

Housebuilding: *Now and in the Future*

Professor Sean Smith BSc, PhD, FIOA, FRSA, HONFRIAS

*Professor of Construction Innovation & Director of ISC
Institute for Sustainable Construction
School of Engineering & the Built Environment
Edinburgh Napier University
www.napier.ac.uk/isc*

Email: Se.smith@napier.ac.uk



THE QUEEN'S
ANNIVERSARY PRIZES
FOR HIGHER AND FURTHER EDUCATION
2015



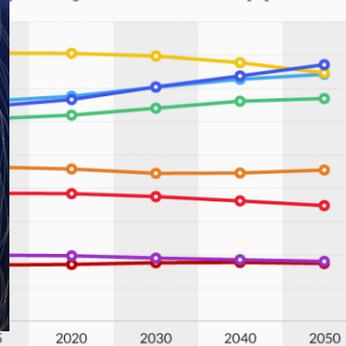


“During the next 20 years the world will spend over \$100 trillion on buildings, transport and infrastructure”

Professor Sean Smith HONFRS, BSc, PhD, FIDA, FRESA
Professor of Construction Innovation & Director of ISC

Germany will be Europe's biggest country by 2050

Population growth in the EU's most populous countries (2015-2050)



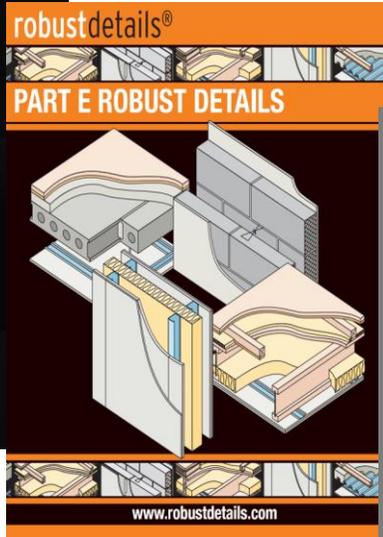
@statistaCharts Source: Eurostat i100 from The



48	Fibre Cement Products	54,942
49	Space Heaters	51,608
50	Wallpaper	51,281
51	Particle Board	50,445
52	Building Stone : processed	44,320
53	Doors & Windows (steel)	39,156
54	Profiles of Vinyl Chloride	34,936
55	Prefabricated Buildings (steel)	33,906



Credit: iStock/themacx



MRes
 Technical Direction
 Employee personal skills development which aligns with employer company objectives

Global factors



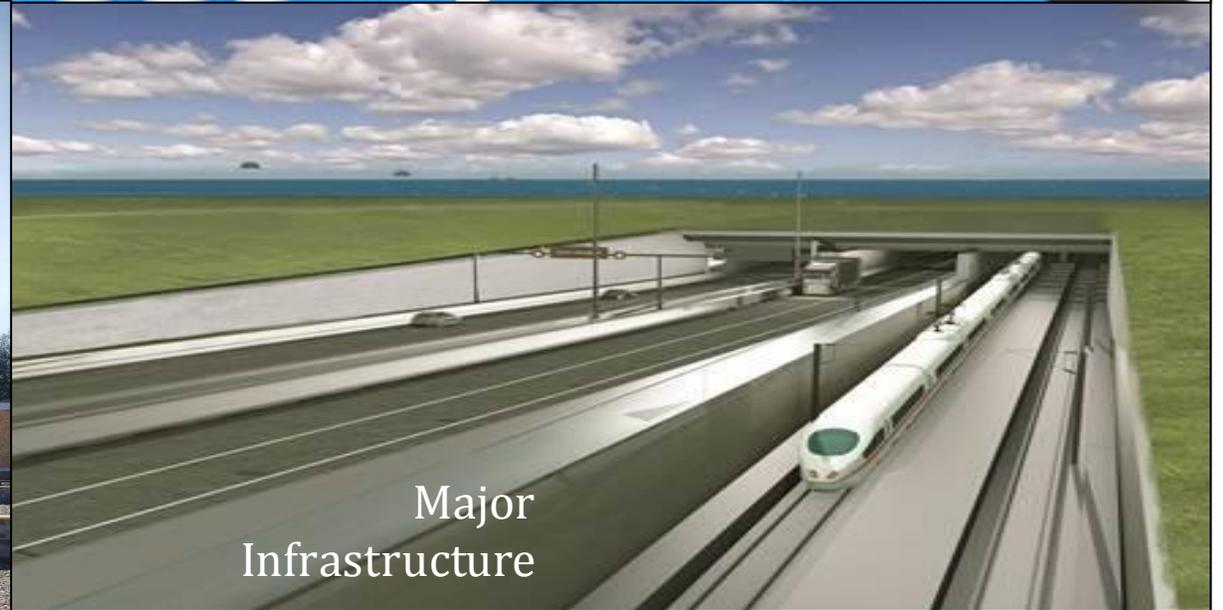
Future Cities



Green Highways



Low Carbon
Logistics



Major
Infrastructure

SUSTAINABLE CONSTRUCTION & TRANSPORT

.....Connecting global issues to support sustainable communities

**“During the next
20 years the world will
spend over \$100 trillion
on buildings, transport
and infrastructure”**

Professor Sean Smith HONFRIAS, BSc, PhD, FIOA, FRSA
Professor of Construction Innovation & Director of ISC

Industry R&D will
provide legacy to
support:
**future
communities,
economic
growth
and
sustainability**



“In the next 20 to 30 years, many countries are going to spend more money on infrastructure worldwide than they have spent in their entire history.”



