ITRC mistral

multi-scale infrastructure systems analytics

Digital Communications

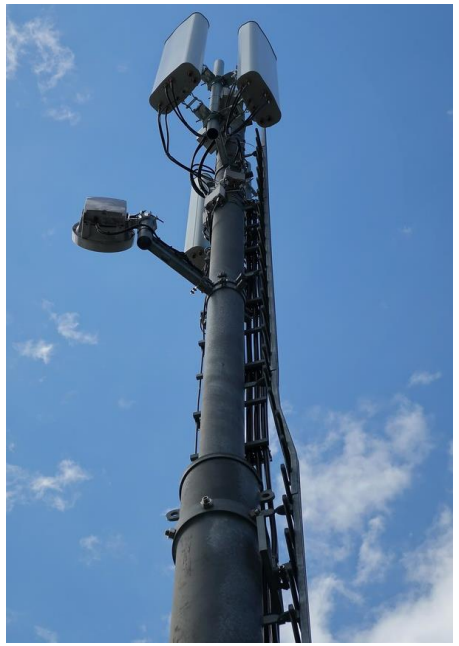
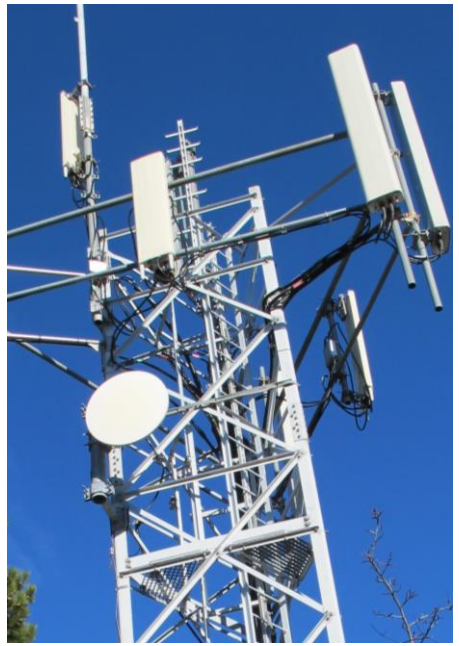
Quantified assessment of 5G & FTTP

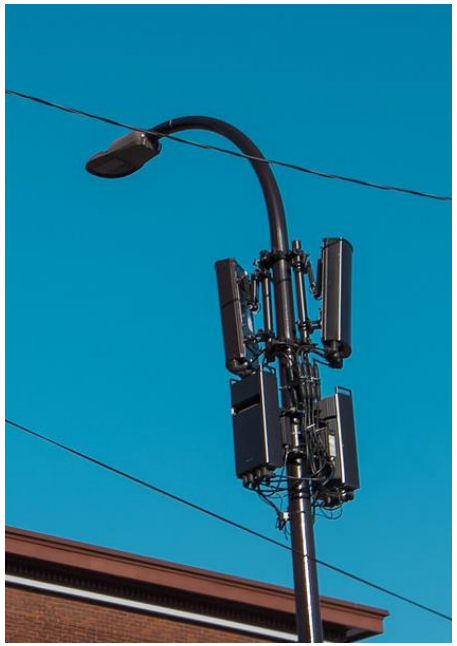
Edward Oughton

EPSRC
Engineering and Physical Sciences Research Council

Decision makers require new evidence

1. What will future mobile data growth look like?
2. Which 5G infrastructure strategies are most cost-efficient?
3. How do 5G economics affect the delivery of this infrastructure to urban, suburban and rural areas?
4. What is the total coverage cost of Fibre-To-The-Premises?



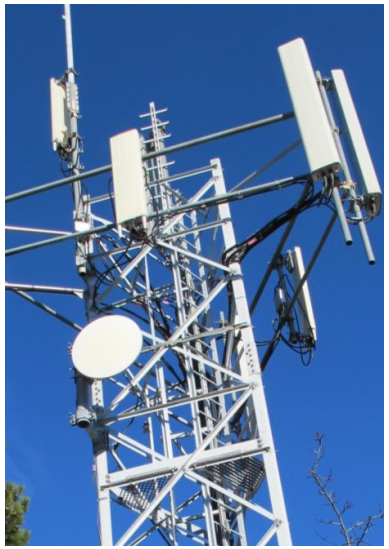
Background

Three ways to enhance a wireless network:

