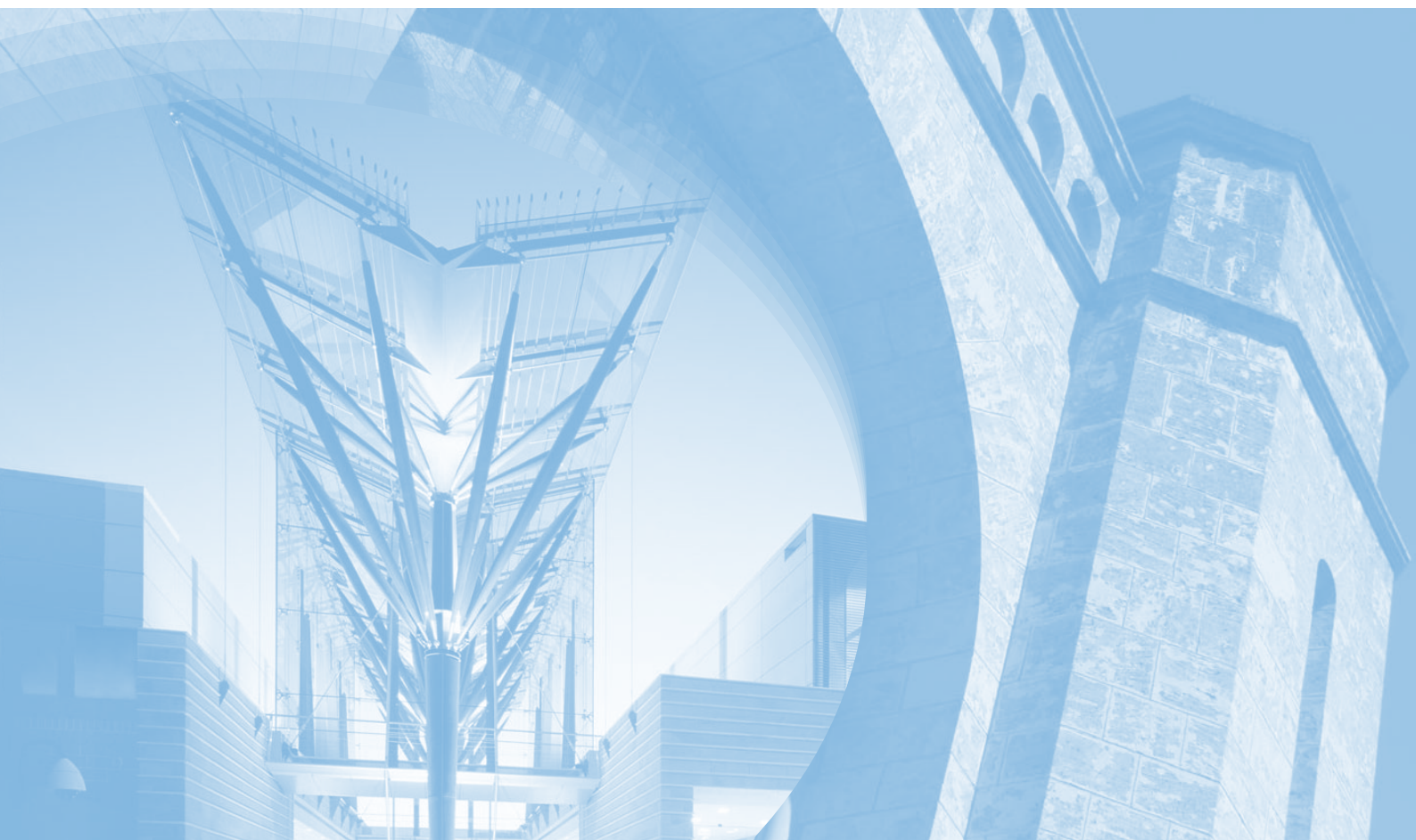


GROUP OF EIGHT INFRASTRUCTURE CONDITION SURVEY 2007

Aggregated data



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ABBREVIATIONS

Survey abbreviations

ARV	Asset Replacement Value
BM	Backlog Maintenance
FCI	Facility Cost Index
FFI	Facility Functionality Index
GFA	Gross Floor Area
Go8	Group of Eight
NA	Not available
NP	Not provided
TEFMA	Tertiary Education Facilities Management Association

Other key terms

ABS	Australian Bureau of Statistics
ARC	Australian Research Council
DEEWR	Department of Education, Employment and Workplace Relations
DEST	Department of Education, Science and Training
DIISR	Department of Innovation, Industry, Science and Research
EIF	Education Investment Fund
HEEF	Higher Education Endowment Fund
HERD	Higher Education Expenditure on Research and Development
NHMRC	National Health and Medical Research Council
OGTR	Office of Gene Technology Regulator
OH&S	Occupational Health and Safety

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EXECUTIVE SUMMARY

The *Group of Eight Infrastructure Condition Survey 2007* represents the Go8's first effort to enhance the quality of information available about the condition of building and support infrastructure of member universities, their capital investment trends and challenges.