Offsite health buildings



Gap sites timber

From rural ...to urban



Floating buildings

Globally we will change how we build and how we get there

Population growth

(Source: UN 2015)

2100 = 11.3 billion

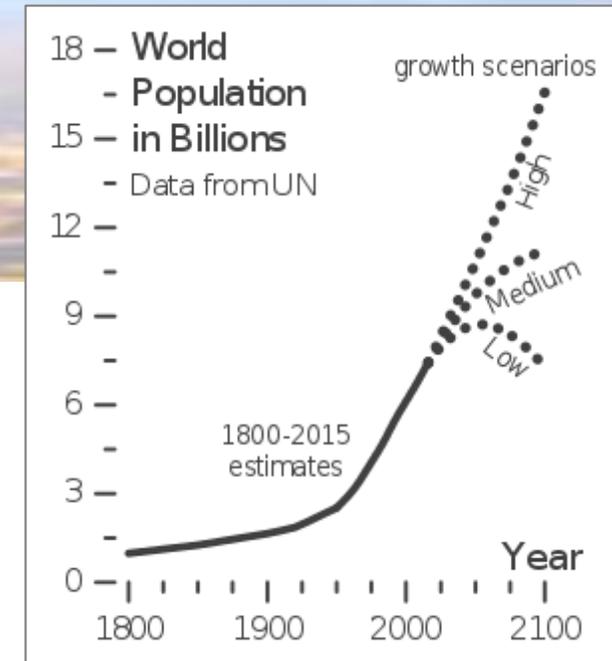
2050 = 9.7 billion

2030 = 8.5 billion

2015 = 7.3 billion

Image: NASA

- Habitat development availability?
- Sustainable communities
- Material resources and processes?
- Building performance?
- Aging population and demographics?



Future Housing Needs

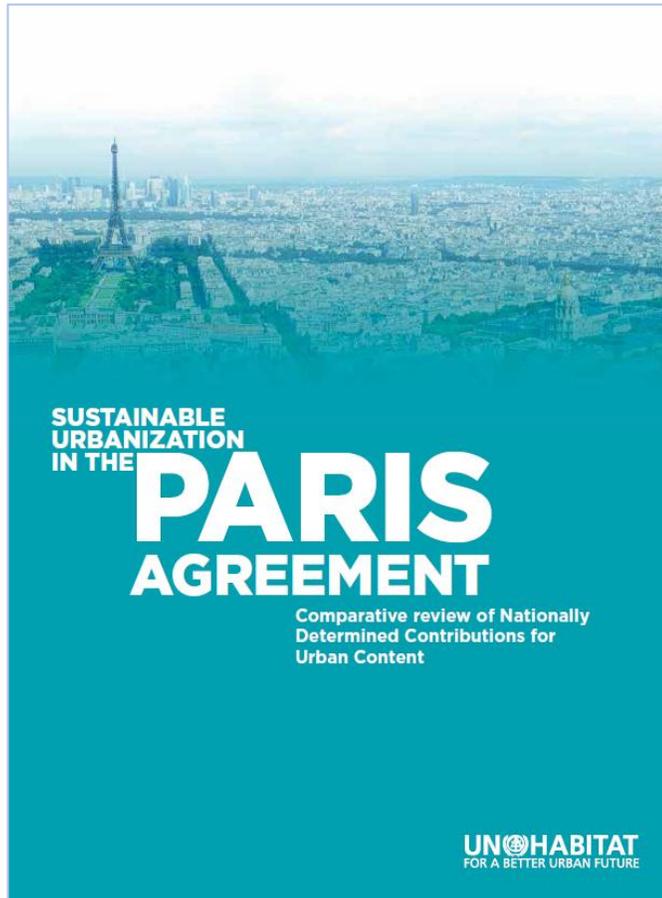
2100 = 11.3 billion



2015 = 7.3 billion

Image: NASA

- Global Household 'average size' ranges from 2.1 to 4.8
- Next 85 years – 4 billion increase in population
- Equivalent to 8 x EU27 Nations
- Probably need to build 1.4 billion homes
- Increase in age, influences from divorce etc..
- Add 25% to future 2100 requirement
- **Total = 2.4 billion homes** required by 2100



