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Infrastructure in Australia

Update to June 2016

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INFRASTRUCTURE IN AUSTRALIA: UPDATE TO JUNE 2016

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1. Engineering construction and infrastructure

1.1 Introduction

In early 2016, Engineers Australia released its *National Infrastructure Investment Update* which examined trends in infrastructure investment in Australia to the end of June 2015. Accompanying reports provided detailed analyses of trends at state and territory level[1]. This research was undertaken in support of Engineers Australia's position statement on infrastructure in which we argue that modern, effective infrastructure is an investment in Australia's future because it is a key enabler of productivity growth which has been the source of almost all improvements in the standard of living of Australian[2].

The conclusion of the update was that the status of Australia's infrastructure is largely unchanged since the 2010 Infrastructure Report Card[3]. Critical to this assessment was the decline in public sector infrastructure investment in the three years prior to 2015. Political leaders agree on the importance of infrastructure investment and state their support for it to increase, but have none-the-less presided over the decline. A contributing factor has been the dearth of information about infrastructure, multiple announcements of projects, disregard for the effects of inflation and disconnection between existing infrastructure assets and standards describing the services that infrastructure was designed to deliver.

Given the pessimistic outlook that emerged in the Update and the apparent upsurge of political interest in infrastructure, Engineers Australia has updated its trend statistics to the end of June 2016. The report again relies on engineering construction statistics provided by the Australian Bureau of Statistics (ABS)[4]. These statistics relate to additions to the stock of infrastructure through work completed on new assets. Statistics are also produced on new infrastructure work commenced and the amount of unfinished work remaining on projects that are underway.

Protocols used by the ABS differentiate the statistics from financial figures that appear in budgets and news accounts. These protocols are applied consistently over time and produce reliable indicators of trends and trend changes.

We use Infrastructure Australia's definition of economic infrastructure as set out in the legislation to establish this organisation. This definition focuses on infrastructure that will materially improve national productivity. This definition includes roads, bridges, railways, harbours, water and sewerage and telecommunications. Engineering construction statistics in recent years have been dominated by construction in support of the resources sector. The treatment of statistics in the popular media rarely has differentiated between construction of economic infrastructure and construction in the resources sector. Engineers Australia unravels the situation by separating out construction that does not fit within our definition of infrastructure and by distinguishing public and private sector construction.

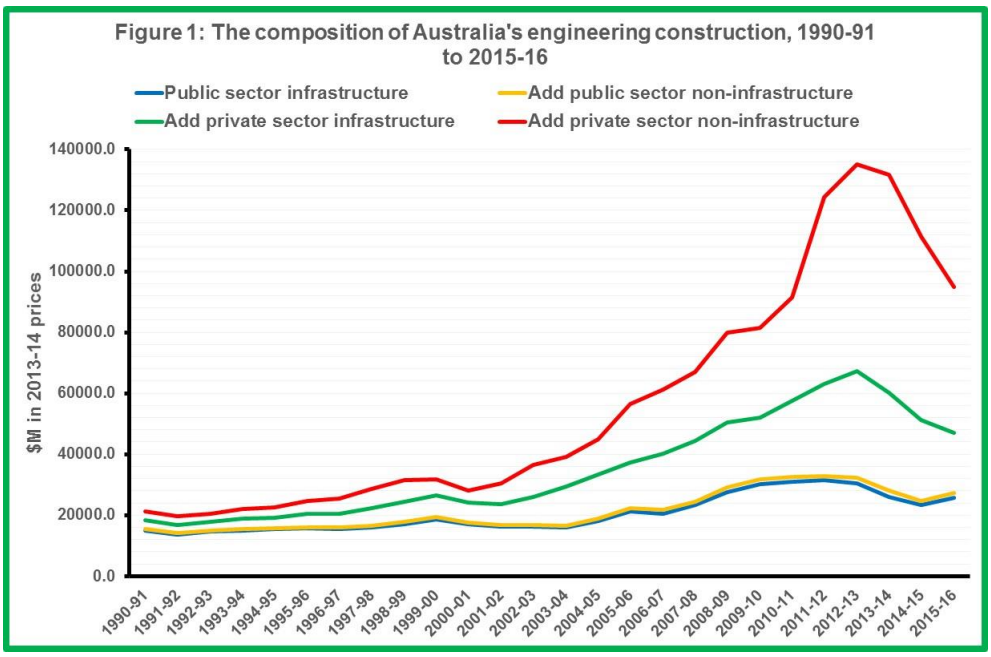
Although primarily interested in updating infrastructure investment trends by one year, we essentially repeat infrastructure trends since 1990-91. Each year the ABS revises the reference year for its chain volume statistics that are the source of the deflators used in estimating our

[1] publicaffairs@engineersaustralia.org.au
[2] See www.engineers australia.org.au
[3] Op cit
[4] ABS, Engineering Construction, Australia, Cat No 8762.0, electronic releases, www.abs.gov.au

trends. In the *National Infrastructure Investment Update,* the reference year was 2012-13. In the latest release of engineering construction statistics, the reference year was advanced to 2013-14. This is applied across the board to maintain consistency of comparison over time.

1.2 The composition of engineering construction

As well as the components of economic infrastructure as defined above, the ABS engineering construction statistics include engineering construction on resources projects, on heavy industry, on recreation and a catch all category for construction that does not fit anything else. All engineering construction contributed to national income but not all of it is economic infrastructure. The key characteristic of economic infrastructure is that the services it provides are not for the exclusive use of the asset owner but are available for use by many individuals and businesses.



In Figure 1 we use a so-called “stack diagram” to illustrate the relative proportions of the main components of engineering construction beginning with public sector economic infrastructure. Nearly all engineering construction by the public sector directly or under contract for it is economic infrastructure. Adding public sector non-infrastructure engineering construction contributes only marginally to the sector’s total.

Private sector infrastructure during the 1990s was comparatively small but over time grew strongly. This was in part because the sector invested in public-private partnerships to construct and subsequently own and operate infrastructure assets, in part because governments privatised previously publicly owned assets and private sector owners engaged in new investment, and in part because owners of resource projects build infrastructure assets to transport resources extracted to markets and to provide other support to these projects.

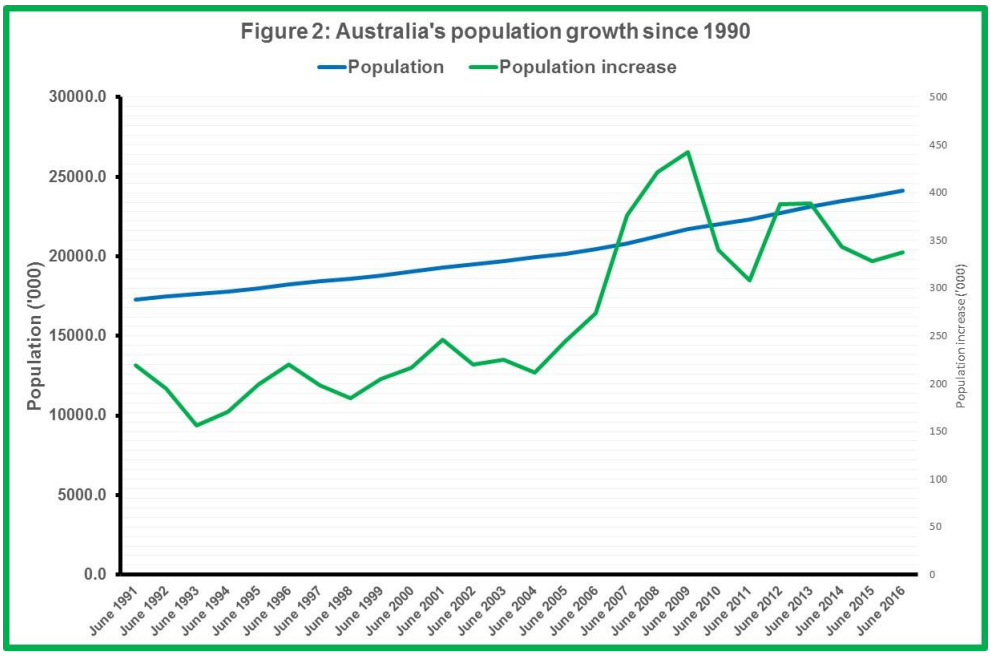
One of the weakness of the ABS statistics is the inability to distinguish these situations. There are reasons to believe that a substantial proportion of the increase in private sector infrastructure investment from 2000 to 2010 was the construction of infrastructure support for resources projects. This investment is critical to the potential of the resources projects

supported, but located geographically away from population centres limiting its broader potential as economic infrastructure. We note that private sector infrastructure investment has been falling for some years in line with the decline in engineering construction on resources projects.

The final element of Figure 1 is the addition of private sector engineering construction on non-infrastructure assets such as mines and heavy industry. The expansion of this element is the main manifestation of the resources boom on engineering construction. The remainder is the unknown portion of private sector infrastructure just discussed.

1.3 Population and population growth

The demand for economic infrastructure services is closely related to the size of Australia's population and population growth. Figure 2 shows that Australia's population has steadily increased since 1990-91. Annual population growth varies from year to year but since about 2007 has generally been higher than in earlier years, averaging 1.6% a year over the last five years compared to 1.3% a year in the earlier period.



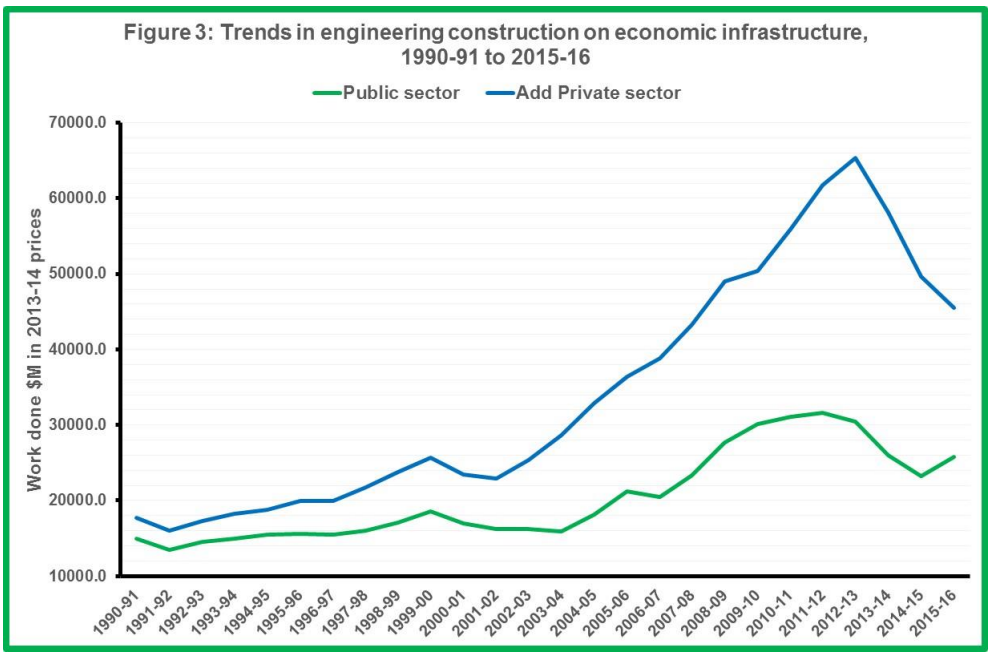
When seen as increments of population rather than annual growth rates, we observe that the annual increase in Australia's population has trended upwards. Although the difference in annual growth rates over the last five years compared to the years prior to 2012 is small, it means over another 100,000 people. In the last five years, the Australian population increased by an average of 357,400 people compared to an average 251,200 a year before 2012. The annual increase compares to Canberra's population of about 385,000, Wollongong's population of about 293,000 and Geelong's population of about 188,000. Australia's population growth explains why our infrastructure is under stress.

1.4 Public sector infrastructure

Public sector engineering construction on economic infrastructure includes the three levels of government, assets constructed by government staff and assets constructed under contract by private sector staff for the public sector. The key attribute is that final ownership of assets constructed is vested in the public sector. Figure 2 repeats the components of Figure 1 dealing with economic infrastructure to highlight the trends in the two sectors. In Table 1 shows statistics for public sector engineering construction on economic infrastructure since 1990-91 and the components of infrastructure expressed in 2013-14 prices. Here we consider the aggregate trend and leave further consideration of individual components until section 1.6.