The survey aims to support the systematic benchmarking of facilities across the Go8, by complementing data shared annually by Australian universities through the Tertiary Education Facilities Management Association of Australia (TEFMA).

In preparing the survey, the Go8 went to considerable lengths to ensure that its methodology was sound, that the data were accurate and, in particular, that any condition and cost estimates were as robust and as objective as possible.

All condition ratings were based on evaluation by institutions using the Facility Cost Index (FCI), an objective measure used by facility managers to assess the condition of buildings and other capital assets. The survey relied upon standard definitions used by TEFMA (see **Appendix 2**). It was prepared in consultation with facilities managers in each Go8 university. All data provided were subjected to an extensive checking process by the Go8, with the data submitted by each institution also checked and confirmed by each facility manager prior to the preparation of this report.

The survey demonstrates starkly that Go8 universities face significant challenges in accessing capital to replace or refurbish ageing teaching and research infrastructure built predominantly between 1940 and 1980. This stock alone accounts for some 56% of total Go8 building infrastructure, 61% of total support infrastructure and backlog maintenance liabilities of \$1.19 billion or 68% of total.

Given the rapid period of expansion the Australian tertiary education sector underwent during the post World War II period, it is likely that the findings of the Go8 survey are indicative of the challenges all Australian universities face in refurbishing or replacing this ageing stock.

It is also likely, however, that the infrastructure challenges Go8 universities face are more acute than other Australian universities due to their relatively large share of heritage listed buildings, their relative research intensiveness, their success in winning nationally competitive research grants, and the resulting disproportionate impact on them of the failure of programs in support of research and research training to cover full economic costs.

The survey's key findings (2007 unless otherwise stated) include:

Building infrastructure

- Total Go8 building Asset Replacement Values (ARV) estimated at \$12.74 billion.
- Total Go8 building Backlog Maintenance Liabilities (BM) estimated at \$1.49 billion or 11.7% of total building ARV.
- 38% of Go8 buildings (682 approximately) rated as in Poor (20.4%) or Critical (17.6%) condition. The remaining 62% of buildings were rated as in Fair, Good or Excellent conditions.
- On average, only buildings constructed between 2000 and 2007 are considered to be in Good condition.
- On average, Go8 institutions reported that three in five buildings would have difficulty complying with modern building standards.
- The estimated cost of the work required to meet modern building standards was at least \$790 million.
- The estimated cost of improving all buildings rated Fair, Poor and Critical to an Excellent condition rating was \$2.955 billion.

Non-building support infrastructure (electrical, gas, sewerage, stormwater etc but not communications infrastructure)

- Total Go8 Asset Replacement Value of this infrastructure was estimated at \$1.37 billion.
- Total Go8 Backlog Maintenance of this infrastructure was estimated at \$256 million or 18.7% of ARV.
- Institutions rated 38% of this infrastructure as in a Good (30.5%) or Excellent (7.5%) condition.
- 27.5% of this infrastructure was rated as in Poor (21%) or Critical (6.5%) condition.
- The estimated total cost of improving all non-building infrastructure rated Fair, Poor and Critical to an Excellent rating was \$421 million.

Communications infrastructure

- Overall, the communications infrastructure of Go8 universities was reported to be in a better state than their building and other non-building support infrastructure.
- However, the situation was variable and some institutions reported rising costs, and a critical need for major work to integrate and renew data and voice services.
- The estimated cost of improving all communications infrastructure rated Fair, Poor and Critical to an Excellent rating was \$178.6 million.

New capital works

Expenditure on backlog maintenance is often offset by higher levels of investment in new capital works. This is particularly the case when the cost of refitting a building to meet modern standards is greater than the cost of replacing it with a brand new building. The survey finds:

- Total Go8 expenditure on new capital projects increased from \$239 million in 2002 to \$515 million in 2006.
- This represented an increase from an average of 4% of total Go8 university income in 2002 to 7.3% in 2006.

