising from demolition, the list of hazardous waste and the description of precautionary measures to be applied, and (5) the inventory of elements, with reference to the quantity, quality conditions and potential reuse rate.

**Examples** Let’s now look at the CIRCuIT demonstrators which utilised PDA’s to maximise material reuse.Demolition of Homebase BrentfordThe Homebase Store, Brentford- a west London ‘high tech’ landmark, completed in 1987 by Grimshaw Architects, features a column-free interior enabled by its 95.7m structural spine, which is supported by steel tensioning rods attached to its 33m mast.Proposed for demolition, the building presents an opportunity to demonstrate its circular potential by means of a material assessment, including a Pre-Demolition Audit, to inform an alternative to the standard pathway for materials using traditional demolition methods.Steel and concrete make up 95% of the estimated 2,195 tonnes of material that would arise from the building demolition. It is believed 90% of this material could be recycled. Additionally, a saving of £489,000 was identified for the reuse option when compared to a new build alternative and the life cycle assessment (LCA) concluded that the reuse option (retaining the substructure, steel frame and roof) would save up to 1,200,440kgCO2 compared to a new building alternative.Demolition of One Leadenhall StreetOne Leadenhall Street is a 10-storey commercial office building with ground floor retail space constructed in the late 1980s. The developer required more floor space for the land area and was unable to safely add more floors above. Office buildings are one of the most frequently demolished groups in London and buildings in areas of high economic activity, such as the City of London, are particularly prone to redevelopment. This is representative building for material and circularity assessments and the key aims were to: * contribute to the improvement of a shared framework and methodology for pre-demolition audits, ultimately improving the forecasting of waste arising, increasing reuse and high value recycling, and achieving less than 5% demolition waste to landfill;
* provide evidence on the technical and economic feasibility of identified reuse/high value recycling options, and;
* provide data to calculate the economic and environmental impact of demolition.

A Pre-demolition audit was conducted, the process was analysed, demolition activity was monitored, and concrete was recycled on site. This led to less than 5% of demolition waste going to landfill, nearly 100% of building materials were recycled, and the use of virgin raw materials was reduced.In conclusion, Pre-demolition audits can help increase reuse and higher value recycling but ideally need to be early in the planning process to allow time for securing reuse/higher level recycling options/off-takers, especially for bespoke elements. |

1. **How to implement a PDA**

**Time:** 10 **Total time:** 45

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| Localization updates:Prepare to discuss the material exchange options available locally when covering point 3 - What should we do with the data that is produced by a pre-demolition audit? | The content of a PDA is obviously very useful. However, as we discussed during out initial activity, the drivers around the PDA and the management of the data are equally important to a good capturing tool.   We will now look at three questions: * Who should be tasked with carrying out a pre-demolition audit?
* How do we embed the PDA into local policy?
* What should we do with the data that is produced by a pre-demolition audit?

 **Who should be tasked with carrying out a pre-demolition audit?** The pre-demolition audit is a specific task within the project planning. The PDA is the first step of a three-step material tracing process, consisting of an auditing phase, a monitoring phase during demolition and disassembly and a final inspection. In the auditing phase an inventory of materials is made. The auditing process delivers the documents needed by the owner to attach to a demolition or renovation permit application to open a call for tenders.   Currently, PDAs are usually completed by demolition contactors. Integrating them into the process here is a good first step, however this does not optimise for the kind of expertise that should be assessing reusability, or for the timing necessary for successful reuse.   The recommendation is to complete PDAs earlier in the process closer to design stage and potentially by a specialist. This means there is a higher chance of reusable material making it into a new building.   **How do we embed the PDA into local policy?** The timing can be influenced by when in the policy process the requirement for a PDA is embedded. Best practices and levels of monitoring vary throughout Europe. In some cases, mandatory PDAs are already implemented, others do PDAs voluntarily and yet others register incomplete data.  Two examples of how CIRCuIT Cities have tackled this: * [The London Plan:](https://www.london.gov.uk/programmes-strategies/planning/london-plan/new-london-plan/what-new-london-plan) Circular Economy Statement
* Encourages the creation of a PDA but the process isn’t required or standardised.
* Copenhagen
* PDAs are considered at two levels. The mandatory screening for hazardous substances and more detailed audits mapping materials, their state, and estimated quantities. For internal demolition projects managed by the city (Schools, kindergartens, libraries, etc.) it is also required to do material screenings to assess the potential for reuse and recycling. This is supported by requirements for selective demolition.

