



Department
for Transport

Rail Corridor Connectivity

Addressing the need


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About | Rail Telecoms

Team formed 2014 following announcement of 'free wifi on trains' by Cameron Government

- Delivered 'wifi on trains' policy – s.6 & s.13 of franchise agreements: 'minimum wifi requirements'
- Developed 'Mobile connectivity on rail' policy – addressing improving train-to-internet connectivity
- Working with Network Rail Telecom to reduce the barriers to deploying telecoms along the rail corridor



“ Ensure rail passenger & operational telecom needs addressed ”

“ Encourage private sector initiatives : William-Shapps Plan for Rail s.48 ”

Policy | Framing the challenge

Poor rail corridor connectivity
impacts the pax experience

Wider benefits of rail corridor
connectivity not sufficiently quantifiable

Establishing the problem

Lack of focus on wider rail
corridor connectivity benefits for
pax & operational needs

Rail corridor is physically
difficult & costly to address

Understanding the problem drivers

Sources of
funding

Lack of commercial incentives
& alignment of interests

Technological challenges:
pax vs operational needs
different

Setting policy

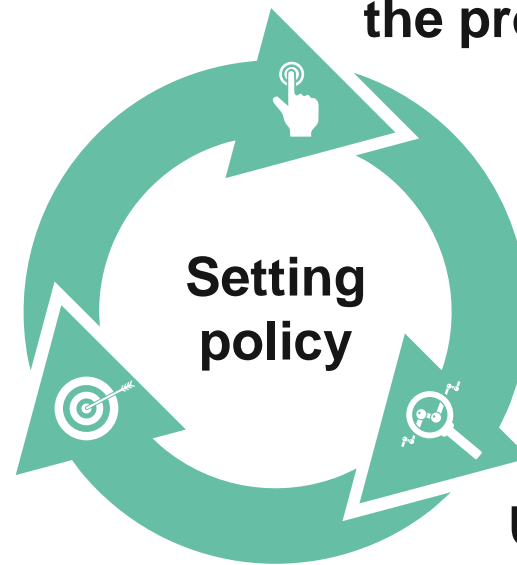
Identifying the benefits

Stimulate new digital
applications for
operational / pax use

Better utilisation
of assets

Delivering wider government
telecoms agenda

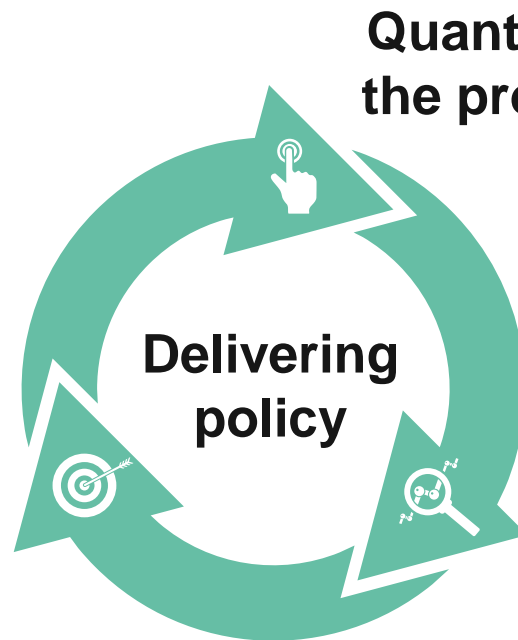
Increased productivity &
satisfaction



Policy | Addressing the challenge

- **DfT:** On-train wifi & mobile connectivity policies – funding
- **NRT:** Asset Reuse – formalised access to GSM-R assets
- **NR:** Project Reach

**Delivering
benefits**



**Quantifying
the problem**

- **Ofcom:** Connected Nations mobile operator signal measurements
- **Transport Focus:** Passenger experience of internet connectivity
- **Umlaut:** mobile data measurements
- **NR:** GSM-R to FRMCS migration
- Industry engagements

**Addressing the
problem drivers**

- **DfT:** Use of overhead line equipment masts
- **DfT:** Carriage attenuation study
- **DfT:** Tunnel propagation study
- **NRT:** On-going policy engagement
- **DfT:** Passenger research & TAG benefits modelling