- However, seven institutions reported that planned capital projects valued at \$1.154 billion were not able to be commenced between 2002 and 2006 due to lack of funds.
- Levels of capital investment varied significantly across the group and from year to year by institution.
- The estimated funding shortfall over the five years 2008 to 2012 for new capital and refurbishment works considered essential was \$3.08 billion.
- A further shortfall of \$2.14 billion was estimated for projects which, while not considered essential were seen as desirable to achieve their strategic objectives.

The global financial crisis has dramatically reduced the investment income of most Go8 universities, with some estimating that revenues from these sources in 2008 and 2009 will be down in excess of 50% compared to 2007 levels.

At the same time, university budgets are under pressure from rising staff and other costs—particularly in the context of the current enterprise bargaining round—and the ongoing failure of competitive research grants to meet full direct and indirect project costs. It is anticipated that in order to contain costs, previously planned new capital projects and maintenance work may need to be deferred as a result of these pressures.

The Go8 survey represents an initial step towards ensuring that Go8 universities have access to reliable contemporary comparative data about the condition of their underpinning infrastructure, their management of this infrastructure, their capital investment levels and practices.

Our expectation is that the survey will be refined and continued over coming years to track trends and improve the quality of the information available to university managers and others with an interest in the quality and sustainability of Australia's higher education sector.

BACKGROUND & CONTEXT

The Group of Eight (Go8) is a coalition of leading Australian universities. Membership comprises the Vice-Chancellors of The University of Adelaide, The Australian National University, The University of Melbourne, Monash University, The University of New South Wales, The University of Queensland, The University of Sydney and The University of Western Australia.

Go8 universities have characteristics including the following:

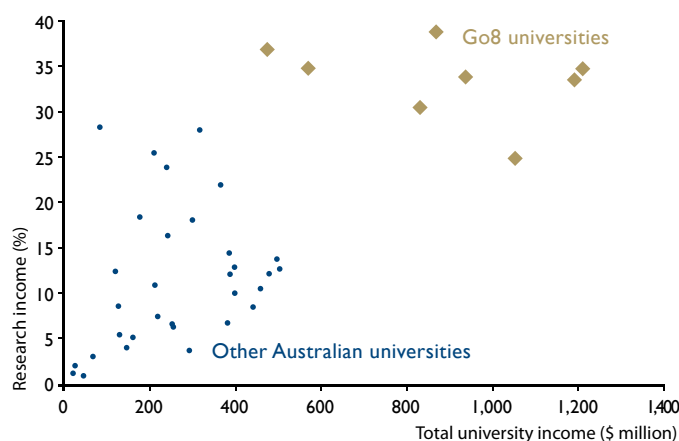
- They are the most research concentrated of all Australian universities and enrol over half of all higher degree by research students.
- Three quarters of Australia's highly cited university researchers (top 0.5% of all publishing authors in a given field) are from Go8 universities.
- They contribute over 70% of the Fellows of the four Australian learned academies.
- They account for 60% of all research income in Australia's university system and for more than 70% of nationally competitive grants awarded through the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC).
- With total building asset replacement values estimated at \$12.7 billion, they account for just under half of total Australian university stock of capital infrastructure (estimated at \$26 billion in 2006).

A key priority for all (Go8) universities is ensuring that their building and support infrastructure is capable of supporting university teaching and research activities that are competitive with the best available internationally.

Contemporary expectations and legislation impose new requirements that affect the development of new capital works and the maintenance of existing facilities. These requirements derive from building code standards and regulations relating to occupational health and safety, energy efficiency, security, access, heritage preservation, the use and storage of hazardous substances, the conduct of research in areas subject to licensing by bodies such as the Office of the Gene Technology Regulator and the Australian Quarantine Inspection Service.

The escalating costs of operating substantial research facilities are especially relevant to Go8 universities because, as **Figure A** demonstrates, their research profiles differ from most other Australian universities.

Figure A. Research income as a percentage of total Australian university income



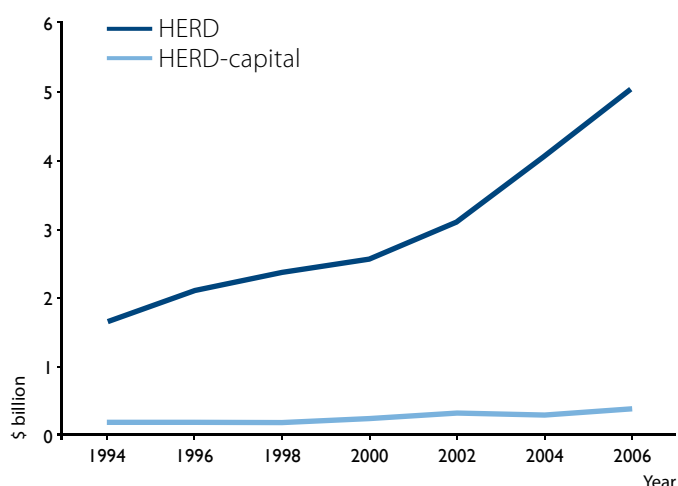
Source: Department of Education, Employment and Workplace Relations (DEEWR), 2006

