Mobile Infrastructure Project Impact and Benefits Report

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The Mobile Infrastructure Project (MIP) aimed to support economic growth in the UK, including in rural areas, by improving the coverage and quality of mobile network services for consumers and businesses that live and work in areas of the UK where existing mobile network coverage was poor or non-existent. Announced in 2011, the project closed in 2016.

An evaluation was carried out to collect evidence on government's role in improving mobile connectivity, demonstrate the impact and benefits of the project and collect learning for future programmes. This document reports the outcomes, benefits and cost effectiveness of the project compared to the scheme's objectives as defined in the re-baselined business case. This report satisfies recommendations 1 and 2 of the Infrastructure and Projects Authority Gateway 5 Review for MIP.

1. Executive Summary

The Mobile Infrastructure Project has delivered 2G, 3G and 4G mobile connectivity through 75 mobile masts to 7,199 premises which previously had no mobile signal, more than had been estimated in the most recent business case. The evaluation showed that communities greatly appreciate the improved mobile connectivity and that it brings a variety of benefits to those communities. It also showed that government intervention was warranted, that delivery costs were lower than expected, and value for money greater than estimated in the most recent business case. The evaluation drew on financial modelling, cost benefit analysis, and a survey of parish councils in the coverage areas of MIP masts. The key findings are:

- The MIP helped to reduce the digital divide and add public value, with 85% of parish council respondents satisfied or very satisfied with the quality of mobile signal received through MIP.
- The project supported economic growth by helping businesses in previously not-spot areas expand and operate more efficiently, as well as making these areas more attractive to visitors and young property buyers.
- The MIP helped increase public safety by providing residents and visitors with a reliable mobile signal for calls to emergency services.
- The MIP helped address market failures by providing mobile connectivity in not-spot areas as well as increasing internet availability in areas which are also affected by poor broadband. Analysis suggests that many of the areas covered by MIP masts would have otherwise not been cost-effective for mobile network operators to cover.
- The total cost of building the 75 masts was lower than expected at £35.81m - 30% less than the estimated cost of building 60 masts.

- The challenges associated with mast site acquisition during MIP has helped inform the Government's mobile strategy by confirming the need for Government to work more closely with mobile network operators. As a result, MNOs committed to new coverage obligations to be delivered by the end of 2017.
- The MIP has helped increase mobile signal quality in areas around not-spots as well as adding connection points to the mobile network for further expansion.

The total cost incurred by Government to build the 75 mobile masts is currently £35.81m. This equates to a cost per mast which is 40% lower than was estimated in the re-baselined business case. Comparing to some of the quantifiable expected benefits of the MIP over 20 years gives a benefit to cost ratio of 0.73. The actual benefit to cost ratio, were it possible to include all of the non-quantifiable benefits to the analysis, is expected to be considerably higher. Although a number of challenges led to revisions in the project's ambitions, the outcomes and benefits of the MIP have outstripped even the most optimistic estimates presented in the final business case.

2. Background

The MIP project was announced in October 2011 by the Chancellor, as part of the National Infrastructure Plan. Its objectives were to support economic growth in the UK, including in rural areas, by improving the coverage and quality of mobile network services for consumers and businesses that live and work in areas of the UK where existing mobile network coverage was poor or non-existent.

The expected benefits for MIP, identified through the BDUK benefits realisation framework, focus on:[1]

- Growth to the economy, through improvements to business productivity, employment and new businesses.
- Public sector efficiency, through increased access to public services and cross Government learning.
- Reducing the digital divide and adding public value through providing increased connectivity.
- Addressing market failure, through enabling the provision of mobile services in areas where the market was not.

Up to £150m was to be set aside for investment in new mobile masts in rural and remote areas in "not spots" - areas with no coverage from any of the UK's four mobile operators. The original ambition was to provide voice and data coverage through MIP to up to 60,000 premises across the UK which previously had no mobile coverage, via up to 575 new masts.

DCMS in 2013 signed a contract with Arqiva to search and acquire mobile mast sites, then build and manage the sites. The capital costs of erecting the masts were to be met by government while the costs of using the new infrastructure would be shared between the UK's four mobile operators (Vodafone, Telefonica/O2, EE and Three), for the 20 year lifespan of the masts.

[1] Environmental benefits were included in the original business case for MIP, however, the impact of MIP on the environment is considered to be marginal therefore has not been assessed.

Due to a number of challenges, the project's ambitions and delivery timeframes were revised on several occasions during the project's lifecycle. In June 2015 the business case was re-baselined to target delivery of 40-60 masts by March 2016.The economic case for MIP, which was updated for the re-baselined business case, produced an upper estimate of the benefit to cost ratio for the project of 0.54. This estimate does not include the wide range of non-quantifiable benefits, and therefore the true value would have been higher.

BDUK has carried out an evaluation of the MIP which aims to assess the success of the project against the re-baselined business case and expected benefits as well as a range of emerging benefits which have been observed since the start of the project. The evaluation methods and results are described in the remainder of this document.

2.1. Evaluation Activities

The MIP business case used a willingness to pay approach to quantify some of the benefits of the project. As recommended by the IPA Gateway 5 review, this analysis has been updated for the purposes of this evaluation and results will be presented later in this document. For full details of the data and assumptions which have been updated, see Annexes A and B.

While the willingness to pay analysis provides a measure of some of the financial benefits of the project, the approach cannot provide a detailed understanding of the real benefits to those in MIP mast areas. As such, BDUK undertook a survey to understand the benefits to consumers and businesses in MIP mast areas. The results of this survey allow us to determine more explicitly whether assumed benefits captured in the BDUK Benefits Realisation Framework have been felt by this population as well as to identify any benefits not previously considered.

The survey was conducted online and targeted parish councils for their opinions on the impact of the scheme to the local area and any lessons and case studies which could be shared. The advantage of this approach was that respondents could be targeted in the exact locations where masts were installed achieved in a way that is cost effective and proportionate to the scope of this evaluation.

A disadvantage of the survey approach is that responses may be unrepresentative. This means that we are unable to draw concrete statistical conclusions about the impacts on not-spot residents and businesses, but can provide more insight than otherwise into the feelings and opinions of those affected by the scheme. Furthermore, the 11 local government districts in Northern Ireland do not have parish councils and do not perform the same functions as Parish Councils in the UK. For this reason no surveys were sent to beneficiaries of the MIP in Northern Ireland.

Other evaluation activities undertaken by BDUK include analysis of the capital build cost which was required to deliver coverage to the 7,199 premises covered by MIP. We have also

analysed the rate of deployment of 2G, 3G and 4G services to better understand the results of our survey as well as to provide better estimates for the cost benefit analysis.