Policy | Spectrum

We don't have a spectrum problem*

... we have a coverage problem

... then perhaps a capacity problem

... and its un-related to technology

** With exceptions: availability of 900 & 1900MHz for FRMCS given standardisation & European manufacturing supply chain*



A story | In 5 parts

Devon & Cornwall

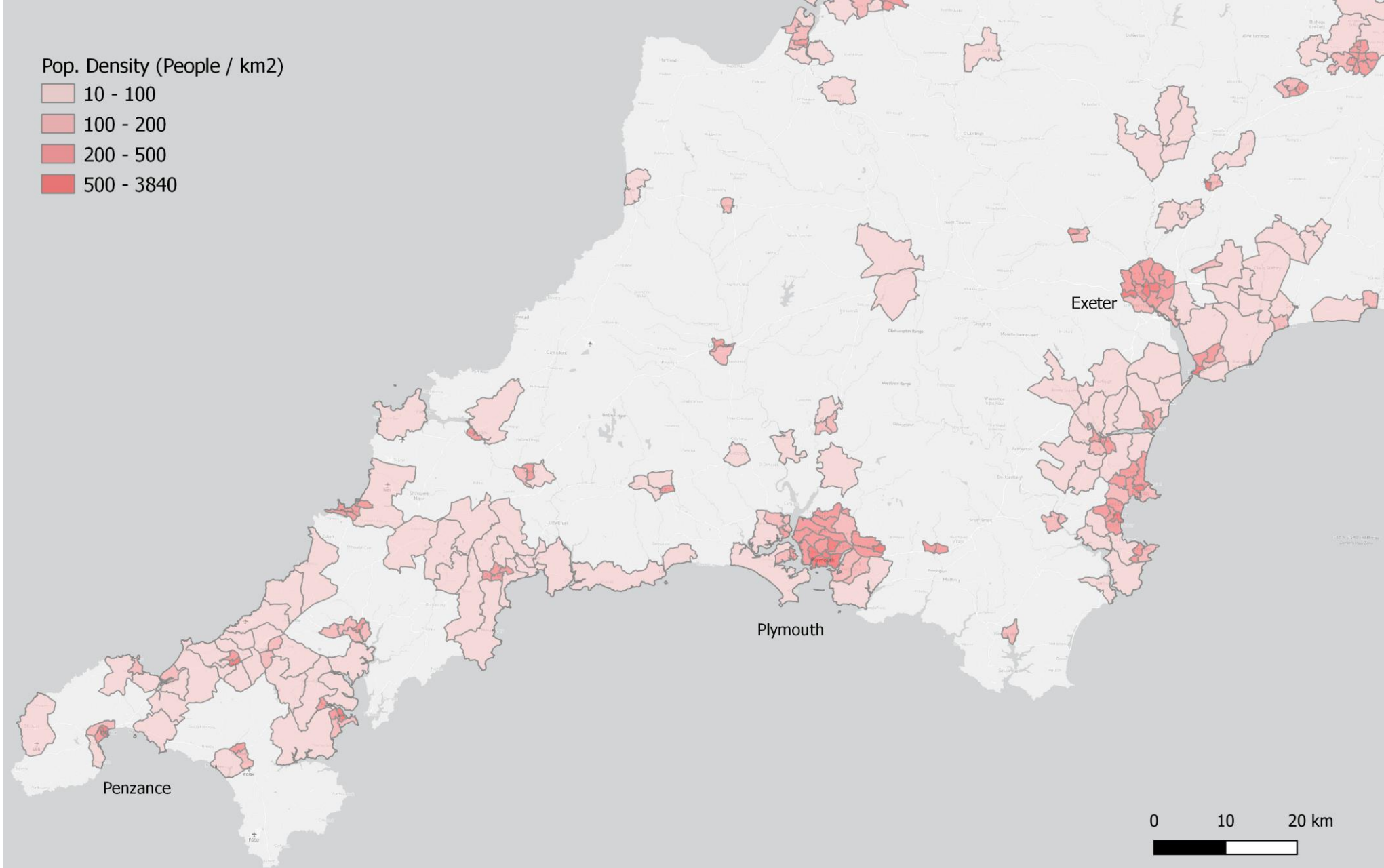
- Good representative geographical area



0 10 20 km

A story |