The former Commonwealth Department of Education, Science and Training (DEST) periodically raised concerns about the lack of data covering key dimensions (asset types, age, value, location, sufficiency, condition and suitability) of Australian university infrastructure.¹ The growth in backlog maintenance liabilities reported annually by institutions, the high levels of demand for funding from existing competitive infrastructure schemes,² and the growing gap between investment in university research and supporting infrastructure demonstrated by **Figure B**, are three indicators of a system under stress. However, the lack of more detailed data hinders the capacity of institutions and governments to make informed decisions about investment priorities.

¹ DEST, *Mapping Australian Science and Innovation*, Main Report, 2003, p.19 & *Response to the Productivity Commission's Draft Report on the Value of Public Support for Science and Innovation*, January 2007, p.4.

² DEST, *Response to the Productivity Commission's Draft Report on the Value of Public Support for Science and Innovation*, January 2007, p.4 'Estimates of universities' deferred maintenance for 2005 totalled \$1.5 billion (up from \$1.2 billion reported for 2004)' & 'In the latest (2006) round of Capital Development Pool (CDP) funding, for example, universities submitted applications for 114 projects totalling \$528.8 million for available funding of \$93.8 million.' For the first application round for the Higher Education Endowment Funding it is understood that even with each institution restricted to a maximum of two 'expressions of interest', proposals seeking a combined \$3 billion have been submitted, with around \$300 million expected to be available for allocation in 2009.

Figure B. Trends in total Higher Education Expenditure on Research and Development (HERD) and the HERD-capital component 1994–2006



Source: Australian Bureau of Statistics, cat. no. 8111.0.

In 2007 the Productivity Commission found that university block grants were under considerable pressure—largely as a result of the ever-increasing demands of competitive research schemes for institutions to cover shortfalls in funding for the direct and indirect costs of the sponsored research.³

The 2008 Federal Budget added \$5 billion to the \$6 billion previously set aside for the establishment of the Higher Education Endowment Fund (HEEF),⁴ to form the \$11 billion Education Investment Fund (EIF).⁵ The expectation is that the income from the EIF, along with its capital, will be invested over coming years to support new capital projects, renewal and refurbishment of infrastructure in Australian universities, vocational institutions, research facilities and major research institutions. Funds from future budget surpluses may also be added to the EIF.

The report of the Review of the National Innovation System, *venturousaustralia*, was released in September 2008. The report recognised that investing public funds in our universities and other publicly funded research organisations makes good economic sense ‘In summary, strength and diversity in our research sector are underlying requirements for Australia’s productivity growth and future prosperity.’⁶ The report recognised the importance to Australia’s innovation system of ensuring that the full costs of university research (including infrastructure costs) are met through a combination of competitive and block funding:

‘A significant risk to the quality and sustainability of university research now and into the future is the gap between the funding targeted to research and the actual cost of that research. The nature of the gap

at the sectorial level is illustrated by ABS data, which shows that in 2006 Australian universities earned \$2.2 billion for research activities and spent \$5.6 billion on research... Cross subsidisation from teaching is not sustainable in the longer term, as inevitably a decline in the quality of student experience and outcomes will result... The absence of full-cost funding is also contributing to inadequate spending on the maintenance of research infrastructure and the commissioning of world-class new infrastructure.’⁷

Shortly following the release of *venturousaustralia*, the Department of Innovation, Industry, Science and Research (DIISR), released a study examining the full economic costs of research and research training in Australia’s universities, and international approaches to these issues.⁸ This study focused on research supported through national competitive grant programs (predominantly through the ARC and the NHMRC). It found that current funding arrangements fall well short of meeting the full direct costs of sponsored projects, let alone their indirect costs which were estimated at up to an additional 66% of total direct project costs.⁹

The study concluded that ‘funding from competitive grants and block grants would need to be increased significantly to meet the direct and indirect costs of competitive research’, and recommended a shift to a new funding model capable of covering full research costs.¹⁰ It documented the arrangements countries such as the US, the UK, Canada, Ireland, Sweden and New Zealand, have in place to fund full research costs, to achieve benefits for their communities including:

- better internal resource allocation
- transparency of cross-subsidies
- improved asset management
- better understanding by researchers of the costs associated with research activity
- integration of financial and academic decision making

³ Productivity Commission (2007) *Public Support for Science and Innovation*, pp.517–518

⁴ www.heef.deewr.gov.au

⁵ www.heef.deewr.gov.au/EIF

⁶ Cutler & Company Pty Ltd (2008) *venturousaustralia*, p.80

⁷ *ibid.*, p.68

⁸ The Allen Consulting Group (2008) *Recognising the full costs of university research*, Discussion Paper, Report to the Department of Innovation, Industry, Science and Research, September

⁹ *ibid.*, pp.vii

¹⁰ *ibid.*, pp.vii–viii & p. 50

- up to date and consistent information for project costing and pricing
- benchmarking on a reasonably consistent basis
- sustainable performance quality.

The report drew a direct connection between evidence of significant 'backlog maintenance' in Australian universities and their need to find additional resources to support research projects funded through national competitive grant programs. It concluded that *'as a result, a large one-off injection of funds to bring buildings and facilities up to current standards will also be necessary. Both the UK and Ireland have faced a similar problem and found it necessary to fund a catch up.'*¹¹

More than half of the total Go8 stock of building infrastructure (56%) was constructed between 1940 and 1980 and is reaching, or has reached, the end of its economic life. For many of these buildings it is not simply a matter of maintaining them, but rather of having to knock them over and start again. The extensive use of asbestos in construction in that era and the fact that many of the buildings would have difficulty complying with modern building, OH&S and other requirements makes maintenance and refurbishment prohibitively expensive. Given the rapid period of expansion the Australian higher education sector underwent following World War II, it is likely that other Australian institutions face similar challenges with infrastructure constructed during this period.

Limited access to affordable land on or near metropolitan campuses is another factor that bears on Go8 institutions' decisions to refurbish old stock, or replace entirely with new. A further significant challenge, particularly for the older Go8 universities, is the high cost of maintenance of their heritage listed buildings.

For more than the past decade, indexation of university block grants has fallen well behind inflation and average wage increases.¹² During this period, research supported by competitive grant programs has only been sustained through cross-subsidisation from other sources of income, most notably fees from international students. In many disciplines, funding for domestic undergraduate teaching and postgraduate by research training has also not covered full costs, and institutions have been restricted in their capacity to recover actual costs from students. At the same time, new Commonwealth Government policy

initiatives have tended to be application-based, and preference proposals that 'leverage' funds from institutions, state governments, the private sector or philanthropists. The combination of these factors has reduced the capacity of institutions to invest in capital maintenance, refurbishment and, to varying degrees, in new capital investment.

The erosion of cash reserves available to support core activities has further reduced funds available for capital works, while inflation and salary increases have placed substantial upward pressure on construction and maintenance costs. More recently, the global financial crisis has dramatically reduced institutions' income from investments, with some Go8 universities estimating that income from these sources in 2008 and 2009 will be down in excess of 50% compared to 2007 levels. It is anticipated that in order to contain costs, previously planned new capital projects may need to be deferred.

Based on a 25 year asset refit/replacement timeframe, institutions should be dedicating around 4% of their Asset Replacement Value (ARV) to maintenance activities (preventative and corrective maintenance, backlog maintenance and refurbishment) annually. For the reasons outlined above, few research-intensive Australian universities have been able to dedicate this amount for maintenance activities on a regular basis. In 2007, for example, Go8 universities dedicated approximately \$262 million or 2% of their total ARV for maintenance activities.¹³

Lower rates of expenditure on backlog maintenance are often offset by higher levels of investment in new capital works. This is particularly the case when the cost of refitting a building to meet modern standards is greater than the cost of replacing it with a completely new building. This survey finds that the between 2002 and 2006 the share of total Go8 income dedicated to new capital works increased from 4.2% to 7.3%. Increasing investment in new capital works is also likely to reflect the tendency of new Government programs to favour the construction of new infrastructure, rather than the renewal of existing stock.

By compiling this survey the Go8 seeks to enhance understanding about the infrastructure investment challenges Australia's leading research universities face.

¹¹ *ibid.*, p.viii

¹² See, for example, Go8 (2004) *Position paper on the indexation of university grants*

¹³ DEEWR (2007) Higher Education Provider Finance Data Series.