2.2. Outputs and Outcomes

MIP has delivered in total 75 new 2G, 3G and 4G enabled mobile masts. These masts have provided a mobile signal to 7,199 premises (which roughly equates to 14,100 residents) in not-spot areas. These outputs, although short of the original project's ambitions, exceed the expectations presented in the re-baselined business case which, even in the best case scenario, expected MIP to deliver only 60 mobile masts. This would have provided coverage to only 5,400 premises, equating to 10,576 residents. The total capital cost for the delivery of 60 masts was projected to be £52.38m, with actual costs being 31.6% (£16.57m) less at £35.81m for the 75 masts which MIP delivered. This means that MIP has delivered a mobile service to approximately 32% more residents at almost half of the cost per person than originally anticipated.

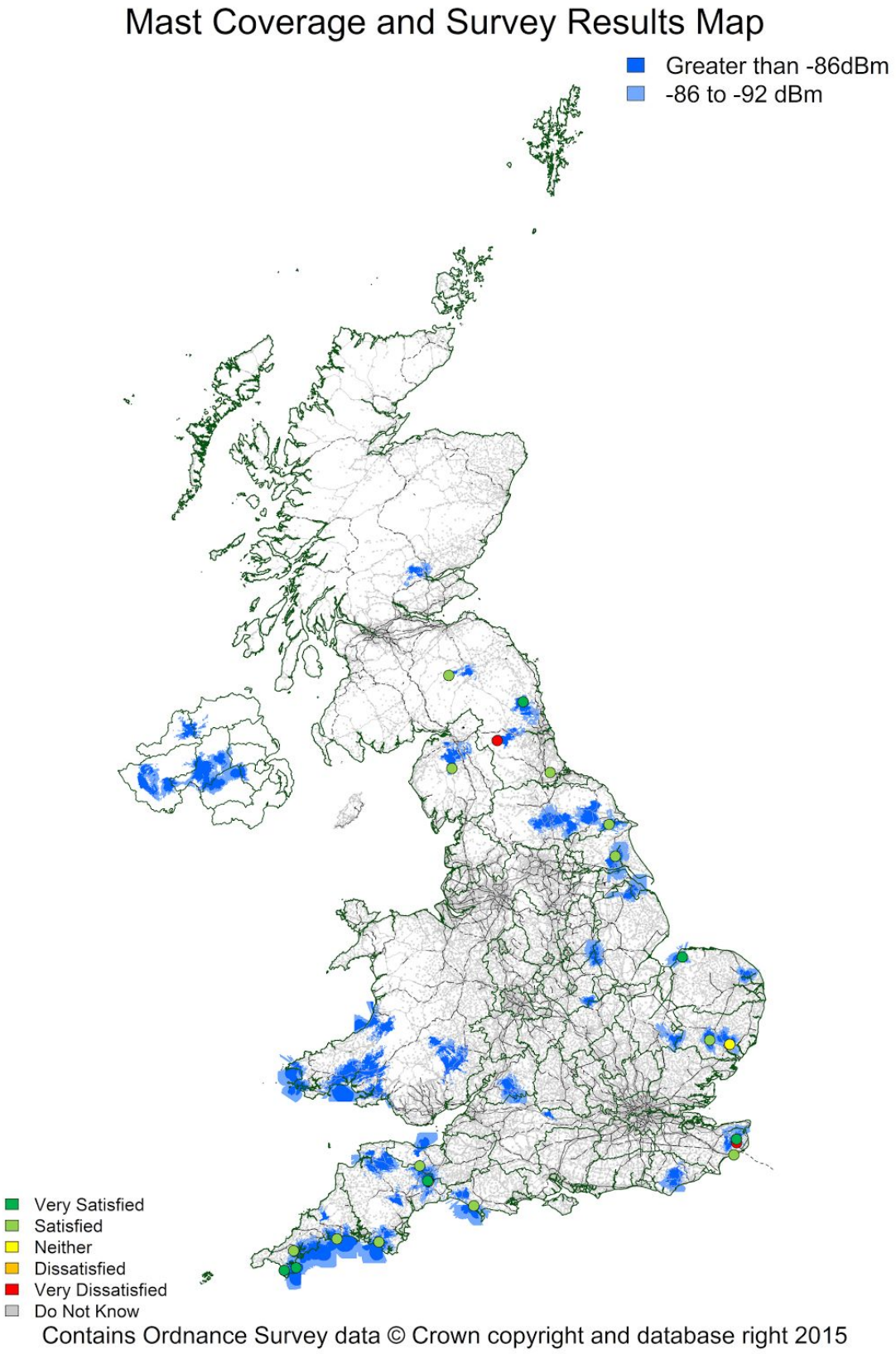
Map 2.2.1 shows the coverage achieved by the new masts at a strength up to -92 dBm and -86 dBm[2]. Overlaid also are the parish councils who responded to our survey, colour-coded by their respective levels of satisfaction with the quality of mobile signal received through MIP.

Parish councils surveyed were those who had had at least one MNO live on a mast near them for at least 3 months at the time of surveying. The MIP project has now almost completed deployment. Using data from January 2017 we know the total number of masts currently enabled with 3G and 4G services for each provider, as given in Table 2.2.2 below.

Service & Provider	January, 2017
3G, EE	72
4G, EE	72
3G, 3	72
4G, 3	69
3G, Vodafone & O2	67
4G, Vodafone & O2	67

Table 2.2.2. Masts enabled with 3G and 4G services.

[2] Coverage data received from Arqiva in 2016. Survey respondents are indicated with approximate locations only.



Map 2.2.1: Mobile coverage achieved through MIP with survey respondents by satisfaction level

3. Benefits

This evaluation has found evidence to suggest that a great many benefits have been felt as a direct result of the Mobile Infrastructure Project. Benefits covered in this section are:

- Reducing the digital divide and adding public value by increasing mobile coverage in not-spot areas
- Providing growth to the economy by helping businesses to run more efficiently and making local areas more attractive for visitors and young property buyers
- Increasing public safety by providing more reliable access to emergency services
- Increasing internet connectivity in areas also affected by poor broadband
- Informing the Government's mobile strategy by setting precedents for further improvements
- Increased mobile signal quality in areas around not-spots

3.1. Reduced the Digital Divide and Added Public Value

The Mobile Infrastructure Project has certainly helped to reduce the digital divide and add public value by providing increased connectivity in areas where the market was failing to do so. As many of the areas targeted by MIP also suffer from poor broadband signal, MIP has further helped to reduce the digital divide by providing 4G mobile internet coverage.