Population density

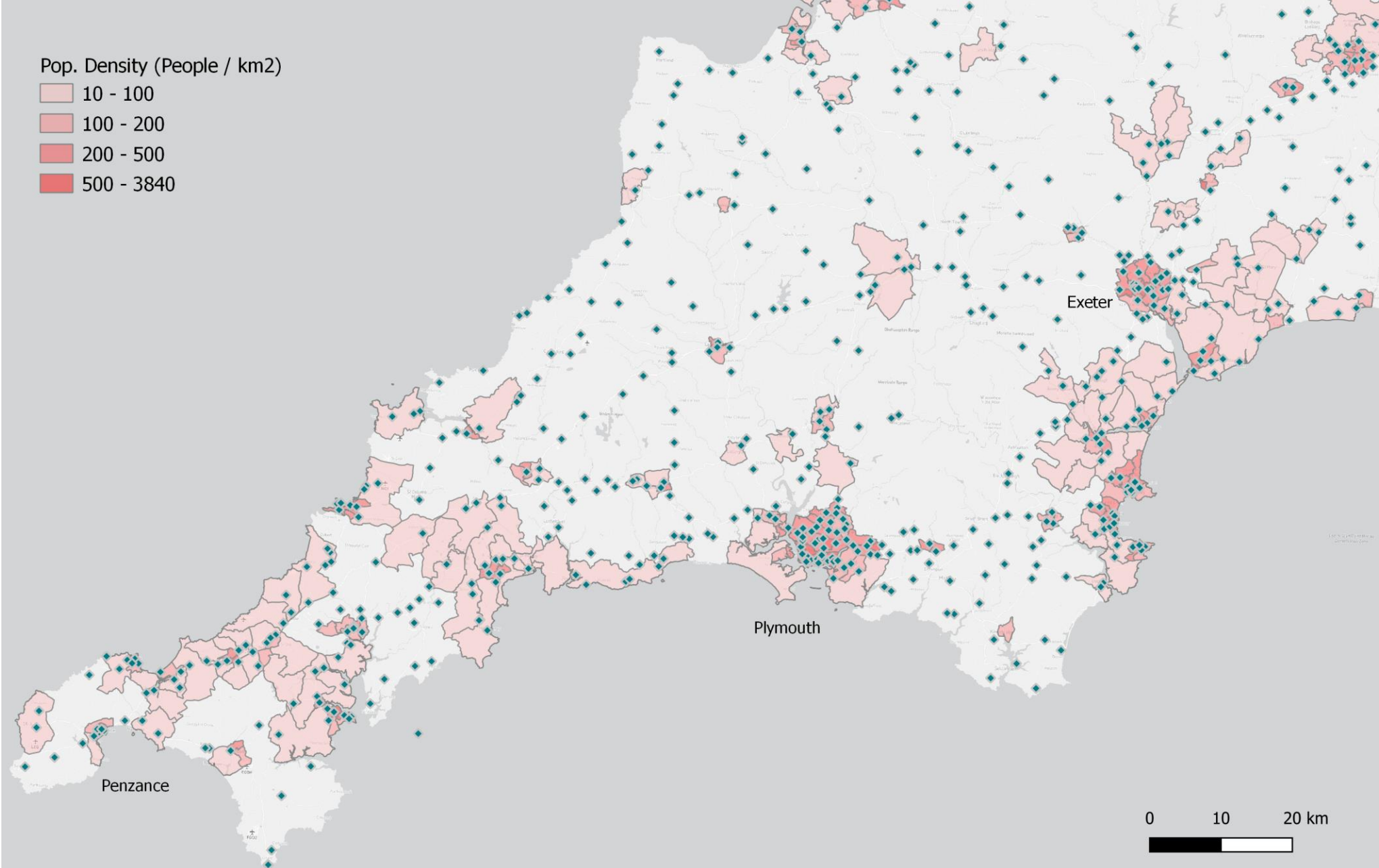


A story |

A mobile operator's 4G mast locations

- As far as we can make out

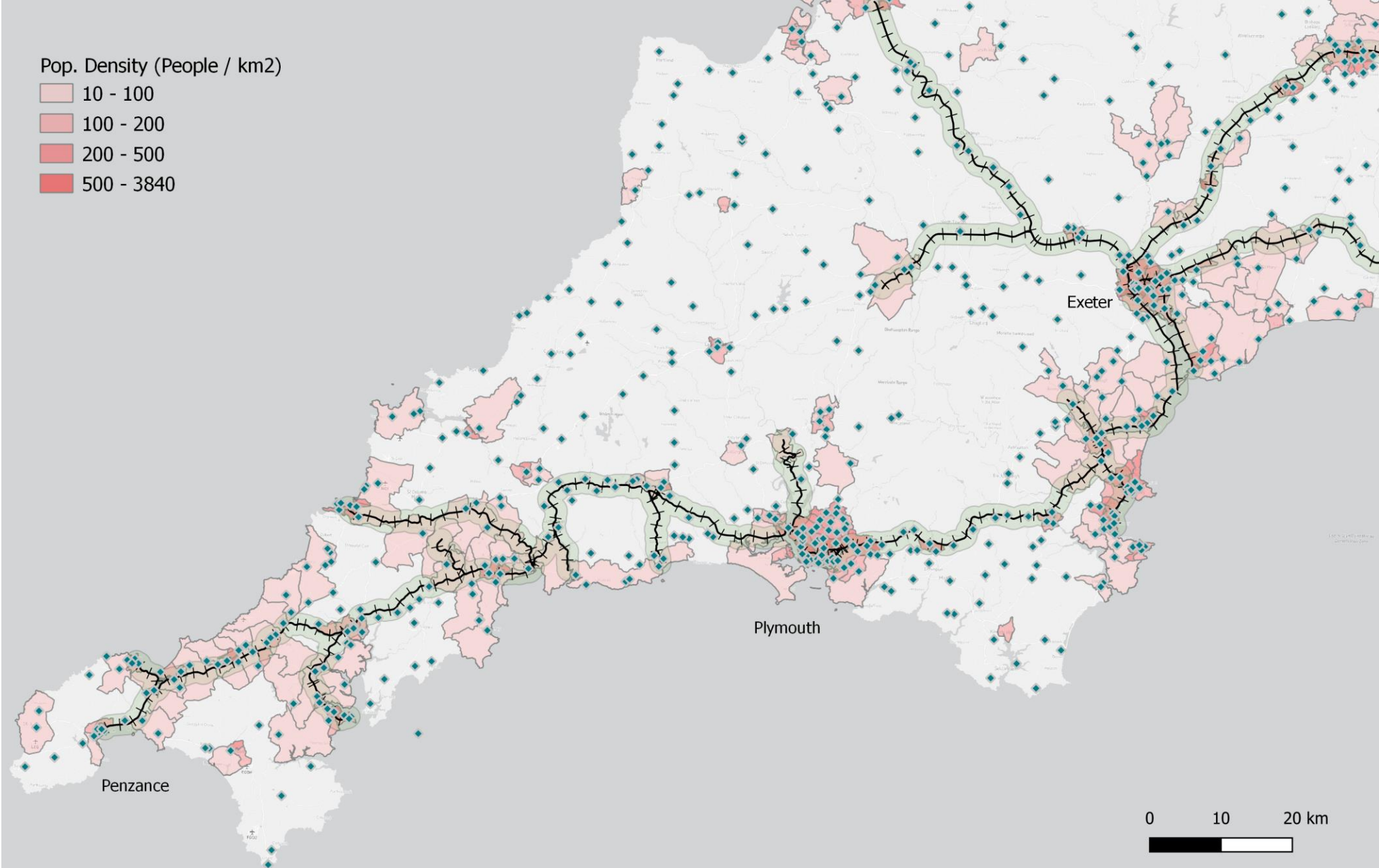
Where the people are (& roads)