 In some cases, PDAs are not required, but deconstruction is: * [Portland Deconstruction Ordinance:](https://www.portland.gov/bps/climate-action/decon/deconstruction-requirements)
* Established in 2016 and expanded in 2020, the deconstruction ordinance applies to demolition permits applied to houses or duplexes built before 1940. This covers approximately 66% of annual demolition permits. The relevant buildings must be deconstructed as opposed to mechanically demolished.

 **What should we do with the data that is produced by a pre-demolition audit?** In all the examples we have discussed, material information is shared with the city who compiles it in a data base. Even within the CIRCuIT project there is research ongoing to determine how to use this data most effectively. To optimally use PDA data it must be updated centrally, in real time, ideally as part of a Material Exchange Portal. To learn more about the Material Exchange Portal, refer to module 4.To drive material exchange and close the loop, the information required in PDAs should connect seamlessly to material exchange platforms to lower the barrier to entry. PDAs have a great deal of potential if they are implemented at scale. On new construction projects, however, enhanced data collection and management techniques should be implemented from the beginning. . One such technique is the use of Building or Material Passports. Material passports are discussed further in module 4.  |

1. **Checking in with the hierarchy and break**

**Time:** 10 **Total time:** 55

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| This is the transition between the two main topics of this session. Share that we will be moving on, and that now is the time for any remaining questions on the last section. Take your time answering these if time allows, if not tell the learners you will follow up on the session with responses to the questions.   Before you recap the hierarchy and move on to the next section, allow for a comfort break.  | When building new we know to build in the consideration for reused materials from and to the site.   To recap, policy should guide those in the construction sector along this thought process:  * **Building nothing:** Rethinking the design brief, do we need to build anything at all?
* **Build for long term use:** Designing for future adaptability and demountability
* **Build Efficiently:** Transforming already existing assets, retaining major elements, reduce unnecessary components.
* **Build with the right materials:** Using reused and low carbon materials, deconstructing and reusing materials in a new design

 This next section is all about future–proofing, designing our spaces in such a way that circularity is the easiest course for our buildings in the future.    |

1. **Designing for Disassembly and Adaptability – a short introduction**

**Time:** 3 **Total time:** 60

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| This next section is all about future–proofing, designing buildings and structures in such a way that circularity becomes the default option in the future.When introducing the concepts of designing for disassembly and adaptability, take time to explain the full definitions and discuss these with the learners.   | We can set ourselves up for success by requiring building design and construction techniques that enable us to disassemble or adapt them with ease. This is where the concept of designing for disassembly and adaptability comes in. The CIRCuIT project chose to align with the definition of DfD given by the ISO standard on Design for Disassembly and adaptability. Design for Disassembly is an “approach to the design of a product or constructed asset that facilitates disassembly at the end of its useful life, in such a way that enables components, [ed. materials] and parts to be reused, recycled, recovered for energy or, in some other way, diverted from the waste stream.” (ISO 20887:2020, 2020)The goal is to build new buildings in such a way that not only reduces the barriers to circular use in the future, but invites it.We are now going to review some great examples of built in adaptability and designing for disassembly developed during the CIRCuIT project |

1. **What does this look like in practice? Best practice examples**

**Time:** 10 **Total time:** 70

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| Facilitation / Alterations | Script |
| If there are any inspirational local examples of designing for disassembly and adaptability, please include in this section.   Before moving into the barriers and opportunities surrounding designing for disassembly and adaptability, we want to illustrate the benefits of building this way.   | Adaptability and designing for disassembly are concepts that have existed for a while in the architectural space but have only somewhat recently risen to prominence so unlike transformation or building reuse, it might not be as straightforward to name some iconic spaces around the city that have embedded these techniques.   Here are two great examples of built in adaptability and designing for disassembly developed during the CIRCuIT project:   [**The Hithe, Albion Street**](https://www.ifdo.co/projects/the-hithe) * The Hithe is an exciting example of ‘circular’ building innovation. Designed to be taken apart and refabricated on a new site, this temporary business incubator space can be used again and again – radically reducing its environmental footprint.
* This 200m2 building is constructed of lower-carbon, more sustainable materials including lightweight steel and a timber frame made with bespoke and prefabricated components and structural insulated panels (SIP). Building onto the site’s existing foundations largely eliminated the need for any new concrete on the project, helping reduce the overall CO2e emissions associated with the building’s construction.
* The building serves as an important community hub, offering affordable workspace to 12 local businesses, helping support the community while Southwark Council develops longer-term plans for the area. When the site is ready for permanent redevelopment, the building will be broken down into its various components and re-erected on an alternative site.
* By designing the building to be demountable and usable again at another site, The Hithe demonstrates how the construction industry can use circular economy thinking to reduce its carbon emissions and offer more sustainable solutions for urban regeneration.

