Theme 1 Property level and scalable solutions

Theme 2 Built environment as a living system, interdependencies with supporting infrastructure

Theme 3 What lies beneath (urban soil resilience, groundwater, geo-environmental engineering)

Theme 4 Ageing built environment and supporting infrastructure

Theme 5

- **Preparing society and industry (consumers, markets and industry interactions)**
- **Preparing research to respond to the needs of society and industry (communities, residents, consumers, markets and industry interactions) in dialogue & partnership**

Theme 6 Data forms, new measurement, modelling and analysis capability and techniques

Theme 7 Built environment – connecting inside and outside

Research need: TO UNDERSTAND WHEN DECISIONS ARE MADE IN THE DESIGN PROCESS

Table number 1A

Detailed description:

DECISIONS ABOUT ENVIRONMENTAL STRATEGY ARE OFTEN BASED ON INTUITION OR PAST PRACTICE. WE NEED EVIDENCE-INFORMED DESIGN GUIDANCE FOR USE BY INDUSTRY.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

TO OPTIMISE THE PERFORMANCE OF NEW (+POTENTIALLY EXISTING) BUILDING STOCK.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

☑ Productivity	P1	P2	P3	P4	P5
☐ Connectedness	C1	C2	C3	C4	C5
☑ Resilience	R1	R2	R3	R4	R5
☐ Health	H1	H2	H3	H4	H5

Research need: Eliminate error in construction

Table number 1A

Detailed description: Zero-error construction

Industry studies have shown 10-20% / year loss of value in construction industry due to

- error (direct + indirect costs)
- rework
- latent defects

Needs to be addressed with techno-socio-economic research

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Working towards eliminating the performance gap between theory & practice in the built environment.

Ref CITB "Get It Right" study

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

☑ Productivity	P1	P2	P3	P4	P5
☑ Connectedness	C1	C2	C3	C4	C5
☑ Resilience	R1	R2	R3	R4	R5
☑ Health	H1	H2	H3	H4	H5

Research need: future performance criterias/measurement

Table number 1

Detailed description:

how to measure the performance of buildings into the future.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- a greater understanding of what is 'smart'
- occupancy levels of buildings
- measurement from social perspectives
- health + well being in environments.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	○	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply	*Circle relevant ambition numbers*				
✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: OVERHEATING, INDOOR AIR QUALITY

Table number 1a

Detailed description:

→ HOW DO YOU BRIEF, DESIGN, COMMISSION, HANDOVER, ~~[illegible]~~ USE AND MAINTAIN BUILDINGS TO HAVE GOOD INDOOR AIR QUALITY AND AVOID OVERHEATING IN NEW, EXISTING AND RETROFITTED BUILDINGS?

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

→ DENSIFICATION

→ NEED FOR AIRTIGHT BUILDINGS

→ HEALTHY BUILDINGS

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: UNDERSTANDING THE PERFORMANCE GAP

Table number 1A

Detailed description:

WE STILL DON'T KNOW WHY, AFTER ANALYSIS OF DEC DATASETS, AND LARGE SCALE POE STUDIES, WHY BUILDINGS USE 3-5 TIMES AS MUCH ENERGY AS PREDICTED.
WE NEED A ROBUST DATASET OF BUILDING PERFORMANCE IN USE.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

IN ORDER TO CHANGE BUILDING PRACTICE.

DISSEMINATE KNOWLEDGE ABOUT PERFORMANCE IN USE/OCCUPANT BEHAVIOUR (N.B. QUALITATIVE RESEARCH).

IMPACT: REDUCE ENERGY CONSUMPTION OF NEW BUILDINGS (NON-DOM BUILDINGS BUILT TODAY USE MORE ENERGY THAN EVER BEFORE)

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Human centred research

Table number 1a

Detailed description:

Design of buildings & cities with human experience in the center of it. / + health & wellbeing.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Buildings & cities are designed based on cost/profit. That doesn't guarantee wellbeing of occupants, the opposite! Socially ~~based~~ informed technological/engineering advances are needed.

Must commence by: now 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: ACCESSIBILITY OF BUILDING PERFORMANCE

Table number 1

Detailed description:

PROVISION, ACCURACY + UPDATE OF BUILDING INFORMATION TO DRIVE ~~SUS~~ BETTER PERFORMANCE.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

NEED TO ~~ALLOW~~ ENABLE POLICY + FISCAL DRIVERS

DEVELOPING TRUST IN INFORMATION

INCREASED EFFICIENCY IN MANAGEMENT OF PROPERTY

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓				✓

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: Interdisciplinary working.

