HOUSING TRANSFORMED
Shifting from Product to Process

Using a digital kit-of-parts to revolutionise how we design and deliver homes

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Structural Timber Conference 2025

Ministry of Housing, Communities & Local Government

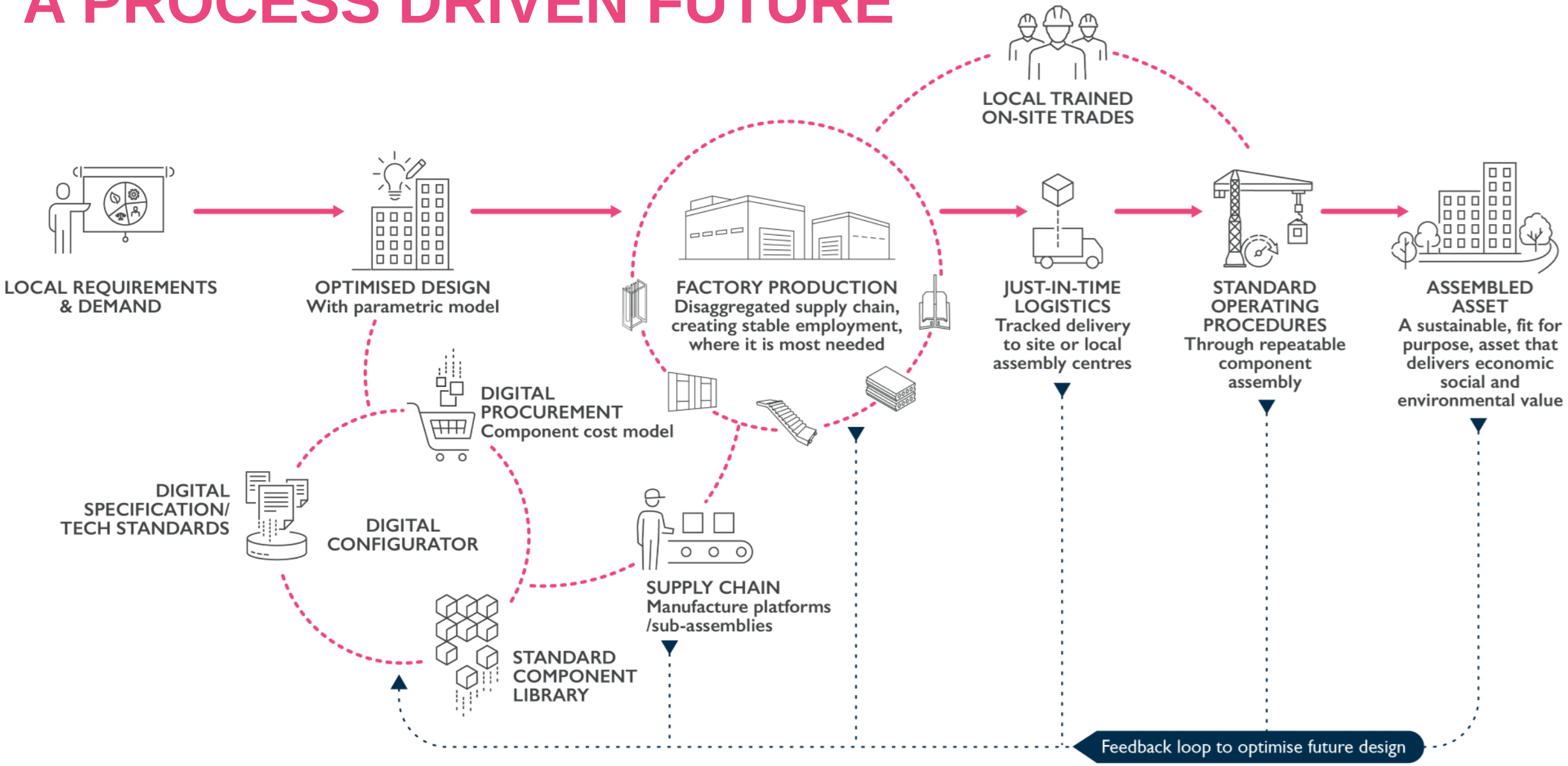
HLM Architects

AKERLOF

LIMBERGER ASSOCIATES

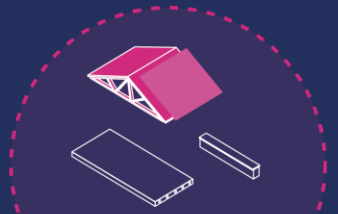
BURO HAPPOLD

A PROCESS DRIVEN FUTURE



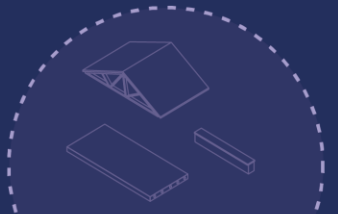
EXISTING - NO STANDARDISATION OR INDUSTRY ALIGNMENT

= RISK
(financial, planning, procurement and / or design)



MANUFACTURER B SYSTEM
(CHOSEN)

MANUFACTURER A SYSTEM



MANUFACTURER C SYSTEM
(ALTERNATIVE)