SUSTAINABLE URBANIZATION IN THE PARIS AGREEMENT

COMPARATIVE REVIEW OF NATIONALLY DETERMINED CONTRIBUTIONS FOR URBAN CONTENT

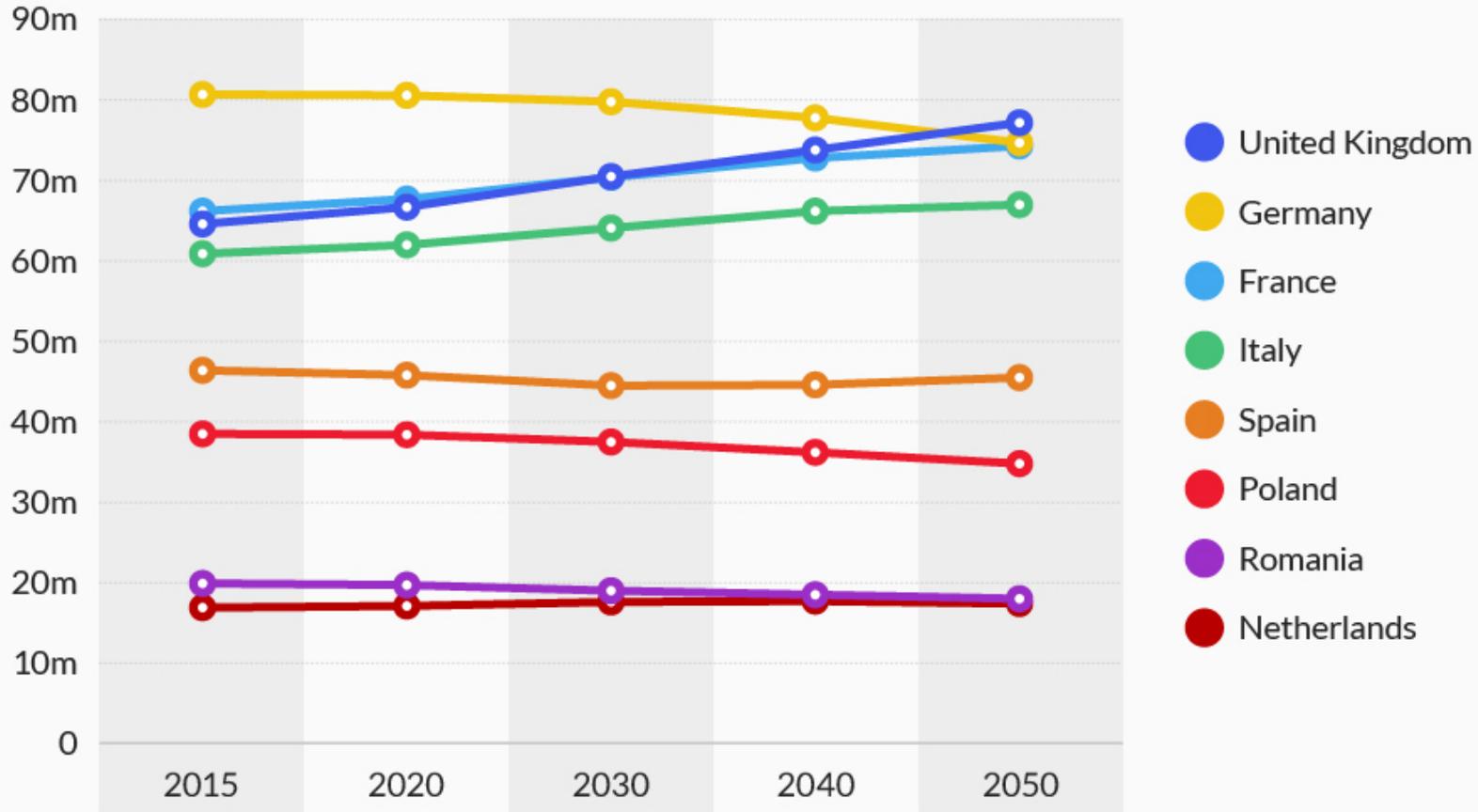
- By 2030, almost 60 per cent of the world's population will live in urban areas
- 95 per cent of urban expansion in the next decades will take place in developing world
- 828 million people live in slums today and the number keeps rising
- The world's cities occupy just 3 per cent of the Earth's land, but account for 60-80 per cent of energy consumption and 75 per cent of carbon emissions
- Rapid urbanization is exerting pressure on fresh water supplies, sewage, the living environment, and public health
- But the high density of cities can bring efficiency gains and technological innovation while reducing resource and energy consumption

Source: <http://unhabitat.org/books/sustainable-urbanization-in-the-paris-agreement/>

UK factors

The UK will be Europe's biggest country by 2050

Forecasted population growth in the EU's most populous countries (2015-2050)



@StatistaCharts

Source: Eurostat



from The INDEPENDENT





**What do the latest official
sub-national population
projections suggest for Great
Britain's 63 cities?**

Addendum to 'People in cities: the numbers'

3. Projected overall population change 2011-2036 for individual cities

Top 10 cities

Rank		000s	Rank		%
1	London	2671.6	1	Cardiff	32.7
2	Birmingham	353.5	2	Coventry	30.8
3	Manchester	272.4	3	Milton Keynes	29.3
4	Bristol	150.1	4	Aberdeen	28.7
5	Edinburgh	135.9	5	Edinburgh	28.4
6	Leeds	122.5	6	London	28.1
7	Cardiff	113.1	7	Crawley	28.0
8	Sheffield	97.7	8	Luton	26.6
9	Coventry	97.6	9	Swindon	26.5
10	Nottingham	94.1	10	Peterborough	24.1

Priority Theme

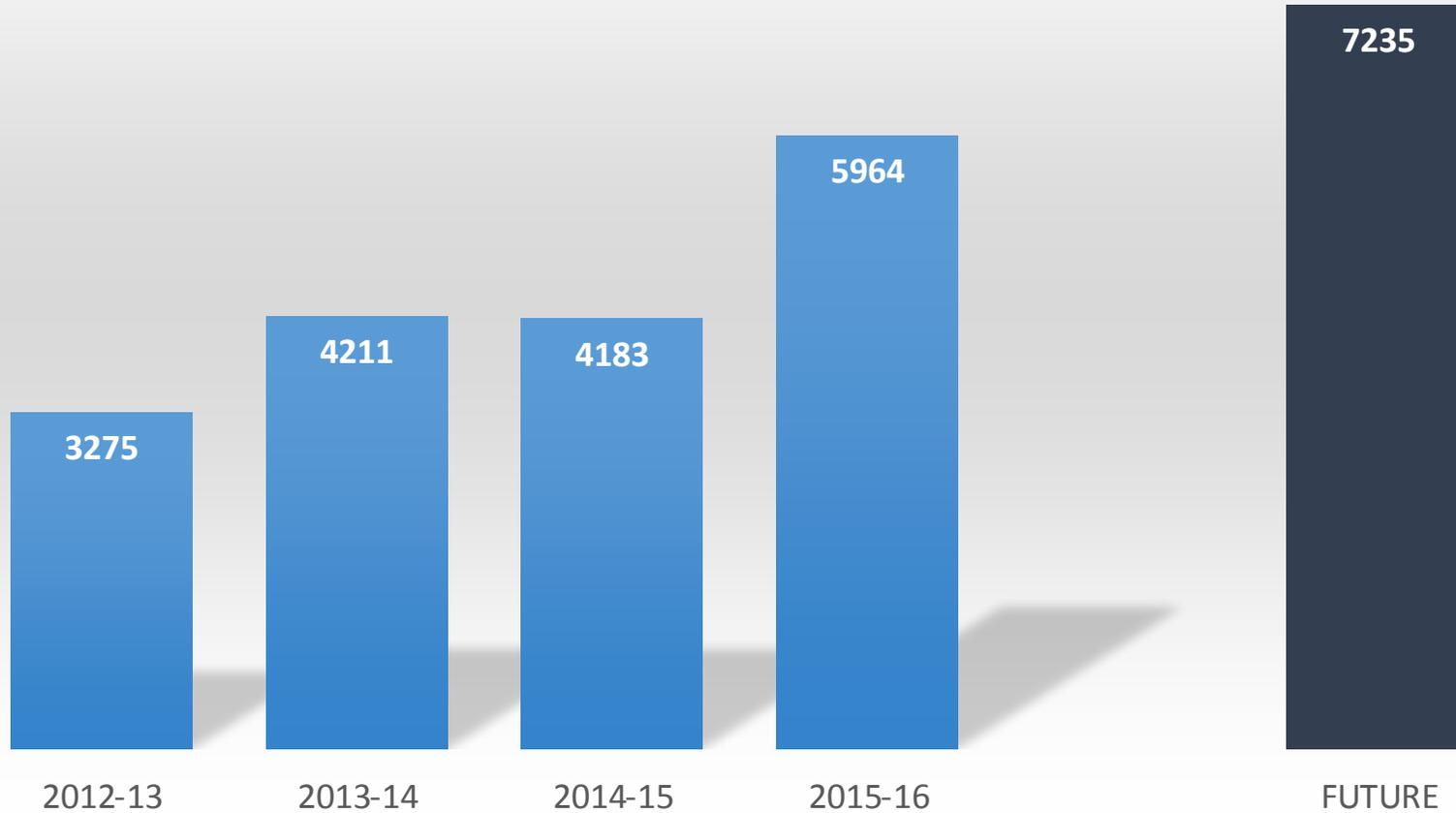
Housing:

**Innovation & Skills
to deliver capacity**

SES Output

Previous & future

SES – Previous and future required annual new build housing requirements (2017-37)



Priority Theme Housing:

- **Innovation & Skills**
- **Step change for the future**
- **45% increase in new homes required**

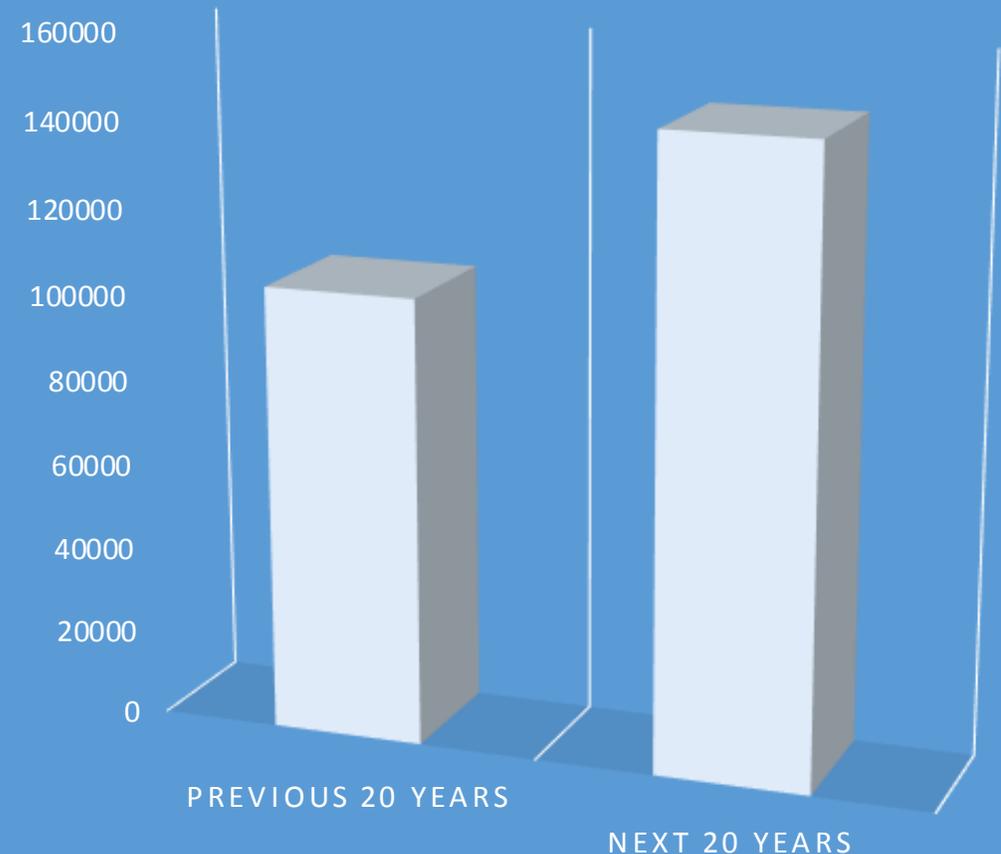
OUTCOME

- Mapping key future skills now undertaken
- Likely that **Offsite (OSM)** will be a key feature in future procurement in SES

Also seen in other regions

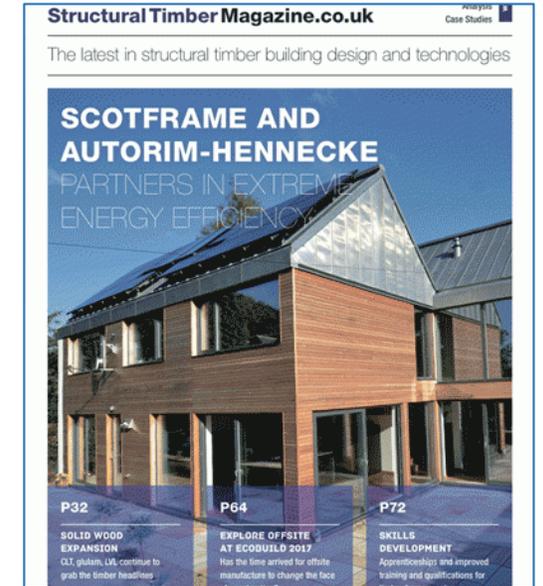
- West Midlands skills shortage – electricians and other skills
- Weekly costs reported in media “£3,000 per week”

COMPARING PREVIOUS 20 YEARS WITH NEXT 20 YEARS HOUSING IN SES REGION



OFFSITE HUB

- Increasing growth in offsite developments
- New offsite manufacturing facilities
- Offsite skills training hubs
- London £800 million modular framework
- More schools being built with offsite