A story |

Where the railway runs

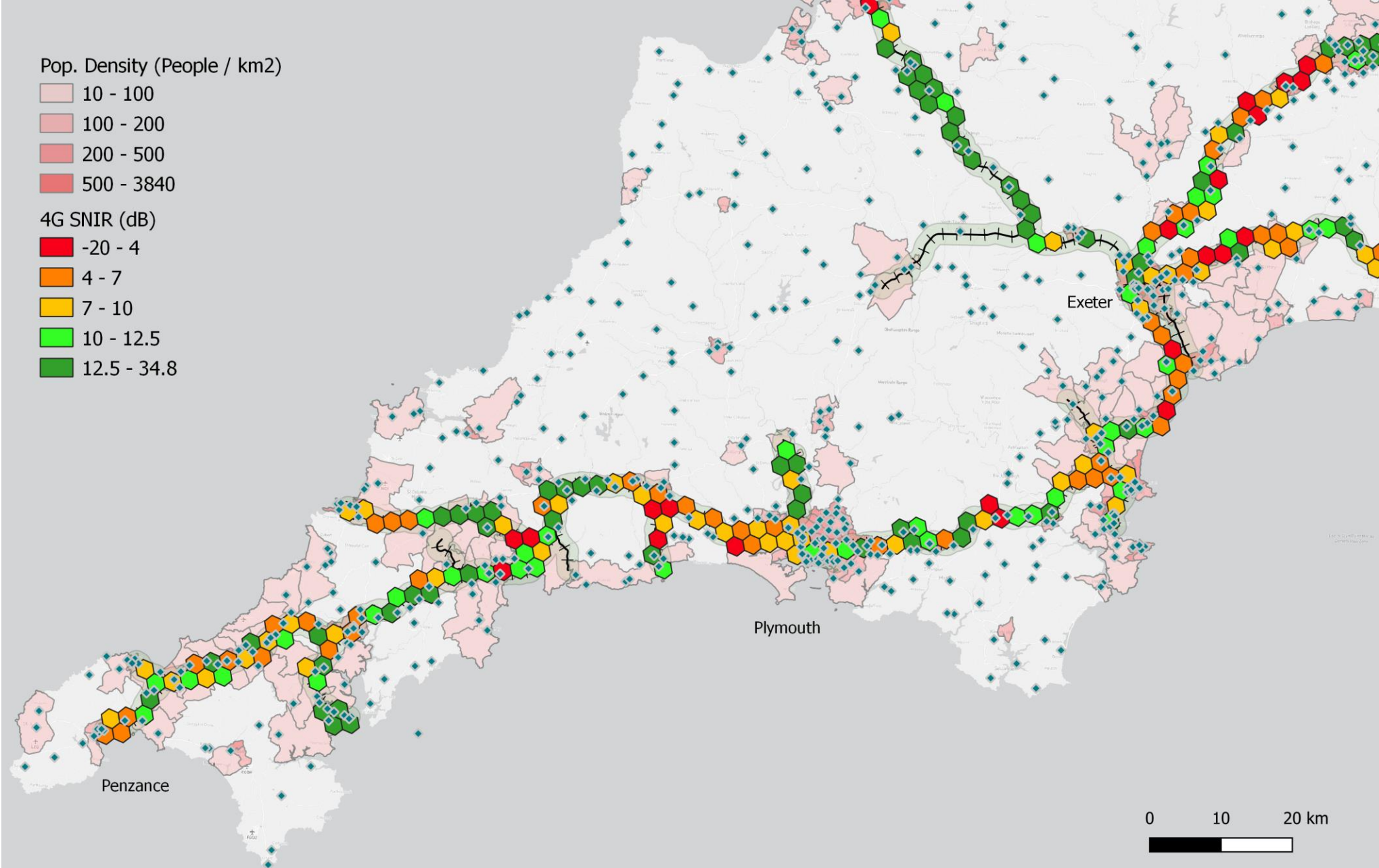
- Buffer 1.5km either side



A story |

Geometric mean of the mobile operator's SNIR measurements

- Uber H3 spatial index
- 'Size 7': 1220m edge lengths
- Roof-top height calibrated SNIR measurements