Table 1: Public sector engineering construction on infrastructure, 1990-91 to 2015-16 ($M in 2013-14 prices)

Year	Roads	Bridges	Railways	Harbours	Water	Sewerage	Electricity	Pipelines	Telecomm	Infrastructure
1990-91	4346.9	419.3	742.4	181.1	1211.4	1064.2	2668.3	191.2	4175.5	15000.4
1991-92	4004.6	435.9	787.5	100.6	1236.5	963.2	2662.3	93.7	3202.8	13487.2
1992-93	5123.4	390.3	911.6	202.4	1096.3	1021.4	2543.7	97.2	3164.0	14550.2
1993-94	5475.1	579.7	1223.9	232.0	1055.6	938.4	2367.0	212.2	2877.3	14961.2
1994-95	5207.0	468.7	1647.2	140.7	797.4	932.4	2220.4	223.7	3815.2	15452.7
1995-96	5454.5	326.1	1683.2	138.8	629.4	816.3	1562.3	547.0	4449.3	15606.9
1996-97	5140.8	338.8	2081.6	291.2	520.7	688.3	1829.9	169.3	4396.2	15456.7
1997-98	6023.1	415.4	1608.3	186.7	531.5	876.5	1679.7	112.1	4546.8	15980.1
1998-99	6697.1	465.2	1427.2	233.3	671.4	953.6	1690.6	175.5	4765.7	17079.7
1999-00	6633.0	570.9	984.3	139.9	877.1	1467.1	2134.3	80.2	5647.9	18534.7
2000-01	6153.3	491.0	798.8	168.9	681.1	1216.0	2390.9	79.6	5022.2	17001.6
2001-02	5510.1	444.8	905.4	329.4	684.5	870.1	2686.0	72.3	4706.0	16208.6
2002-03	5702.4	350.9	1125.0	238.2	692.5	1023.4	2916.5	46.4	4140.1	16235.3
2003-04	5277.3	307.7	1767.5	241.8	884.7	1206.4	2997.2	42.1	3182.6	15907.4
2004-05	5952.1	402.6	2373.4	226.2	1188.2	1130.9	3388.7	20.5	3497.4	18180.0
2005-06	6582.4	616.1	2260.2	181.6	1173.8	1115.6	4635.7	146.7	4477.2	21189.2
2006-07	7441.6	993.7	1934.8	184.1	1440.0	1377.5	5126.6	237.5	1692.5	20428.2
2007-08	8202.1	1218.5	1606.1	534.6	4324.8	1929.5	5412.1	43.9	34.0	23305.5
2008-09	10622.6	1209.6	2285.2	734.2	4173.0	1986.9	6561.6	11.2	58.5	27642.8
2009-10	10167.5	1301.7	3563.4	763.0	4422.7	2494.2	7244.5	15.8	193.6	30166.3
2010-11	11657.4	1222.7	4255.6	760.1	3097.4	2959.2	6805.8	34.6	286.3	31079.1
2011-12	13501.2	831.3	3683.4	363.5	2881.0	2484.0	7278.5	36.6	544.6	31604.1
2012-13	13402.1	731.5	3291.4	270.8	2564.1	2292.0	6973.8	43.7	825.4	30394.8
2013-14	11085.6	644.8	2724.0	490.1	1870.8	2148.7	5926.2	14.2	1103.8	26008.2
2014-15	10053.9	401.6	1978.5	646.3	1404.9	1600.8	5194.5	10.0	1946.1	23236.6
2015-16	10729.8	694.7	2559.9	489.2	1439.4	1849.1	4085.8	13.8	3872.8	25734.4



Public sector investment in economic infrastructure peaked at $31.604 billion in 2011-12 and fell in each of the next three years and was $23.237 billion in 2014-15. This decline was highlighted in the *National Infrastructure Investment Update* cited earlier. During this period Australia's population increased by 1,061,000.

In 2015-16, public sector infrastructure investment increased by 10.8% to $25.734 billion while the Australian population increased by another 337,900.

The increase in infrastructure work completed was related to a small increase in infrastructure work commenced in 2014-15 that reversed three years of falling new commencements. In 2015-16, there was a more decisive increase in new commencements. The 2014-15 gain was from $24.533 billion to $24.877 billion. The 2015-16 increase was 21.5% to $30.219 billion. This change is illustrated in the pipeline diagram Figure 4.

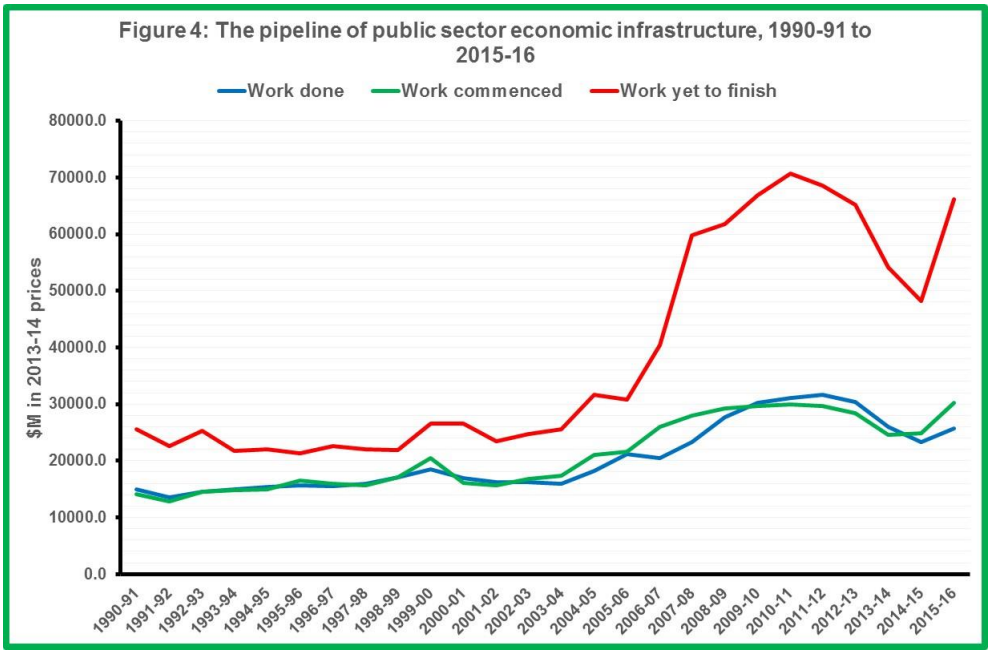


Figure 4 also illustrates the trend in uncompleted public sector engineering construction on infrastructure. Unfinished work fell rapidly during the three years of falling construction completed and three years of falling commencements. In 2014-15, there was 2.09 years of uncompleted work underway at the prevailing rate of completion, considerably less than at the peak in 2010-11. In 2015-16, unfinished work increased to 2.57 years even though there was an increase in the rate of completions.

The conclusion we draw from these observations is that public sector engineering construction at the national level appears to have recovered from the three years of decline prior to June 2015. The increase in commencements and unfinished work both suggest that work completed is likely to increase again in 2016-17. Offsetting this positive result is that the level of infrastructure work completed in 2015-16 is about the same as in 2008 and since then Australia's population has increased by 3,299,300.

1.5 Private sector infrastructure

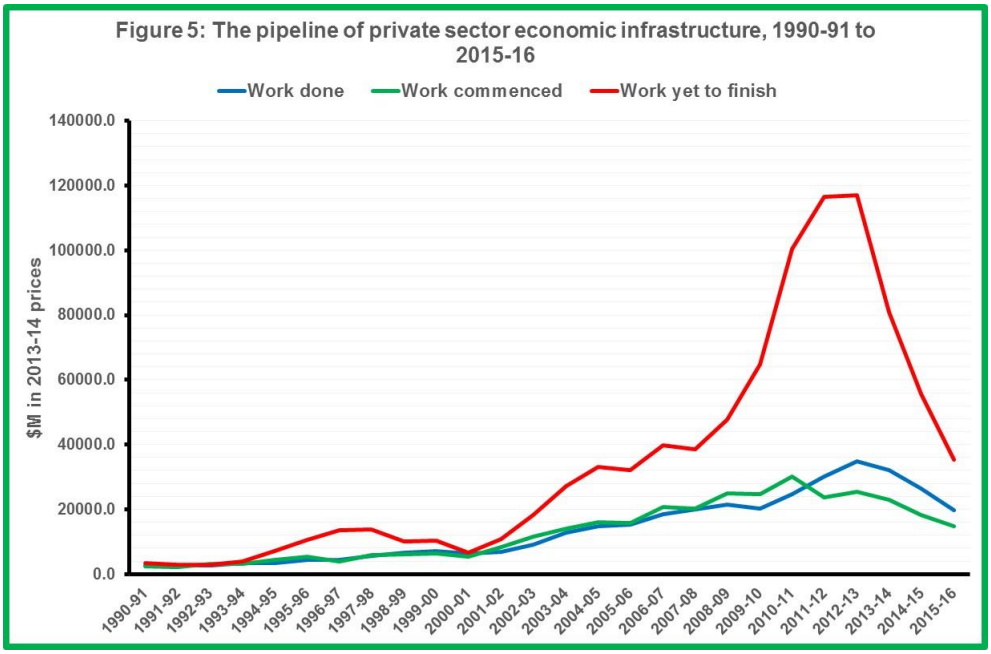
Private sector engineering construction on economic infrastructure relates to assets that are owned and operated by the private sector once construction has been completed. Infrastructure constructed by the private sector but subsequently owned by the public sector are not treated as private sector but as public sector activity.

Private sector engineering construction on infrastructure is difficult to evaluate for the reason discussed above. The key characteristic of infrastructure is widespread accessibility. Improving transport connectivity between population centres can lead to substantial business activity as connections previously inconvenient become straightforward for numerous businesses and individuals. In contrast, transport connectivity between remote mine and port is critical to the mine's viability but is unlikely to be used by anyone other than the mine's transport contractor.

Since 2000, a substantial part of private sector engineering construction on infrastructure has been in support of the resources boom. Nearly all pipeline construction is by the private sector. Similarly, much of the investment in harbours was of a similar type. However, there is greater ambiguity in respect to railways, electricity and water, while telecommunications have become an important area of private sector construction since the privatisation of Telstra. These areas of ambiguity should be borne in mind when assessing private sector trends.

Table 2: Private sector engineering construction on infrastructure, 1990-91 to 2015-16

Year	Roads	Bridges	Railways	Harbours	Water	Sewerage	Electricity	Pipelines	Telecomm	Infrastructure
1990-91	1872.2	20.1	32.2	89.6	183.3	171.3	173.0	124.8	16.1	2682.6
1991-92	1846.0	21.3	59.4	53.4	106.4	100.7	177.6	176.5	12.2	2553.5
1992-93	1733.2	5.3	22.3	58.0	145.3	131.8	140.2	332.3	122.6	2690.9
1993-94	2020.9	18.4	68.2	121.6	255.0	193.2	267.9	247.0	146.1	3338.2
1994-95	1926.2	11.0	49.3	44.2	462.7	125.8	283.1	296.2	125.9	3324.3
1995-96	1869.5	63.0	103.3	41.4	429.7	250.4	750.8	458.9	328.9	4295.9
1996-97	2464.5	57.5	133.7	133.7	202.9	126.5	690.4	399.1	279.1	4487.3
1997-98	3064.0	38.8	282.2	339.0	230.1	169.1	997.6	491.6	111.2	5723.7
1998-99	3542.3	103.9	257.5	314.7	233.3	128.2	1223.2	655.6	181.1	6639.8
1999-00	2716.8	164.7	244.6	126.5	272.8	237.5	2150.4	655.8	555.8	7124.9
2000-01	1960.8	19.6	139.7	136.6	283.2	293.7	2237.9	363.1	963.9	6398.6
2001-02	2340.9	49.6	407.9	156.1	214.0	235.6	2046.4	755.4	548.9	6754.8
2002-03	3622.0	109.2	773.5	203.3	240.7	412.6	1942.7	1338.3	522.2	9164.5
2003-04	5638.7	61.5	387.7	406.3	418.7	686.4	2104.5	1984.3	1099.5	12787.6
2004-05	6902.3	117.3	659.6	1032.2	479.8	400.9	2886.5	937.4	1257.3	14673.3
2005-06	7167.0	21.4	621.0	1121.1	576.8	410.6	2552.3	1155.5	1558.4	15184.2
2006-07	6334.1	79.9	1171.8	1190.6	562.6	429.4	3554.6	1067.3	4038.0	18428.2
2007-08	5597.3	103.3	1730.1	1132.2	824.0	981.8	4080.3	690.1	4831.0	19970.2
2008-09	6461.0	91.7	1277.8	1302.6	628.9	1074.3	5469.2	930.0	4135.9	21371.4
2009-10	5212.0	49.6	1430.8	1553.0	1859.0	553.6	4562.9	1081.3	3916.0	20218.1
2010-11	5480.6	116.2	2238.1	3035.7	3111.6	688.6	4446.6	1844.0	3830.6	24792.0
2011-12	5587.7	151.6	4211.1	5545.5	2098.2	700.5	4762.8	2599.4	4511.3	30168.1
2012-13	5284.1	69.0	4422.5	7259.4	1443.5	649.0	7015.0	4180.2	4580.3	34903.0
2013-14	4315.1	124.0	3976.2	5330.7	1193.1	599.6	6406.8	5342.9	4856.5	32144.9
2014-15	4490.3	269.6	3253.7	2364.8	919.9	421.8	3817.4	6169.0	4679.3	26385.6
2015-16	4429.8	168.6	1068.3	658.0	616.9	671.0	3545.6	3636.4	4960.9	19755.5



Private sector statistics for engineering construction on economic infrastructure are shown in Table 2 using the same format as for public sector statistics. Figure 5 shows the private sector infrastructure pipeline since 1990-91. The coincidence between these trends and the duration of the resources boom is striking.