"Excellent project that has provided contact at last with the outside world"

In order to assess the success of the project in delivering this, as already mentioned in this report, BDUK conducted a survey of parish councils. The parish councils surveyed were those who at the time (October 2016) had had at least one MNO live on a MIP mast near them for at least 3 months. 57 surveys were sent out and we received 26 responses, giving a response rate of 45.6%.

Of the 26 respondents, 6 reported the members of their community to be very satisfied with the quality of mobile signal in their area provided through the MIP, while a further 16 said they were satisfied, giving a satisfaction rate of almost 85%. Chart 3.1.1 below shows the full spectrum of responses.

Chart 3.1.1. Respondent satisfaction with quality of mobile signal (percentage of respondents)

When asked for further details, 9 respondents remarked that they had seen significant improvements in the quality of mobile signal in their area, while a further 10 had seen some improvement. 4 respondents remarked that the process took longer than expected. In fact, 1 of the 2 dissatisfied respondents, reported some improvement in the quality of mobile signal but was disappointed due to delays in some of the MNOs going live on the mast. The other dissatisfied respondent was the only one to state that they had not noticed any improvement in the quality of mobile signal.

Respondents were also asked to choose from a list of positive and negative possible impacts of the project, results for which are given in Chart 3.1.2.

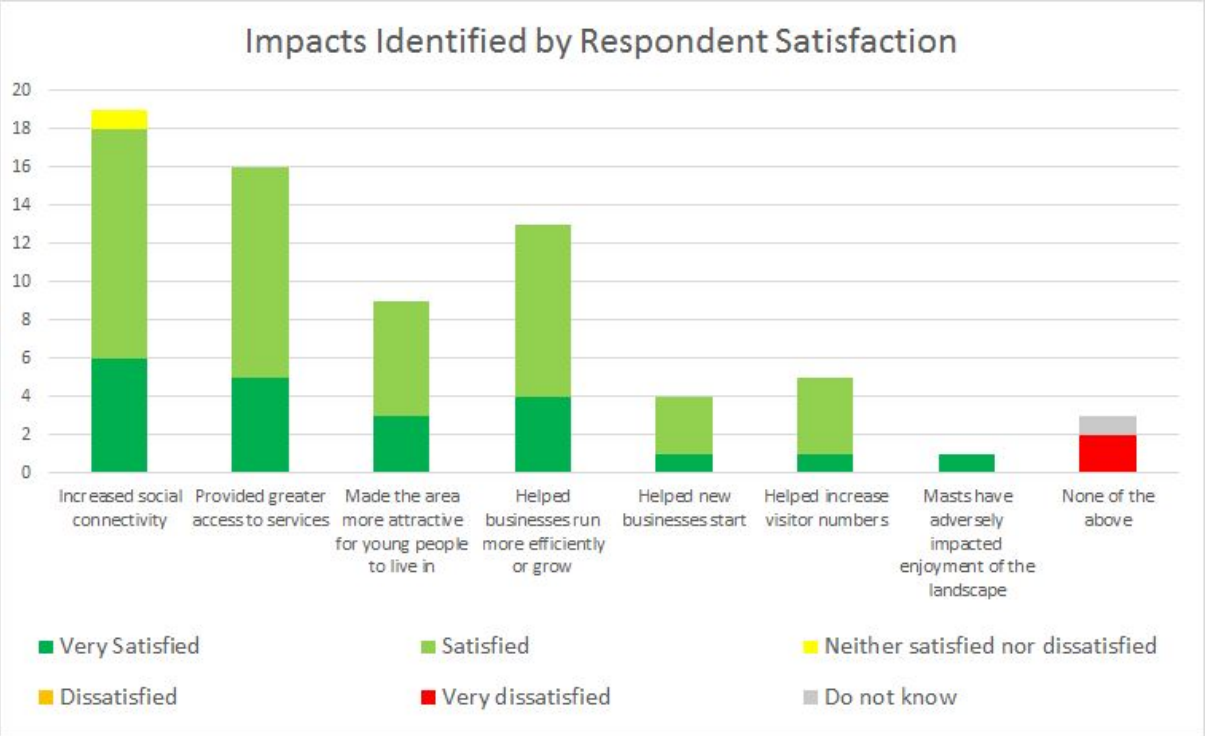


Chart 3.1.2. Possible impacts identified by respondents. Satisfaction levels relate purely to satisfaction with the quality of mobile signal received through MIP.

19 of the 26 respondents (73%) agreed that the MIP had helped to increase social connectivity in their area. Furthermore, 16 respondents (62%) agreed that the project had helped to provide greater access to services such as information on leisure activities, travel information, online shopping, or public services. Interestingly, only those who responded with

‘very dissatisfied’ or ‘do not know’ could not identify any impacts from those above. Furthermore, only one respondent noted that masts may have adversely impacted the landscape in their area, and this respondent was very satisfied with the signal quality. When asked for further comments, a further 4 satisfied respondents mentioned an initial or partial negative reaction to the masts’ visibility. This suggests that the overall attitude towards the impacts of the masts is very positive.

3.2. Economic Growth

The Mobile Infrastructure Project has had a positive, albeit difficult to measure, impact on economic growth. 13 of the 26 survey respondents (50%) agreed that the MIP has helped businesses run more efficiently or grow, while a further 4 (15%) agreed that the project has helped new businesses start (Chart 3.1.2).

Additionally, a survey carried out to support the original business case[3] asked businesses in not-spot areas to quantify the negative impact of having poor mobile signal. Of those who could estimate this impact, almost 65% reported losses between £100/ month and £250/month due to a lack of mobile connectivity. The remaining 35% reported monthly losses in excess of this value, with 1 per cent (large businesses) indicating monthly losses greater than £50,000/month. The avoidance of these costs is not included in the cost benefit analysis for MIP as it would be too speculative to be defensible, however, there is little doubt from this and the survey responses that the 75 new mobile masts funded by the MIP are helping to reduce the negative impact on businesses in previously not-spot areas.

"we have 2 masts that have made a huge difference bringing our rural communities into the 21st century"

Another positive impact of MIP on the economy is that of making surrounding areas more attractive, be that for young property buyers or visitors. While it is likely that the full effect of these impacts are yet to be felt, 9 respondents agreed that the MIP had made their area more attractive for young people to live in and 5 agreed that the project has helped to increase visitor numbers. The survey which was carried out to support the original business case attempted to estimate the value of good mobile connectivity to frequent local visitors and tourists. While it found that local visitors were willing to pay almost as much as residents for some mobile services[4], it is difficult to measure the extent to which good mobile connectivity will encourage greater numbers of visitors or property buyers in the future. It is encouraging, therefore, that some of our survey respondents already feel that the MIP masts are having a positive effect.