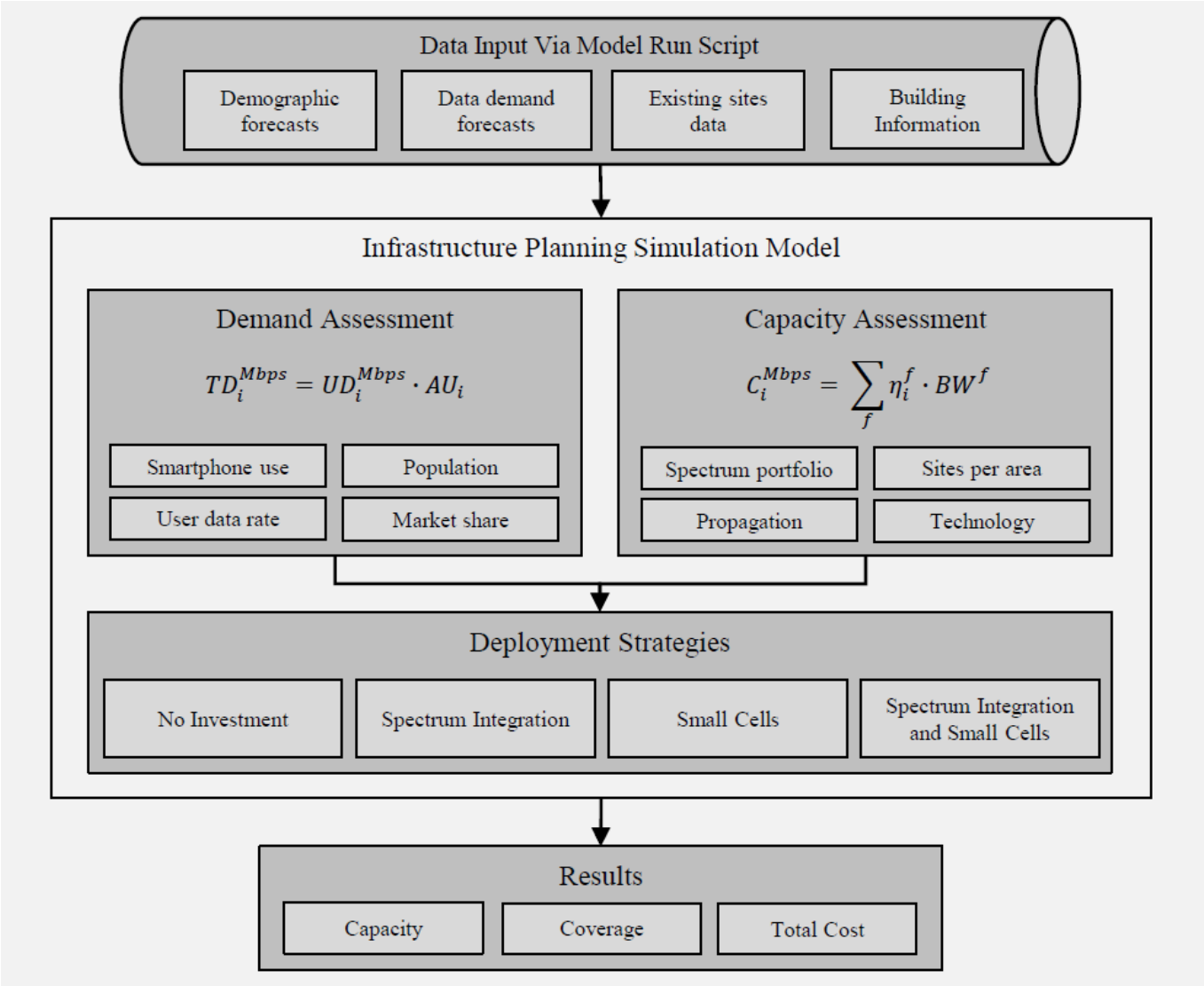
1. Improve efficiency
2. Add more transfer capacity
3. Build more cell sites

Four main 5G deployment options:

- No investment
- Spectrum integration (1 & 2) (brownfield)
- Small Cells (1, 2 and 3) (greenfield)
- Spectrum Integration and Small Cells (1, 2 and 3) (brownfield and greenfield)

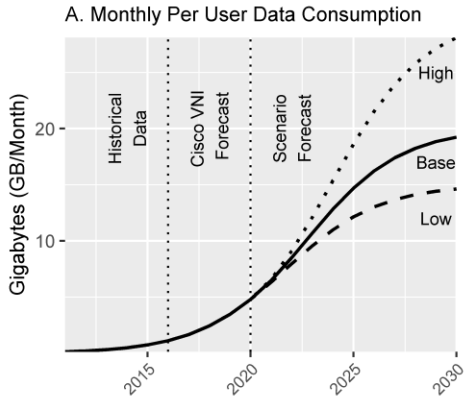


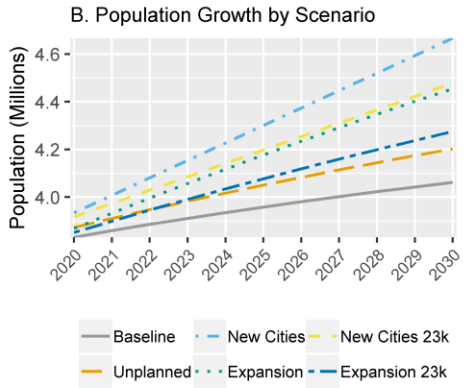
The model

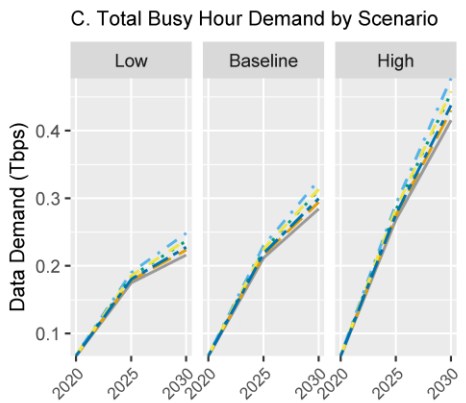

Data Input Via Model Run Script
Demographic forecasts
Data demand forecasts
Existing sites data
Building Information
Infrastructure Planning Simulation Model
Demand Assessment
$TD_i^{Mbps} = UD_i^{Mbps} \cdot AU_i$
Smartphone use
Population
User data rate
Market share
Capacity Assessment
$C_i^{Mbps} = \sum_f \eta_i^f \cdot BW^f$
Spectrum portfolio
Sites per area
Propagation
Technology
Deployment Strategies
No Investment
Spectrum Integration
Small Cells
Spectrum Integration and Small Cells
Results
Capacity
Coverage
Total Cost