A story | Across the country

Coverage at train roof-top height is highly variable

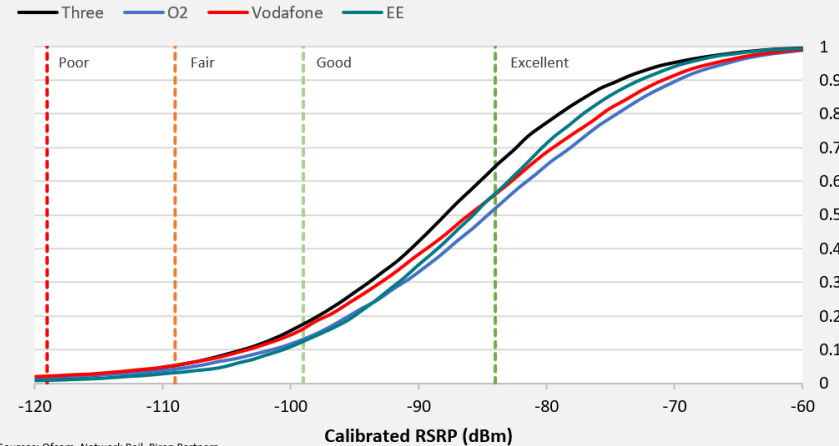
- Passenger reception further impacted by carriage design (~15dB)
- Distribution of mobile signals by operator varies considerably

Good Signal ≠ Good Data Speeds

For Train Operators it's the overall experience of all passengers that's important

RSRP how good is it across the railway?

Cumulative Distribution Function of geometric mean of RSRP by mobile operator



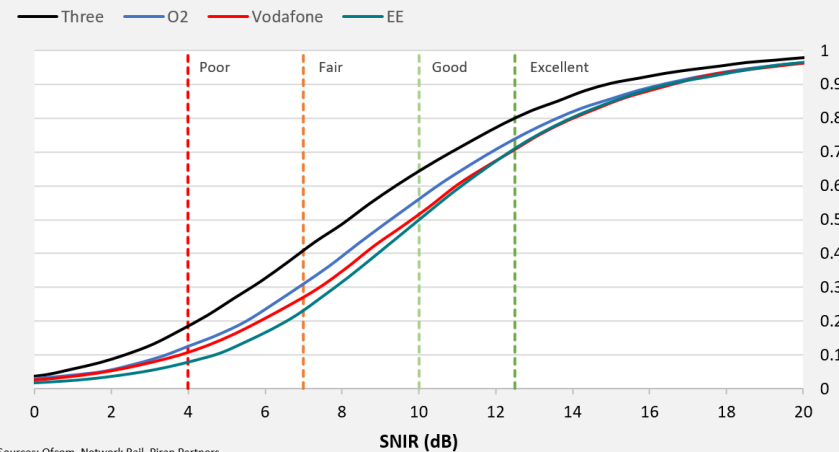
Mobile operator 'not-spots' per hexagon

(where geometric mean of mobile operator's RSRP < -99dBm)

0	4444	71%	All mobile operators RSRP > -99 dBm
1	736	12%	1 mobile operator's RSRP < -99 dBm
2	498	8%	2 mobile operators' RSRP < -99 dBm
3	255	4%	3 mobile operators' RSRP < -99 dBm
4	293	5%	All mobile operators' RSRP < -99 dBm

SNIR how good is it across the railway?

Cumulative Distribution Function of geometric mean of SNIR by mobile operator



Mobile operator 'not-spots' per hexagon

(where geometric mean of mobile operator's SNIR < 7dB)

0	2387	38%	All mobile operators SNIR > 7 dB
1	1575	25%	1 mobile operator's SNIR < 7 dB
2	1225	20%	2 mobile operators' SNIR < 7 dB
3	656	11%	3 mobile operators' SNIR < 7 dB
4	383	6%	All mobile operators' SNIR < 7 dB

Focus on needs & levers of control

Passengers *(bandwidth needs: 100-200MHz via CA or contiguous)*

- More contiguous coverage – for 4G / 5G ‘through window’
- Plus, capacity – particularly if using dedicated ‘indirect’ train-to-internet solutions with on-train gateways

Operational (FRMCS) *(bandwidth needs: 5-10MHz)*

- Highly available reliable coverage for 200kbps – 5Mbps (depending on services)
- Cell-edge performance is key

Operational (IoT) *(bandwidth needs: 200kHz)*

- Reliable coverage for c.100kbps (e.g. NB-IoT)





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Thank you

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