- Attracting more interest from students and school pupils
- Industry needs offsite!!
- *B2B, Quality checks, Repeatability, Reproducibility, Performance*



EU & Brexit

- 12% of UK construction workforce from Europe
- In London some HB companies employ 35% to 50% EU workers
- EU workers leaving UK in future could cause significant skills shortages across the UK
- Loss in London may also cause southern drift of northern workforce
- Future pressures on capacity, labour costs and delivery times

Pressures, Uncertainties and Key Factors

Economic Growth in some EU countries – attracting UK-EU workers to return home

Drop in **Pound-Euro exchange**

Nov 2016 and Oct 2016 (£) depreciated 20%

Applying to be resident

- 50 page document
- Fees

Applying for a UK passport

- 80+ page document
- £2,000 fees
- Exams and tests

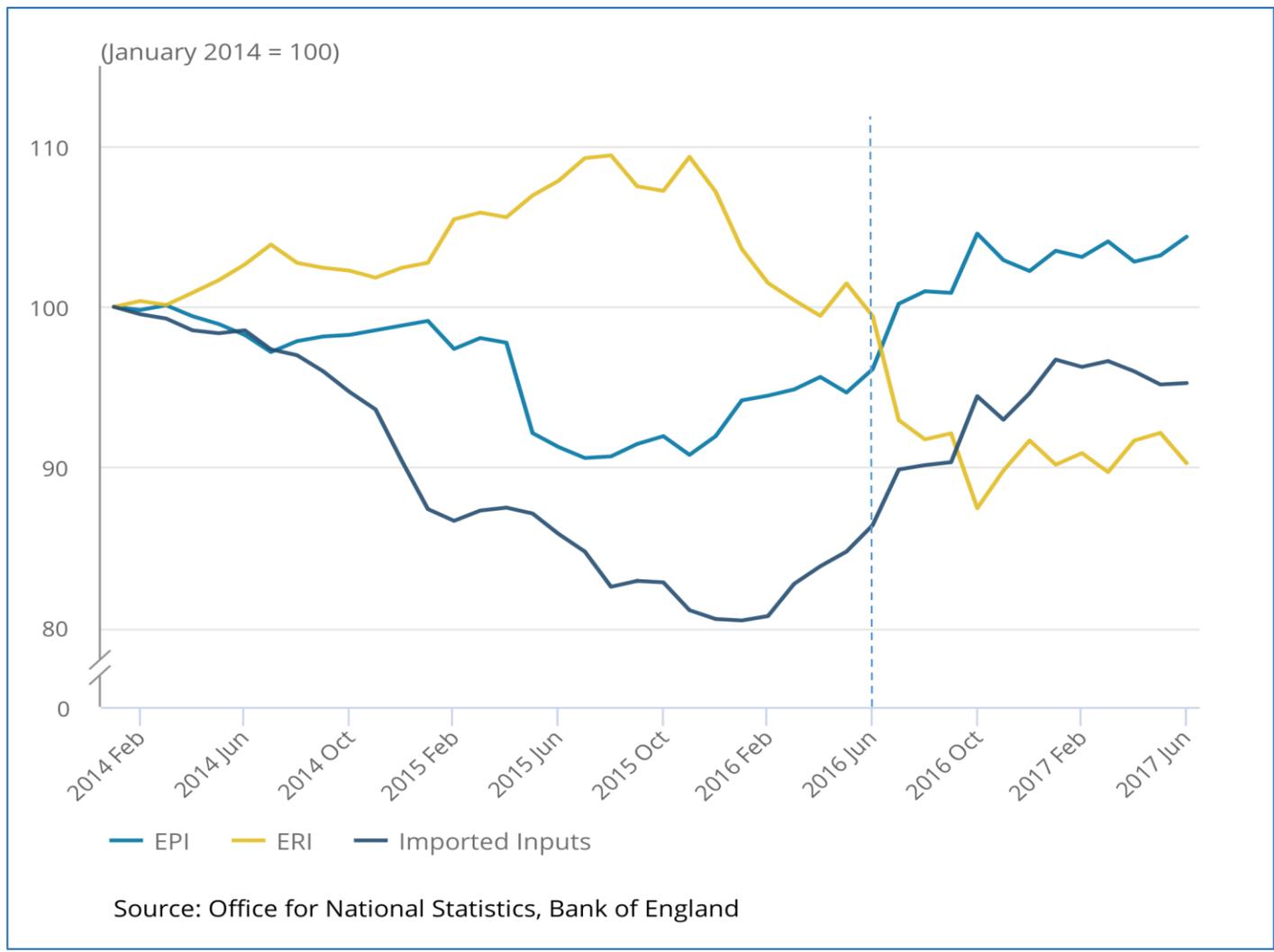
Not feeling wanted!