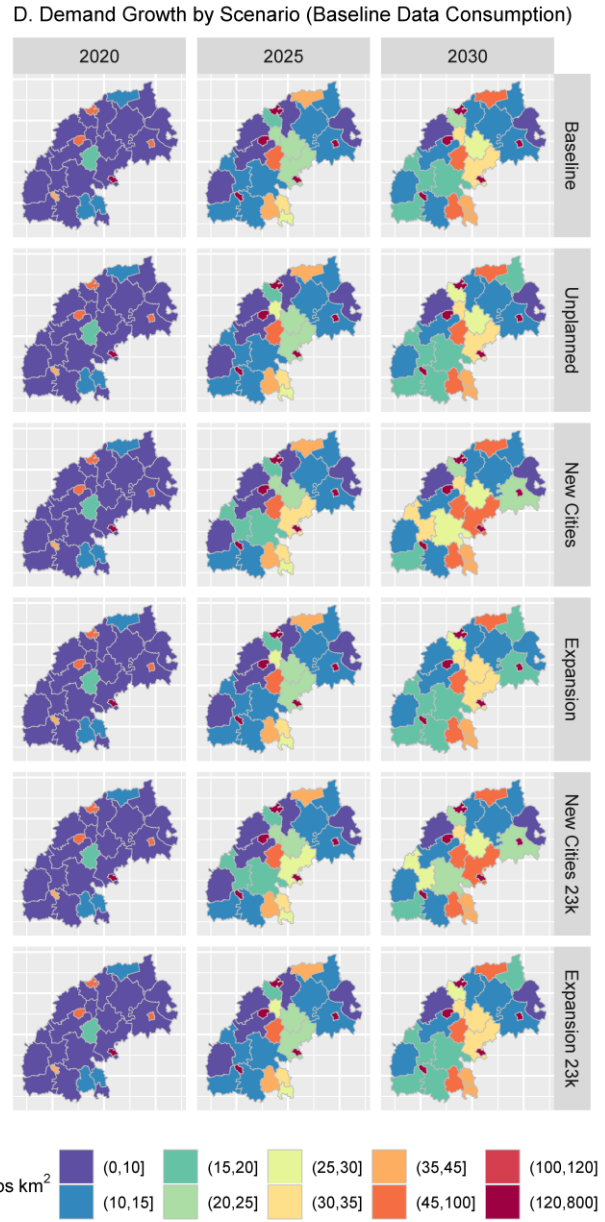
ITRC mistral
multi-scale infrastructure systems analytics

What will future mobile data growth look like?