Table number 2

Detailed description:

Support, training and funding mechanism to properly support interdisciplinary research

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Not enough time, patience to develop communication with researchers from other teams

Rush in terms of career, need to publish, research council boundaries to get proposals/results out quickly and to fit within boundaries

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓	✓	✓	✓	✓

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	
Health	H1	H2	H3	H4	H5

Research need: The role of disruptive ~~technologies~~ changes

Table number 2a

Detailed description:

We are very bad at predicting the future. So we need to look at various ~~pot~~ possibilities: population might go up or down; we might work more at home; live to 120; have suffered a world war.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Looking at only one future is not wise

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Full decarbonisation of the built environment

Table number 2a

Detailed description:

We have been playing with this. We need to know what a zero carbon society looks like.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

UK GHG policy

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Incorporation of Buildings as a Living System

Table number 2a

Detailed description:

Can buildings become more like organisms?

Development of a building system where the building becomes more self sustaining.

Manage their own waste, use renewable energy sources, (solar, wind) pollution management through green walls, roofs, balconies...

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Reduced pressure on land, infrastructure improving peoples' health within buildings.

Large surface area becomes available to incorporate vegetation within the city

Massive reduction of the pressures on waste management infrastructure

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓				

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Need to understand what might population needs be in relation to the buildings we want to live in by/in 2080

Table number 29

Detailed description:

* Need for highly adaptable building & infrastructure
* Need to recognise that the building needs are likely to change rapidly as the needs of the current generation are likely to be different from the future generation (say in 2080)
* Perhaps need to develop appropriate predictive models

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Why & Knowledge gap

* It will help address the difficulty in predicting what sort of buildings will be needed in the future

Impact

* Creating appropriate buildings that meet the needs of the population

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: incorporation of biodiversity into future transport networks. Table number 9

Detailed description:

Current transport networks have an associated network of linear habitats - e.g. Road verges, urban greenways.

As transport develops how will these areas' biodiversity be maintained or improved.

Will new transport facilities offer opportunities to provide for wildlife.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Biodiversity protection

wellbeing of people living in the urban environment.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓		✓		

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Understanding how the built environment can interact more directly with the natural environment

Table number 2a

Detailed description: The built environment has traditionally been very static and disconnected from the surrounding natural environment. More research is needed on how buildings can interact more directly with natural systems in order to create more dynamic buildings that can use natural resources as an energy source, for heat and light, and for food. Understanding how building users interact with the natural environment aspects of the built environment is also crucial.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

A key driver is sustainability - more dynamic buildings should be lower carbon and encourage re-use of resources. The research could feed into best practice around design, construction, and use of more dynamic 'green' buildings and built-environment spaces.

Must commence by: (2020) 2030 2050+

Must be achieved by: 2020 2030 (2050+)

Circle as appropriate

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓	✓			

Research need: Interdisciplinary research on societal change & interaction with human & technological systems

Table number 2b

Detailed description:

Engineers, natural scientists, social scientists (political, geographical, psychological, ~~[illegible]~~ sociological) & computer scientists/technologists need to work together to understand how communities interact with human technological systems, to ensure that ~~[illegible]~~ genuine breakthroughs can occur

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- Unintended consequences of energy efficiency technologies
- Unintended ~~uses~~ social outcomes
- Unintended uses of built environment
- Repurposing ageing infrastructures, maintaining for resilience (exceeding design limits)

Must commence by: (2020) 2030 2050+

Must be achieved by: 2020 (2030) 2050+

Circle as appropriate

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	P1	(P2)	P3	P4	(P5)
✓ Connectedness	C1	(C2)	(C3)	C4	(C5)
✓ Resilience	(R1)	(R2)	R3	(R4)	R5
✓ Health	H1	(H2)	H3	H4	H5

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓	✓			

Research need: Adaption to a very different climate

Table number 2a

Detailed description:

We need work on not a slightly different climate, but a very different one

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

We are failing to control the temperature rise

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓			✓	✓

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Research on adaptation for climate change and reduce health eff

Table number 2b

Detailed description:

1) Green infrastructure: Green walls, Sustainable drainage.

2) Energy security - using green technologies/renewables to produce energy.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

1) Improve air quality

2) Improve productivity - using vertical gardening

3) Producing energy out of green systems and waste.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓			✓	✓	

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: HEALTHY URBAN FORM - What does it look like?