Private sector engineering construction on infrastructure peaked in 2012-13 at $34.903 billion in 2013-14 prices. In the *National Infrastructure Investment Update*, we noted that the 2014-15 outcome was the second of two years of substantial decline. Changing the reference year for our deflators does not change that result. In 2014-15, private sector engineering construction on economic infrastructure fell by 17.9% in real terms and even more in nominal terms.

To emphasize the connection to the resources boom, the fall in 2015-16 was even larger with infrastructure completed falling by 25.1% over 2014-15. The level of work completed, $19.755 billion was 43.3% less than in the peak year and was commensurate with the level of construction in 2007-08.

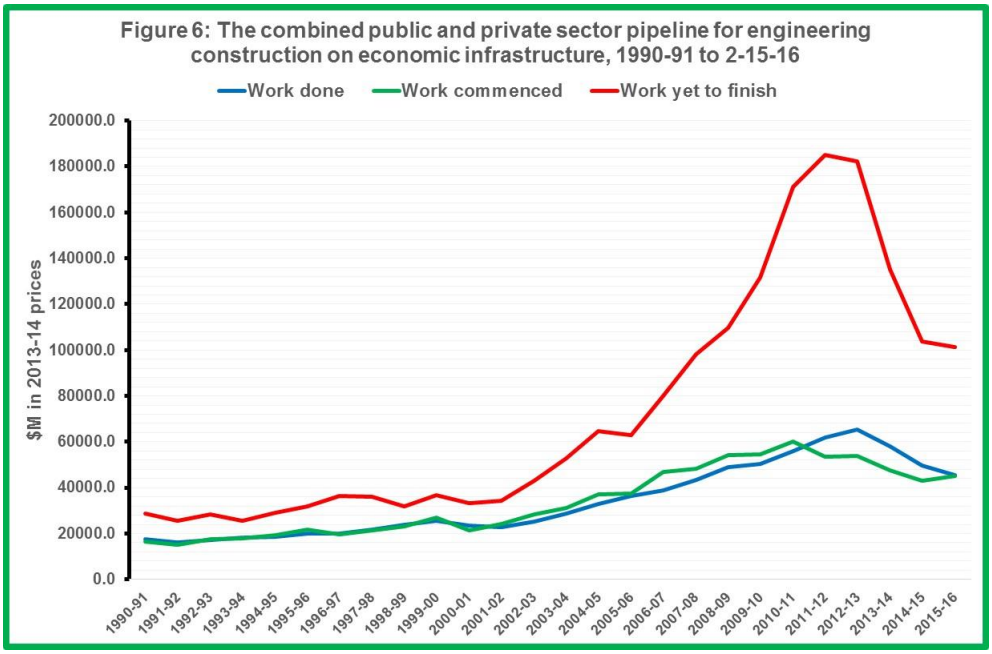
Commencements of private sector engineering construction on infrastructure peaked much earlier than work completed, in 2010-11 when work valued at $30.049 billion commenced. Since the peak construction commencements have declined except for a hiccup in 2012-13 when there was a temporary reversal. In 2014-15, the fall in commencements was 20.8%. In 2015-16, the proportional reduction was less at 18.9% and reduced commencements to $14.766 billion. We make two observations about this figure:

- Despite the contraction, it is higher than private sector commencements on infrastructure in years prior to 2004-05.
- Much of the reduction has occurred in asset categories that are closely linked to the resources sector.

Unfinished private sector engineering construction on infrastructure peaked at an extraordinary $117.139 billion in 2012-13 and has since fallen as dramatically as the increase leading to it. In each year since the peak, the amount of unfinished work fell by over 30% with the degree of fall increasing over time. The fall in 2014-15 was 31.3% and in 2015-16 it

increased to 36.6% reducing the quantum of unfinished work to $35.277 billion. At the present rate of completions, this represents 1.78 years of work.

The Engineers Australia assessment of these results is that the consequences of the ending of the resources sector construction boom are still working their way through the system with further falls to come. Both commencements and unfinished work continue to fall rapidly pointing to further reductions in work completed for the foreseeable future.



In Figure 6 we combine the infrastructure pipelines for the public and private sectors to consider whether the improving circumstances in the public sector are sufficient to offset the continuing contraction in the private sector. The supporting statistics for work completed are shown in Table 3 and, so far as work completed is concerned, the answer is an emphatic no. The combined amount of construction on infrastructure fell by 8.3% to $45.490 billion in 2015-16, continuing a contractionary trend that began in 2012-13.

However, in 2015-16 combined sector new construction commencements increased by 4.4% from $43.082 billion to $44.985 billion ending the contractionary trend that began in 2010-11. Although combined sector unfinished construction continued to fall, the 2015-16 fall slows substantially to 2.2% compared to the 2014-15 fall of 23.2%. What we see here is that the increase in public sector infrastructure completed has not been sufficient to fully offset the fall in private sector completions, but there are signs of change in both commencements and unfinished work. Further increases in commencements over the current and coming years are necessary to consolidate these indications.

Table 3: Combined private and public sector engineering construction on infrastructure, 1990-91 to 2015-16

Year	Roads	Bridges	Railways	Harbours	Water	Sewerage	Electricity	Pipelines	Telecomm	Infrastructure
1990-91	6219.1	439.5	774.6	270.7	1394.7	1235.6	2841.3	315.9	4191.6	17683.0
1991-92	5850.7	457.2	846.8	154.0	1342.9	1063.9	2839.9	270.1	3215.0	16040.6
1992-93	6856.6	395.6	933.9	260.4	1241.5	1153.2	2683.8	429.6	3286.6	17241.1
1993-94	7496.0	598.0	1292.0	353.6	1310.6	1131.6	2634.9	459.2	3023.4	18299.5
1994-95	7133.1	479.7	1696.5	184.9	1260.1	1058.2	2503.5	519.9	3941.1	18777.0
1995-96	7324.0	389.1	1786.4	180.1	1059.1	1066.7	2313.1	1005.9	4778.2	19902.8
1996-97	7605.3	396.3	2215.3	424.9	723.6	814.7	2520.3	568.3	4675.3	19944.0
1997-98	9087.2	454.2	1890.5	525.6	761.7	1045.7	2677.2	603.7	4657.9	21703.8
1998-99	10239.4	569.1	1684.7	548.1	904.7	1081.8	2913.8	831.1	4946.8	23719.5
1999-00	9349.8	735.7	1228.9	266.4	1149.9	1704.6	4284.7	736.0	6203.7	25659.6
2000-01	8114.1	510.5	938.4	305.6	964.3	1509.8	4628.8	442.7	5986.0	23400.2
2001-02	7851.0	494.4	1313.3	485.5	898.6	1105.7	4732.3	827.7	5255.0	22963.4
2002-03	9324.3	460.1	1898.5	441.5	933.2	1436.0	4859.1	1384.7	4662.3	25399.8
2003-04	10916.0	369.1	2155.2	648.1	1303.4	1892.9	5101.8	2026.5	4282.1	28695.0
2004-05	12854.4	519.8	3033.0	1258.4	1668.1	1531.8	6275.2	957.9	4754.7	32853.3
2005-06	13749.4	637.5	2881.2	1302.8	1750.6	1526.2	7188.0	1302.2	6035.5	36373.4
2006-07	13775.7	1073.6	3106.6	1374.7	2002.6	1806.9	8681.2	1304.8	5730.4	38856.4
2007-08	13799.4	1321.8	3336.2	1666.8	5148.8	2911.3	9492.4	734.0	4865.0	43275.7
2008-09	17083.6	1301.4	3563.0	2036.8	4801.9	3061.3	12030.8	941.2	4194.4	49014.2
2009-10	15379.5	1351.2	4994.2	2316.1	6281.6	3047.8	11807.4	1097.1	4109.6	50384.5
2010-11	17137.9	1338.9	6493.6	3795.8	6209.0	3647.8	11252.4	1878.7	4116.9	55871.1
2011-12	19088.9	982.9	7894.4	5909.1	4979.2	3184.5	12041.3	2636.1	5055.9	61772.2
2012-13	18686.2	800.6	7714.0	7530.2	4007.6	2941.0	13988.8	4223.9	5405.7	65297.8
2013-14	15400.8	768.7	6700.2	5820.8	3063.9	2748.3	12333.0	5357.1	5960.3	58153.0
2014-15	14544.2	671.2	5232.2	3011.1	2324.8	2022.6	9011.9	6179.0	6625.3	49622.2
2015-16	15159.6	863.2	3628.2	1147.2	2056.4	2520.1	7631.4	3650.2	8833.7	45489.9

1.6 The components of infrastructure

Statistics relating to the components of economic infrastructure are included in Tables 1, 2 and 3. The public and private sector pipelines for each component are illustrated and briefly discussed in the Appendices which also include formal definitions for each component. In this section we draw on this information to explore the asset category changes that underpin the conclusions reached in sections 1.4 and 1.5.

Table 4: Summary of changes to economic infrastructure in 2015-16

Sector	Public sector		Private sector		Both sectors combined	
Asset type	Share (%)	Change (%)	Share (%)	Change (%)	Share (%)	Change (%)
Roads	41.7	6.7	22.4	-1.3	33.3	4.2
Bridges	2.7	73.0	0.9	-37.5	1.9	28.6
Railways	9.9	29.4	5.4	-67.2	8.0	-30.7
Harbours	1.9	-24.3	3.3	-72.2	2.5	-61.9
Water	5.6	2.5	3.1	-31.9	4.5	-11.5
Sewerage	7.2	15.5	3.4	59.1	5.5	24.6
Electricity	15.9	21.3	17.9	-7.1	16.8	-15.3
Pipelines	0.1	38.3	18.4	-41.1	8.0	-40.9
Telecommunications	15.0	99.0	25.1	6.0	19.4	33.3
Infrastructure	100.0	10.7	100.0	-25.1	100.0	-8.3

In Table 4 we summarise the results that emerge for 2015-16. Results are provided for each sector and the two sectors combined. In each case we set out the relative size of each asset type in the sector last year and the change in construction work completed since 2014-15.

In the public sector, engineering construction on infrastructure increased by 10.7% over 2014-15. There was growth in all asset classes with the exception of harbours where the amount of work completed contracted by 24.3%. The largest asset class was roads which accounted for 41.7% of public sector infrastructure completed. Taking account of railways, harbours and

bridges, well over half of public sector infrastructure completed was devoted to transport. Telecommunications and electricity accounted for a further 31% of infrastructure.

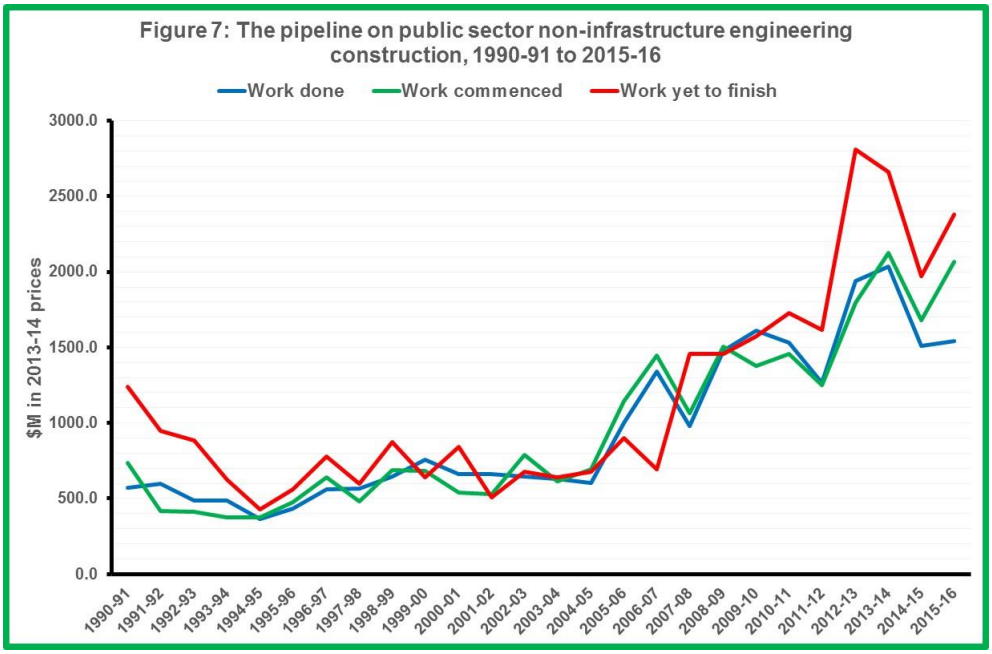
Private sector engineering construction completed in 2015-16 contracted by 25.1%. Only two asset categories, sewerage and telecommunications recorded increases. Sewerage accounted for just 3.4% of infrastructure completed but telecommunications was the most important private sector component accounting for 25.1% of infrastructure completed. We have noted that several private sector infrastructure components have been influenced by the ending of the resources construction phase. However, these results suggest that factors other than resources contraction are at play.