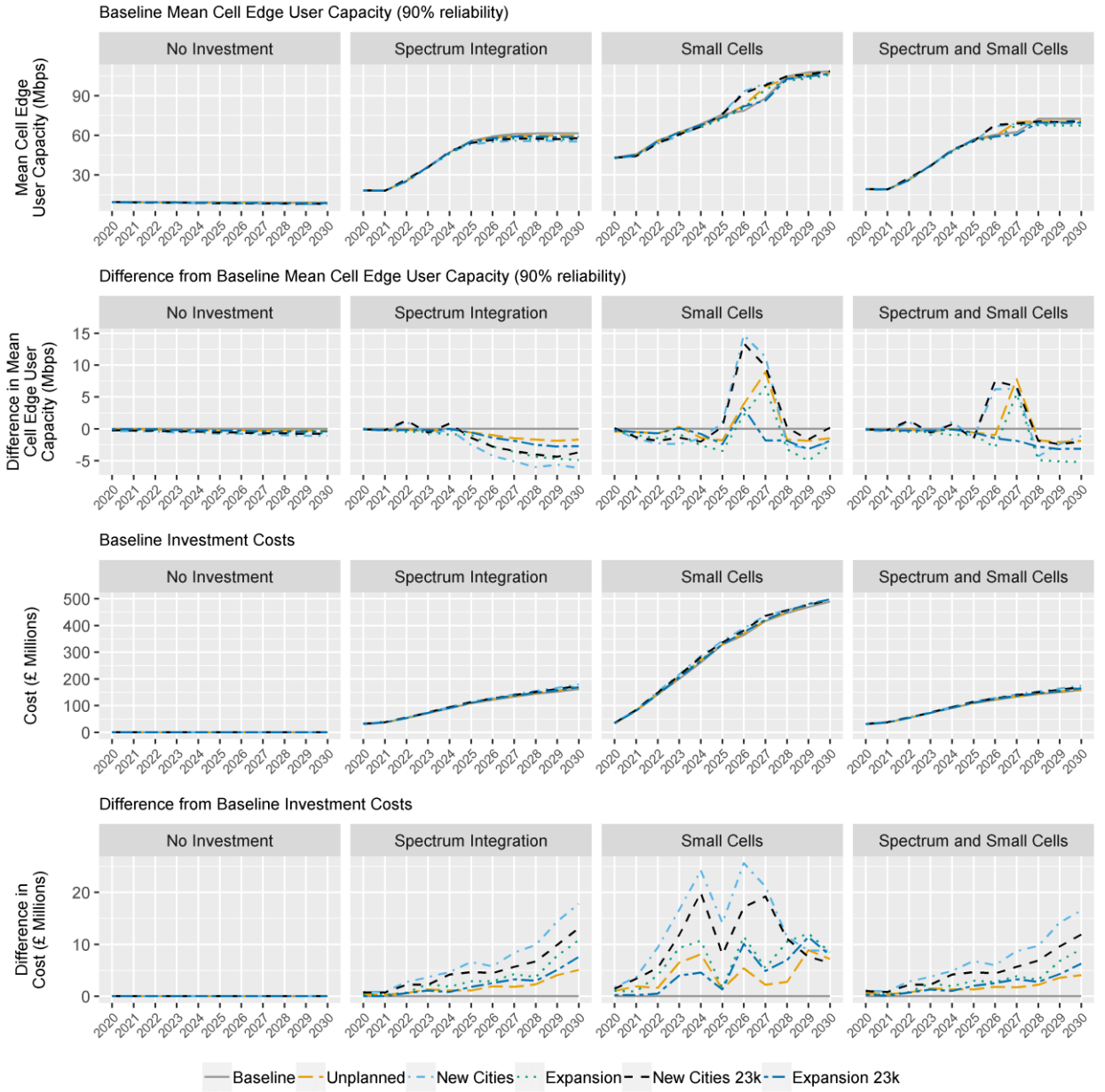




EPSRC
Engineering and Physical Sciences Research Council

ITRC mistral
multi-scale infrastructure systems analytics

Performance of 5G infrastructure strategies



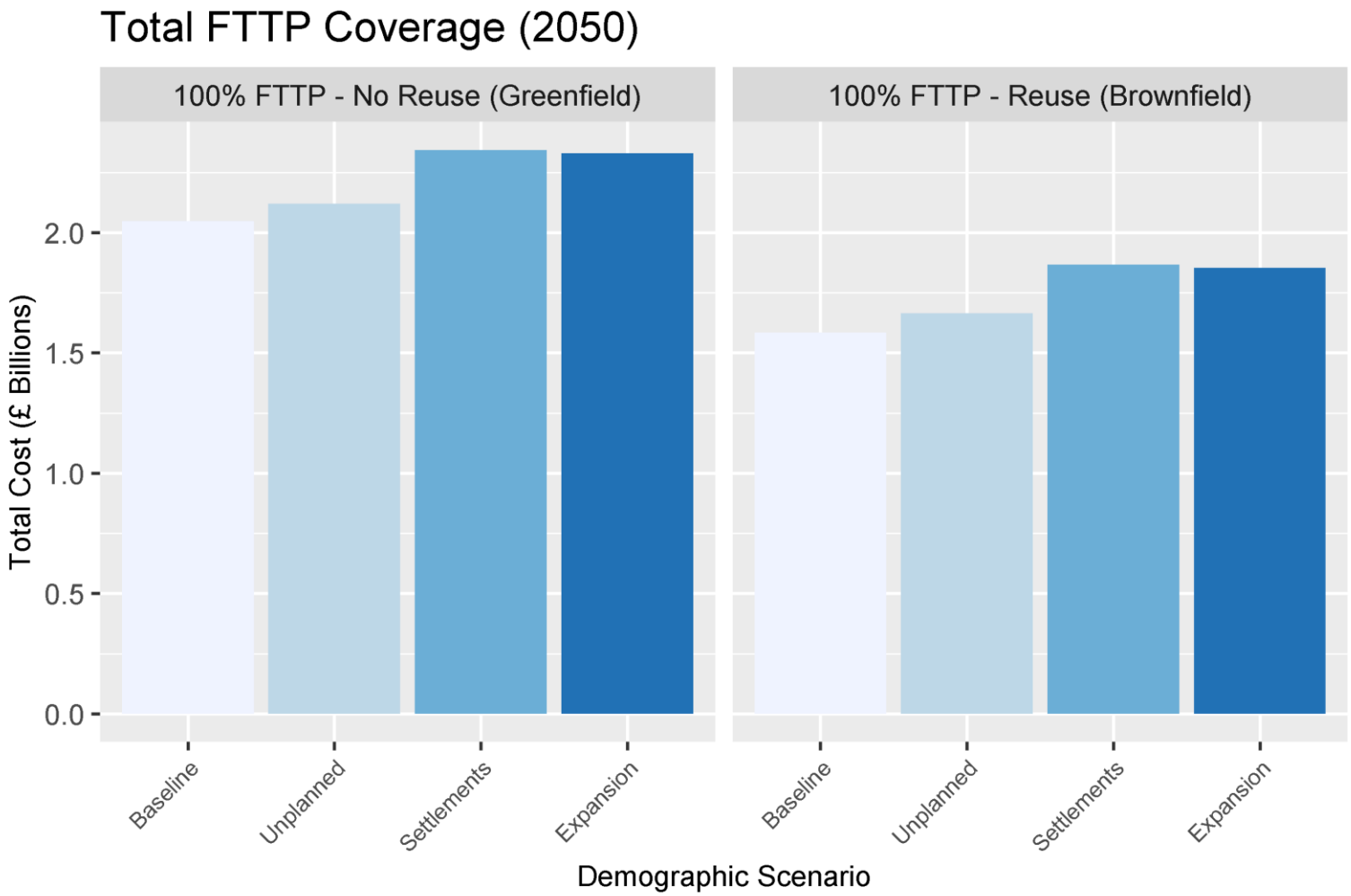
EPSRC
Engineering and Physical Sciences Research Council

ITRC mistral
multi-scale infrastructure systems analytics

5G economics: Urban, suburban and rural

EPSRC
Engineering and Physical Sciences Research Council

FTTP total coverage cost



Findings

1. Upgrades to existing brownfield Macro Cells satisfy demand for 5G enhanced mobile broadband
2. Limited need for Small Cells, except in dense urban centers
3. Strategically consider Macro Cell sites and underground fibre ducting when planning greenfield developments.
4. Make publicly-owned street furniture, buildings and ducting available (i) for Small Cell sites in urban centres, and (ii) Macro Cell sites in suburban and rural areas without charging excessive rental values.

ITRC mistral

multi-scale infrastructure systems analytics

Digital Communications

Quantified assessment of 5G & FTTP

Edward Oughton

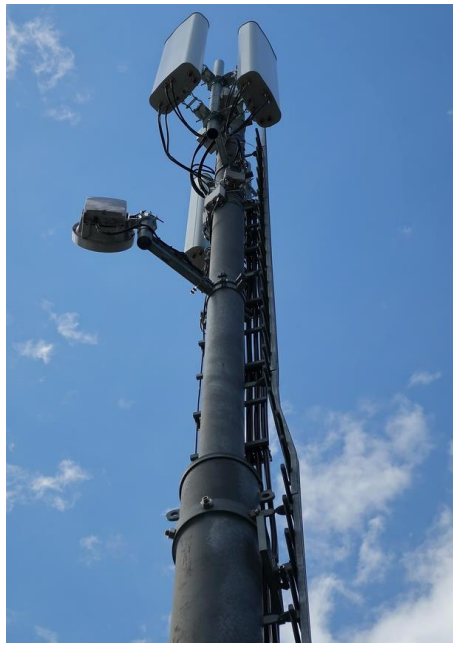
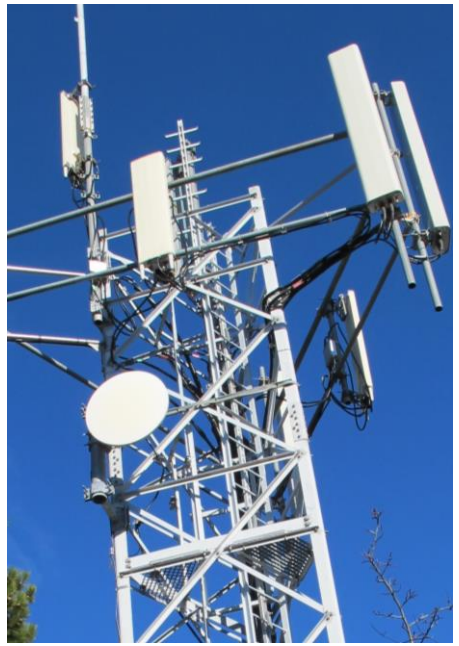
#OxCamITRC #OxCamArc @UKITRC