Table number 2b

Detailed description: to encompass GREEN INFRASTRUCTURE encourages ACTIVE TRAVEL LIVING HAPPILY @ DENSITY

How can we make urban environment healthier?
- avoid overheating
- improve air quality

energy efficient + comfortable in winter + summer

Drivers:

Why is this research needed, what impact will it have, what knowledge it fill?

urbanization
housing shortage
ageing popul^n
↳ health issues
eg air pollution, obesity, sedentary lifestyle

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ✓ ESRC ✓ AHRC BBSRC ✓ MRC ✓ STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: DATA ANALYTICS FOR ~~IMPROVED~~ SMARTER BUILT ENV. MANAGEMENT

Table number 3

Detailed description:

USE OF NEW / EXISTING SENSORS OF DIFFERENT KIND ~~TO~~ SMART PROCESSING VIA DATA ANALYTICS → IMPROVED BUILDING / BUILT ENV. MANAGT.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- IMPROVED QUALITY OF LIFE
- INCREASED EFFICIENCY OF USING ENERGY FOR HEATING, ETC., WATER
- NEED FOR SMARTER, LOW COST SOLUTIONS TO MAKE BUILDINGS / BUILT ENV. MORE INTELLIGENT

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Integrated modelling of the Built Environment

Table number 3

Detailed description:

To understand the interactions between infrastructure, water/air/soil, people etc.

To understand the cascaded impacts of system failures

To build resilience into the Built Environment.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- Threats,
- Reduce the consequences of failures

Must commence by: 2020 (circled) 2030 2050+

Must be achieved by: 2020 2030 2050+ (circled)

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓				

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3 (circled)	C4	C5
Resilience	R1	R2 (circled)	R3	R4 (circled)	R5 (circled)
Health	H1	H2	H3	H4	H5

Research need: Cost effective adaptation/retrofits against floods

Table number 3

Detailed description:

* Knowledge on cost effective adaptation/retrofits is very limited across country
* more research needed on propagation of floods, networks, probability & studies

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

~~LWEC there~~

lot of commercial studies available not a lot of methods available to judge the cost effectiveness & appropriateness of them.

Must commence by: now 2020 2030 2050+

Must be achieved by: 2020 (circled) 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✗	✗				

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4 (circled)	P5
Connectedness	C1 (circled)	C2	C3	C4	C5
Resilience	R1	R2 (circled)	R3	R4 (circled)	R5
Health	H1	H2	H3	H4	H5

Research need: NEXUS UNDERSTANDING

Table number 3

Detailed description:

IMPROVED UNDERSTANDING OF WATER-ENERGY-FOOD NEXUS IN THE BUILT ENVIRONMENT VIA NOVEL METABOLISM BASED APPROACH FOR IMPROVED EFFICIENCY AND RESILIENCE TO CLIMATE CHANGE / OTHER UNCERTAINTIES

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- NEXUS NOT WELL UNDERSTOOD CURRENTLY
- MAJOR IMPACT IN THE UK AND DEVELOPING COUNTRIES (FAST GROWING CITIES IN INDIA, CHINA)

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓	✓			

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: understand urban soil - built environment interaction (water) ★ able number 3

Detailed description:

Little quantitative info about urban soil, even less on the effect of various construction activities, building forms & type — in both spatial & temporal dimensions.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

underground infrastructure operation & resilience

urban green space

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓		✓		

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: EXPLORE BUILDING DESIGN OPTIONS INTEGRATING BUILDINGS WITH GREEN INFRASTRUCTURE

Table number 3

Detailed description:

HOW CAN URBAN SPACES BE USED TO REDUCE IMPACTS OF FLOOD & DROUGHT HAZARDS AND ASSOCIATED RISK. (including likely increase in frequency of surface water flooding)
Use aquifers, underground spaces, paths, transport corridors to achieve benefits
PLAN BUILDINGS AND SPACES TOGETHER!

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- CLIMATE CHANGE (FREQUENCY OF FLASH FLOODING GOING UP)
- INCREASING URBANISATION.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ✓ ESRC ✓ AHRC BBSRC MRC STFC ✓

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Low Carbon & Adaptable retrofit

Table number 4

Detailed description:

Are the current retrofit solutions in them easily adaptable to take into account the continous aging of ~~the~~ buildings & infrastructure and changing climate

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Why

Built environment ~~needs~~ (buildings & infrastructure) needs keep changing. The retrofitting today will also age

Impact

Creating buildings & infrastructure that meet the needs of the current generation while not disadvantaging the needs of the future generation.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply		*Circle relevant ambition numbers*				
✓	Productivity	P1	P2	P3	P4	P5
	Connectedness	C1	C2	C3	C4	C5
✓	Resilience	R1	R2	R3	R4	R5
	Health	H1	H2	H3	H4	H5

Research need:

Table number 4

Detailed description:

Resilience as a goal of innovation

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Irreducible uncertainty in future.