DESIGN BASED ON SELECTED MANUFACTURER'S SYSTEM - BESPOKE AND NO STANDARDISATION

EARLY ENGAGEMENT STRUCTURED AROUND A SINGLE SUPPLIER

IF AN ALTERNATIVE MANUFACTURE IS REQUIRED - ANY CHANGE OF SYSTEM RISKS REDESIGN

DEVELOP BRIEF AND SELECT A SYSTEM → DESIGN → PLANNING → APPROVAL → SINGLE SUPPLIER TENDER AWARD

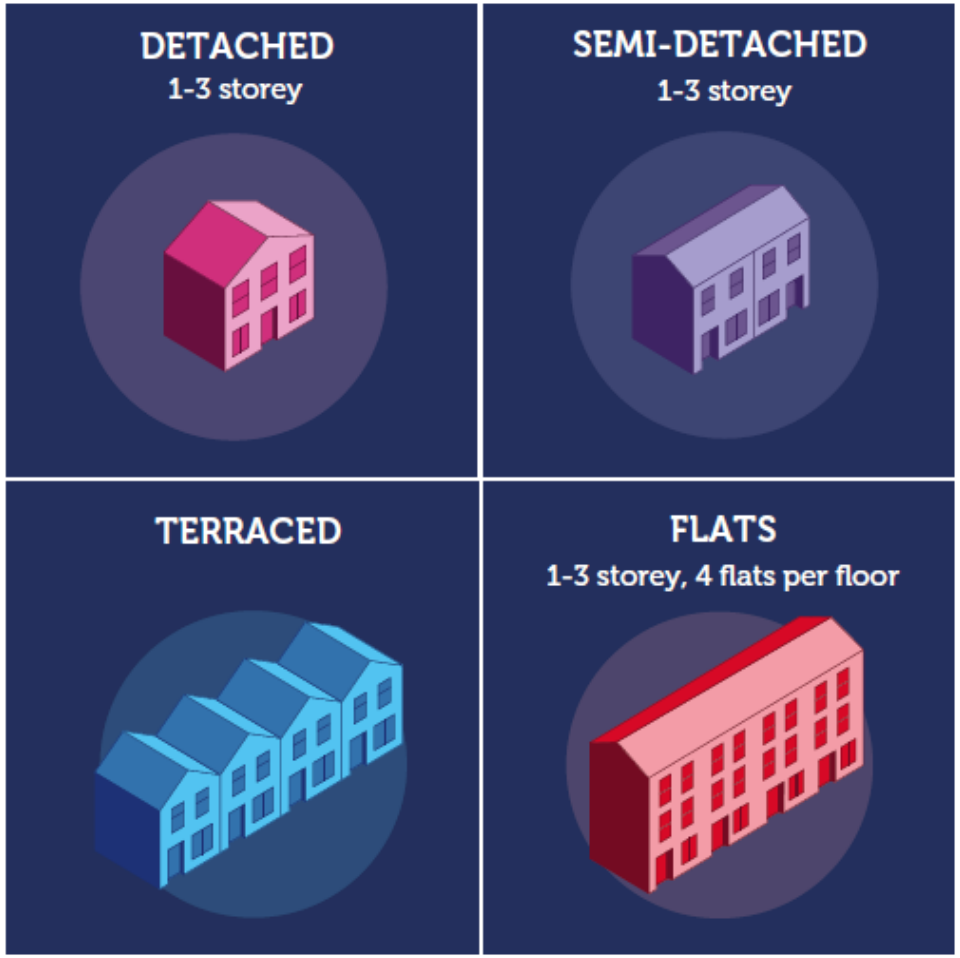
ONE MANUFACTURER ABLE TO DELIVER PROJECT AS DESIGNED

CONSTRUCT WITH THE CHOSEN SYSTEM

MHCLG KIT OF PARTS PROJECT

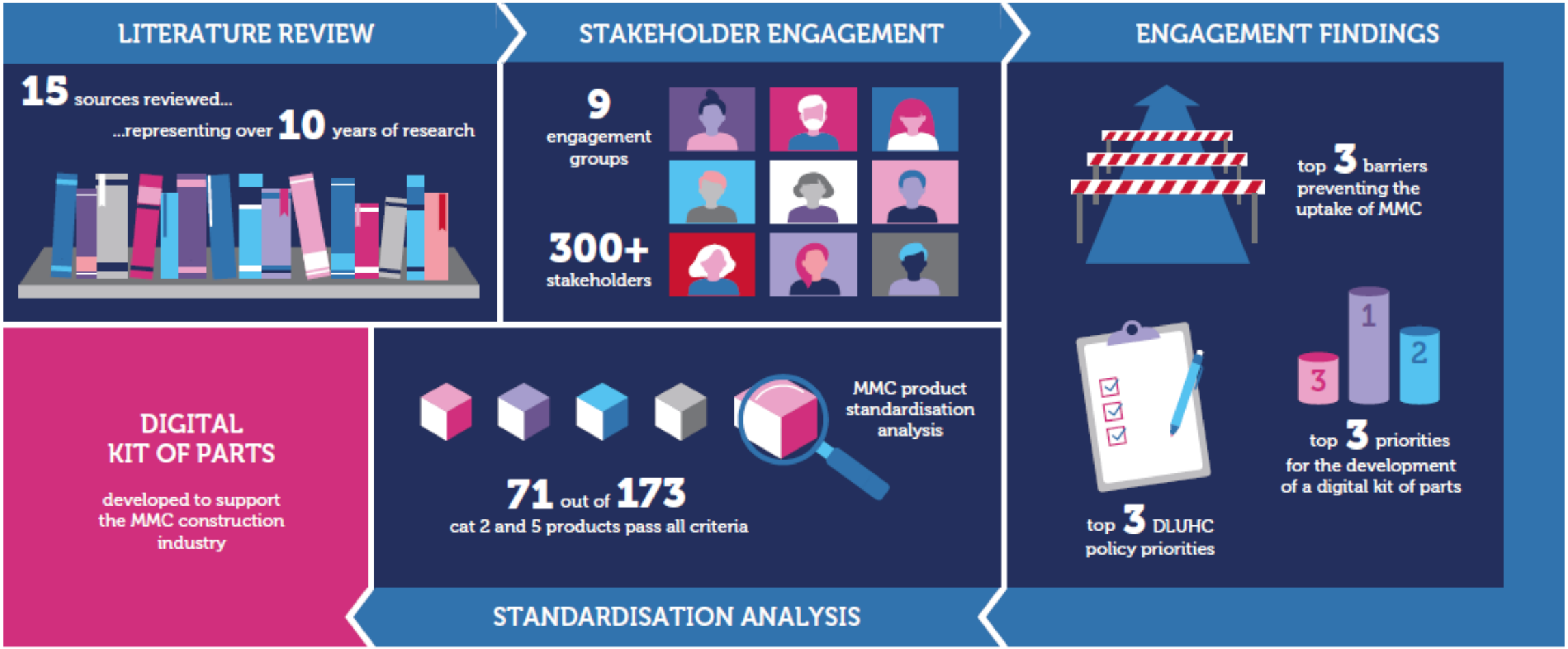
- **1 year research project** for the Ministry of Housing, Communities and Local Government **(MHCLG)** (Finished Spring 2024)
- **Focussing on MMC Category 2 & Category 5**

