Methodology note for the average annual infrastructure investment estimates

1.1 This note provides further information regarding the methods employed to produce the average annual infrastructure investment estimates on page 6 (repeated on page 84) of the National Infrastructure Plan 2013.

1.2 The figures show average annual infrastructure investment in the UK for the periods 2005-10 and 2011-13. These estimates improve the understanding of historic infrastructure investment, statistics for which are not available elsewhere.

1.3 A consistent, transparent and comprehensive approach is used. The figures for average annual infrastructure investment represent both public and private capital spending from the identified published sources, across six key infrastructure sectors, which are the main focus of the National Infrastructure Plan 2013: communications, energy, transport, water, waste and flood defence.

Sources

1.4 The sources provide a consistent estimate of infrastructure investment across periods, using publicly available data. To accomplish this, data are compiled from published public sector sources, such as Public Expenditure Statistical Analyses (PESA). Additionally, published data from private sector sources, such as company accounts, are included to provide a more comprehensive picture of investment.

1.5 A document published alongside the National Infrastructure Plan 2013 lists the sources used to calculate the estimates, all of which are available in the public domain.[1]

1.6 The sources provide a consistent estimate of investment through time. Some sources report data by financial year, while other sources report it by calendar years; they have been included as they are published in the source material. No adjustments have been made to account for differences in the point at which a year ends, i.e. calendar or financial, because it is consistent for each source across the time periods included in the estimates. Therefore there is only a minimal impact when making comparisons across the two time periods.

1.7 The sources provide a reliable estimate of investment across sectors by including robust and relevant published measures. Minor differences between sources may arise reflecting the terminology of the measures that are available and the variation in accounting methods used in company accounts. For example, some sources may include maintenance and repair costs whereas others cover just the initial development and construction costs. Some examples of variance across sectors and organisations in the terminology used include, 'investment spending', (e.g. Oxford Economics report on UKMPG ports); 'capital expenditure', (e.g. regulatory accounts for water companies in England and Wales); and, 'capital investment' (e.g. Manchester Airports Group annual report).

1.8 Data compiled relate to the following organisations within each of the sectors:

[1] HM Treasury, Sources for the National Infrastructure Plan 2013, 4 December 2013: https://www.gov.uk/government/publications/national-infrastructure-plan-2013

1 **Communications**: Investment made by providers, networks and services listed in the Ofcom Infrastructure Report 2013 update.[2] Data for Three (Hutchinson Whampoa), Arqiva and Everything Everywhere, and their respective predecessors, are not included as they have not published consistent UK specific data across the two periods.

2 **Energy**: A comprehensive measure of investment by the energy industries is taken from the Energy Sector Indicators, published by DECC.

3 **Transport**: Public sector capital expenditure data are as published by HM Treasury in the Public Expenditure Statistical Analysis (PESA) and the COINS datasets.[3] Private sector investment consists of investment made by the major UK airports, namely Heathrow, Gatwick, Stansted and Manchester Airport Group, which account for 64 per cent of passengers at airports in the UK,[4] and estimates on port infrastructure investment made by members of the UK Major Ports Group, which operate 41 ports and 2 terminals and account for 70 per cent of tonnage handled in the UK.

4 **Waste**: Public sector capital expenditure on waste, as published in the COINS and OSCAR datasets.[5]

5 **Water**: Data on gross capital expenditure for England and Wales are sourced from Ofwat (the Water Services Regulation Authority) for the period up to 2009-10, and the individual regulatory accounts of water companies, as identified by Ofwat,[6] in later years. Data on capital investment are also obtained from the accounts of Scottish Water (a publicly owned company, answerable to the Scottish Government) and on capital expenditure from the accounts of Northern Ireland Water (a Government owned company) for all years.

6 **Flood defence**: Data comprise of expenditure in England as measured using the capital element of Flood Defence Grant in Aid data.

1.9 The source data consist of a mixture of current price data (CP) and constant price data (KP). Current price data are expressed in terms of the prices in that period; for example 2012-13 data expressed in terms of the prices in 2012-13. Constant price data allow figures to be represented with the effects of changes in the price level removed. The values for each time period are expressed in terms of the prices in some base period, for example 2010-11 data expressed in terms of the prices in 2012-13. This provides an approximation of how much the investment carried out in 2010-11 would be worth if it had been carried out in 2012-13.

Methods

1.10 Once the data are collected, the current price data are converted to constant 2012-13 prices using the GDP deflator.[7] This removes the impact of inflation and changes in price levels through time so that all of the data are comparable. The same adjustments are applied across all sectors and types of infrastructure, as is a standard practice when deflating spending measures.

1.11 The method of adjusting current price data to constant price data is shown in Equation 1. The current price investment data ($I_{s,y}(CP)$), for each source (s) and year (y), are multiplied

[2]Ofcom, Infrastructure Report 2013 Update, 24 October 2013: http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/infrastructure-report/IRU_2013.pdf

[3] HM Treasury, COINS datasets, 2013: http://webarchive.nationalarchives.gov.uk/20130405170223/http:/www.hm-treasury.gov.uk/psr_coins_data.htm

[4] Civil Aviation Authority, Airport Statistics, 2012: http://www.caa.co.uk/docs/80/airport_data/2012Annual/Table_01_Size_of_UK_Airports_2012_Comp_2007.pdf

[5] HM Treasury, OSCAR datasets, 2013: https://www.gov.uk/government/publications/oscar-annual-data-october-2013

[6] Ofwat, Links to companies' regulatory accounts, 2012: http://www.ofwat.gov.uk/regulating/reporting/earlierreports/prs_web2012regaccounts

[7] HM Treasury, GDP deflators at market prices and money GDP, updated September 2013: https://www.gov.uk/government/publications/gdp-deflators-at-market-prices-and-money-gdp-march-2013

by the ratio of the deflator in the required base year (P_0) and the deflator in the reference year to which the prices currently relate (P_t) to produce the constant price measure ($\mathrm{I}_{s,y}(KP)$). This accounts for the difference in the general price level between the two years.