Must commence by: 2020 2030 2050+

Must be achieved by: ~~2020~~ ongoing 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply		*Circle relevant ambition numbers*				
✓	Productivity	P1	P2	P3	P4	P5
	Connectedness	C1	C2	C3	C4	C5
✓	Resilience	R1	R2	R3	R4	R5
✓	Health	H1	H2	H3	H4	H5

Research need: Developing a standardised assessment method to rate building adaptability

Table number 4

Detailed description:

- To develop an objective assessment method for rating the adaptability of buildings
- Identify the various factors that affect/contribute to building adaptability

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- Adaptability is a lifecycle consideration that requires an objective assessment method to assist decision makers in the design/creation of buildings.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Adaptability Performance Certification

Table number 4

Detailed description:

Identifying current adaptability of existing buildings, & through predicting future needs identify what design interventions are needed to retain the building for the future.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

This will inform the better maintenance, refurb & reuse of existing buildings

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Modelling changes in Buildings + Infrastructure

Table number 4

Detailed description:

- Understanding and modelling changes in buildings with respect to cause/effect and solutions
- studying a large dataset of building changes to develop robust forecasting models of building changes.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Understanding changes that buildings have to undergo is necessary to plan for how they can be made more adaptable

Must commence by: Now 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	X	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need:

Table number 4

Detailed description:

All buildings age
- how to design for maintainability? + disassembly.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Because modern const. systems are often difficult to maintain + disassembl

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate but is ongoing.

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: Building-in adaptability in existing (ageing) buildings

Table number 4

Detailed description:

- Developing an understanding of how existing buildings can be made more adaptable
- Developing tools and systems to make this possible

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Extending the useful life of existing buildings should factor in possible changes that might occur in future, so the adaptation potential needs to be considered in ~~its refurbishment~~ their refurbishment.

Must commence by: NOW 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	✓	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
☒ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Building valuation in the context of adaptability

Table number 4

Detailed description:

- How can we value the building environment beyond the current grading system?
- Valuing in terms of potential for adaptation, creating a sense of place and inclusivity.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

* material constraints and environmental impacts
  → reusing buildings and avoiding demolishing of current built environment.
* contribute to tools and models of adaptability.
* Knowledge gaps
  * financial tools for climate change adaptation.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
	X			X	

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

X Productivity	P1	P2	P3	P4	P5
X Connectedness	C1	C2	C3	C4	C5
X Resilience	R1	R2	R3	R4	R5
X Health	H1	H2	H3	H4	H5

Research need: Innovative materials for refurbishment

Table number 4

Detailed description:

Investigating novel materials for refurbishment & adaptation of existing buildings to NZEB future
- materials such as energy facades, ultra-thin insulations, also green/natural/ ~~textiles~~ bio-based materials chemically engineered for strength

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Support adaptation of aging building stock.

Development of new materials for filling new needs.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓		✓		

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Life cycle carbon & energy implications

Table number 4

Detailed description:

Develop understanding of embodied carbon, particularly of existing building, in order to cost environmental impacts of interventions.
~~[illegible]~~ New materials

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Considerable gap in knowledge in this area is leading ~~regul~~ policy & practice towards higher carbon solutions.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Business models to realise value from research — Table number 5

Detailed description:

Build a team of experts from across academia, industry, developers, end users to:

- understand current commercial behaviours
- develop new business models.
- test & pilot in practice

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Commercial business models in fragmented construction industry is a major barrier to society seeing value/benefit from novel research.

Must commence by: 2020 **2030** 2050+

Must be achieved by: 2020 2030 **2050+**

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: Holistic water systems around buildings — Table number 5

Detailed description:

Water conservation and collection systems and water resilient construction

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Climate change will shift requirements in UK but also opportunity to decentralise water supply

Must commence by: **2020** 2030 2050+

Must be achieved by: 2020 2030 **2050+**

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	**P1**	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	**R1**	**R2**	**R3**	**R4**	**R5**
✓ Health	**H1**	H2	H3	H4	**H5**

Research need: EPSRC to facilitate industry/research networks

Table number 5

Detailed description:

Innovate UK funds research which is identified by industry as directly relevant.
There is still a gap between most academic research and most industry practice. There would be huge value in bringing together these 2 communities of practice to identify the barriers and future research focus to adapt the built environment to future climate change.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Must commence by: 2020 (circled) 2030 2050+