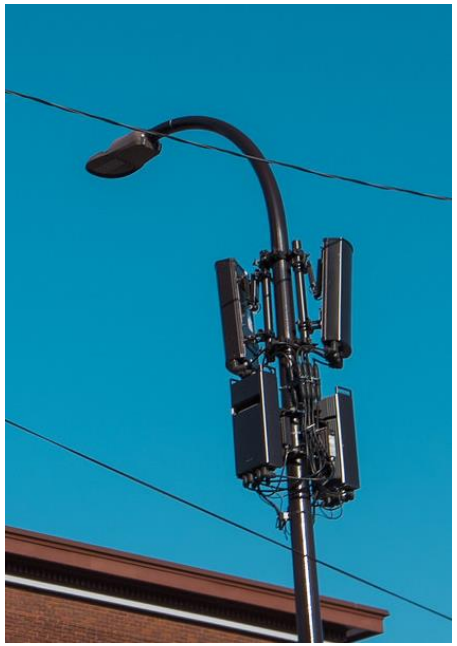
EPSRC
Engineering and Physical Sciences Research Council

ITRC mistral
multi-scale infrastructure systems analytics

Decision makers require new evidence

1. What will future mobile data growth look like?
2. Which 5G infrastructure strategies are most cost-efficient?
3. How do 5G economics affect the delivery of this infrastructure to urban, suburban and rural areas?
4. What is the total coverage cost of Fibre-To-The-Premises?



EPSRC
Engineering and Physical Sciences Research Council

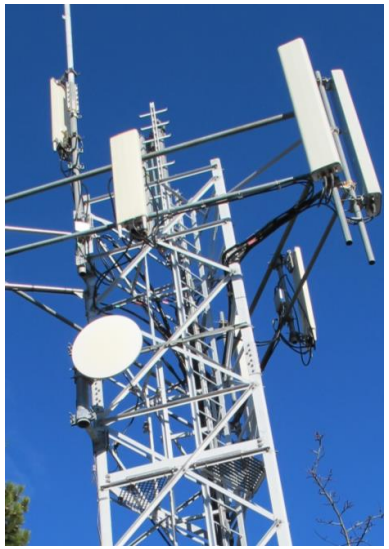
Background

Three ways to enhance a wireless network:

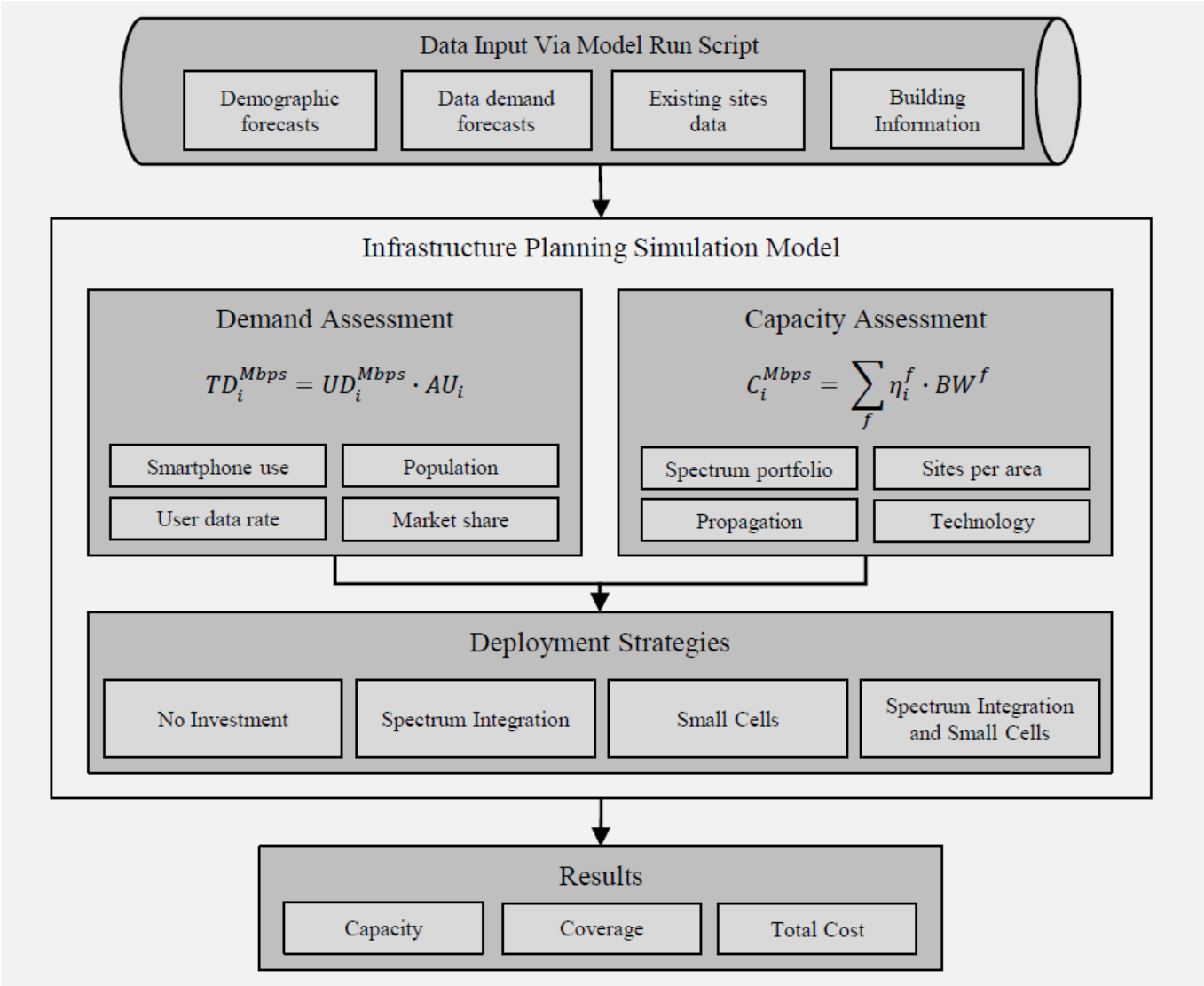
1. Improve efficiency
2. Add more transfer capacity
3. Build more cell sites