 [**Design for Disassembly Warehouse – Espoo**](https://www.circuit-project.eu/van-demo2) * Traditionally warehouses are designed and built for 50-year service life and they must be demolished when the building is not needed anymore. Warehouses are typically buildings, which are needed in a relatively short period and in a certain location. Therefore, structures of warehouse are designed according to DfD principles in this demonstration. This will contribute to prolongation of the building’s components lifetime, with the goal to minimize consumption of virgin resources.
* This demonstrator developed a steel frame demountable warehouse on a demountable concrete foundation. There were no on-site welding connections. All connections in steel structures and concrete foundation as well were made by bolts. This makes all connections and joints removable for the purpose of reuse.
* The embodied carbon footprint of DfD structures was found to be slightly higher during the first life of the building but much lower in second and third life compared to the baseline.
* Developed structure need less material because more rigid connections of steel structures. Additionally, the size can be adjusted by adding or removing frames.
* When designing for disassembly regulating factors such as loads, fire class, purpose of building etc. can be more challenging to comply with. hence such factors should be taken into account in early stages of DfD design.
* New structures developed in this demonstration will potentially increase circularity, reusability, material efficiency and cost efficiency of the structures over the whole life-cycle.

 **Rightsizer*** The RightSizer concept emerged as a support framework to enable the construction industry to design circuar, net-zero buildings using a new construction ecosystem through the standardisation of component sizes, and MMC’s.
* The RightSizer team has expanded the functionality of the system to become a universal and adaptable construction solution to support flexible multi-generational living and other uses including office, light industrial, parking and meanwhile use.
* RightSizer offers a ‘how-to’ guide to designing buildings for 2030 and beyond, heralding a low carbon built environment. The designs concept is based around design for manufacture, assembly, flexible layouts, adaptive reuse and disassembly at end of life. The system comprises a long term ‘support’ layer, the superstructure that can be disassembled and reassesmbled, allowing layout reconfiguration and optionality.
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1. **Designing for Disassembly and Adaptability – barriers at a large scale**

**Time:** 5 **Total time:** 75

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|  This is a content overview. In this section you will be sharing the barriers we found in the CIRCuIT project to implement Dfd and adaptability at scale.    | The CIRCuIT project conducted interviews with industry across all four cities. The results of these interviews painted a picture as to the market barriers, opportunities, and accelerators around adaptability and designing for disassembly at scale.   These barriers were identified across all four cities: **Assumptions of increased costs** * Industry actors assume that CC will be more difficult, more costly, and riskier when compared to business as usual.

**Lack of economic incentives** * Construction decision-makers are separated from long-term consequences of their decisions and lack economic incentives for investing in CC. Most construction projects are driven by a focus on minimising capex, while the value of CC accrues over the building lifecycle. For this type of projects documented short to medium term gains such as lower construction costs, reducing risks, and improving branding of projects are key to the transition.

**Insufficient know-how in industry** * Lack of knowledge and experience in industry around the value of Circular Construction (CC) and how to implement it.

**Unclear risk management** * CC re-distributes risks within the construction value chain through e.g., new ownership arrangements or upcycling of construction and demolition waste. The industry lack frameworks for sharing and minimising re-distributed risks related to CC.

**Lack of circular resource portals** * Construction lacks systems that provide overview of the availability of secondary resources and enable an efficient marketplace for these.

**Lack of market ready solutions** * Material and service providers are currently not able to deliver and promote market ready and off-the-shelf CC solutions.