Must be achieved by: 2020 2030 (circled) 2050+ (circled)

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5 (circled)
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2 (circled)	R3	R4 (circled)	R5 (circled)
○ Health	H1	H2	H3	H4	H5

Research need: ~~Impr~~ Sustainable Housing ~~Bar stating the benefits~~

Table number 5

Detailed description:

Development of identifying the needs of people living in homes into future first to enable impact 2050 as part of an accessible, inclusive and productive society

Drivers: – Accessibility of technology b
– technology in hom
– Sustainability of people supported in community.
– impact peoples lives and ability to remain healthy + productive
– designing homes that can adapt + respond to changing need across life span

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Must commence by: 2020 2030 (circled) 2050+

Must be achieved by: 2020 2030 2050+ (circled)

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity		P2	P3	P4	P5
✓ Connectedness		C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: Behaviour & lifestyle' interacting with built conditions

Table number 5

Detailed description:

We need to understand how people behave and form habits related to different built conditions. We can't just assume if we build X then Y will happen

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Because we need to integrate skills and knowledge from social & behavioral disciplines into natural sciences/eng. neering to avoid costly failures of investment

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

def. near future

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

possibly

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

cycles because involve behaviours

e.g. nature access

if this means healthy genic living

Research need: Affordance of living spaces

Table number 5

Detailed description:

How can technology/design facilitate diverse life styles/user needs

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Demographic shifts and inclusivity mean that standard building types no longer fit for purpose

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: How do we fundamentally change the 'delivery' end of the industry to actually create autonomous, off-grid buildings?

Table number 5

Detailed description:

The systems can be created, the social research could be done, but the physical entity still needs to be built. Hence, the current construction models need to change

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

1 – we don't know how to transform the industry & sustain that transformation

2 – we still don't know if, where and when automation & robotics would help.

3 – we don't know how to change commercial models.

Must commence by: 2020 (circled) 2030 2050+

Must be achieved by: 2020 2030 (circled) 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✓ Productivity	P1 (circled)	P2 (circled)	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4 (circled)	R5
○ Health	H1	H2	H3	H4	H5

Research need: NEW MODE OF TRANSPORT

Table number 5

Detailed description:

DRIVERLESS CARS

MINI DRONES FOR PEOPLE TRANSPORT

WILL CHANGE THE NEED & CAPACITY OF PUBLIC TRANSPORT, THUS TRANSFORMING THE CHARACTERISTICS OF THE BUILDING TO ACCOMODATE ALTERNATIVE TRANSPORT MODE (i.e. SPECIAL LANDING/PARKING AREAS) – MODE OF TRANSPORT SHOULD BE (1) ZERO IMPACT ON ENVIRONMENT

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

TO IMPROVE CONNECTIVITY & TRANSPORT

Must commence by: (2020) 2030 2050+

Must be achieved by: 2020 (2030 — 2050+)

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✗	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✗ Productivity	P1 (circled)	P2	P3	P4	P5 (circled)
✗ Connectedness	C1	C2 (circled)	C3 (circled)	C4 (circled)	C5
✗ Resilience	R1	R2 (circled)	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Business models to exploit building technologies

Table number 5

Detailed description:

Advanced building technologies that may not fit with existing construction/development business models may be passed over in favour of more traditional ~~[illegible]~~ technologies with poorer performance or environmental impact.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Need to exploit novel technologies.

Perhaps regulation is required to force 'good' practice.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓				

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	★	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Suitable planting for very large scale 'green' buildings

Table number 5

Detailed description:

Which plants would offer maximum benefit in terms of ecosystem services but also be suitable for planting on and up multi'storey buildings.

* Could they offer pollution control, food, water retention...

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

With limited ground area and likely increases in vertical areas - we will need to maximise the benefits of building greening.

This could provide food for an increasing population, mental well being, health of people + the environment...

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ✓ ESRC ✓ AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Waste management methodologies.

Table number 5

Detailed description:

Increased population + pressure on infrastructure

- Could buildings manage their own waste products (sewerage, packaging...)

Could each building include a 'process' by which waste is treated + reused - e.g. to fertilise the plants etc.

Research is required into how e.g. hydroponics in the extreme.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Increased populations would create more waste

Due to growing up and on buildings plants would be likely to require fertilising due to small quantities of substrate.

There are some small scale research projects currently but much more req.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ✓ ESRC ✓ AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Understanding how buildings and green infrastructure interact.