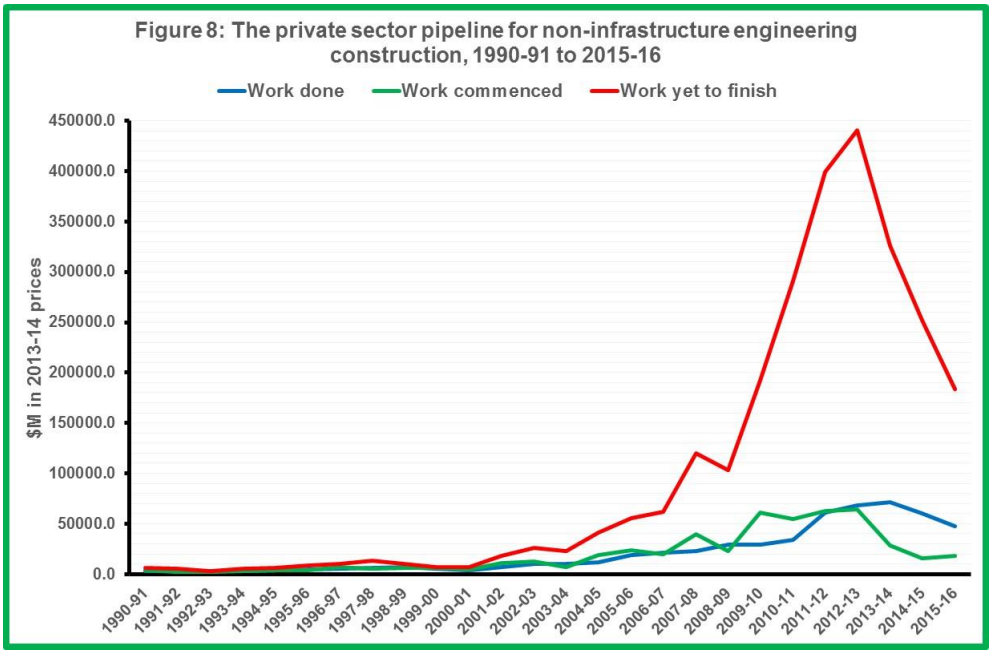
When statistics for the two sectors are combined some of the private sector contraction is offset by public sector expansion. This occurred in roads and bridges where the overall outcomes showed expansion. However, in the case of railways and electricity, public sector expansion was insufficient for overall asset class growth. In two asset classes, sewerage and telecommunications, public and private sector activity reinforced each other. Overall, engineering construction on infrastructure contracted by 8.3% in 2015-16.

We note last year that the ending of the resources sector construction boom resulted in a massive contraction in demand in the Australian economy. Many commentators, including some in government have argued that the slack would be taken up by expansion in residential and other commercial construction. The figures reported here show that this was challenging when only infrastructure is considered. In the next section we consider direct construction on resources sector assets and it becomes clear that the proponents of this view have not studied the numbers.

1.7 Engineering construction additional to infrastructure

There are several categories of engineering construction that fall outside our definition of economic infrastructure. In the public sector most of this construction falls into the recreation category. Construction of recreational facilities is also significant in the private sector but during the last decade has been swamped by engineering construction in the resources and heavy industry sectors. In this section we briefly consider the scale and trajectories for non-infrastructure engineering construction beginning with the public sector whose pipeline for these elements is illustrated in Figure 7. The private sector pipeline is shown in Figure 8.





What is striking about these diagrams is the extraordinary difference in scale. With over $1.2 billion in work completed, the construction of recreational facilities by the public sector is larger than construction completed on three infrastructure categories, bridges, harbours and pipelines and not far behind the construction on water facilities. Since about 2000, all three pipeline elements for public sector recreation construction have moved upwards in a zig zag fashion, but with a pronounced slowdown this past year.

In Figure 8, the ending of the resources boom is clearly evident from 2012-13 onwards. Construction work completed has been falling but in 2015-16 was still $47.749 billion with most in the resources category. This was around about the same amount of construction as combined sector construction on infrastructure. This level of activity may be part of a falling

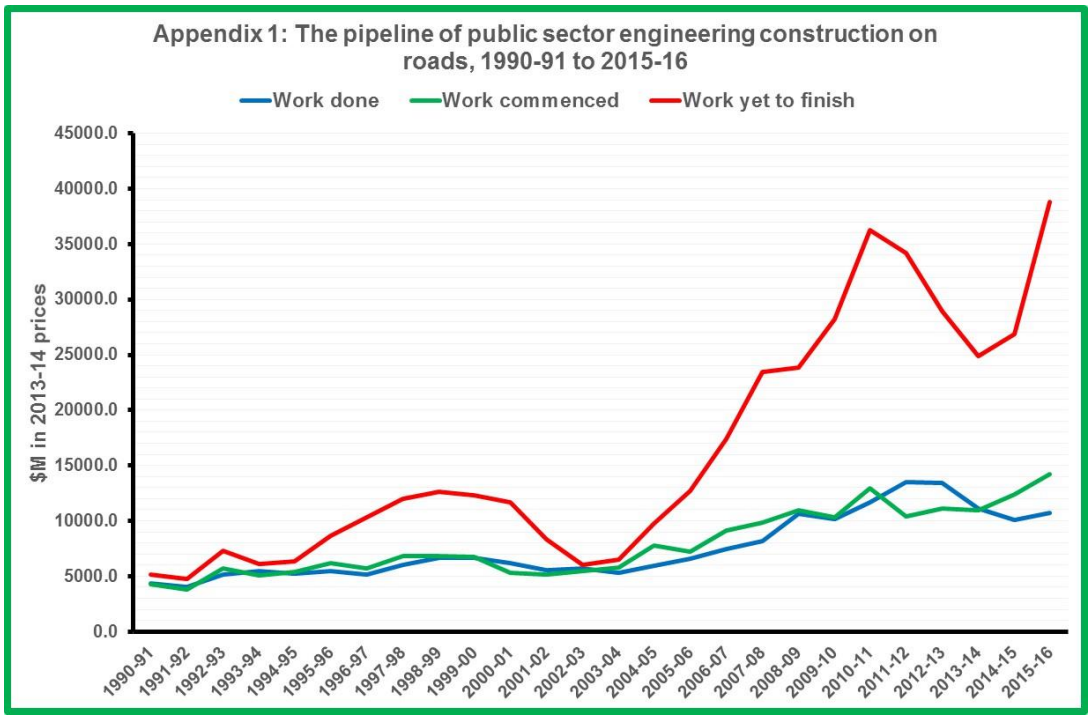
trend but it is of vital importance to Australian economic activity and to the employment of engineers.

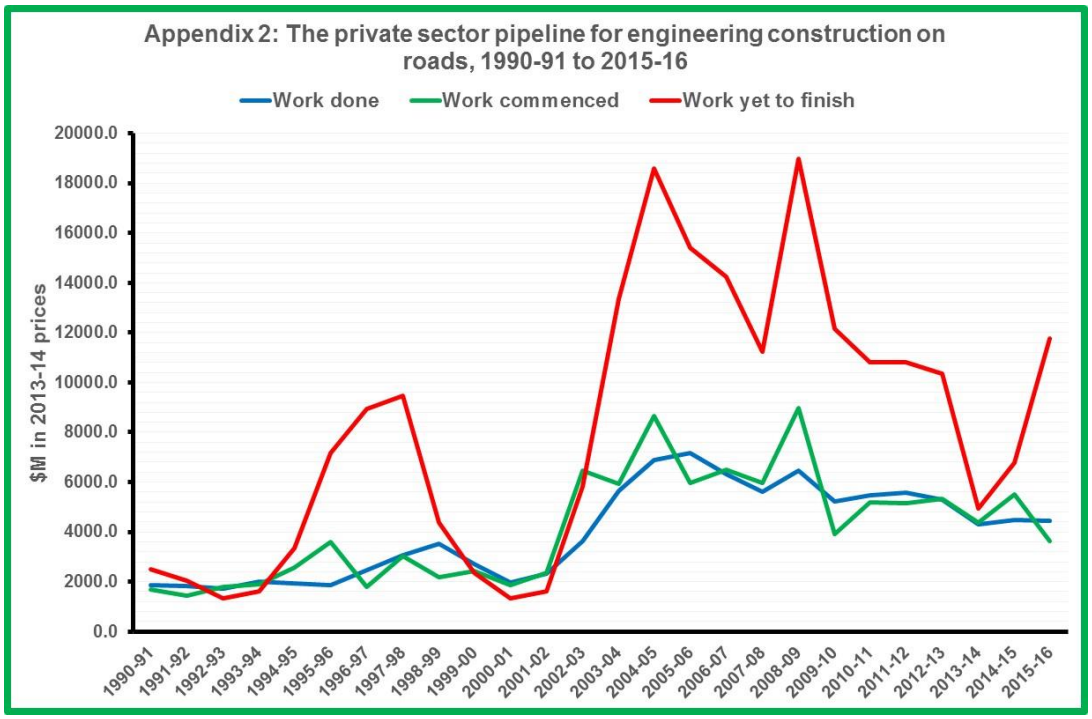
However, new commencements of non-infrastructure construction have fallen from $65.870 billion in 2012-13 to $19.899 billion in 2015-16 and the amount of unfinished work in the system has experienced a dramatic fall. Despite these dramatic changes, the amount of uncompleted work is 3.77 years at the current rate of completions. The non-infrastructure sector, including the resources sector, remains an important source of engineering construction and should not be discounted.

2. Appendices

2.1 Roads

More fully, roads, highways and subdivisions includes parking areas, cycle paths, airport runways, pedestrian and vehicle overpasses, traaffic lights, rounabouts, associated road drainage works, street and highway lighting, road resurfacing, kerbing and guttering and road tunnels.