3.3. Public Safety

The additional mobile coverage provided by the MIP masts has helped residents and visitors in the affected areas have a greater feeling of safety, with 8 of our survey respondents specifically mentioning that residents and/or visitors are now able to access emergency services or call for help in areas where they previously had no signal. The '999' (or '112')

[3] RAND, Estimating the value of mobile telephony in mobile network not-spots, 2014
[4] See Annex A for the results from this

service handles around 36 million phone calls per year, two thirds of which come from mobile phones[5]. Considering the estimated proportion of the UK population covered by the MIP masts, this could mean that over 5000 calls to emergency services per year will be connected faster or more reliably due to the MIP project.

3.4. Internet Connectivity

In those not-spot areas covered by MIP where broadband coverage is also very low, residents are now able to use 3G and 4G signal to access the internet.

Of our survey respondents, 5 explicitly commented that some of their parishioners were now able to use their mobile internet to compensate for the lack of broadband coverage in their area. Furthermore, 2 satisfied respondents expressed concern that they had not yet been able to receive a 4G signal. This suggests that the 3G and 4G capability of the MIP masts has helped to further reduce the digital divide, since internet connectivity would not have been addressed had these areas been left without high-speed mobile data.

3.5. Informing Government Mobile Strategy

"A very good government initiative and one to be commended"

Government investment in infrastructure has not only provided a means for the private sector to deliver services to not spot areas, but also helped Government mobile strategy to evolve. MIP confirmed the need for Government to work more closely with mobile operators to ensure they are able to roll out their networks into rural areas. The challenges associated with mast site acquisition, experienced during MIP, has helped bring about new legislation to relax the planning regime, which makes it easier for mobile operators to obtain planning permission for mast sites. In addition, MIP highlighted the challenges associated with Government providing direct investment in infrastructure, and spurred Government to broker more ambitious coverage requirements from the mobile operators as part of their spectrum licence conditions. For example, O2's licence obligation to deliver indoor 4G coverage to 98% of premises in the UK by end 2017 will further improve mobile coverage while other mobile operators have publicly stated that they will match this commitment. Furthermore, £5bn worth of industry investment has been guaranteed as a result of the legally binding agreement with the mobile operators which requires all of the four mobile network operators to deliver voice and text coverage to at least 90 per cent of the UK's landmass by the end of 2017.

Funding for the 75 commercially non-viable masts delivered through MIP has also helped to add additional connection points for further expansion of the mobile network into not-spot areas. Additionally, the MIP has demonstrated multi-user sites as a viable business model for publically funded infrastructure. While the industry has been engaging in site sharing programmes for some time, with Ofcom also encouraging mobile network operators to share

[5] Ofcom, Location information for emergency calls from mobile phones, 2014

masts or sites where possible, this business model could be taken up more widely and be implemented in other government funded schemes.

3.6. Better Services to Areas Around Not-Spots

By setting the signal strength threshold to -86 dBm for providing coverage to not-spots, rather than -92 dBm, the MIP has delivered four times stronger signal in affected areas than that which MNOs have agreed to deliver to 90% of the UK's landmass by 2017. An additional benefit is that, as can be seen by the coverage map on page 3, a signal strength of -92 dBm reaches considerably farther than -86, and thus has helped to improve the signal quality for premises in not-spot and partial not-spot areas which are not included in the 7,199 figure.

4. What contribution did the scheme make to the outcome?

The Mobile Infrastructure Project has addressed market failure by providing mobile coverage where the market previously hadn't. In 2012, Health & Safety Laboratory estimated that there were a total of 80,484 premises in not-spot areas with a total population of 157,656 residents. The MIP has been responsible for providing mobile coverage of greater than -86 dBm signal strength to 7,199, or 9% of these premises. There is also good reason to suspect that many of the areas in which the MIP has intervened would have continued to be overlooked by the market for the foreseeable future. Analysis suggests that 63 of the 75 mast sites are not commercially financially viable, as they cost more to build per premise than the £1000 they can reasonably be expected to earn in profit over 20 years.

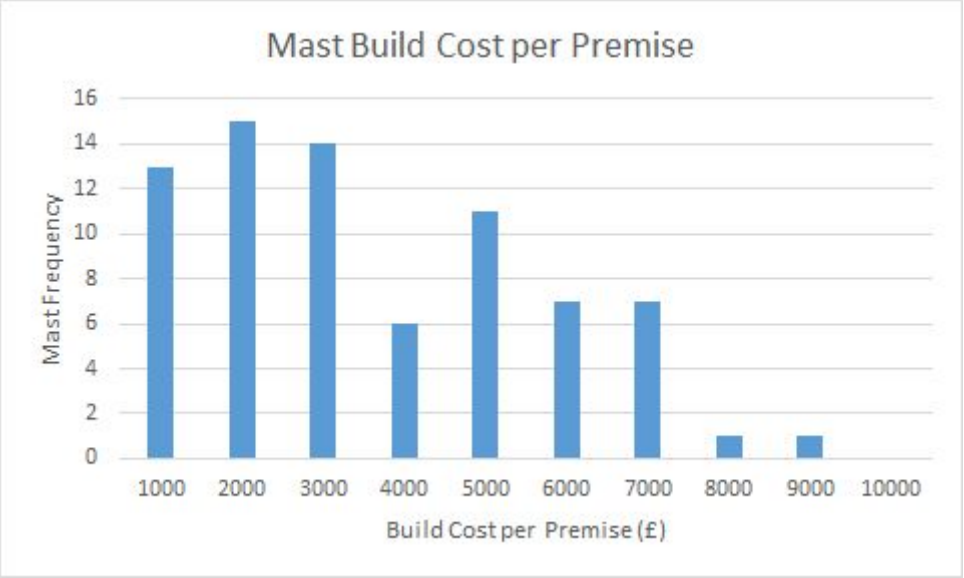


Chart 4.1.1. Build cost per premise histogram

This estimate of expected profit is based on the generous assumption that 50% of not-spot residents purchase a new mobile phone subscription at the average annual cost of £180[6]. We can discount the average revenue and operational cost[7] per not-spot premise at an annual rate of 3.5%, factoring in 3 years for take-up to be achieved, to get that the expected profit is only £1000 over 20 years.

Comparing this to the capital costs paid for each mast in the scheme, shown in chart 4.1.1, shows that for at least 83% of masts built, the capex was greater than our estimate of average expected revenue. While MNOs' business models are likely to be more complex, and while it is true that MNOs run some masts at an effective loss in order to maintain their nationwide coverage and service, the above analysis suggests that many of the masts built through MIP would not have been commercially viable and might never have been built without Government intervention.