Table number 5

Detailed description:

delivering food security health etc via green infrastructure requires better understanding of impact on buildings & building technology

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

~~Allows~~ Enables transformation of building / urban spaces to better meet future needs

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓				✓	

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: Understanding how built environment can be democratised

Table number 5

Detailed description:

There is a trend towards decentralisation and regionalism - and also towards localism. There is a need to better understand how the built environment can better match up with the aspirations and wishes of the people who will interact with that environment - how can these people be empowered to own the design, construction, and use of a building?

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Built-environment research needs to keep up with societal changes and understand the implications of these for how buildings are designed, constructed, and used. This research could be used to better understand and facilitate greater democratisation and bottom-up approaches to the built environment and feed into government policy on decentralisation and localism.

Must commence by: (2020) 2030 2050+

Must be achieved by: 2020 2030 (2050+)

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
	✓	✓			

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition number*

◯ Productivity	P1	P2	P3	P4	
◯ Connectedness	C1	C2	C3	C4	C5
◯ Resilience	R1	R2	R3	R4	R5
◯ Health	H1	H2	H3	H4	H5

Research need: Preparing research community to meet society + industry

Table number 5

Detailed description:

Upstream engagement between communities, industry + researchers to deliver research projects that address broad stakeholder needs

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Valley of death for researcher led innovation

Public + market rejecting research findings + recommendations

Must commence by: (2020) 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
	⊗	⊗			

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

⊗ Productivity	P1	P2	P3	P4	P5
⊗ Connectedness	C1	C2	C3	C4	C5
⊗ Resilience	R1	R2	R3	R4	R5
⊗ Health	H1	H2	H3	H4	H5

Research need: INCLUSIVE & HEALTHY RESIDENTIAL DESIGN

Table number 5

Detailed description:

- IDENTIFYING THE MOST ADVANTAGEOUS FRAMEWORKS TO DESIGN AND BUILD INCLUSIVE AND HEALTHY RESIDENTIAL PLACES – BOTH SINGLE BUILDINGS AND NEIGHBOURHOODS.
- IDENTIFYING THE SCALE AT WHICH NEIGHBOURHOODS CAN BE SELF-SUSTAINING WITHIN THEIR BUILT SPACE + PLACES.

Drivers:

Why is this research needed, what impact will it have, what knowle it fill?

- EFFICIENT LAND USE
- INCLUSIVE HOUSING MARKETS
- SUSTAINING BUILDING CONSTRUCTION
- HEALTHY INTERIOR AND EXTERIOR PLACES.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply		*Circle relevant ambition numbers*				
✓	Productivity	P1	P2	P3	P4	P5
✓	Connectedness	C1	C2	C3	C4	C5
✓	Resilience	R1	R2	R3	R4	R5
✓	Health	H1	H2	H3	H4	H5

Research need:

Table number 5

Detailed description:

How can the new business models be facilitated that takes into account not only construction of a building but actually it's operating and running costs?
Can we learn from other industries such as aircraft industry?

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply		*Circle relevant ambition numbers*				
✗	Productivity	P1	P2	P3	P4	P5
	Connectedness	C1	C2	C3	C4	C5
✗	Resilience	R1	R2	R3	R4	R5
	Health	H1	H2	H3	H4	H5

Research need: CONNECTING A HEALTHIER POPULATION

Table number 5

Detailed description:

IOT SHOULD ALLOW GREATER CONNECTIVITY & DATA COLLECTION ON HEALTH PARAMETERS (?) VIDEO & FED TO HCPS. DATA MINING IN CONJUNCTION WITH OTHER DATA ON LIFESTYLE SHOULD ALLOW TO MAP WAYS TO PREVENT & OR PROVIDE QUICK INTERVENTIONS TO SOLVE ACUTE HEALTH PROBLEMS IN A MORE EFFICIENT MANNER.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

HEALTHIER NATION

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	⊗	○	○	⊗	○

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
⊗ Connectedness	C1	C2	C3	C4	C5
⊗ Resilience	R1	R2	R3	R4	R5
⊗ Health	H1	H2	H3	H4	H5

Research need: Integrated approach to collecting, processing + storing Data

Table number 6

Detailed description:

- Develop standardised ways to collect and process data
- Develop suitable mechanisms to collect/process data (e.g. intelligent sensors)
- Disaggregating energy data

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- to better understand how energy is used in buildings

Must commence by: Now 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply

Circle relevant ambition numbers

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Boring evidence for maintenance + refurb

Table number 6

Detailed description:

many existing systems and innovations fail because of poor maintenance.