MARKET Economics

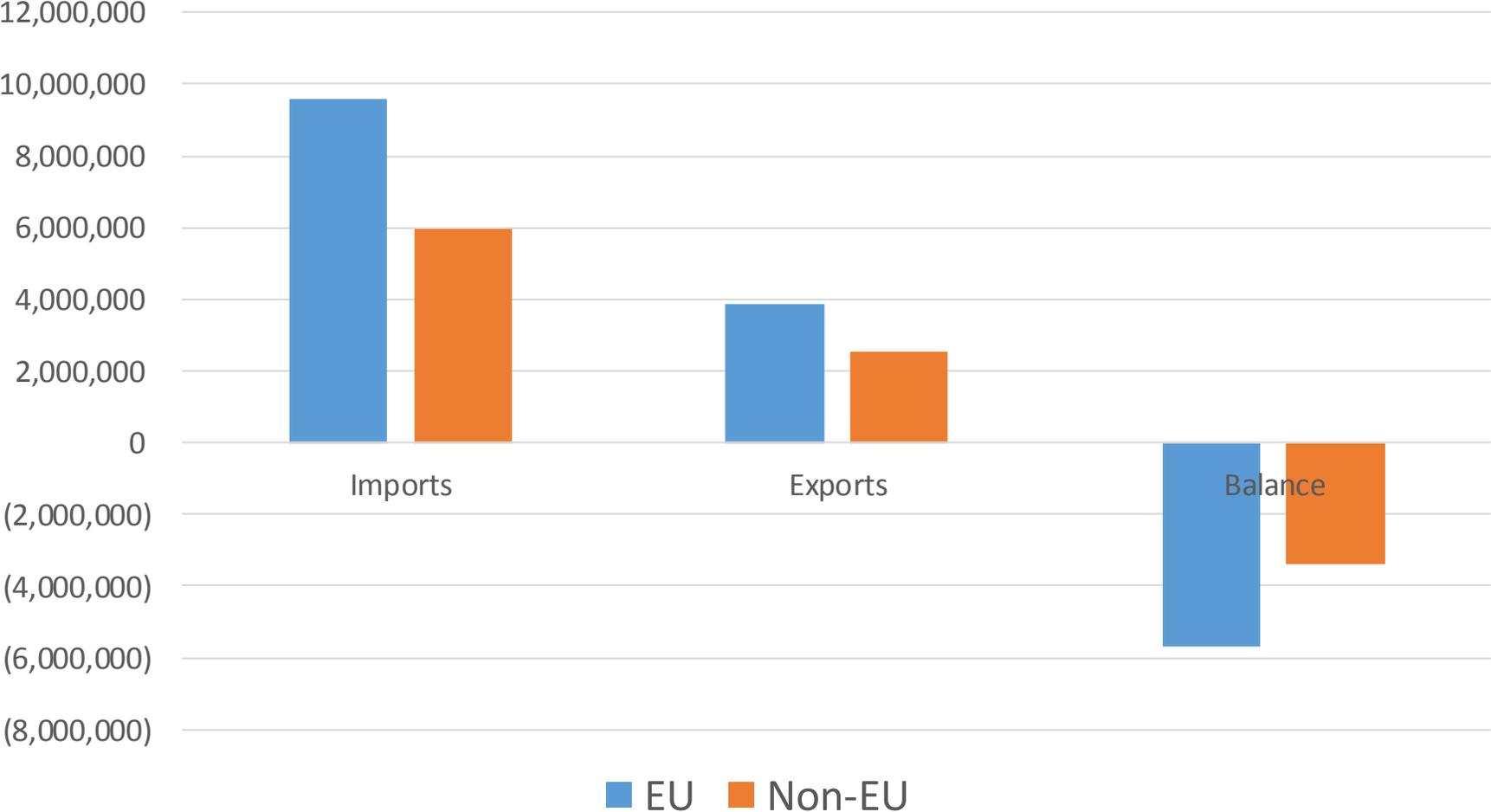
EPI – Export Price Index

ERI – Exchange Rate Index

II – Imported inputs (producer price index [PPI])



UK Trade - Construction Products 2016 Imports & Exports (£'000s)

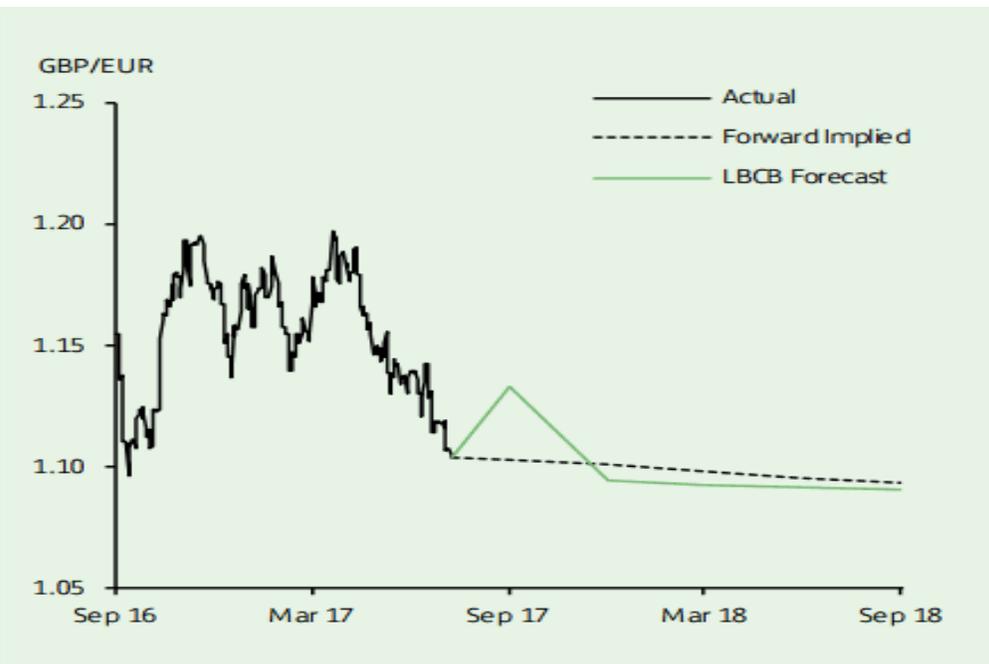




Possible choppy waters ahead!

If pound continues to devalue against the Euro this will increase import costs and material prices.