Four main 5G deployment options:

- No investment
- Spectrum integration (1 & 2) (brownfield)
- Small Cells (1, 2 and 3) (greenfield)
- Spectrum Integration and Small Cells (1, 2 and 3) (brownfield and greenfield)

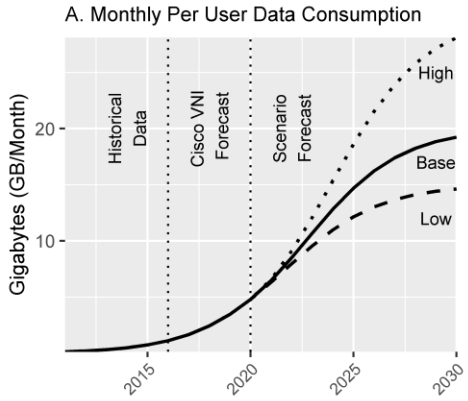


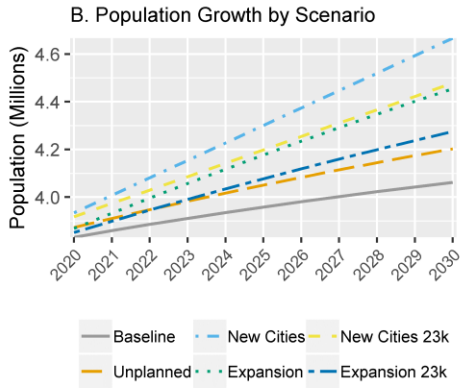
The model

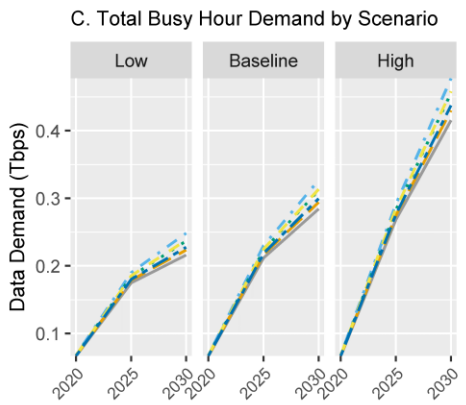

Data Input Via Model Run Script
Demographic forecasts
Data demand forecasts
Existing sites data
Building Information
Infrastructure Planning Simulation Model
Demand Assessment
$TD_i^{Mbps} = UD_i^{Mbps} \cdot AU_i$
Smartphone use
Population
User data rate
Market share
Capacity Assessment
$C_i^{Mbps} = \sum_f \eta_i^f \cdot BW^f$
Spectrum portfolio
Sites per area
Propagation
Technology
Deployment Strategies
No Investment
Spectrum Integration
Small Cells
Spectrum Integration and Small Cells
Results
Capacity
Coverage
Total Cost

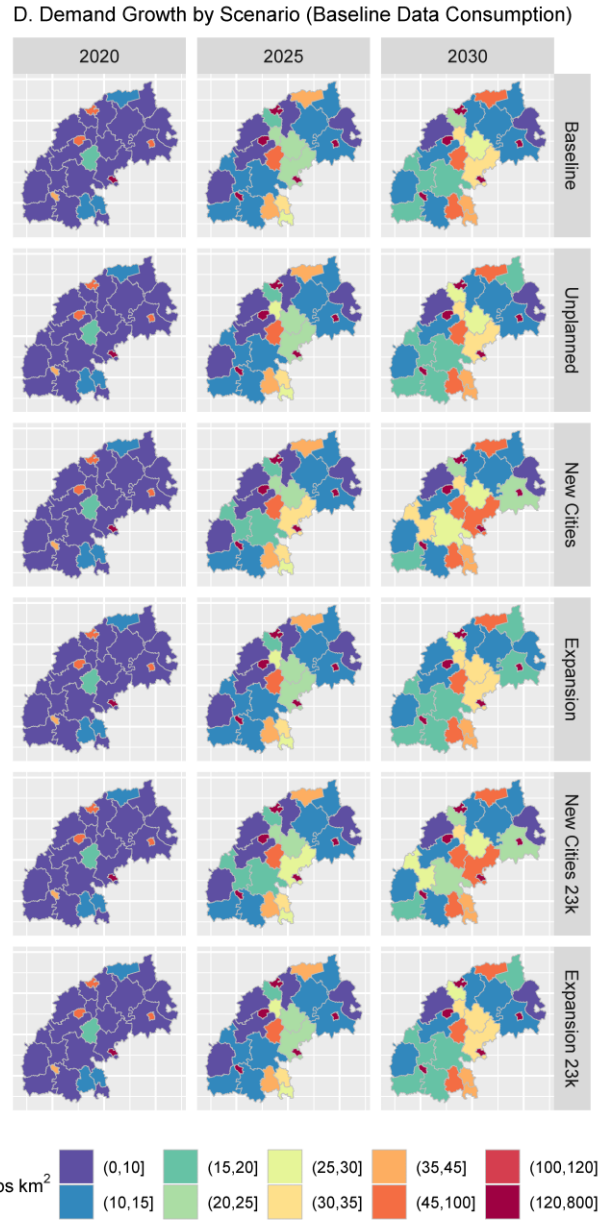
ITRC mistral
multi-scale infrastructure systems analytics

What will future mobile data growth look like?