Equation 1: Adjusting current price investment data to constant price investment data using a price deflator

$$\mathrm{I}_{s,y}(KP) = \mathrm{I}_{s,y}(CP) \cdot \frac{P_0}{P_t}$$

1.12 Equation 1 can be applied to express investment data for the year 2011-12 in terms of 2012-13 prices. The value of the deflator in 2012-13 (P_0) would be divided by the value of the deflator in 2011-12 (P_t), and then multiplied by the value of current price investment in 2011-12. See appendix A for a worked example.

1.13 In some instances the sources publish data in constant prices but these are not comparable with the other data when measured in terms of the prices for a different base year, for example if measured in 2010-11 prices as opposed to 2012-13 prices. Therefore data published in constant prices in the source material are also adjusted to 2012-13 prices, using the GDP deflator, under the same principle. One exception to this concerns the publication for water investment in England and Wales from 2005-06 to 2009-10. This source originally expressed data in terms of the price level in 2009-10, using the retail price index (RPI) as a deflator. These data are therefore converted to current prices using the RPI[8] before applying the GDP deflator to estimate constant price figures on a consistent basis to all other data. This means that all data have been adjusted, to take account of changes in the general price level through time, in the same manner.

1.14 The two time periods, 2005 to 2010 and 2011 to 2013, presented in the publication are selected to allow for a comparison across parliaments. The constant price data for each source are averaged across the years that make up the relevant time periods, by first aggregating the data for the relevant years ($\sum_{y \in Y}(I_{s,y})$) and then dividing by the relevant number of years (Y), 5 for the first period and 3 for the second period, as shown in Equation 2. The only exception is for data on UK ports which are only available to 2011-12 and are therefore averaged across 2 years in the latter period. This provides the average annual investment, in constant price terms, for each source across the relevant period ($\overline{\mathrm{I}_s}$). See appendix A for a worked example.

Equation 2: Estimating average annual investment by source

$$\overline{\mathrm{I}_s} = \frac{\sum_{y \in Y}(I_{s,y})}{Y}$$

1.15 The figures for the annual average value of investment from each source are aggregated across the six infrastructure sectors, as shown in Equation 3, resulting in the estimates presented in the National Infrastructure Plan.

Equation 3: Aggregating average annual investment across all sources

$$\text{Average annual infrastructure investment} = \sum_{s \in S} \overline{\mathrm{I}_s}$$

[8] ONS, Consumer Price Inflation, October 2013: http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices/october-2013/index.html

Status

1.16 The source data are already in the public domain and are owned by the departments, organisations or companies that provided the sources. As a result the estimates are not considered to be Official or National Statistics.

Appendix A: Worked examples

A worked example of the deflation process is provided in Table 1.A. In summary, current price data are multiplied by the ratio of the prices in the required base year and the year that the prices are currently measured in, to account for differences in the price level between these years.

In the example, the value of investment for source A in 2010-11 is £960 million in terms of current 2010-11 prices. The first step in adjusting this to constant prices is to create a price adjustment factor, using the ratio of the deflator in the required base year (2012-13) and the year that the data is currently measured (2010-11). In the example the price level, expressed as an index, increased from 96 to 100 between 2010-11 and 2012-13. This indicates that prices increased by approximately 4.2 per cent, resulting in a price adjustment factor of 1.042. Next, the price adjustment factor is multiplied by the current price measure to obtain a constant price measure. In the example, the value of investment in 2010-11 is estimated to be worth £1,000 million in terms of 2012-13 prices. This process adjusts data to account for changes in the general price level across years, and provides an approximation of how much the investment carried out by source A in 2010-11 would be worth if it had been carried out in 2012-13.

Table 1.A: Worked example of the deflation process for source A

Measure	2010-11	2011-12	2012-13
£ million, current prices (CP)	960	1274	1000
Deflator (index 2012-13=100)	96	98	100
Price adjustment factor	100/96 = 1.042	100/98 = 1.020	100/100 = 1
Price adjustment calculation	960 x 1.042	1274 x 1.020	1000 x 1
£ million, constant 2012-13 prices (KP)	1000	1300	1000

Note: Data are for illustrative purposes only. Differences occur in the example due to rounding.

A worked example of the averaging and aggregation process is provided in Table 1.B.

Constant price data for each source are averaged across years by aggregating the data across the years within a period and dividing by the number of years for which data are included. The averaging calculation, in the worked example, aggregates the constant price value of investment for source A across the three years to obtain £3,300 million. This is then divided by three to provide an estimated £1,100 million of investment for that source in the period covering 2011-13. No investment data are available for source C in the year 2012-13; however, this does not mean that zero investment occurred in this year. Therefore data are only aggregated and divided across the two years in which data are available to calculate average investment for that source. The figures for the average value of investment for each source are then aggregated across sources, resulting in £2,000 million of average annual infrastructure investment for the period covering 2011-13 in the example.

Table 1.B: Worked example of the averaging and aggregation process, £ million, constant 2012-13 prices

Source	2010-11	2011-12	2012-13	Averaging calculation	Average 2011-13
A	1000	1300	1000	3300/3 = 1100	1100
B	700	700	700	2100/3 = 700	700
C	150	250	-	400/2 = 200	200
Total					2000

Note: Data are for illustrative purposes only.