SUMMARY OF SURVEY RESULTS

The survey sought data and other information about the building infrastructure, non-building support infrastructure (excluding communications), communications infrastructure, recent and proposed new capital investment. A summary of the survey findings relevant to each of these areas is provided below. The data underpinning these summaries are reported in *Appendix 1*.

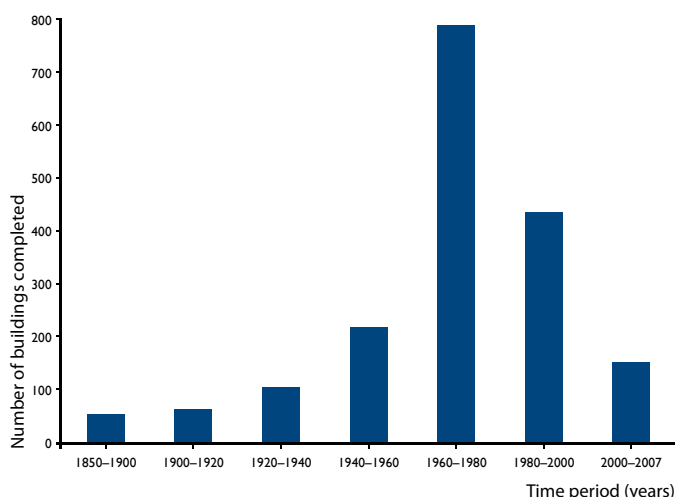
Buildings

Value, periods of construction & backlog maintenance

- As at November 2007, the total Go8 ARV was estimated at \$12.74 billion.
- This includes some 1799 buildings across the eight institutions.¹⁴

Figure C shows the number of buildings constructed by Go8 universities during each of the seven survey time periods from 1850 to 2007.

Figure C. Go8 total buildings by broad time period 1850–2007



- Of the total Go8 buildings, 214 buildings (only 12%) were constructed during the period 1850–1940.
- 56% of all buildings (1000) were constructed between 1940 and 1980. This stock accounts for 55.5% (\$7.06 billion) of institutions' combined building ARVs and 68% (\$1.02 billion) of their BM liabilities. Of this stock, some 785 buildings

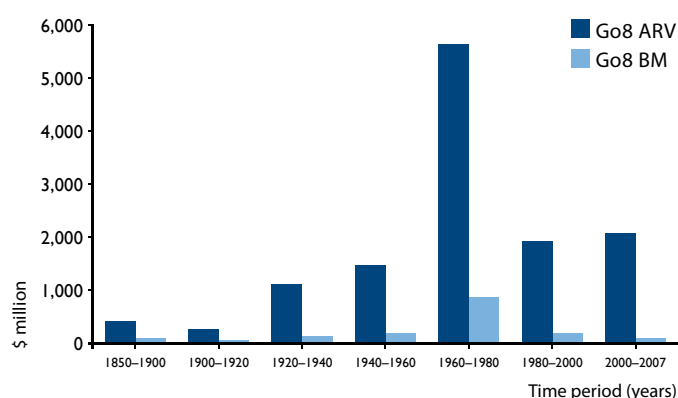
¹⁴ Data provided by UniMelb covered only its main Parkville campus.

¹⁵ See *Appendix 2* for an explanation of the formula.

(44% of total) were constructed between 1960 and 1980 with these buildings alone accounting for 44% of total ARV (\$5.6 billion) and 55% (\$830.6 million) of BM liabilities.

Figure D shows the combined Go8 ARV and backlog maintenance breakdowns for the seven survey periods from 1850 to 2007.

Figure D. Go8 total building Asset Replacement Value and estimated Backlog Maintenance liability by broad time period 1850–2007



As expected, the GFA of Go8 building stock reflects the proportions of total construction activity that occurred during each period. Buildings constructed between 1960 and 1980 accounted for some 1.63 million square metres of space (45.6% of total space) whereas buildings constructed between 1850 and 1940 account for less than 10% of total space.