5. Cost Effectiveness

The potential value for money of the Mobile Infrastructure Project could not have been estimated with the aid of market-related information because, by definition, the supply of the service did not exist in not-spots. Demand for the service had not yet been revealed in an active market, and the costs of supplying it had not been measured.

For this reason, a contingent valuation survey was undertaken among not-spot residents, businesses and visitors. This assessed the potential value for money of the MIP based upon the willingness to pay for mobile coverage among potential customers. RAND were commissioned by DEFRA and DCMS to estimate the willingness of not-spot residents and visitors to pay for the extension of mobile coverage to not-spots.

In broad terms, the benefit of removing not-spots was estimated by the willingness to pay of the beneficiaries of the policy in excess of the amount that they would pay for a service contract.[8] RAND took measures, detailed in their report, to control for sample selection bias, however the willingness to pay estimates may still be vulnerable to various biases. For full details of the WTP figures produced by RAND, see Annex A.

The original cost benefit analysis for MIP indicated that the benefit to cost ratio of the project would fall between 0.46 and 0.54 with the then NPV of the project being between -£19m and -£29m. This variation was due to a number of scenarios being considered, for details of which one may see the Full Business Case for MIP.

5.1. Updated Cost Benefit Analysis

The revised benefit to cost ratio for MIP is 0.73, higher than even the most optimistic estimate of 0.54 in the business case. The updated benefit to cost ratio and NPV of the project can be compared to the original scenarios in Table 5.1.1 below. Although the project

[6] Ofcom 2016 Market Report

[7] Revenue is calculated from customer take-up multiplied by £179.64, the average Annual cost of a mobile phone subscription according to the Ofcom 2016 Market Report. Opex is assumed at £9000 per mast, consistent with data provided by Arqiva in 2016, which equates to £93.76 per premise per annum

[8] RAND, 2014. Estimating the value of mobile telephony in mobile network not-spots

still appears to have a present value below 0, in fact, the actual value of the project is likely to be much higher due to the multitude of non-monetised benefits discussed in this document.[9]

Scenarios	BCR	NPV
Maximum (60 sites)	0.54	-£21.00m
Medium (50 sites)	0.50	-£20.05m
Minimum (40 sites)	0.46	-£19.04m
Actual (75 sites)	**0.73**	**-£10.25m**

Table 5.1.1. New BCR and NPV figures compared with originals

This section sets out the assumptions which have been updated in the model in order to produce an updated benefit to cost ratio and a net present value of the project. It should be noted that the original NPV was calculated for the financial year 2010/11 which is the year in which the Mobile Infrastructure Project was announced. The updated analysis calculates NPV for the year 2012/13 since this is the first year in which actual costs were accrued.

The total capital expenditure for all of the 75 sites built is estimated to be **£35.81m.** This includes build costs, administrative costs and other non-build capital expenditure.[10] The operating expense estimated in 2016 by Arqiva is **£9,000** per mast. For the purpose of the model, we have adjusted for inflation to present costs in 2013/14 prices. This is in order to match the costs of the project to the benefit given by the WTP figures which were created by RAND in 2013/14.

Discounting at an annual rate of 3.5% over 20 years, gives a present value of **£38.43m** in costs. Meanwhile, the present value of the benefits calculated from the WTP figures above is **£28.17m.** This gives a benefit to cost ratio of **0.73** and net present value of the project equating to **-£10.25m**. Details of the calculations which result in these figures can be found in Annex B. The main reasons for the improvements in the results of this cost benefit analysis compared to the re-baselined business case are:

- More masts were built than estimated, with a final total of 75 compared to the upper estimate of 60.
- The masts which were built cover a larger number of premises than was expected in the business case, with around 96 premises covered per mast compared to the estimated 90. This increases the measured benefits per mast.
- Actual Capex costs were lower per mast than expected, with the 75 masts costing over 30% less than the cost estimated for 60 masts. This means that on average, each mast cost over 40% less in capital expenditure to build than originally expected.
- Updated operational cost estimates were £9k per mast per annum, 40% lower than the original estimate of £15k.

[9] While WTP provides an indication of some of the benefits it does not fully capture wider externalities and impact on the wider group. Since a lack of data limits the depth to which these benefits can be estimated, the original business case attempted to capture some of these social impacts using network effects. We have retained this approach in our updated analysis but this means that the benefit to cost ratios presented here need to be interpreted with caution. For a detailed explanation of network effects and their impact here, see the original business case for MIP.

[10] An additional cost of up to £3m may be claimed by Arqiva in 2017, however, since the actual value of this cost is as yet unknown, it has been excluded from this analysis. The cost/benefit impact should this additional cost be approved does not materially impact on the conclusions drawn from this analysis.

While the above analysis suggests that the measured benefits do not cover the costs of the scheme, we note that this is likely to be an underestimate of the total benefits of the scheme. In particular, we do not include any long term profits to Arqiva or MNOs even though we include their operational costs.[11] Furthermore, we have not estimated many of the benefits outlined in previous sections, such as public sector efficiency and growth to the economy, which also potentially underestimates the benefit to cost ratio. We have also only used WTP figures for a 2G service, even though MIP delivered 3G and 4G. For an updated analysis which uses WTP figures for 3G/4G services, see Section 5.2. Finally, we are only accounting for benefits over 20 years, since an assumption has been made on the life of the technology, even though benefits could be observed further than this time period.

5.2. Cost Benefit Analysis with Updated WTP

Section 3.2. presented the updated cost benefit analysis using the same methodology as was used in the business case, as recommended by the Gateway 5 review. As explained in the business case, this used the WTP estimates provided by RAND for 2G services of the same signal quality as that available in nearby areas. This was in keeping with the original stated ambition for MIP which was to provide 2G services through 650 new masts, although the contract itself capped the number of new masts at 575, a constraint agreed with the MNOs. However, due to a number of challenges detailed in the project closure document, the actual contract signed with Arqiva stipulated that all mobile masts would have capability which is equivalent to a 4G signal.

Table 2.2.2 in Section 2.2 shows the number of masts which have MNOs live and delivering 3G and 4G services. This data is in line with the expected live dates for each MNO assumed in the WTP analysis, suggesting that the RAND WTP figures which should be used in this analysis are those for 3G/4G services of similar quality to that in nearby areas. These are:

- Residents: £13.40/month (+/- £3.00)
- Local visitors: £13.20/month (+/- £5.10)
- Businesses: £29.60/phone/month (+/- £16.60)
- Tourists over 65: 40 pence/day (+/- £0.35)
- Tourists under 65: 20 pence/day (+/- £0.10)

Updating the WTP to 3G/4G roughly equates to an estimated additional £4m of benefits, producing a new benefit to cost ratio of **0.84**. Table 3.2.3. below gives a comparison of the BCR and NPV of the MIP using the two different sets of WTP values.