  (2D panellised systems and non-structural assemblies)
- Develop a **proof-of-concept digital "kit of parts" for low-rise housing**
- **Improve supply of new homes** by making the process **more efficient and higher quality**
- Key step by government **to translate policy into practice.**



Not covered: Above 11 metres, non-residential use, buildings over 3 storeys, buildings incorporating lifts, buildings with centralised MEP systems

RESEARCH METHOD

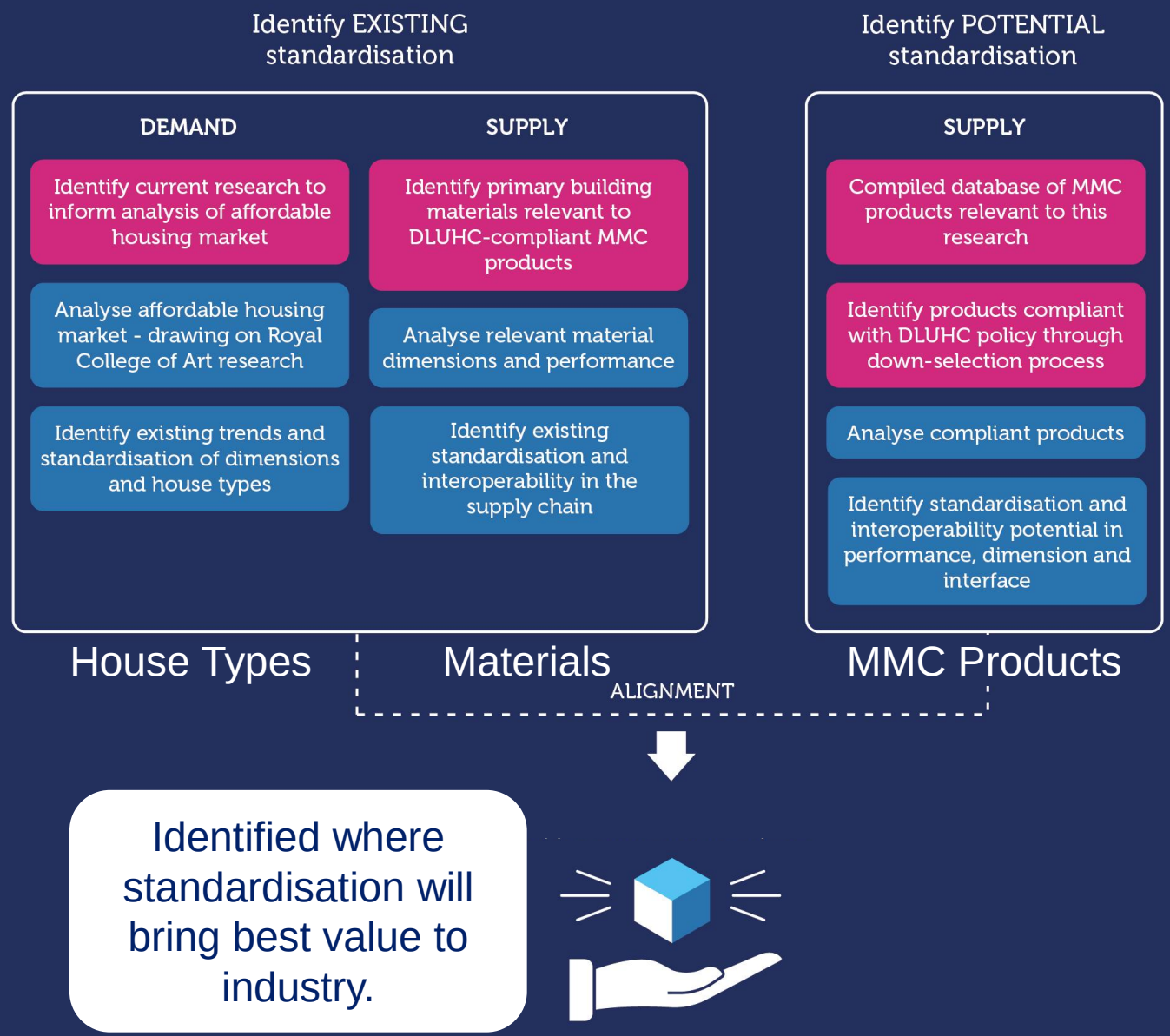


STANDARDISATION WITHIN THE D-KOP

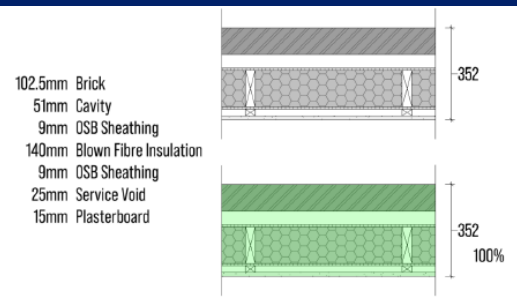
Sofia Raineri

STANDARDISATION METHODOLOGY

- 2023 RCA research on >25,000 house types (housing demand)
- Existing standardisation in material supply chain - **600 offsite products by 270+ manufacturers**
- Robust details
- STA / SCI fire rated details