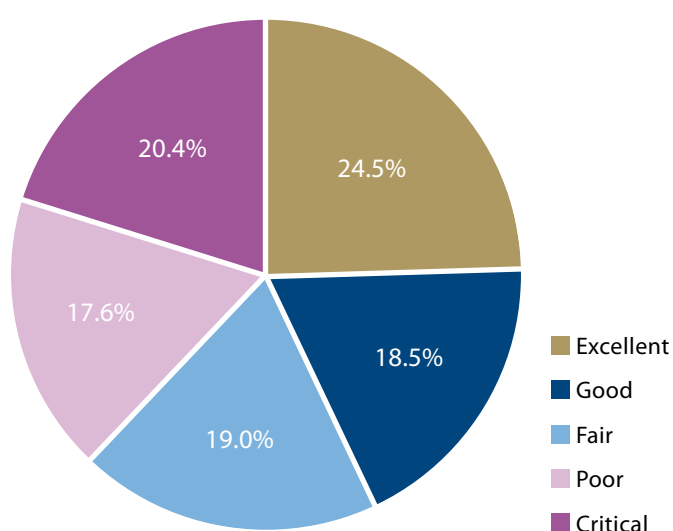
Condition

- Total backlog maintenance liabilities were estimated at \$1.49 billion or 11.7% of total ARV. However, for many buildings, backlog maintenance is no longer considered a relevant indicator of condition, as such buildings can only be brought up to modern standards through replacement with new stock. The ARV of such buildings is generally considered more relevant.
- Of the total stock of Go8 buildings 24.5% were rated as in Excellent condition according to assessment using a scale based on the TEFMA Facility Cost Index (FCI).¹⁵
- 18.5% were rated as in Good condition.
- 19% were rated as in Fair condition.

- The remaining 38% of buildings (682 approximately) were rated as in either Poor or Critical conditions (20.4% Critical & 17.6% Poor).¹⁶
- Many of the buildings completed between 1940 and 1980 were viewed as either having reached, or as reaching, the end of their economic lives and as a source of ever mounting maintenance costs. Many buildings from this period were constructed using asbestos products, making remedial and replacement work particularly expensive.

Figure E shows the proportion of Go8 buildings estimated in each condition category—Excellent to Critical.

Figure E. Proportions of Go8 building infrastructure rated Excellent, Good, Fair, Poor & Critical

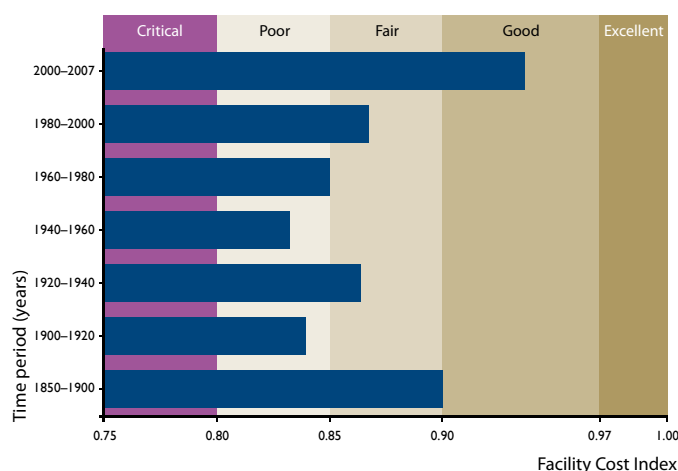


- The estimated cost of improving all buildings rated Fair, Poor, and Critical to a Good rating was \$1.658 billion.
- The estimated cost of improving all buildings rated Fair, Poor and Critical to an Excellent rating was \$2.955 billion.
- Institutions reported that about three out of every five buildings would have difficulty complying with relevant building and other requirements (OH&S, OGTR etc).
- The estimated cost of the work required to meet modern day standards was \$788.3m.

Institutions were asked to provide the Facility Cost Index and Facility Functionality Index breakdowns for all buildings constructed during each of the survey's seven time periods. The FCI is a measure of the condition of the asset relative to its 'as new'

condition. The FFI is a measure of the extent to which an institution's facilities meet current teaching, research and legislative requirements. **Figure F** shows the average Go8 FCI for buildings constructed during each period.

Figure F. Go8 average Facility Cost Index 2006 ratings by broad time period 1850–2007



Qualitative responses related to the condition of building infrastructure

There was a consistency of concern across most Go8 universities about the condition of the large proportion of building stock constructed during the post World War II period of expansion. As noted above, more than 50% of all Go8 building stock was constructed during this period and much of this is reported to have reached the end of its functional life. Institutions' comments about the condition of their building stock include:

- 'Approximately 70% of university buildings were constructed before 1980 and reflect that era's design and construction standards. Teaching and research facilities do not comply with contemporary standards and designs. This has a significant impact on the university's ability to provide quality outcomes.'
- 'A significant proportion of the building and infrastructure assets have reached the end of their economic lives due to their age and are now in need of capital renewal to various degrees. As an organisation... we should [not] become too involved in debates around facilities and the extent of upgrade works required, once a building reaches the stage of a critical FCI it is generally more cost effective to carry out a significant single upgrading project rather than carry out a large number of individual maintenance tasks.'

¹⁶ See page 17 for an explanation of these ratings.