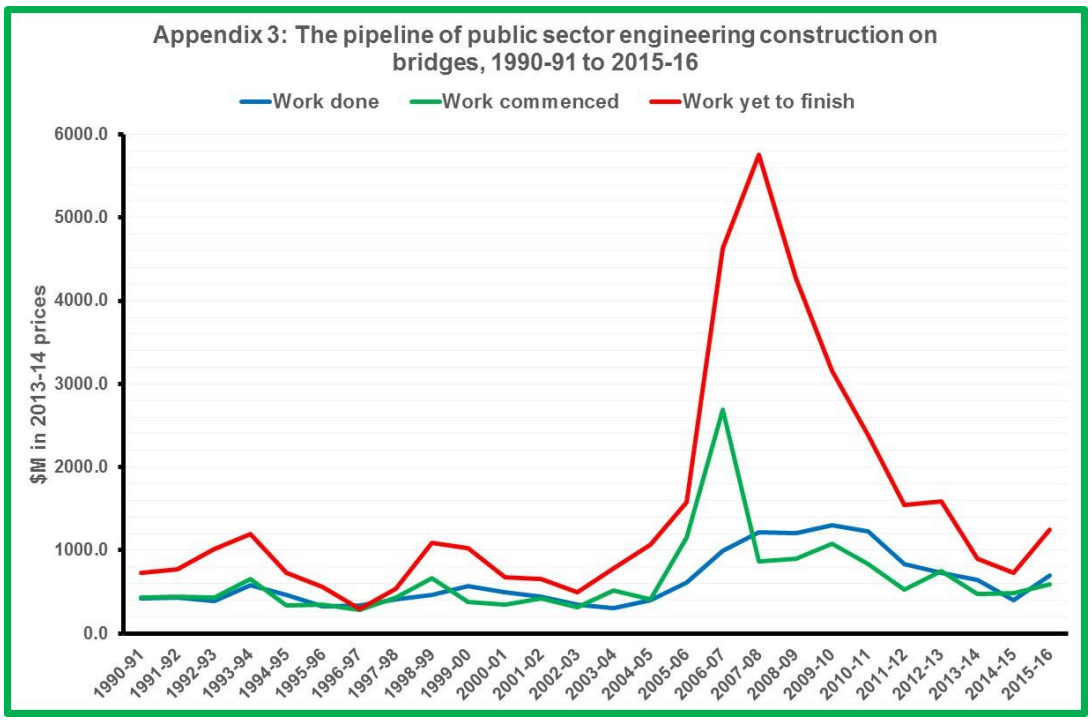


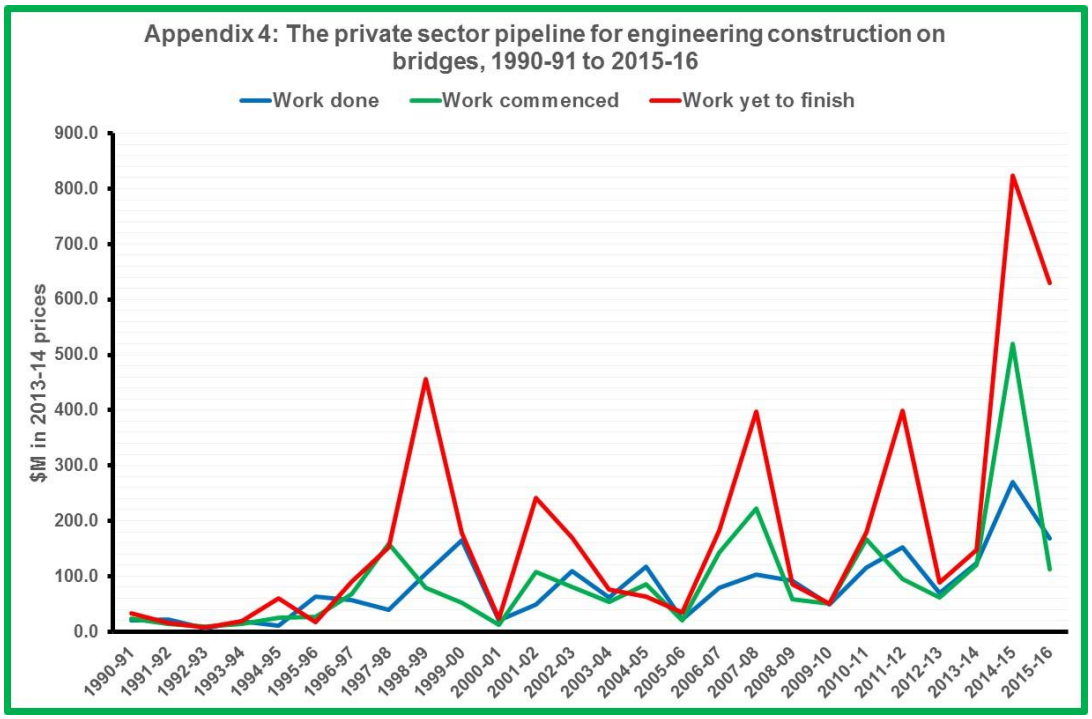
Public sector construction is 41.7% of public sector construction on economic infrastructure in 2015-16. Construction completed recovered in 2015-16 as a result of an increasing level of commencements reversing a falling trend.

Private sector construction is 22.4% of the sector's economic infrastructure in 2015-16. Last year activity was flat as a result of falling commencements but a significant amount of unfinished construction is in the system.

2.2 Bridges

Bridges includes the support of roads, railways, causeways and elevated highways.

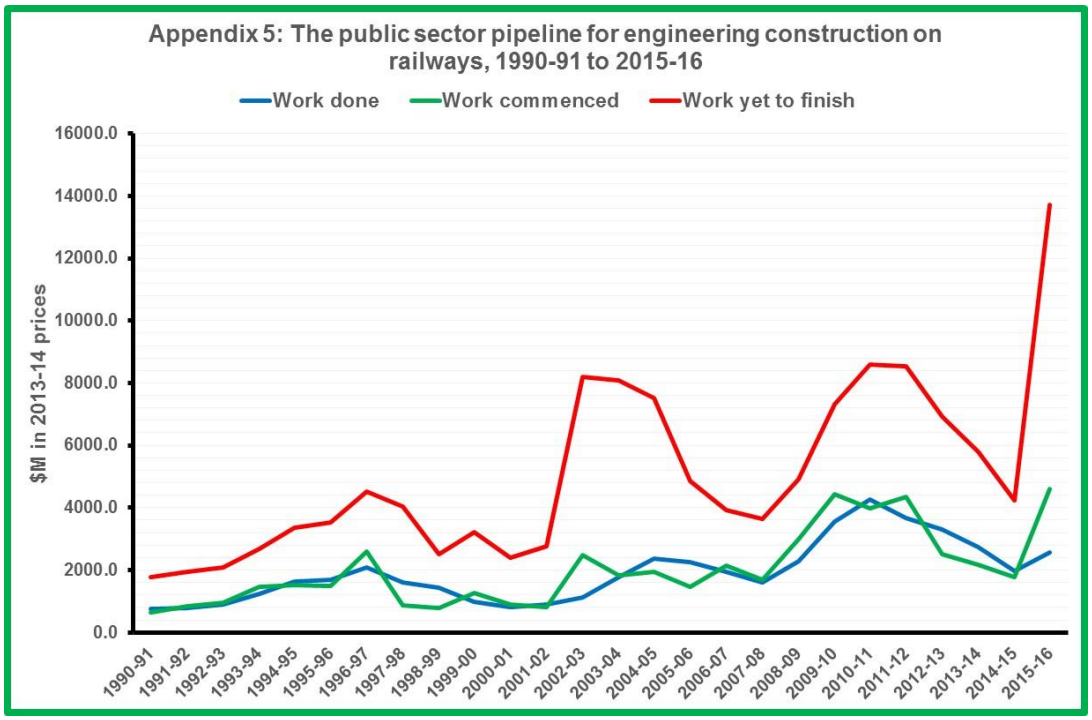


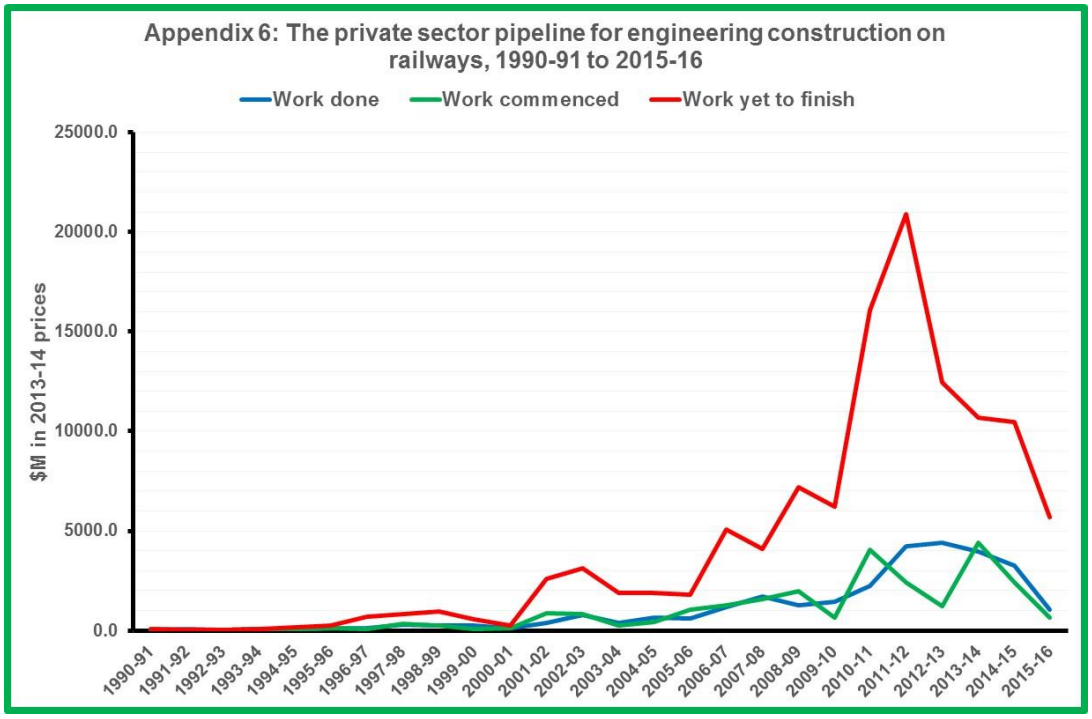


This is one of the smallest components of economic infrastructure. In 2015-16 there was a small recovery in public sector construction but private sector construction fell. Overall activity likely to be determined by small increase in new commencements in the public sector.

2.3 Railways

Railways includes tracklaying, overhead power lines and signals, platforms, tramways, tunnels for underground railways and fuel hoppers.

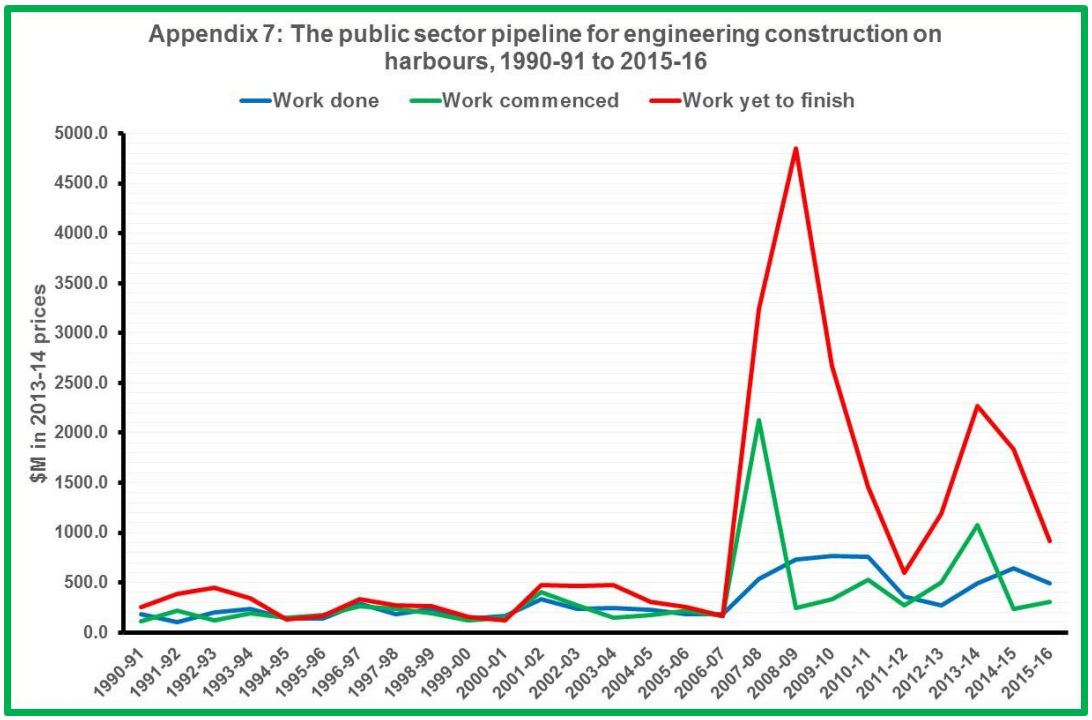


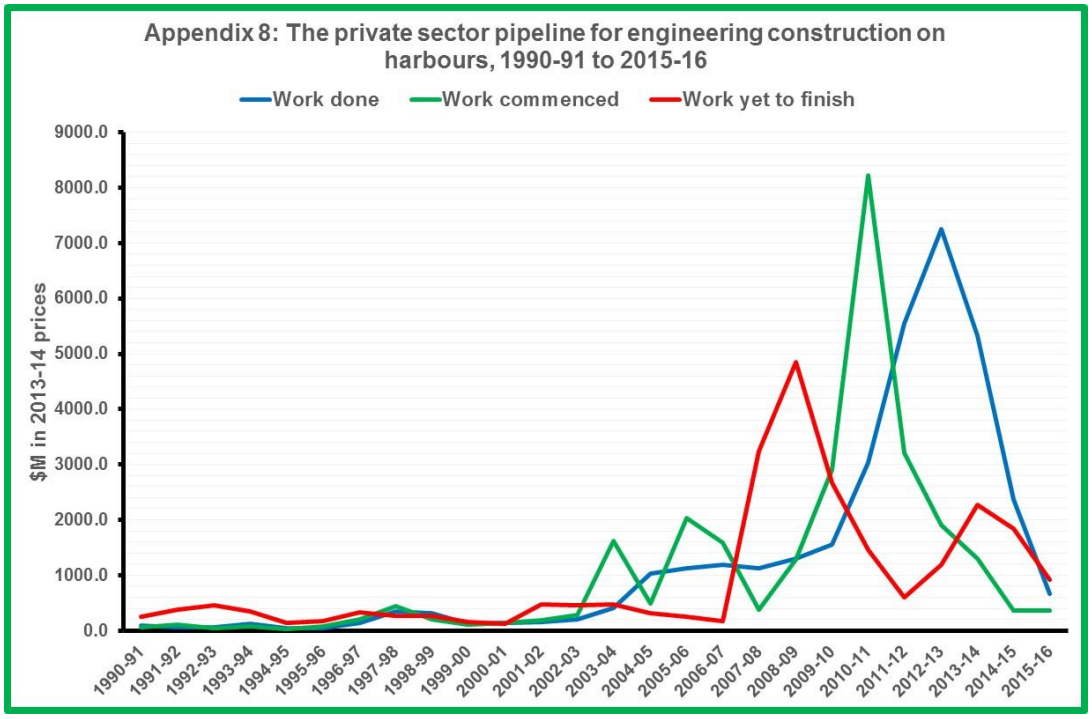


Railway construction was 9.9% of public sector economic infrastructure in 2015-16. After a period of decline, public sector construction increased in 2015-16 and increased commencements suggest this will continue. In the private sector, railway construction was 5.4% of infrastructure in 2015-16 and all three elements of the pipeline experienced large falls.