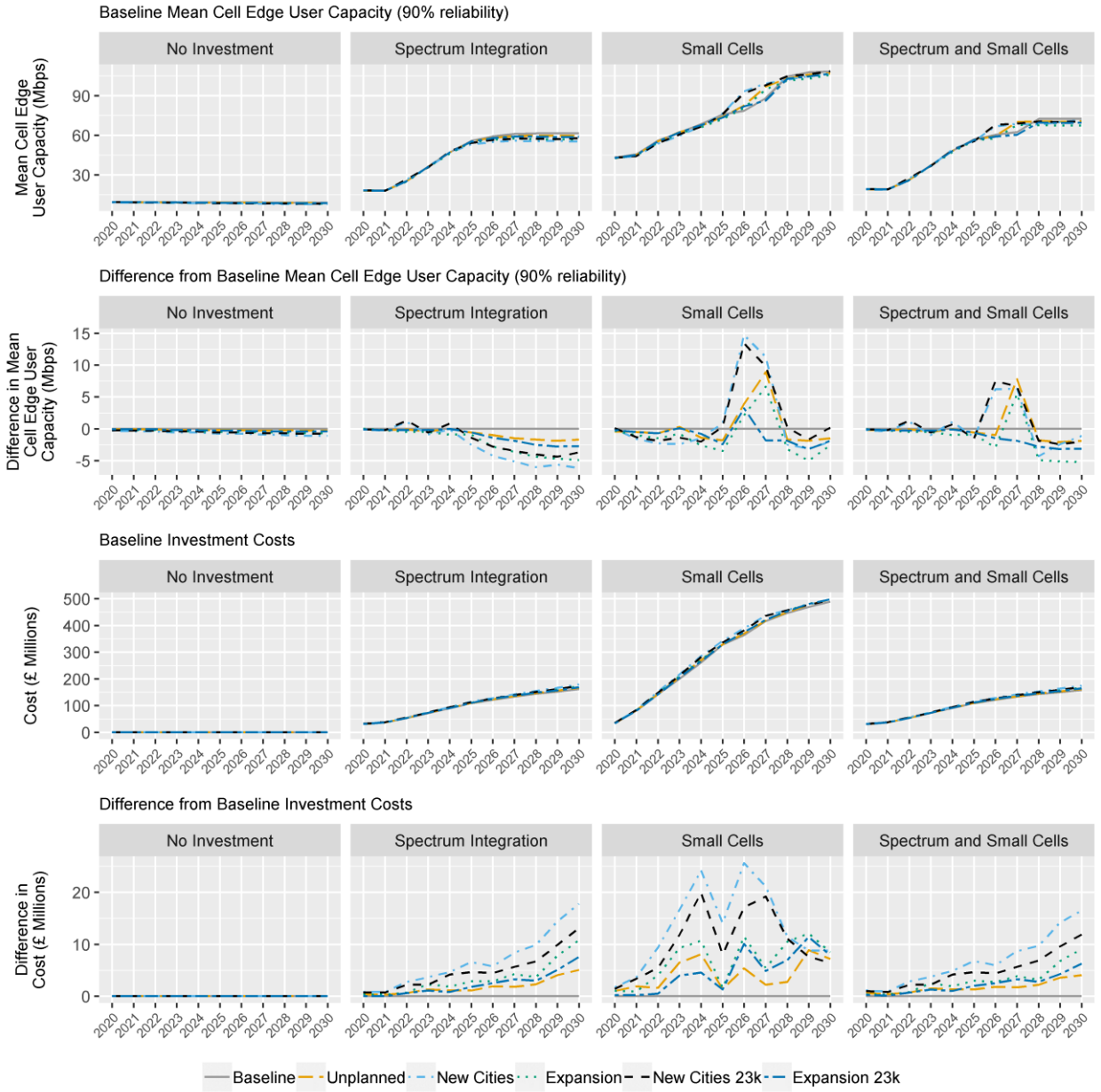




EPSRC
Engineering and Physical Sciences Research Council

ITRC mistral
multi-scale infrastructure systems analytics

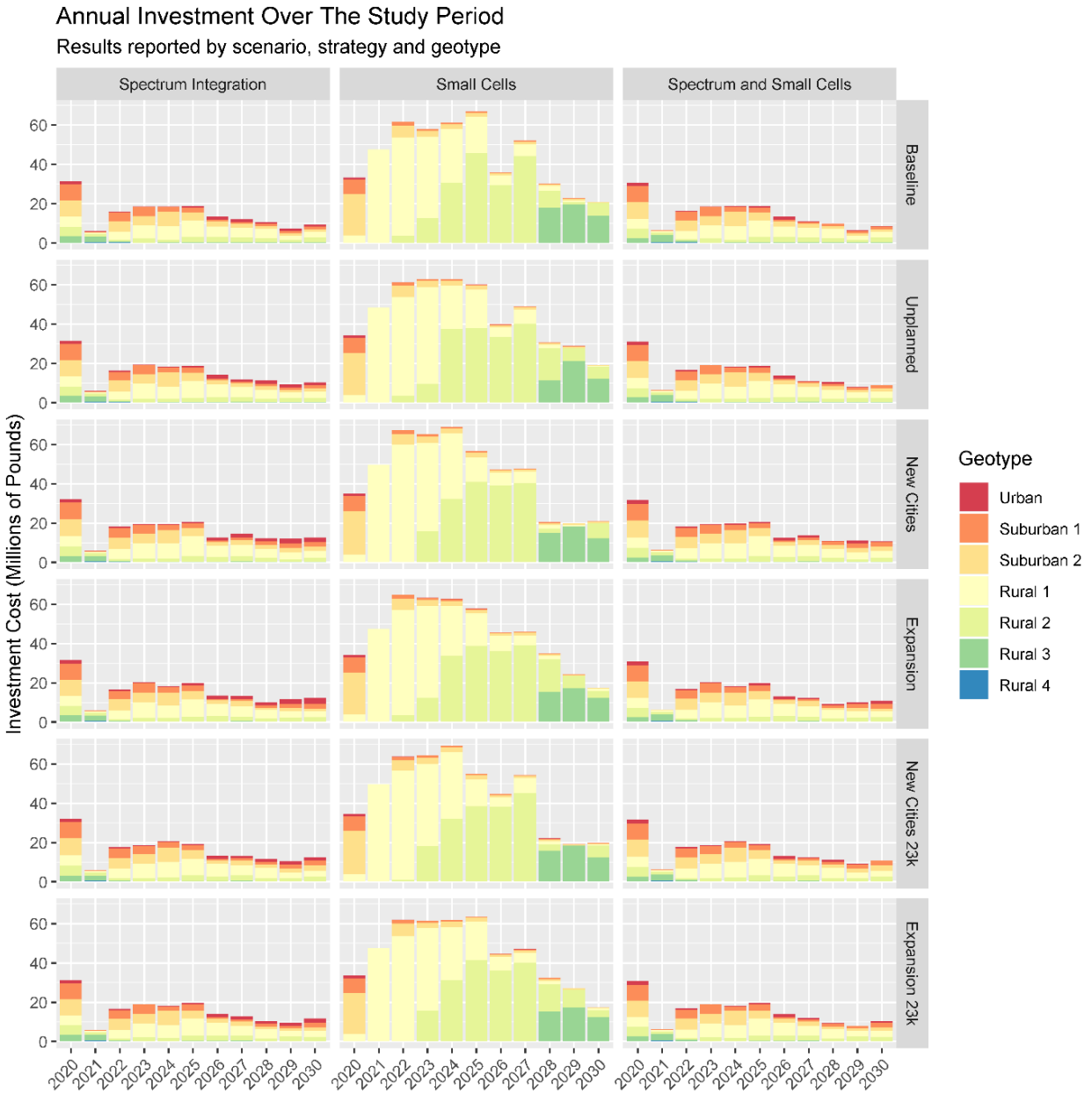
Performance of 5G infrastructure strategies