STANDARDISATION METHODOLOGY



Product Name:

Timber panels

MMC:	Kit of Part:
2D Primary Structural Systems	External Wall

Energy Compliance:		Dimension Range (mm):	
U-Value (W/m²K)			
Value 1:	0.25-0.1 W/m2K	Value 1 (Lowest):	352mm
Value 2:		Value 2:	
Value 3:		Value 3 (Highest):	
Air Permeability (m3/(h.m²)):	5.0-1.5		

Scalability:

Scalability (Min. Order):	1 unit. Moderate CAPEX.
Scalability (Max Order):	1000 unit PA. Moderate CAPEX.

Versatility for MMC Categories:

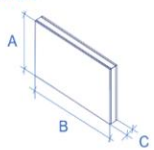
Category 1 Suitability:

Suitable for use in modular line loaded timber frame systems. (Score 5).

Safety:		Lifespan of product:	
Fire Safety Standard:	60mins, A1, Class 0	Durability:	BOPAS Accredited
Structural Certification:	BS EN 1995-1-1		

Standardisation Analysis: External Wall Data

Example: House type dimensions, MMC External Wall Panel data… height, length, depth



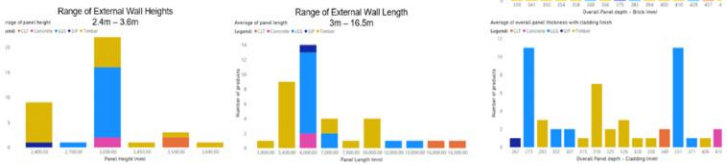
Material Key: Steel Frame, Timber Frame, SIP, CLT, Concrete

Range of External Wall Heights 2.4m – 3.6m

Range of External Wall Length 3m – 16.5m

Typical 2 & 3 BR House Types: Recommended maximum footprint 5.1m x 9m

Range of External Wall Depths 267mm – 488mm



	A Recommended External Wall Panel Height	B Recommended External Wall Panel Length	C External Wall Panel Depths (0.18 U-Value)
Timber/ SIP:	2.4m or 3m	5.4m	Maximum: 488mm
LGSF/ Concrete:	3m	6m	Brick masonry range: 339mm-488mm
CLT:	3.5m	16m	Rainscreen cladding range: 267mm-410mm

Floor & Ceiling Performance / Dimensions

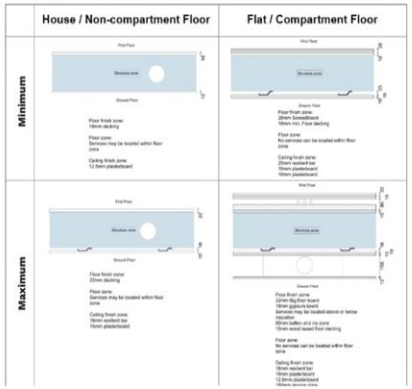
Using robust details that achieve typical low-rise housing requirements for fire and acoustics:

Fire:
- Flats up to 5m:REI 30
- 2 storey dwellings: R 30 EI 15
- Dwellings up to 3 stories: REI 30
- Flats/Dwellings up to 11m: REI 60
- Compartment floors: REI 60

Acoustics:
- Dwelling house up to 3 storeys: min. 40 RwdB airbourne
- Dwellinghouses and flats with separating function: min. 45 DnTw+CtrdB airbourne / max. 62 LnTw+Ctr dB Impact

Soffit/Ceiling finish range:
- Houses: 12.5mm-31mm
- Flats: 45mm-208.5mm

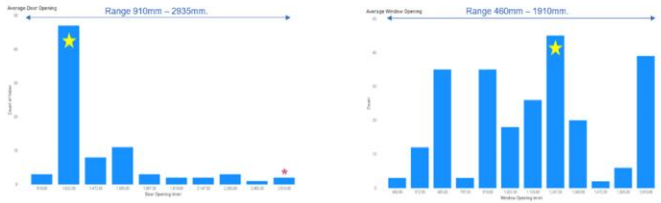
Floor decking/finish range:
- Houses: 18mm-22mm
- Flats: 46mm-136mm



Door & Window Standardisation Demand

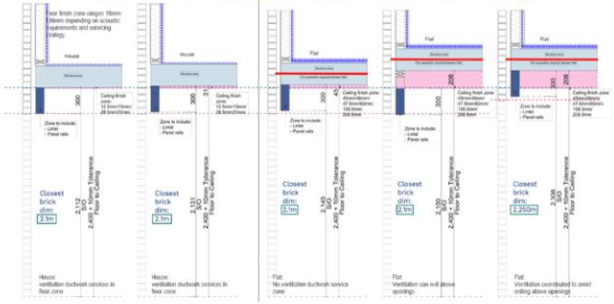
Door width s/o range:
- 910mm – 2935mm.
- Default value should be 1022.5mm

Window width s/o range:
- 460mm – 1910mm.
- Default value should be 1247.5mm



* Overall s/o range:
Most external wall manufacturers advise restricting opening width to 3m. This aligns with demand where the maximum door opening width seen in the standard house types is 2935mm.

Standardisation Analysis: External Opening



Opening Recommendations for designers:
- Allow min. 300mm between head of any structural opening and floor/roof structure above to avoid additional costs.
- Align structural opening head height to brick dimensions: generally, 2.1m (houses/flats).
- Best floor to ceiling finish dimension is 2.4m (+10mm tolerance) to reduce material waste. Note: 2.5m required in Greater London Authority.
- Most common structural joist depths are 220mm and 254mm. Ceiling finish zone varies – increases for service zone in flats, which affects floor to floor.