Scenarios	BCR	NPV
75 Sites, 2G Service	**0.73**	**-£10.25m**
75 Sites, 3G/4G Service	**0.84**	**-£6.16m**

Table 3.2.3. BCR and NPV with different WTP assumptions

[11] For example, Arqiva charge site rental from MNOs while MNOs can expect to sell more mobile contracts. The net profit of these is a benefit which hasn't been included in the analysis since WTP is a measure of value on top of a standard mobile phone subscription.

This analysis is not necessarily representative of current willingness to pay for these services as it is reasonable for consumers to expect a better quality product for the same price. However, given that the model we are using has a duration of 20 years coupled with the fact that it should be easier and cheaper to enable the existing masts with any new technologies, it is still reasonable to consider the BCR obtained with the higher WTP figures for the purpose of understanding the net benefit of the masts being enabled with this technology. In this case, BCR improves by 0.11. However, for comparison with the FBC, it is recommended that the 0.73 figure is used.

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Annex A

This provides details of all of the data which was used in the benefit to cost ratio analysis. Data which has been updated since the FBC is indicated with a more recent date.

Willingness to pay for mobile coverage in not-spots

SOURCE: RAND (2014)	Low Interval	Mean WTP	High Interval	90% Confidence Interval
RESIDENTS' WILLINGNESS TO PAY £ per month				
2G same signal quality	7.90	12.00	16.10	4.1
2G better signal quality	18.30	23.40	28.50	5.1
3G/4G same signal quality	10.40	13.40	16.40	3
3G/4G better signal quality	18.20	24.70	31.20	6.5
BUSINESSES' WILLINGNESS TO PAY £ per month				
2G same signal quality	9.50	21.00	32.50	11.5
2G better signal quality	10.50	24.50	38.50	14
3G/4G same signal quality	13.00	29.60	46.20	16.6
3G/4G better signal quality	8.60	33.20	57.80	24.6
LOCAL VISITORS' WILLINGNESS TO PAY £ per month				
2G same signal quality	2.50	6.30	10.10	3.8
2G better signal quality	11.00	15.10	19.20	4.1
3G/4G same signal quality	8.10	13.20	18.30	5.1
3G/4G better signal quality	13.70	22.00	30.30	8.3
TOURISTS' <65 WILLINGNESS TO PAY £ per day				
2G same signal quality	0.10	0.20	0.30	0.1
2G better signal quality	2.00	2.70	3.40	0.7
3G/4G same signal quality	NA	NA	NA	NA
3G/4G better signal quality	NA	NA	NA	NA
TOURISTS' >65 WILLINGNESS TO PAY £ per day				
2G same signal quality	0.05	0.40	0.75	0.35
2G better signal quality	2.20	3.00	3.80	0.8

3G/4G same signal quality	NA	NA	NA	NA
3G/4G better signal quality	NA	NA	NA	NA
NOT SPOT MOBILE COVERAGE % of population	97%			

Mobile subscription data

SOURCE: OFCOM MARKET REPORT	2013	2016
OFCOM AVERAGE MONTHLY SUBSCRIPTION £	15.57	14.97
NUMBER OF SUBSCRIPTIONS '000s	82700	91500
UK MOBILE CALLS millions of minutes	122000	143000
SMS MESSAGES millions	152000	101000

Not-spot area data

SOURCE: HSL ESTIMATES	2012
TOTAL NOT SPOTS (100m x 100m)	23846
TOTAL PREMISES IN NOT SPOTS	80484
WORKFORCE IN NOT SPOTS	35027
TOTAL POPULATION OF ALL NOT SPOTS	157656

UK Tourists and Visitors

SOURCE: VISITBRITAIN	2012	2015
UK DAY VISITS MILLION	1712	1525
LONDON DAY VISITS MILLION	309	280
OTHER UK DAY VISITS MILLION	1403	1245
TOTAL UK OVERSEAS VISITORS MILLIONS	31.1	36.11514962
TOTAL UK OVERSEAS VISTOR DAYS MILLIONS	230.2	273.05394
TOTAL UK OVERSEAS OVER 65 VISITOR DAYS MILLIONS	19.6	26.2

TOTAL LONDON OVERSEAS VISITORS MILLIONS	15.5	18.58114536
TOTAL LONDON OVERSEAS VISITOR DAYS MILLIONS	94.3	108.3214332

ONS Data

SOURCE: ONS	
AREA OF UK square km	243610
AREA OFLONDON square km	8382
2010 OUTPUT MULTIPLIER TELECOMMUNICATIONS	1.463
2010 OUTPUT MULTIPLIER CONSTRUCTION	1.829

Satellite phone costs (note 2014 data has been used for all but handset cost)

SOURCE: WWW.SATPHONE.CO.UK	**2014**	**2015**
HANDSET COST £ excl VAT	649	703
USEFUL LIFE yrs	3	3
SATELLITE RENTAL £ per mth	0	0
TERRESTRIAL CALL COSTS units per min	60	60
SMS COSTS units per message	20	20
TERRESTRIAL CALLS £ per minute incl VAT	1.8	1.8
SMS MESSAGES £ per message incl VAT	0.6	0.6

Network effects data

SOURCE: SEE FBC	
Additional % sales of 1% increment to past sales:	
Germany	0.71

Portugal	0.9
High Income Countries	0.15
Norway	1.185

Mast operational costs

SOURCE: ARQIVA	ESTIMATE	2016 ESTIMATE
OPEX £ million per site p.a.	0.015	0.009

OTHER INPUTS	
VAT RATE	0.2

POPULATION ESTIMATES	mid-2012	mid-2015
England and Wales (Office of National Statistics) '000s	56,567.80	57,885.40
Scotland (National Records of Scotland) '000s	5,313.60	5,373.00
Northern Ireland (Northern Ireland Research and Statistics Agency) '000s	1,823.63	1,851.60
TOTAL UK	63,705.03	65,110.00

Annex B

The following tables provide the calculations which produced the cost benefit analysis in Section 5. The model uses 20 years of cost and benefit projections but, for ease, only 10 years have been shown here.