Lloyds forecast estimates the next year averaging out at £1 to 1.09 Euro



Rank	Product Category	UK - EU Imports (£'000s)
1	Electrical Wires	874,587
2	Sawn Wood > 6mm thick	775,862
3	Central Heating Boilers	571,357
4	Paints & Varnishes	431,337
5	Aluminium for Fabrication	380,832
6	Lamps & Fittings	369,500
7	Structural Units (aluminium)	311,150
8	Air Conditioning Equipment	287,438
9	Linoleum Floor Coverings	260,588
10	Structural Units (steel)	255,076
11	Steel for Fabrication	236,963
12	Plugs & Sockets	213,556
13	Fan Systems	199,737
14	Mastics, Putty	186,969
15	Taps & Valves	183,756
16	Copper Pipes	181,304
17	Windows (wood)	169,925
18	Builders Ironmongery	163,170
19	Glazed Ceramic Tiles	162,859
20	Other Plastic Building Products	139,592

21	Prefabricated Concrete Products	132,595
22	Lifts & Escalators	125,852
23	Fire & Security Alarms	117,957
24	Ceramic Sanitaryware	104,498
25	Wood Block Flooring	99,392
26	Concrete Reinforcing Bars	99,349
27	Plastic Pipes	86,870
28	Doors (wood)	85,917
29	Steel Tubes & Hollow Sections	80,348
30	Doors & Windows (aluminium)	78,454
31	Plastic Sanitaryware	76,132
32	Metal Sanitaryware	71,332
33	Other Builder's Woodwork	67,633
34	Fitted Kitchens (assembled)	66,216
35	Clay Bricks	65,936
36	Air Purifying Equipment	65,477
37	Water Heaters	65,100
38	Laminated Wood	64,120
39	Slate Products*	64,101
40	Unglazed Ceramic Tiles	63,455

41	Radiators	63,288
42	Concrete Pipes	59,353
43	Asphalt Products*	58,497
44	Other Glass Products	58,463
45	Fibreboard	57,379
46	Flat Glass	55,824
47	Prefabricated Buildings (wood)	55,559

48	Fibre Cement Products	54,942
49	Space Heaters	51,608
50	Wallpaper	51,281
51	Particle Board	50,445
52	Building Stone : processed	44,320
53	Doors & Windows (steel)	39,156
54	Profiles of Vinyl Chloride	34,936
55	Prefabricated Buildings (steel)	33,906

56	Plasterboard	32,022
57	Electrical Insulators	31,680
58	Nails & Screws	30,823
59	Doors & Windows (plastic)	24,746
60	Slag for Construction	20,705
61	Tar & Bituminous Mixtures	19,262
62	Prefabricated Buildings (other)	11,418
63	Lime	1,366
64	Densified Wood	892
65	Portland Cement	27



3 different options

1. EFTA – Norwegian type model
2. Parity Agreement – no tariffs
3. WTO - default



WORLD TRADE
ORGANIZATION

IF “no deal” is struck between the UK & EU then one of the likely outcomes is to default to the WTO scheme.

- EU WTO Average levy for UK is **5.8%**
- Tariff costs vary depending on the product category and country
- Annual increase import cost to UK construction sector may be **£540 million**



Some *example* construction related tariffs:

Carpets	7.8%
Plastics	6.1%
Paints & varnishes	6.0%
Aluminium	5.7%
Ceramic products	5.1%
Glass	5.0%
Electrical	2.4%
Wood	1.9%

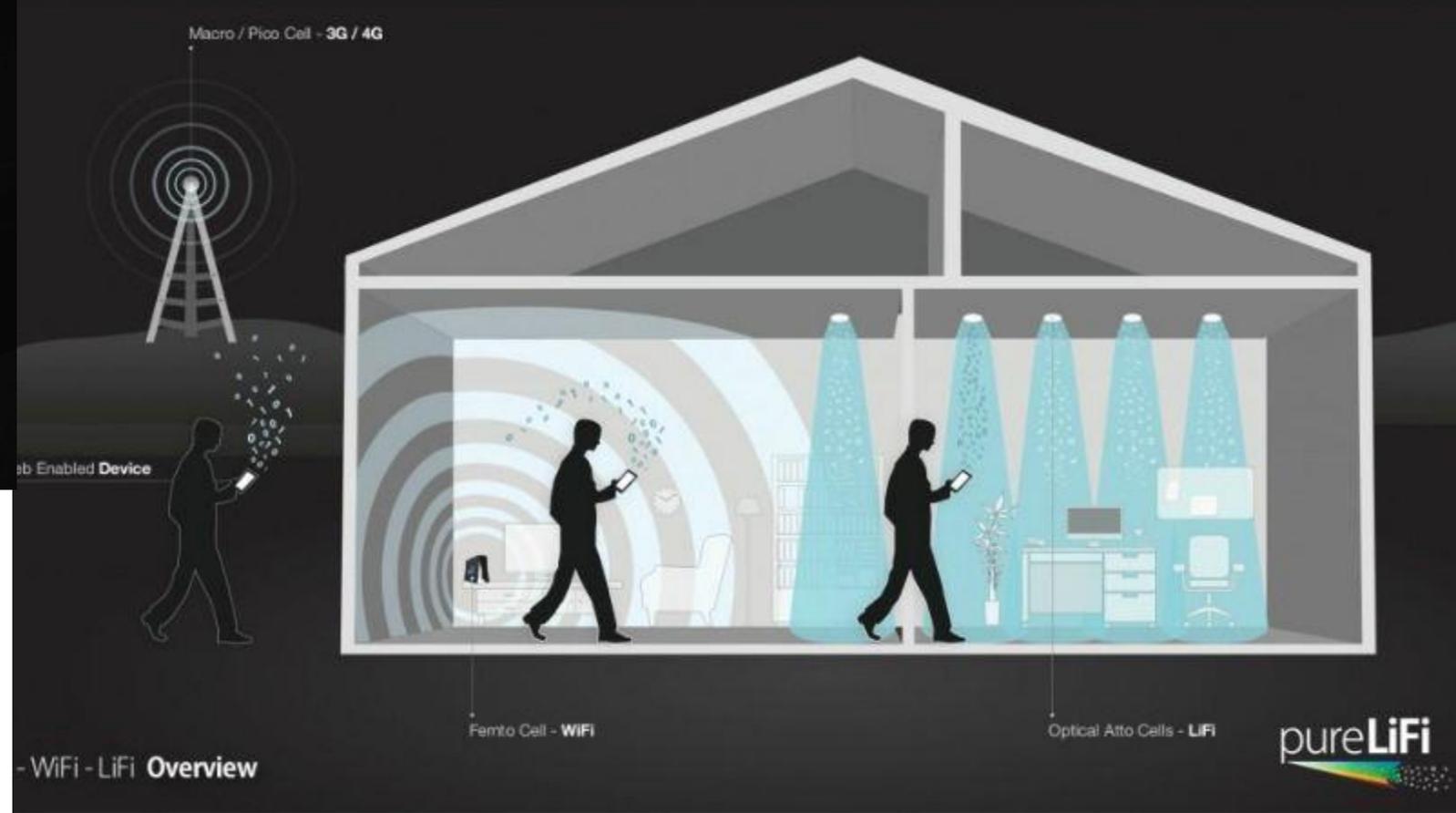
Li-Fi



Credit: iStock/themacx

Li-Fi:

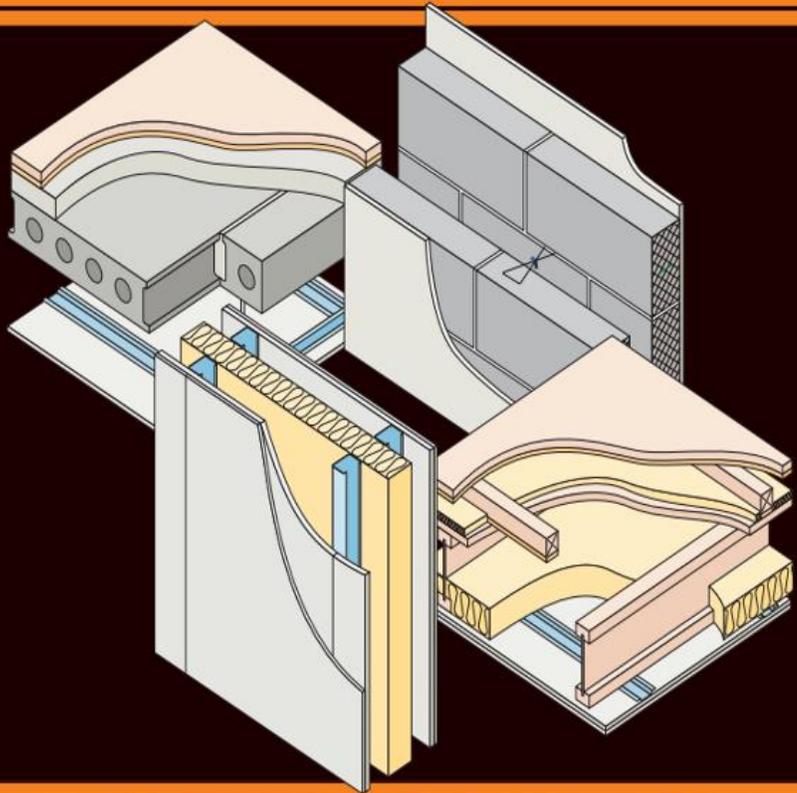
- Light fidelity is a visible light communication (VLC) technology
- Uses common household LED light bulbs to enable data transfer
- Bounce technology 70 Megabits/sec
- 100 x faster than Wi-Fi



- Does not transmit through walls
- Applications into home office environment – higher security applications
- Requires lights to be on – aligns with solar power installations well

<https://www.youtube.com/watch?v=FbDohcbuhu0>

<http://purelifi.com/technology/>



Design & On-site Performance

- Process born via HBF members and product suppliers
- Continues to improve
- 99% compliance

World leading sound insulation database

- Worked with DCLG/Scot Gov to 'object' to proposed ISO changes for low frequencies
- Successfully showed the 'impossible case' of testing on site at such low frequencies
- Also fed in to new international Research & Innovation papers

Also New ISO Classification (A-G) for sound insulation levels due in 2018

- RD will advise HBF members of influences and effects





Image 2: Photograph taken at Oxfgangs School of the gable wall after the collapse.



Image 3: Photograph taken at Oxfgangs School of the gable wall after the collapse.



Image 4: Photograph taken at Oxfgangs School of the gable wall after the collapse.

COLE report (270 pages)

Key issues:

- Structural issues with wall ties, workmanship and gable brick walls
- Scrutiny and Site Inspection
- Lack of embedment, lack of ties, lack of head restraints, wind posts, narrow inner leaf walls
- 17 schools affected,
- Different lead contractors and subcontractors across sites

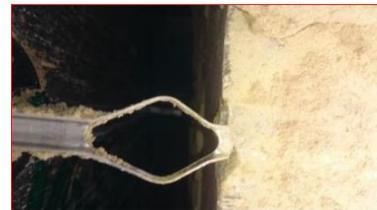
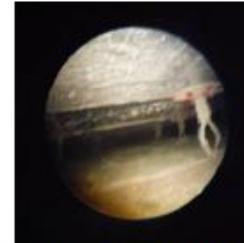


Photo 0185
Location 61A – Embedment 0mm



no embedment at Drummond High



Image 14: Survey photographs demonstrating failure to find head restraints at Goodtrees Neighbourhood Centre.

Scot Gov consultation

Fire and smoke detectors:

- Aim to create consistency and clarity across different housing tenures
- Private rented is currently same as new build
- Proposal for all housing tenures to be the same as private rented

<http://www.gov.scot/Publications/2017/09/8183/downloads#res524309>

ISC International Research Theme:
Resilience and frameworks for Storm Surge



ISC - International Research Theme:

Architecture of Emergencies in the Middle East
Developing future transitional shelters

MRes

Technical Direction

Employee personal skills
development which aligns
with employer company
objectives

Further information:
Contact Prof Sean Smith – se.smith@napier.ac.uk

MRes (Technical Direction)

- Masters in Research
- Part time study
- Employers may fund staff as part of their CPD

Could be based on:

- *Future construction innovation*
- *Products / system development*
- *Regulatory impacts*
- *Technical compatibility*
- *Offsite systems review*
- *Housing design plans*

The above are some examples

Output: Technical Report

No exams