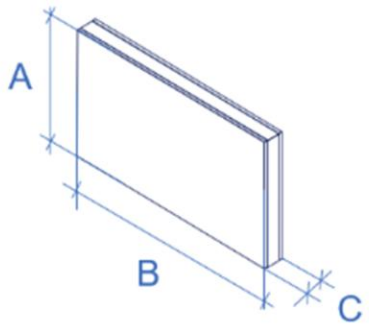
STANDARDISATION METHODOLOGY

Standardisation Analysis: External Wall Data

Example: House type dimensions, MMC External Wall Panel data… height, length, depth

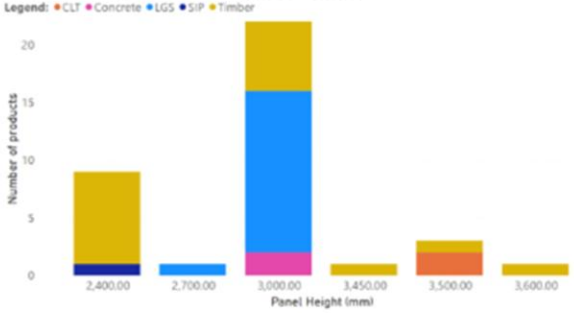
Material Key

- Timber Frame
- Steel Frame
- SIP
- CLT
- Concrete



Typical 2 & 3 BR House Types:
Recommended maximum footprint 5.1m x 9m

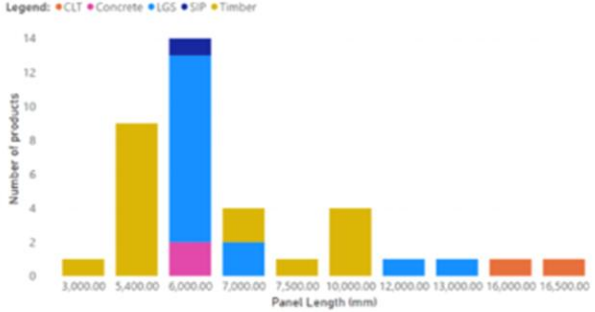
Range of External Wall Heights
2.4m – 3.6m



A **Recommended External Wall Panel Height**

Timber/ SIP:	2.4m or 3m
LGSF/ Concrete:	3m
CLT:	3.5m

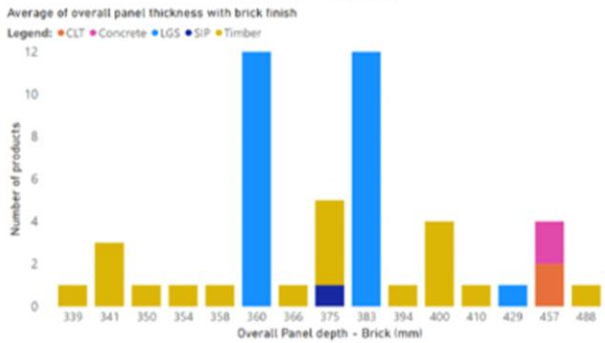
Range of External Wall Length
3m – 16.5m