Refurbishment options are more complex too evaluate than demolition and new build, so are often eliminated early in options appraisal.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- evaluation of the benefits to performance + cost of good maintenance / disbenefits of neglect
- evaluation of refurb options to provide evidence on similar terms to new build

Must commence by: 2020 (circled) 2030 2050+

Must be achieved by: 2020 (circled) 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✗	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

✗ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
✗ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Improved built environment efficiency

Table number 16

Detailed description:

More sustainable construction with lower materials and energy demand.

- design for realistic building loads
- technologies for increased structural efficiency.
- bespoke, modular construction to increase efficiency.
- efficient services

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

/BIM?

increased 'intelligence' to yield structural and operational efficiencies

Must commence by: 2020 2030 2050+ (circled)

Must be achieved by: 2020 2030 (circled) 2050+ (circled)

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	○

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need:

Table number 6

Detailed description:

- building fabric from moisture, rain + wind
- culturally valued structures.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

- Research priority identified by Adaptation Sub-Committee in Climate Change Risk Assessment Evidence Report. Impact - protection of buildings eventual outcome
- Again research priority identified by ASC in CCRAER. Recognisation of value of historical + culturally appreciated buildings + profile to increase protection. There is Historic 2020 funding for cultural buildings + Scottish Heritage take a particular interest

Must commence by: ? 2020 2030 2050+

Must be achieved by: 2020 ? 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓					

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

◯ Productivity	P1	P2	P3	P4	P5
◯ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
◯ Health	H1	H2	H3	H4	H5

Research need: Collaborative Encouragement on Sensor System for different green applications

Table number 6

Detailed description:

collaborative research towards useful data capture / sensor deployment & infrastructure.
Public / Private Partnership
- large capital investment is somewhat hindering.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

→ Improved Private Sector uptake
→ help engage end-users with energy impact
→ Behaviour change
→ data for purpose.

Must commence by: 2020 ~~2030~~ 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
X	X				

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

X Productivity	P1	P2	P3	P4	P5
X Connectedness	C1	C2	C3	C4	C5
X Resilience	R1	R2	R3	R4	R5
X Health	H1	H2	H3	H4	H5

Research need: Communication of 'value' to end-users

Table number 6

Detailed description:

Understand users/recipients of research before and after conducting research
NOT just a pathways to impact but a research project about impact and communication around changes in the built environment

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Improve take-up of positive changes in the built environment (e.g. low-carbon, adaptive etc)

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	○	○	✓

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: Breaking down of 'silos' in energy system research

Table number 6

Detailed description:

Constructing common vernacular between areas of research involving different disciplines and sectors
(e.g. specifically energy generation, distribution and demand)

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Improve integration of research across different skill sets

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
○	✓	○	✓	○	✓

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

○ Productivity	P1	P2	P3	P4	P5
○ Connectedness	C1	C2	C3	C4	C5
○ Resilience	R1	R2	R3	R4	R5
○ Health	H1	H2	H3	H4	H5

Research need: TESTING INFRASTRUCTURE

Table number 6

Detailed description:

NEED LARGE-SCALE TESTING INFRASTRUCTURE FOR NEW INDOOR / OUTDOOR INNOVATIONS

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Difficult to evaluate, for example, GI elements and their multiple functions without a controllable and flexible environment.

Eg. Vegetation uptake of pollutants and evaluation of remediation under different environmental conditions

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓		✓	✓	

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

CONNECTING INSIDE + OUTSIDE

Research need: MAKING INNOVATION CHEAP

Table number 7

Detailed description:

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

new technologies - how do we make them accessible to mass market

eg double-glazed barn doors..

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

CONNECT^G INSIDE + OUTSIDE

Research need: AGILE REGULATION

Table number 7

Detailed description:

do other countries have agile regul^n? (eg France)

issues in UK

- declining trust in professions

+ half-hearted regulatory policing after the fact

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Inflexible regulatory regimes discourage innov^n

Need agile regulation - an oxymoron?!

to allow and encourage ~~information~~ innovation

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

CONNECTING INSIDE + OUTSIDE

Research need: HUMAN BEHAVIOUR + PSYCHOLOGY

Table number 7

Detailed description:

can we quantify human behaviour? better?

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

current silo'sm fails to get to grips with human behaviour

eg buildings design for expert control, what happens when expert leaves?

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: CONNECT OUTSIDE + INSIDE – FUTURES Table number 7

Detailed description:

(A) Impact of electric transport on noise + air pollution ⇒ occupants more willing to open windows

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Uncertainties around design in future e.g.

(A) transport – private, electric, ~~4~~ more home-working ?

(B) decarb grid – can use energy as long as zero C ?