		Totals	Assum.	Year Number	1	2	3	4	5	6	7	8	9	10
				Financial Year	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
	MNOs	150			0	2	3	73	72	0	0	0	0	0
	Cumulative Sites	TRUE			0	1	2.5	39	75	75	75	75	75	75
	Cumulative Premises	7,199			0	96	240	3,743	7,199	7,199	7,199	7,199	7,199	7,199
	Cumulative Persons	0	1.96		0	188	470	7,333	14,102	14,102	14,102	14,102	14,102	14,102
	Cumulative Businesses	0	0.15		0	14	35	543	1,044	1,044	1,044	1,044	1,044	1,044
	Cumulative Day Visitors	0	0.02		0	4	10	161	309	309	309	309	309	309
	Cumulative Overseas Tourist <=65	0	0.96		0	180	460	7,022	13,504	13,504	13,504	13,504	13,504	13,504
	Cumulative Overseas Tourist 65+	0	0.10		0	19	48	746	1,433	1,433	1,433	1,433	1,433	1,433
COSTS	COSTS		NPVs											
	CAPEX		31.70		2.100	2.475	5.370	25.299	0.562	0.000	0.000	0.000	0.000	0.000
	OPEX	£0.009m	3.47		0.00	0.01	0.0225	0.391	0.675	0.675	0.675	0.675	0.675	0.675
	CAPEX 2013/14 Prices		31.23		2.135	2.475	5.291	24.818	0.543	0.000	0.000	0.000	0.000	0.000
	OPEX 2013/14 Prices		3.35		0.000	0.009	0.022	0.339	0.652	0.652	0.652	0.652	0.652	0.652
	NPV of Total (2012/13)	£34.581m	34.58		2.135	2.484	5.313	25.157	1.195	0.652	0.652	0.652	0.652	0.652
BENEFITS - 2G SAME QUALITY	LOW INTERVAL		NPVs											
	WILLINGNESS TO PAY (2013/14)	WTP per												
	Residents	£7.90	6.87		0.00	0.02	0.04	0.70	1.34	1.34	1.34	1.34	1.34	1.34
	Businesses	£9.50	0.61		0.00	0.00	0.00	0.06	0.12	0.12	0.12	0.12	0.12	0.12
	Day Visitors	£2.50	0.05		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	Overseas Tourists													
	65 and under	£0.10	0.01		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	65 +	£0.05	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
	NPV of Total (2012/13)	£8.733m	8.73		0.00	0.02	0.06	0.88	1.70	1.70	1.70	1.70	1.70	1.70
	MEAN WTP		NPVs											
	WILLINGNESS TO PAY (2013/14)	WTP per												
	Residents	£12.00	10.44		0.00	0.03	0.07	1.06	2.03	2.03	2.03	2.03	2.03	2.03
	Businesses	£21.00	1.35		0.00	0.00	0.01	0.14	0.26	0.26	0.26	0.26	0.26	0.26
	Day Visitors	£8.30	0.12		0.00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	Overseas Tourists													
	65 and under	£0.20	0.01		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	65 +	£0.40	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
	NPV of Total (2012/13)	£13.121m	13.12		0.00	0.03	0.09	1.33	2.55	2.55	2.55	2.55	2.55	2.55
	HIGH INTERVAL		NPVs											
	WILLINGNESS TO PAY (2013/14)	WTP per												
	Residents	£16.10	14.00		0.00	0.04	0.09	1.42	2.72	2.72	2.72	2.72	2.72	2.72
	Businesses	£32.50	2.09		0.00	0.01	0.01	0.21	0.41	0.41	0.41	0.41	0.41	0.41
	Day Visitors	£10.10	0.19		0.00	0.00	0.00	0.02	0.04	0.04	0.04	0.04	0.04	0.04
	Overseas Tourists													
	65 and under	£0.30	0.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	65 +	£0.75	0.01		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
	NPV of Total (2012/13)	£17.510m	17.51		0.00	0.05	0.11	1.77	3.41	3.41	3.41	3.41	3.41	3.41

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BENEFITS - 2G BETTER QUALITY

			Year Number	1	2	3	4	5	6	7	8	9	10
			Financial Year	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
LOW INTERVAL		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£18.30	15.91		0.00	0.04	0.10	1.81	3.10	3.10	3.10	3.10	3.10	3.10
Businesses	£10.50	0.68		0.00	0.00	0.00	0.07	0.13	0.13	0.13	0.13	0.13	0.13
Day Visitors	£11.00	0.21		0.00	0.00	0.00	0.02	0.04	0.04	0.04	0.04	0.04	0.04
Overseas Tourists													
65 and under	£2.00	0.14		0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.03	0.03	0.03
65 +	£2.20	0.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£18.152m	18.15		0.00	0.05	0.12	1.84	3.53	3.53	3.53	3.53	3.53	3.53
MEAN WTP		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£23.40	20.35		0.00	0.05	0.13	2.06	3.96	3.96	3.96	3.96	3.96	3.96
Businesses	£24.50	1.58		0.00	0.00	0.01	0.16	0.31	0.31	0.31	0.31	0.31	0.31
Day Visitors	£15.10	0.29		0.00	0.00	0.00	0.03	0.06	0.06	0.06	0.06	0.06	0.06
Overseas Tourists													
65 and under	£2.70	0.19		0.00	0.00	0.00	0.02	0.04	0.04	0.04	0.04	0.04	0.04
65 +	£3.00	0.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£23.621m	23.62		0.00	0.06	0.15	2.39	4.60	4.60	4.60	4.60	4.60	4.60
HIGH INTERVAL		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£28.50	24.79		0.00	0.06	0.16	2.51	4.82	4.82	4.82	4.82	4.82	4.82
Businesses	£38.50	2.48		0.00	0.01	0.02	0.25	0.48	0.48	0.48	0.48	0.48	0.48
Day Visitors	£19.20	0.37		0.00	0.00	0.00	0.04	0.07	0.07	0.07	0.07	0.07	0.07
Overseas Tourists													
65 and under	£3.40	0.24		0.00	0.00	0.00	0.02	0.05	0.05	0.05	0.05	0.05	0.05
65 +	£3.80	0.03		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£29.091m	29.09		0.00	0.08	0.19	2.94	5.66	5.66	5.66	5.66	5.66	5.66