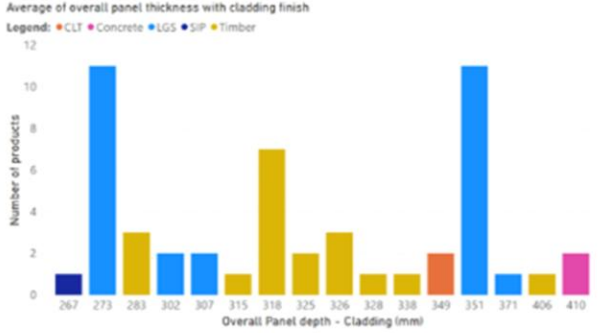


B **Recommended External Wall Panel Length**

Timber:	5.4m
LGSF/ Concrete:	6m
CLT:	16m

Range of External Wall Depths
267mm – 488mm

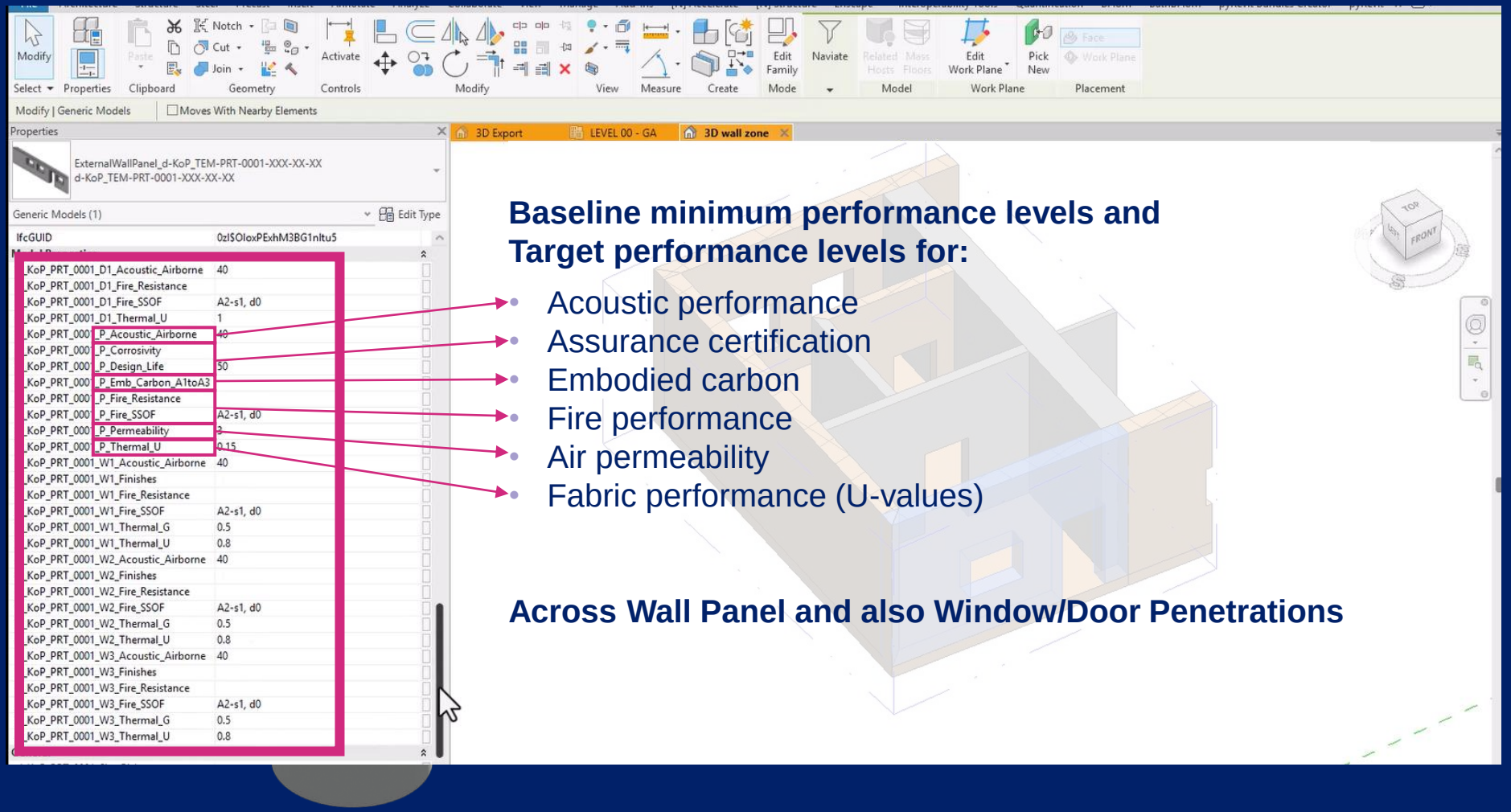




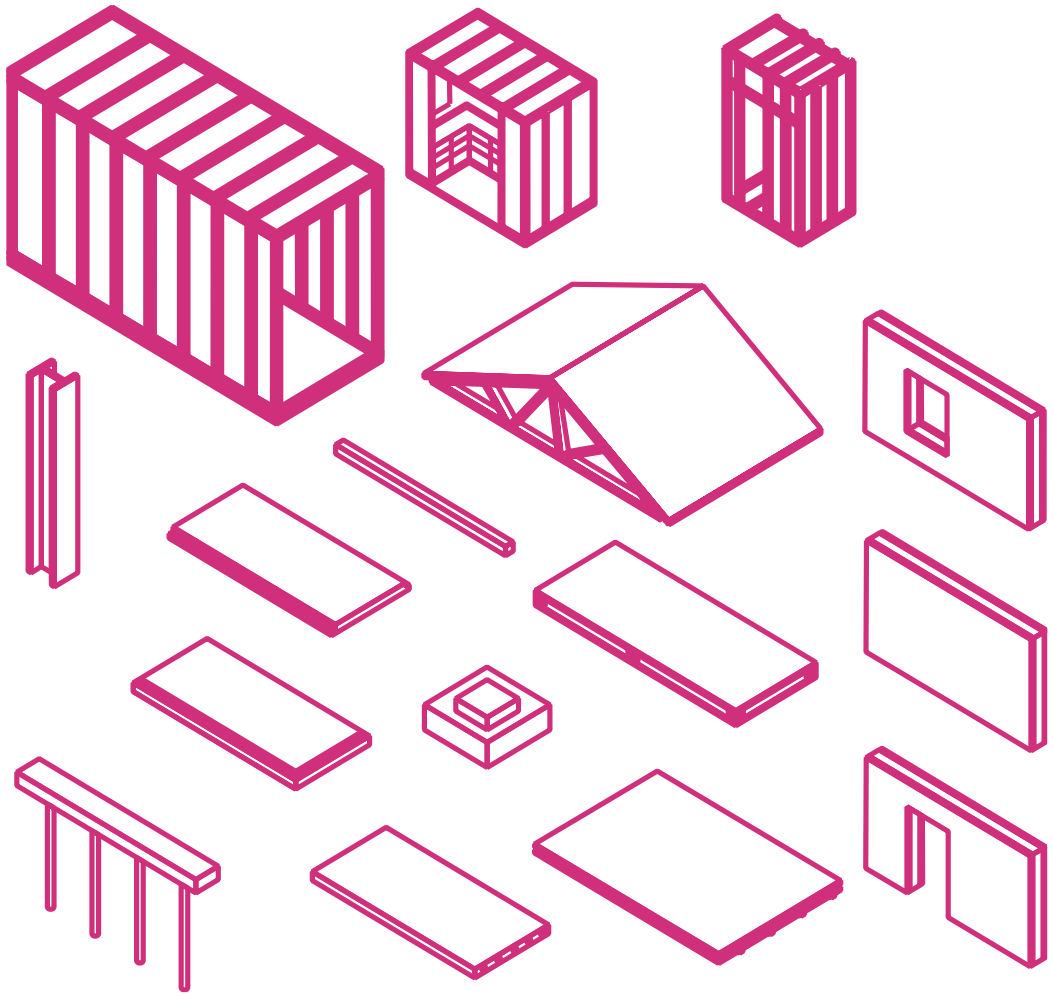
C **External Wall Panel Depths (0.18 U-Value)**