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ✓ ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: Understand Routes to successful Adoption

Table number

Detailed description:

Studies needed to understand test & prove how the fragmented construction industry can get from TRL 3-8 successfully i.e. realise benefit & value in practice
→ speed up rate of R&D & diffusion in future

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Much technology exists in the labs / in theory, but not widely adopted by construction industry / built environment.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need:

Table number

Detailed description:

100% correct construction process
- Technology
- contracts ★

↓

operation (optimising energy use)
- maintenance
- flexibility of use
- fault finding
- + how to get buy in from users.

↓

refurbishment

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

We still have a performance gap
We ~~need~~ know there is a problem between what is designed + what is built
Any technical advances require equivalent research into contracts around the construction process to ensure it gets to market.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need:

Table number

Detailed description:

Effective drainage to avoid moisture in building envelope.

Interface of building drainage + urban drainage modelling

Interface with green infrastructure

Data gathering / understanding from building envelope

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Currently no knowledge of the impact of moisture penetration - following system exceedence / inundation - on occupants' health

How do green walls impact on drainage / load attenuation?

Need to understand the influence of wind + wind driven rain

What are the health risks? - Moisture - Flooding - Sediment

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need:

Table number

Detailed description:

Regulatory requirements of evolving technology.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Innovation, building + retrofit performance

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
	✓				

EPSRC prosperity outcomes:

Tick all that apply	*Circle relevant ambition numbers*				
✓ Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need:

Table number

Detailed description:

Densification, technologies, process + performance

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

ongoing

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
	✓				

EPSRC prosperity outcomes:

Tick all that apply	*Circle relevant ambition numbers*				
✓ Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: HOLISTIC VIEW OF AIR QUALITY/URBAN FORM Table number

Detailed description:

Holistic view of outdoor comfort & air quality.
Research into interactions between buildings / atmosphere

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Poor air quality in low wind speeds
High winds cause danger & distress
(Major concern in London & other urban areas)

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ✓ ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: Quantification/embracing of uncertainty & connection with decision makers

Table number

Detailed description:

→ simple models (not simplistic)
→ compartmental nature of uncertainty quantification techniques
→ Limited consideration of uncertainties/trade-offs interacted by decision makers
→ Adaptation to climate change needs to adopt a hybrid approach
→ Resilient systems need to embrace uncertainty

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

→ Develop a better understanding of impact of uncertainty on improved design and operation;
→ Develop a better understanding of context uncertainty (localised) & assessment techniques
→ Decision support tools (limited/cager adoption)

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC	ESRC	AHRC	BBSRC	MRC	STFC
✓	✓	✓			

EPSRC prosperity outcomes:

Tick all that apply — *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need: SENSORS FOR WELLBEING INDICATORS

Table number

Detailed description:

DATA COMBINATION FROM AUTOMATIC SENSORS, MARKET DATA AND PERCEPTION — AND IMPACT ON PROPERTY VALUATIONS.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

HOW DO WE ENSURE ACCURACY OF INFO BUT ALSO BUILD IN THE IMPORTANCE OR SIGNIFICANCE FOR WELLBEING.

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ✓ ESRC ✓ AHRC BBSRC MRC ✓ STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

✓ Productivity	P1	P2	P3	P4	P5
✓ Connectedness	C1	C2	C3	C4	C5
✓ Resilience	R1	R2	R3	R4	R5
✓ Health	H1	H2	H3	H4	H5

Research need: Adaptable and Inclusive Cities

Table number

Detailed description:

How to vision the new cities where operation/functionality the economic values are part of a wider value assessment such as access, inclusiveness/fairness heritage to create a city as a "genius loci"

Driver

Why is research needed, what impact will it have, what knowledge gap will it fill?

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need:

Table number

Detailed description:

Adapting buildings for greater population densities.
→ infrastructure required (water/power)
→ building environment (ventilation overheating)
→ wellbeing.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5

Research need:

Table number

Detailed description:

How do societal changes affect our interaction with built environment?
flexible adaptable transformation of built environment.

Drivers:

Why is this research needed, what impact will it have, what knowledge gap will it fill?

Must commence by: 2020 2030 2050+

Must be achieved by: 2020 2030 2050+

Circle as appropriate

Interlinkages with other RC subject domains

Place stickers in as many boxes as apply

NERC ESRC AHRC BBSRC MRC STFC

EPSRC prosperity outcomes:

Tick all that apply *Circle relevant ambition numbers*

Productivity	P1	P2	P3	P4	P5
Connectedness	C1	C2	C3	C4	C5
Resilience	R1	R2	R3	R4	R5
Health	H1	H2	H3	H4	H5