EPSRC
Engineering and Physical Sciences Research Council

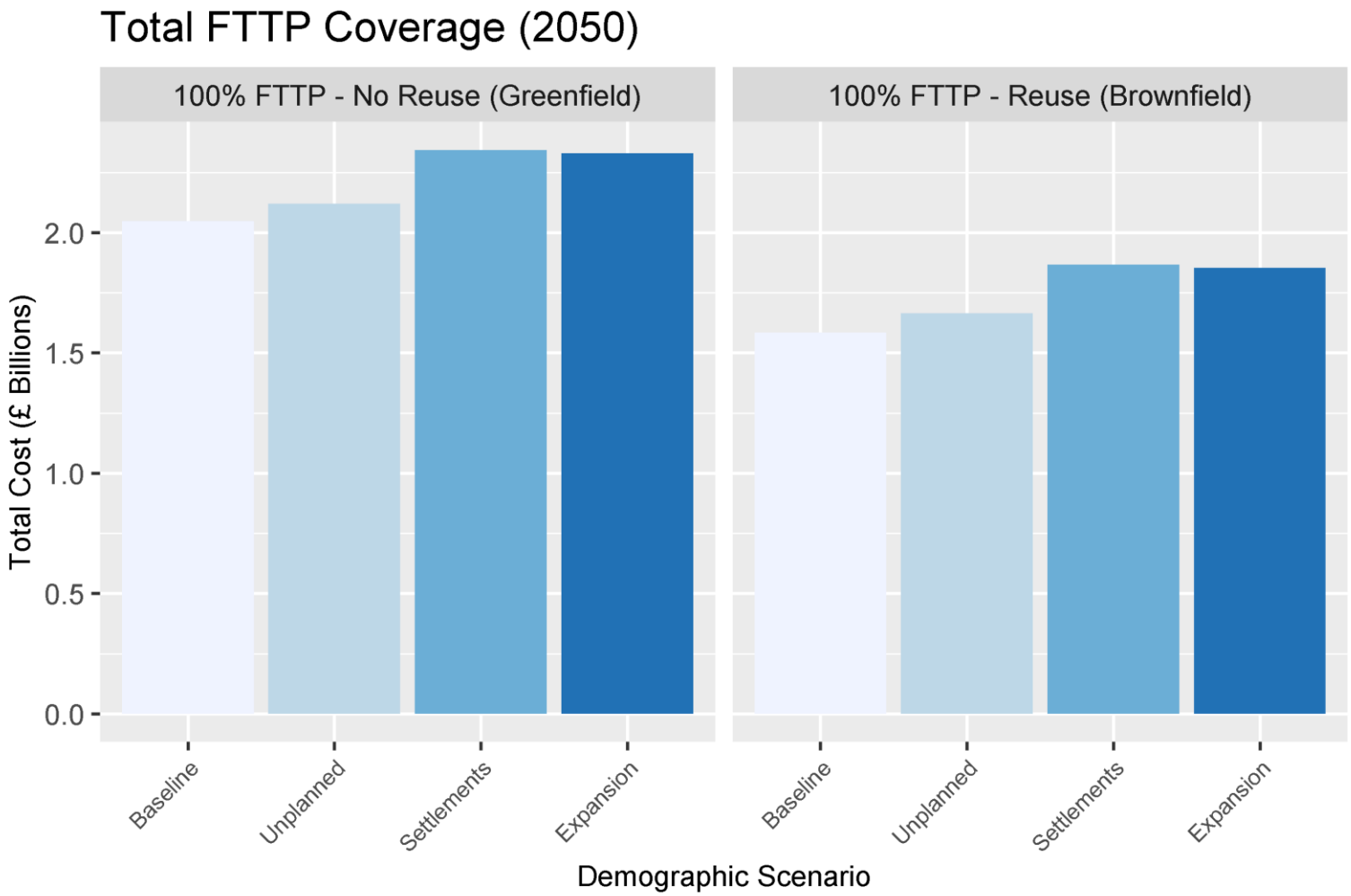
ITRC mistral
multi-scale infrastructure systems analytics

5G economics: Urban, suburban and rural



EPSRC
Engineering and Physical Sciences Research Council

FTTP total coverage cost



Findings

1. Upgrades to existing brownfield Macro Cells satisfy demand for 5G enhanced mobile broadband
2. Limited need for Small Cells, except in dense urban centers
3. Strategically consider Macro Cell sites and underground fibre ducting when planning greenfield developments.
4. Make publicly-owned street furniture, buildings and ducting available (i) for Small Cell sites in urban centres, and (ii) Macro Cell sites in suburban and rural areas without charging excessive rental values.