2.4 Harbours

Harbours includes boat and yacht basins, breakwaters, retaining walls, docks and piers, terminals, wharves, dredging works and marinas.

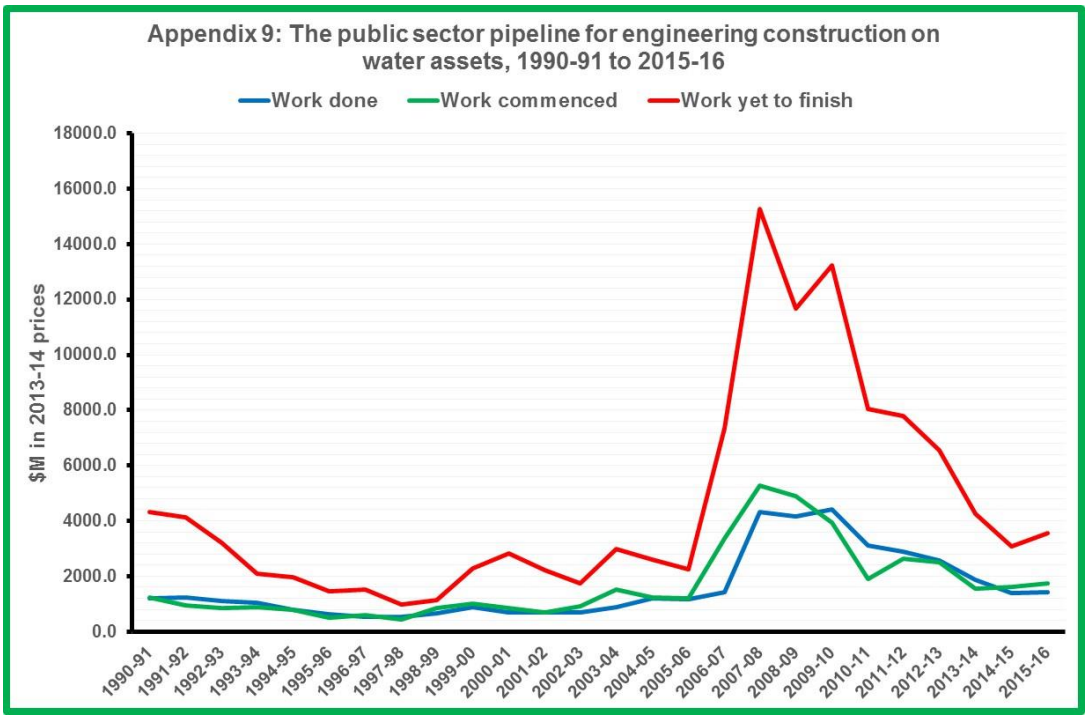


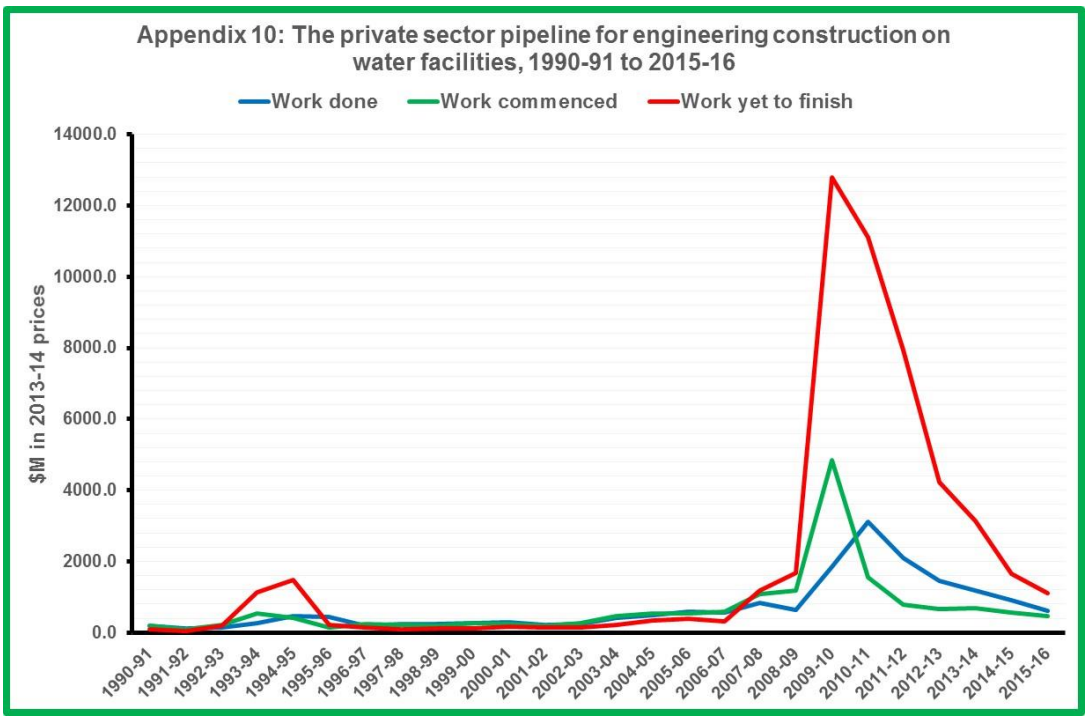


This category of infrastructure was 2.5% of overall construction in 2015-16 with construction in the private sector larger than in the public sector. Construction completed has fallen in both sectors, quite sharply in the private sector. New commencements have flattened out at a low level and suggest new activity will flatten out at historically low levels.

2.5 Water

Water storage and supply includes dams, weirs, reservoirs, embankments for water diversion, water pipelines, mains and treatment plants, flood prevention and erosion, aqueducts, water conduits and systems conveying water to residences, commercial and industrial establishments.



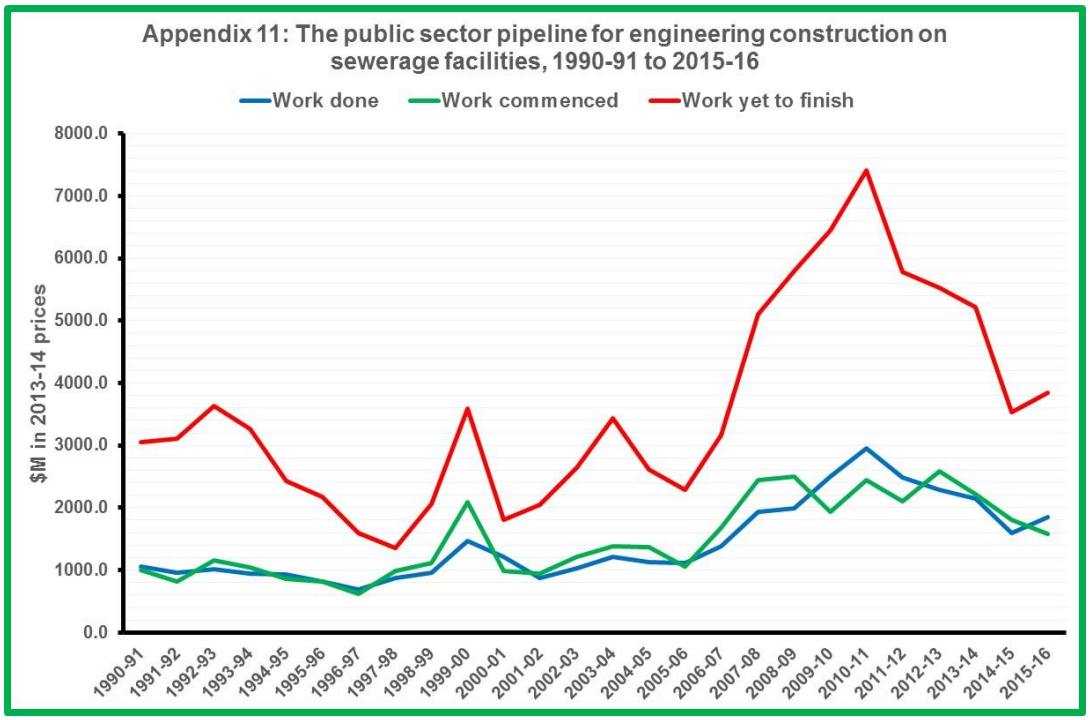


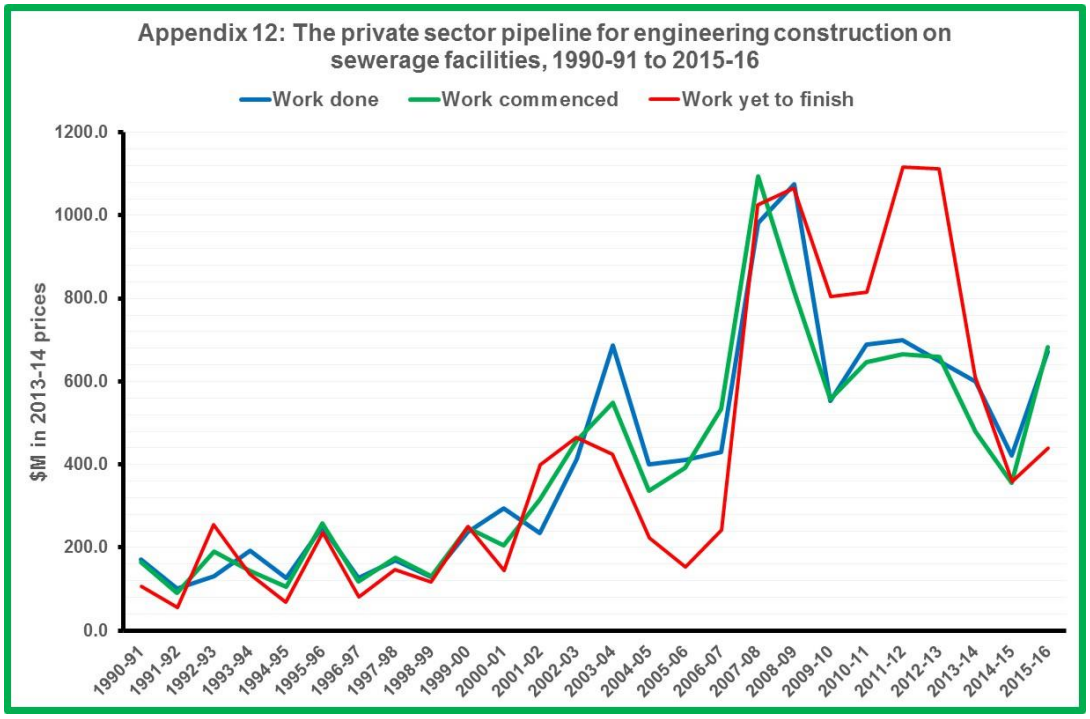
Engineering construction completed on water assets in 2015-16 was 4.5% of overall infrastructure completions with the larger share undertaken by the public sector. There was a small rise in public sector construction completed and a large fall in private sector activity. Public sector commencements experience a small increase while commencements continued

to fall in the private sector, the two offsetting each other suggesting little change in the near future.

2.6 Sewerage

Sewerage and drainage includes sanitary and storm sewers, sewerage treatment plants, stormwater drains and drainage systems.