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1. **Designing for Disassembly and Adaptability – opportunities**

**Time:** 10 **Total time:** 85

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| Facilitation / Alterations | Script |
| This is a content overview. In this section you will be sharing the opportunities we found in the CIRCuIT project to implement Dfd and adaptability at scale.  | Adaptability and designing for disassembly are the future-focused aspects of sustainability futureproofing the industry for better outcomes in the next building cycle. These elements need to be true for adaptability and designing for disassembly to take hold.   **Invest in education and know-how** * Improvement in know-how around CC across value chain through investment in training and public information portals for the industry will initiate market response.
* Where organisations can access information, share barriers, and work with public authorities to develop pilots or contracts to remove barriers.

**Building business cases** * Public planning and construction projects can be utilised to develop and document business cases for CC through better alignment of capex and opex across full asset life cycles, e.g., where investment in design for disassembly and flexibility during construction can improve building operations or extend the expected building life-cycle.

**Develop pilots and demonstrations** * Public authorities can partner with industry stakeholders to develop pilots and demonstrators to document costs and performance for decisionmakers.
* Support and finance CC flagship projects and partnerships with industry leaders to set ambitious examples and promote cross value chain collaboration

**Clarify circular policies and guidance** * Public authorities can improve industry understanding of CC conditions by providing simple policies and clear guidance on their objectives, policies, and roadmaps.
* Public procurement amounts to 12% of global GDP, public authorities should build and procure on circular principles, including whole lifecycle costs.
* Example, [MMC Buyer’s Club:](https://www.centreforlondon.org/publication/made-for-london/)  In London, a group of boroughs with significant housing targets to meet are collaborating on meeting these targets through MMC – Modern Methods of Construction. This collaboration involves a consistent design scheme and consolidated asks of the supply chain. In this way the boroughs are able to achieve the benefits of scale both in terms of cost and in terms of leverage over environmental requirements.

**Incentivise EOL resource management** * Ensuring circular material flows, through policies and regulation that incentivise reduction, reuse and recycling of construction materials in refurbishment and new construction.

**Develop circular construction standards** * Development and implementation of new standards for CC will help shape the market for circular solutions by giving construction clients clear measures for asking for and rewarding CC in procurement as well as building trust with solution providers around the long-term viability of developing CC services.
* Developing and applying circular planning policies, local plans, and KPIs that provide CC projects with advantages in obtaining planning approval.
* Example: In [Paris’ climate plan](https://www.c40knowledgehub.org/s/article/Paris-Climate-Action-Plan-Towards-a-carbon-neutral-city-and-100-renewable-energy?language=en_US) there is a requirement 30% of office buildings should be ‘reversible’ or highly adaptable by 2030, with that figure growing to 50% by 2050. This was born out of the significant use changes over the last few years and the identified need to protect buildings from early obsolescence in this way.

**Progressive economic regulation** * Market regulation to support CC solutions: such as CO2 taxes, emissions limits, required offsets, increasing CDW treatment costs, removing VAT on reused materials.

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1. **Wrap up**

**Time:** 10 **Total time:** 95

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| Facilitation / Alterations | Script |
| Invite attendees to consider what they have just learned and how they could implement what we have discussed in their city  | We just reviewed three core design strategies, and how the city can take action to integrate these into practice.

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| Answer the following questions to yourself and when you are ready share with the person sitting next to you.   * Which design interventions are best suited to your city's needs?
* Which intervention are you able to champion in your role?
* What is the next step or the key missing piece of information you need to take the next step?
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1. **Sources**

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| Case Study: Portland Deconstruction Ordinance | <https://www.portland.gov/bps/climate-action/decon/deconstruction-requirements> |
| Case Study: The Hithe | <https://www.ifdo.co/projects/the-hithe> |
| Case Study: Design for disassembly warehouse- Espoo | <https://www.circuit-project.eu/van-demo2> |
| ‘Public procurement amounts to 12% of global GDP’ | <https://ellenmacarthurfoundation.org/circular-public-procurement-a-framework-for-cities#:~:text=Public%20procurement%20accounts%20for%2015,economies%20by%20applying%20circular%20economy> |
| Case Study: MMC buyers club | <https://www.centreforlondon.org/publication/made-for-london/> |
| Case Study: Parisian Climate Plan | <https://www.c40knowledgehub.org/s/article/Paris-Climate-Action-Plan-Towards-a-carbon-neutral-city-and-100-renewable-energy?language=en_US> |