BENEFITS - 3G/4G SAME QUALITY

			Year Number	1	2	3	4	5	6	7	8	9	10
			Financial Year	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
LOW INTERVAL		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£10.40	9.04		0.00	0.02	0.06	0.92	1.76	1.76	1.76	1.76	1.76	1.76
Businesses	£13.00	0.84		0.00	0.00	0.01	0.08	0.16	0.16	0.16	0.16	0.16	0.16
Day Visitors	£8.10	0.15		0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Overseas Tourists													
65 and under	£0.10	0.01		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65 +	£0.05	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£11.239m	11.24		0.00	0.03	0.07	1.14	2.19	2.19	2.19	2.19	2.19	2.19
MEAN WTP		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£13.40	11.65		0.00	0.03	0.08	1.18	2.27	2.27	2.27	2.27	2.27	2.27
Businesses	£29.60	1.91		0.00	0.00	0.01	0.19	0.37	0.37	0.37	0.37	0.37	0.37
Day Visitors	£13.20	0.25		0.00	0.00	0.00	0.03	0.05	0.05	0.05	0.05	0.05	0.05
Overseas Tourists													
65 and under	£0.20	0.01		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65 +	£0.40	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£15.024m	15.02		0.00	0.04	0.10	1.52	2.92	2.92	2.92	2.92	2.92	2.92
HIGH INTERVAL		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£16.40	14.26		0.00	0.04	0.09	1.44	2.78	2.78	2.78	2.78	2.78	2.78
Businesses	£46.20	2.98		0.00	0.01	0.02	0.30	0.58	0.58	0.58	0.58	0.58	0.58
Day Visitors	£18.30	0.35		0.00	0.00	0.00	0.04	0.07	0.07	0.07	0.07	0.07	0.07
Overseas Tourists													
65 and under	£0.30	0.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65 +	£0.75	0.01		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£18.809m	18.81		0.00	0.05	0.12	1.90	3.66	3.66	3.66	3.66	3.66	3.66

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BENEFITS - 3G/4G BETTER QUALITY

			Year Number	1	2	3	4	5	6	7	8	9	10
			Financial Year	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
LOW INTERVAL		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£18.20	15.83		0.00	0.04	0.10	1.60	3.08	3.08	3.08	3.08	3.08	3.08
Businesses	£8.60	0.55		0.00	0.00	0.00	0.06	0.11	0.11	0.11	0.11	0.11	0.11
Day Visitors	£13.70	0.26		0.00	0.00	0.00	0.03	0.05	0.05	0.05	0.05	0.05	0.05
Overseas Tourists													
65 and under	£2.00	0.14		0.00	0.00	0.00	0.01	0.03	0.03	0.03	0.03	0.03	0.03
65 +	£2.20	0.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£17.994m	17.99		0.00	0.05	0.12	1.82	3.50	3.50	3.50	3.50	3.50	3.50
MEAN WTP		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£24.70	21.48		0.00	0.06	0.14	2.17	4.18	4.18	4.18	4.18	4.18	4.18
Businesses	£33.20	2.14		0.00	0.01	0.01	0.22	0.42	0.42	0.42	0.42	0.42	0.42
Day Visitors	£22.00	0.42		0.00	0.00	0.00	0.04	0.08	0.08	0.08	0.08	0.08	0.08
Overseas Tourists													
65 and under	£2.70	0.19		0.00	0.00	0.00	0.02	0.04	0.04	0.04	0.04	0.04	0.04
65 +	£3.00	0.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£25.444m	25.44		0.00	0.07	0.17	2.57	4.95	4.95	4.95	4.95	4.95	4.95
HIGH INTERVAL		NPVs											
WILLINGNESS TO PAY (2013/14)	WTP per												
Residents	£31.20	27.13		0.00	0.07	0.18	2.75	5.28	5.28	5.28	5.28	5.28	5.28
Businesses	£57.80	3.72		0.00	0.01	0.02	0.38	0.72	0.72	0.72	0.72	0.72	0.72
Day Visitors	£30.30	0.58		0.00	0.00	0.00	0.06	0.11	0.11	0.11	0.11	0.11	0.11
Overseas Tourists													
65 and under	£3.40	0.24		0.00	0.00	0.00	0.02	0.05	0.05	0.05	0.05	0.05	0.05
65 +	£3.80	0.03		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Mean Network Impacts		1.20		0.00	0.00	0.01	0.12	0.23	0.23	0.23	0.23	0.23	0.23
NPV of Total (2012/13)	£32.894m	32.89		0.00	0.09	0.21	3.33	6.40	6.40	6.40	6.40	6.40	6.40

Annex C

Provided here are the survey questions which were sent to parish councils to aid in this evaluation. The actual survey was produced in Qualtrics and sent digitally.

MIP Questionnaire for Parish Councils - v0.3 10.10.2016

The Mobile Infrastructure Project (MIP) has, or soon will, provide mobile coverage to 75 areas that were previously without mobile signal. Following an investment in infrastructure, it is good practice for government to review the project, understand the impact the investment has made, and learn lessons about what went well, and what could have gone better.

As a Parish Council, the Department for Culture, Media and Sport believes you are uniquely placed to provide a summary of what impact the new mobile coverage has made, and to help us deliver better infrastructure projects in the future. We have sent you this survey because at least one mobile network operator has, through a mast provided by MIP, in your area served your area or an area adjacent to it for at least three months.

The following questions ask you for your views on how the new mobile signal has impacted your community, for case studies which would give us more in-depth insight, and any other general feedback.

We appreciate your time in responding to this survey.

1. Could you please provide the following details to help us identify who has completed this survey:

Parish Council Name:	
Address:	
Respondent's name:	
Respondent's telephone number:	
Respondent’s email address:	

2. In general, how satisfied do you think your community is with the **quality of mobile signal (for example, strength and coverage)** provided through the Mobile Infrastructure Project.

Very satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very Dissatisfied	Do not know

Please provide any comments on the **signal quality** in the box below:

3. A number of potential impacts (both positive and negative) related to improved mobile signal from MIP masts have been suggested. Do you think any of these have been felt in your community? (Please select all that apply)

Increased social connectivity (e.g. phone calls, texts, social media)	
Provided greater access to services (e.g. information on leisure activities, travel information, online shopping or public services)	
Made the area more attractive for young people to live	
Helped businesses run more efficiently or grow	
Helped new businesses start	
Helped increase visitor numbers	
Masts have adversely impacted enjoyment of the landscape	
None of the above	

If there are any other impacts (either positive or negative) you think should be considered, please detail below:

4. To aid our understanding of the impacts of the MIP project we would like to develop **case studies** demonstrating the **impact of having mobile connectivity in areas which formerly had no mobile coverage former not-spot areas**. Could you please provide any potential case study examples below? Examples could include local businesses that have seen their business grow, or members of that public that have particularly benefited, from improved mobile coverage.

   For each example, having asked their permission, please provide a summary and contact details for the relevant person.

5. We would welcome any other comments you may have on the Mobile Infrastructure Project.

Thank you for your time in answering this survey, please click on the forwards arrow to submit your response.