Maximum:	488mm
Brick masonry range:	339mm-488mm
Rainscreen cladding range:	267mm-410mm

REVIT DIGITAL KIT-OF-PARTS



STANDARDISATION SUMMARY



The dKop is formed by:

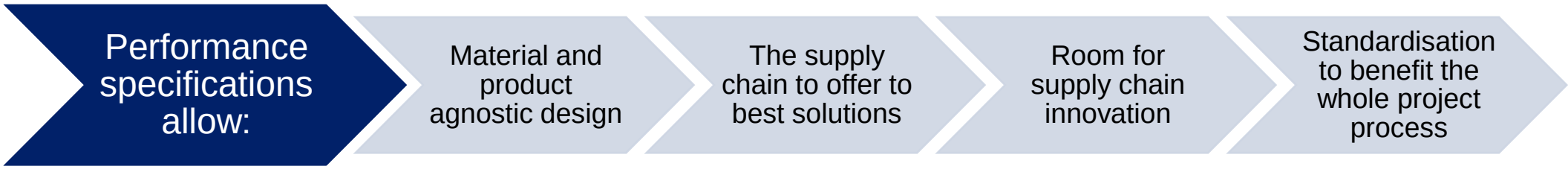
- External wall (L x W x H x D, structural opening dimensions and head height, cill heights, lintel depth)
- Upper floors (spans, joist depth, range of overall depths, service zones, ceiling heights)
- Party Walls (L x W x H, depth range by material)
- Roof (spans and pitch)
- Internal Partitions (L x W x H, depth range for compartment & non-compartment)
- Wet rooms (layout and plan dimensions)

Digital Kit-of-Parts

Katie Rudin

WHAT IS THE D-KoP?

The d-KoP is a consistent method of generating **performance specifications** for MMC components in the construction of low-rise housing



HOW IT HELPS INDUSTRY

Transform productivity and data driven decision making:

- Standard data exchange reduces errors and increase certainty within design
- Scales efficiencies and industrialisation of housing delivery

Support and enhance modern standards:

- Create certainty and predictability of what's expected for new homes
- Support compliance with existing policy (design codes, the BIM mandate, BSA)

Level the Playing Field for SMEs:

- Provide SMEs with the investable market needed to support growth
- Create the capacity within the SME housebuilding sector

Offsite aligned design solutions:

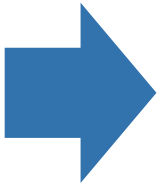
- Ensure design solutions align with the offsite industries capabilities
- Compatible across multiple suppliers and systems.

Kit-of-Parts in Practice

Sofia Raineri

What are the opportunities?

Manual Processes



Digital Kit of Parts

Challenges:

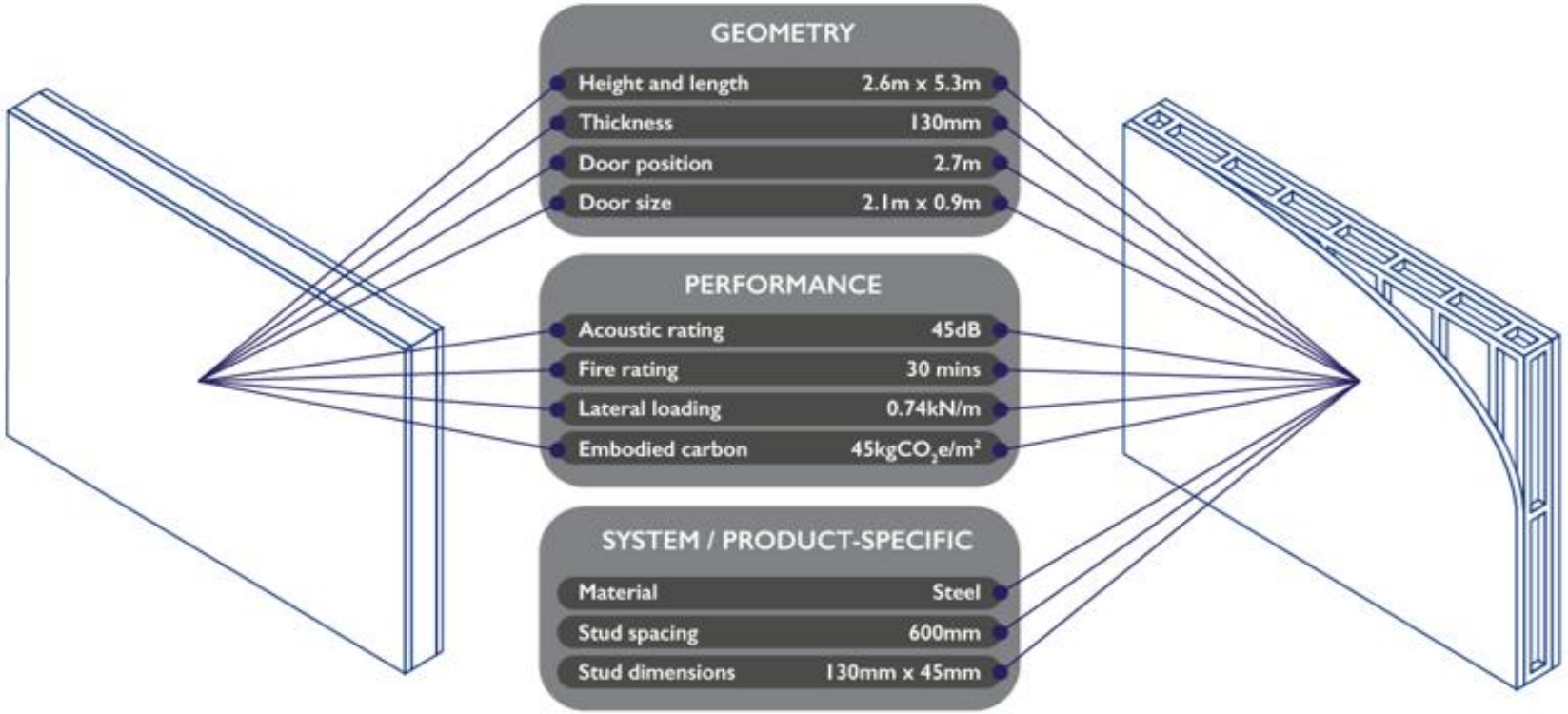
- Prone to errors
- Process knowledge is embedded in delivery teams making it vulnerable to team turn-over
- De-centralised decision making
- Risk of creeping change
- Not easily scalable