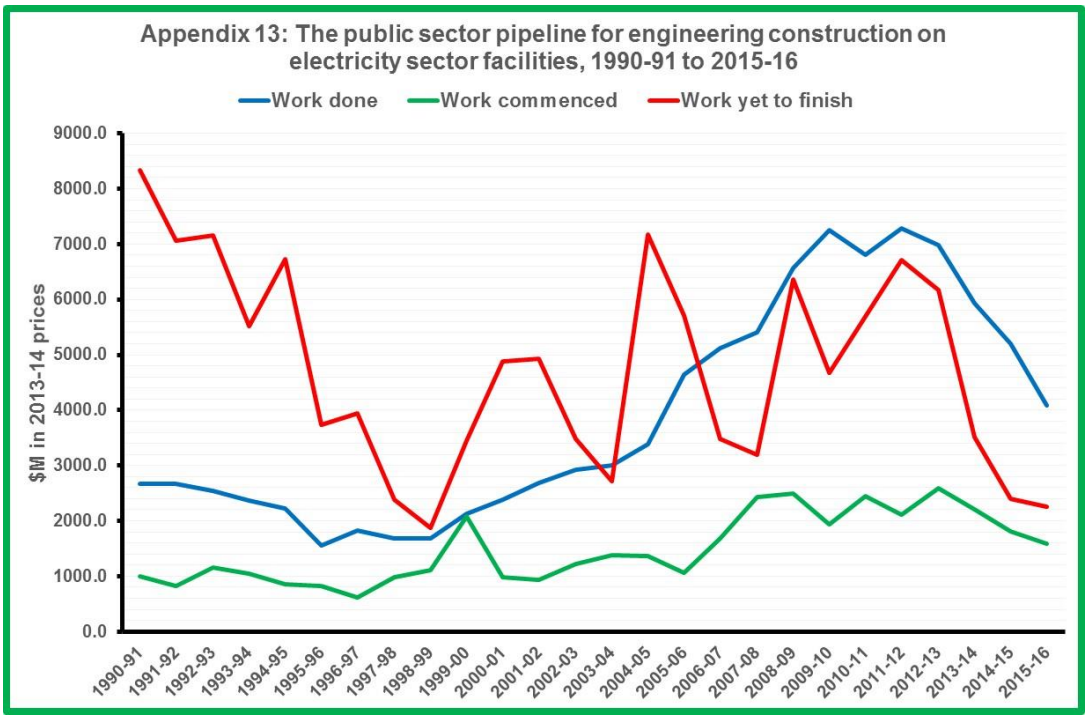


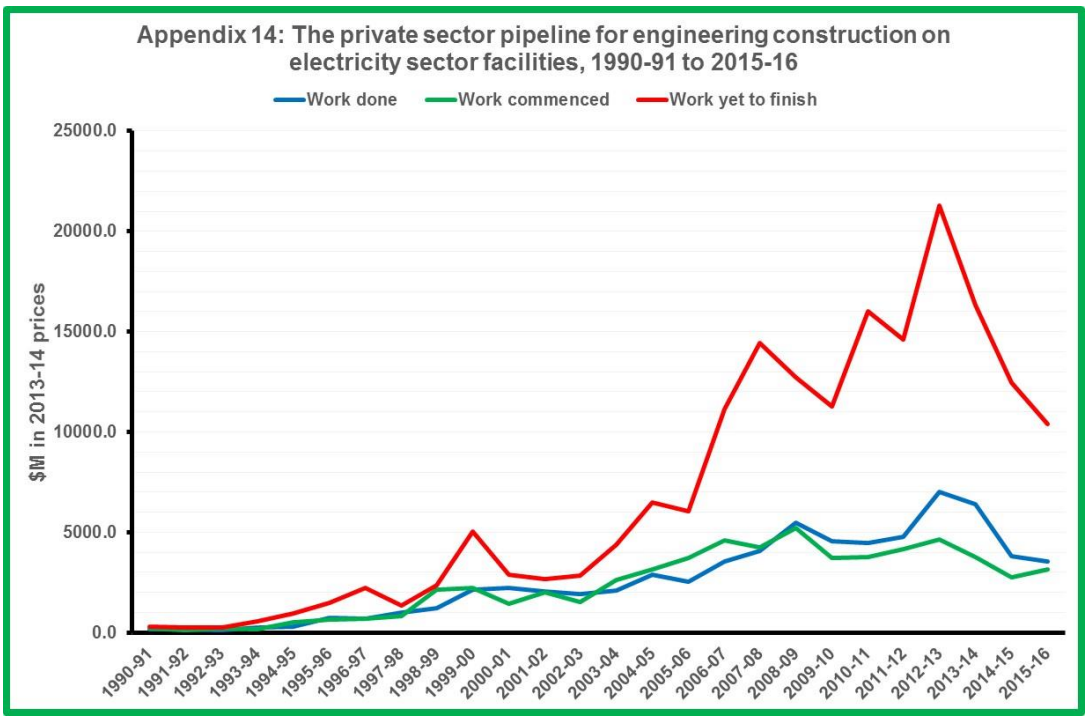


Overall, this sector accounted for 5.5% of infrastructure completed in 2015-16 with the scale of activity favouring the public sector three to one. In 2015-16, both public and private sectors experienced increases in construction completed. Public sector commencements fell but increased in the private sector yielding a small overall increase suggesting activity could remain around current levels in the near future.

2.7 Electricity

Electricity generation, transmission and distribution includes power stations, substations, hydro-electric generating plants, associated work such as towers and chimneys and transmission and distribution lines.



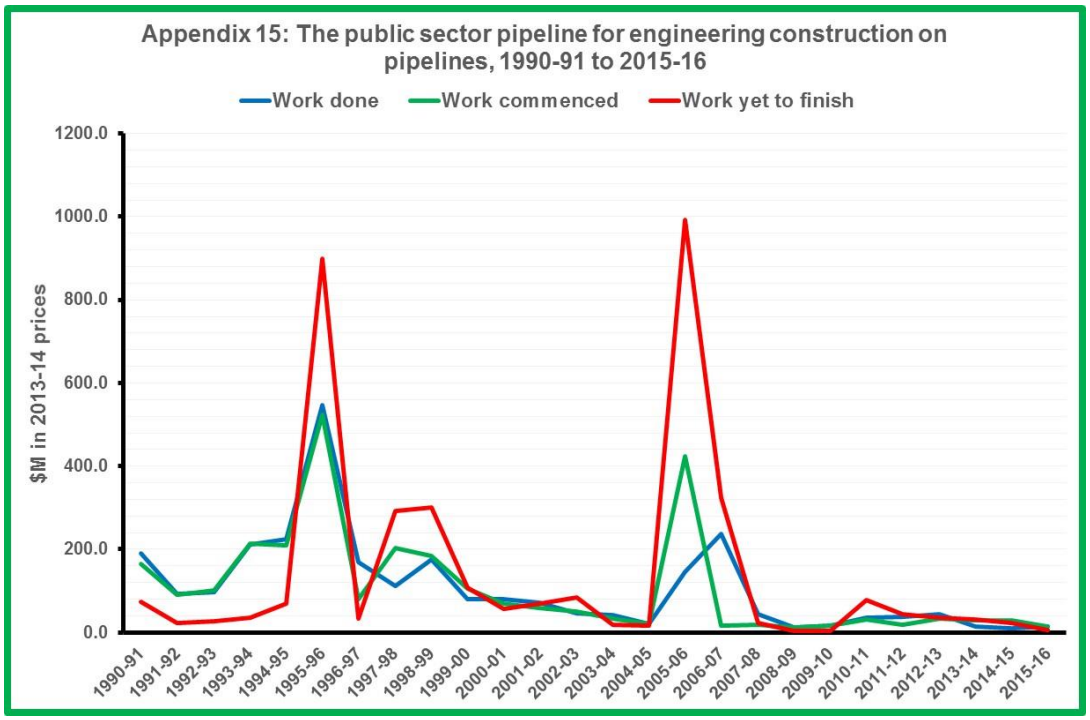


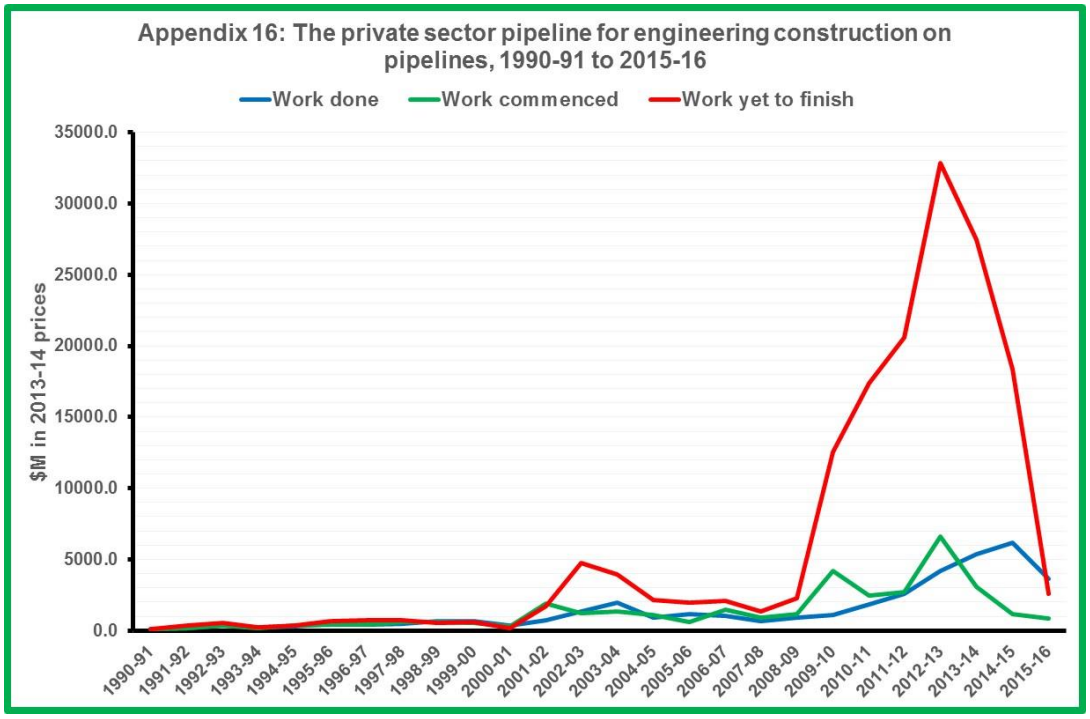
The electricity sector was a substantial component of each sector's infrastructure completed in 2015-16, 15.9% of the public sector and 17.9% of the private sector. Construction work completed fell in both sectors, more sharply in the public sector. New commencements fell in

the public sector but increased in the private sector but not enough to prevent overall commencements falling. This suggests further falls in completions can be expected.

2.8 Pipelines

Pipelines includes oil and gas pipelines, urban supply mains for gas and pipelines for refined petroleum products, chemicals and foodstuffs.

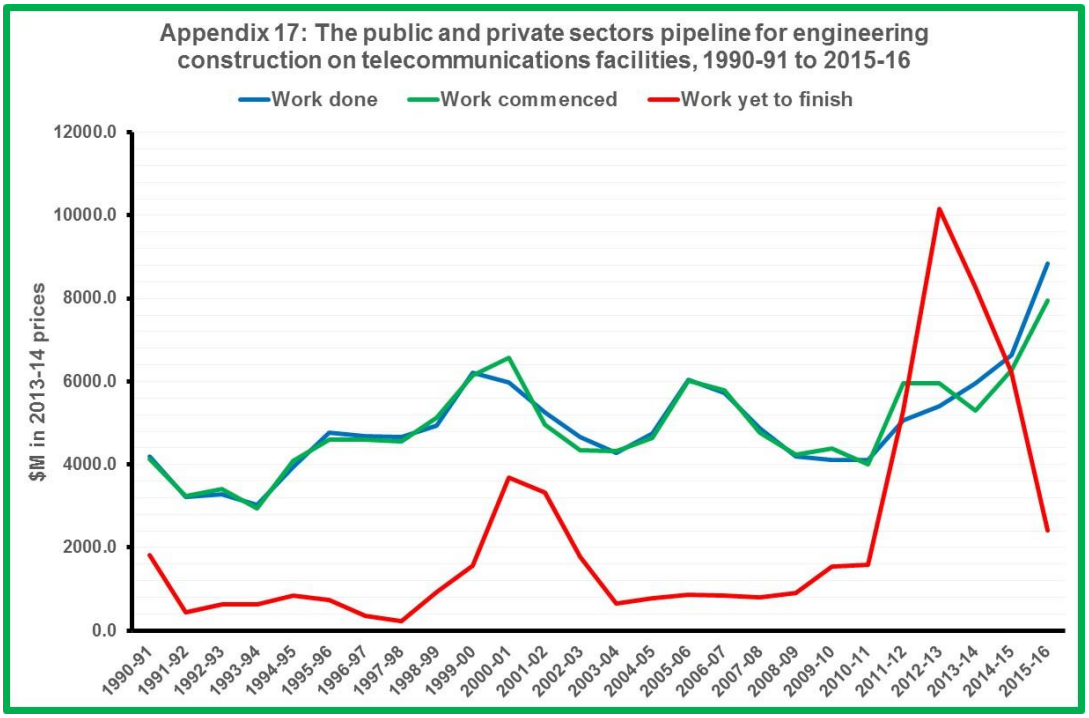




Almost all engineering construction on pipelines is by the private sector and was 18.4% of the sector's infrastructure work completed in 2015-16. Private sector completions fell by 41.1% in 2015-16 reflecting a longer period of contraction in new commencements. The amount of unfinished work has also dramatically fallen suggesting that further falls in construction completed can be expected.