Opportunities:

- Improved Accuracy
- Consistency
- Efficiency
- Improved Communication
- Better Coordination
- Data informed choices
- Captures continuous improvement
- Scalable

One Kit, endless possibilities

Building with Data



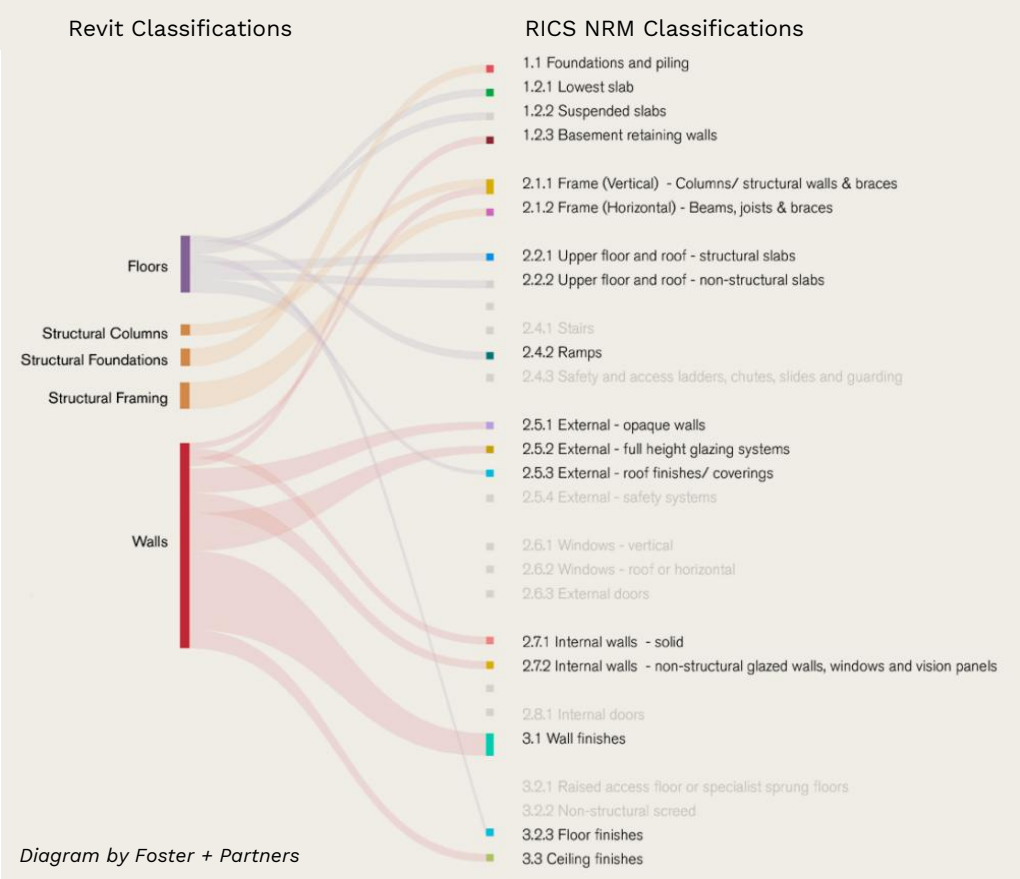
90% of construction companies will soon rely on data analytics tools

Those companies that can capture data, analyse it, and produce practical insights will likely enjoy lower costs, better project performance, greater efficiency, and safer workplaces.

~KPMG, 'Familiar challenges – new approaches,' 2023

Opportunity through Data

And more…



OneClick LCA Embodied Carbon tool import:

Material	Old quantity	New quantity	CLASS	Comment	Building Parts	Change
Glass wool insulation, L = 0.037 W/mK, T: 50-200 mm, 140 kg/m3, KL/KT 37 (Isover Saint Gobain)	48.0 m3	50.0 m3	EXTERNAL WALL	Wall type #1	1.2.3 External walls	+4.2 %
Ready-mix concrete, normal strength, generic, C25/30 (3600/4400 PSI), with CEM I, 0% recycled binder	40.0 m3	50.0 m3	FOUNDATION	Wall type #1	2.3.2 Cooling plant and distribution	+25.0 %
Hollow core concrete slabs, generic, C30/37 (4400/5400 PSI), 0% (typical) recycled binders in cement	25.0 m3	40.0 m3	SLAB		1.2.1 Frame (beams, columns and slabs)	+60.0 %
Ready-mix concrete, normal-strength, generic, C20/25 (2900/3600 PSI), 0% recycled binders in cement	10.0 m3	15.0 m3	SLAB	Foundations	1.2.1 Frame (beams, columns and slabs)	+50.0 %
Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	2.34 m3	3.34 m3	FOUNDATION	Foundations	1.1 Foundations (substructure)	+42.7 %
Reinforcement steel (rebar), generic, 60% recycled content, A615	12000.0 kg	12500.0 kg	EXTERNAL WALL	For retaining walls	1.2.3 External walls	+4.2 %

THANK YOU

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