2.9 Telecommunication

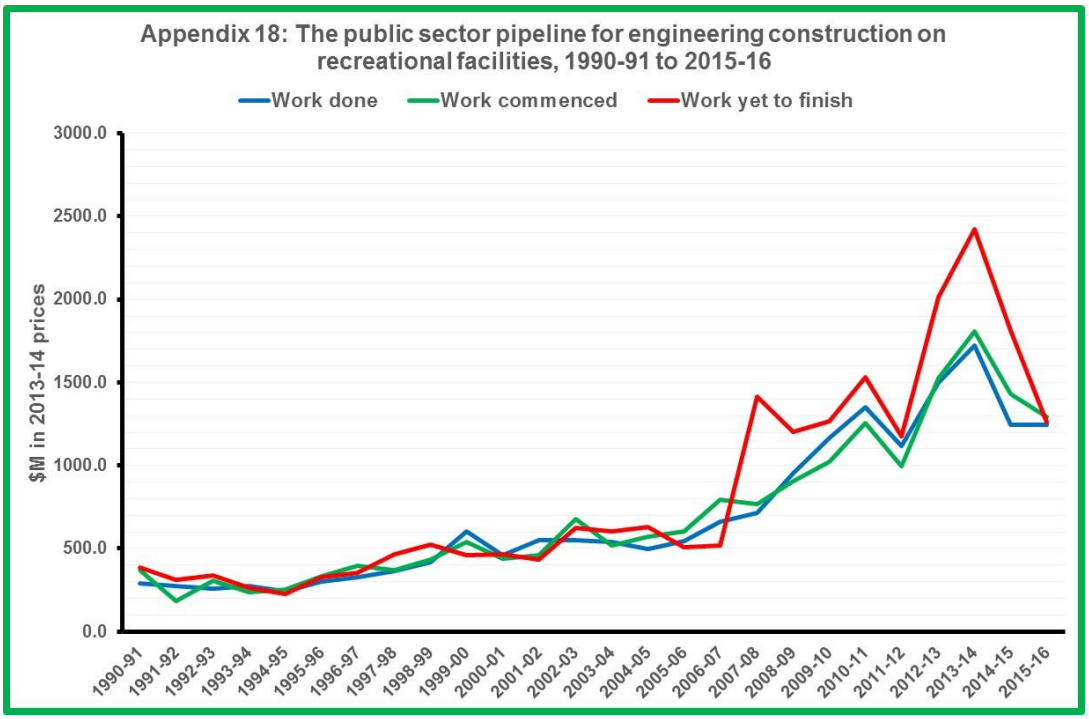
Telecommunications includes mobile phone, radio, television, microwave and radar transmission towers, telephone lines and underground cables and coaxial cables. We focus on the combined public and private sector construction pipelines due to the confusion caused by the privatisation of an almost fully owned government monopoly about a decade ago.

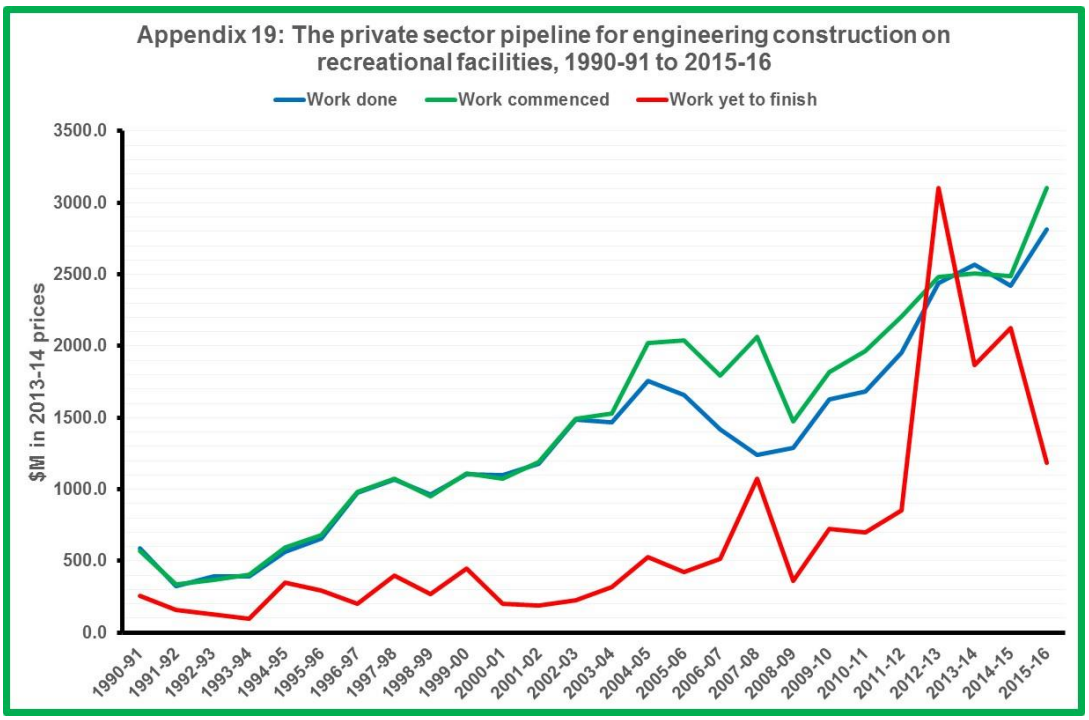


Engineering construction on telecommunications increased by a third in 2015-16 eclipsing the 11.2% rise the previous year. Telecommunications construction is now at its highest ever level with work valued at $8.834 billion completed. New commencements have also increased substantially although the backlog of uncompleted work has substantially reduced. The indications are that construction completed will continue to increase.

2.10 Recreation

Recreation includes golf courses, playing fields, racecourses, stadiums, swimming pools, landscaping and park construction. This category sits outside of the definition of economic infrastructure but activity is too large to ignore.

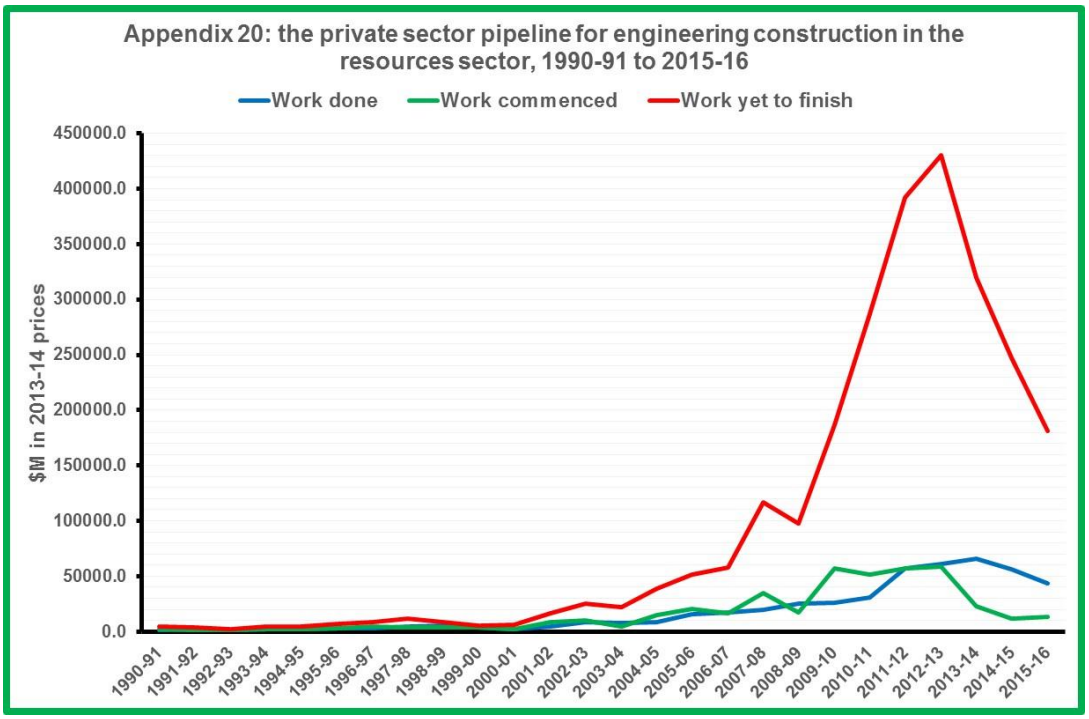




In 2015-16, construction completed by the public sector fell but construction completed by the private sector increased sufficiently to produce an overall increase over the previous year. There was a similar relationship with respect to new commencements also leading to an overall increase suggesting that the present trends in each sector will continue.

2.11 Resources

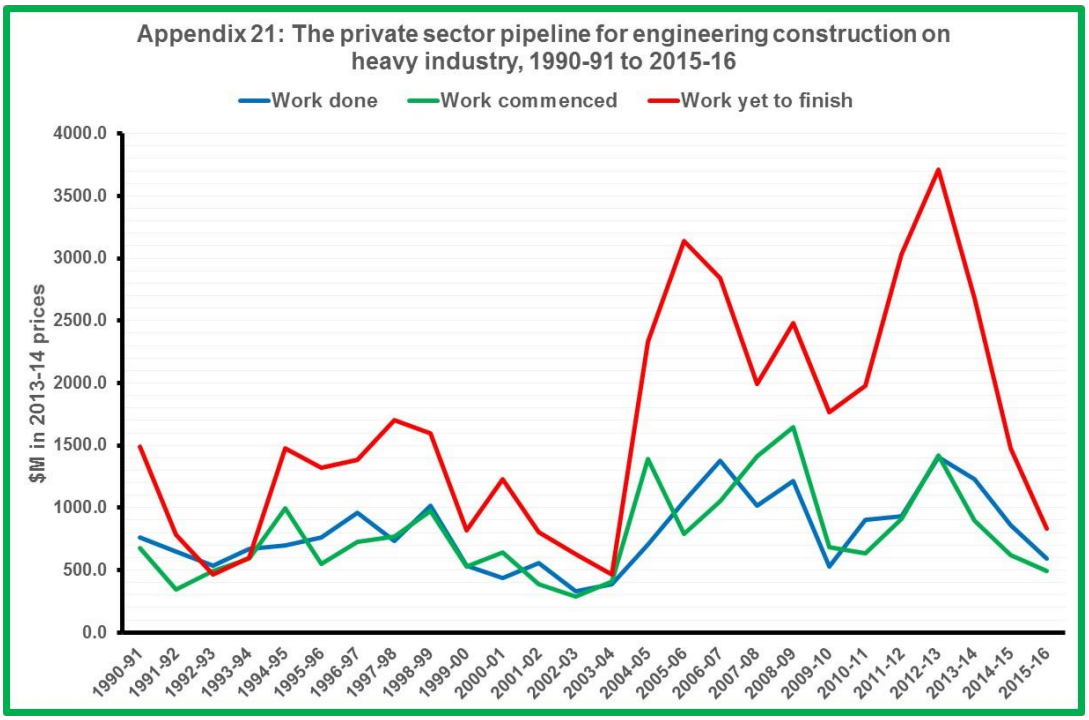
This sector is more accurately defined as oil, gas, bauxite, alumina and other minerals and includes construction of production, storage and distribution facilities, refineries, pumping stations and the construction of mines. Almost all activity is by the private sector. We include this sector because of the sheer scale of activity and the extraordinary changes in activity levels over the past decade and a half.



Although the work completed trend in the above graph appears low, in fact the 2015-16 level of completions was $43.719 billion, almost as high as all engineering construction on economic infrastructure by both the public and private sectors combined. The peak in activity occurred two years earlier and was $66.252 billion at a time when combined sector infrastructure completed was $58.152 billion, a large share of which could also be attributed to the resources boom. It is clear from the other pipeline elements that the boom is well and truly over but the depressed level of commencements shown in the diagram is still $13.707 billion with another $181.360 billions of unfinished work in the system. While the pundits have moved on, the remaining scale of construction in this sector continues to dominate.

2.12 Heavy Industry

More accurately other heavy industry and includes construction of chemical plants, blast furnaces, steel mills, other industrial processing plants and ovens.



This sector stands in contrast to the resources sector and underpins the decline in Australian manufacturing. The level of activity is and has historically been low and is completely swamped by construction in the resources sector.

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