- 'The university has a large number of buildings that were constructed 30 to 45 years ago and are now in need of significant refurbishment to comply with current legislative and regulatory requirements and to provide a functional and safe environment for students and staff.'
- 'On average the majority of existing building stock rates either Fair (average more than halfway through service life) or Poor (near the end of service life). Most of the Fair/Poor buildings were built during the period 1950 to 1970 with a design life of 40 years which is approaching. A few post WW2 buildings have been successfully refitted to an excellent standard at a total project cost of approximately \$2,500/m².'
- 'With a significant post-war expansion of the building stock many of the significant teaching and research facilities are near the end of their practical life and face ever mounting maintenance charges to remain operational.'
- 'There are six major buildings rated below FCI of 90%, and these share the history that they were built in the late 1960s or early 1970s, and the techniques of the construction has resulted in considerable remediation coming due at the same time.'

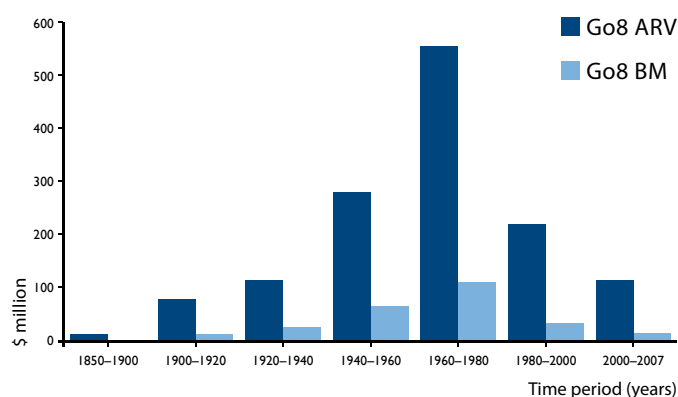
Non-building support infrastructure

Value, periods of construction & backlog maintenance

- The ARV of this infrastructure was estimated at \$1.37 billion.
- On average, 24.3% (ARV \$332.4. million) of this infrastructure was completed between 1980 and 2007.
- 40.6% (\$555.2 million) was completed between 1960 and 1980.
- 20.5% (\$280 million) was completed between 1940 and 1960.
- 8.2% (\$112.3 million) was completed between 1920 and 1940.
- The remaining 6.4% (\$86.3 million) was completed between 1850 and 1920.
- The total Go8 backlog maintenance liability estimate for non-building support infrastructure was \$256 million or 18.7% of ARV.

Figure G shows the combined Go8 non-building infrastructure ARV and BM breakdowns for the seven survey periods from 1850 to 2007.

Figure G. Go8 total non-building Asset Replacement Value and estimated Backlog Maintenance liability by broad time period 1850–2007



Condition

- Institutions rated, on average, 7.5% of their total non-building infrastructure as Excellent, 30.5% Good, 34.5% Fair, 21% Poor and 6.5% as in a Critical condition. However, there were wide variations in the proportions of non-building infrastructure rated in each category across the group.
- The estimated total cost of improving all non-building infrastructure rated Fair, Poor and Critical to a Good rating was \$193.9 million.
- The estimated total cost of improving all non-building infrastructure rated Fair, Poor and Critical to an Excellent rating was \$421 million.

Qualitative responses related to the condition of non-building infrastructure

- One institution reported significant shortcomings in site servicing infrastructure, especially sewer, water and electricity. It rated its sewer infrastructure, some of which is over 80 years old, as poor and questioned its capacity to accommodate further expansion. It identified a number of looming capacity constraints for its electrical infrastructure. These arise from additional requirements for air-conditioning, energy consumption monitoring and the need for improved management from both cost and environmental perspectives.
- A second institution rated its overall site infrastructure as in Poor to Fair condition, with 80% of available funds directed to corrective maintenance. Remaining funds are channelled to support minor upgrades and environmental works: 'issues affecting 'fit for purpose' include the adequacy of the high voltage power supply and the capacity of the fire services water mains system. Storm water, sewer and campus roads all require substantial works to achieve present day standards.'

- Another described its overall stock of non-building infrastructure as in Fair condition. However, it identified ageing infrastructure and capacity constraints as likely to restrict further development if left in their current state: ‘Some inground services are 60 years old with the average estimated at 30 years... In the next 13 years the university expects it will need to replace the majority of inground services on our main campus.’
- A fourth described its stock as aged but remaining in a serviceable condition. However, gas mains and fire mains require replacement due to changes in regulations.
- Another reported that above and below ground services at two campuses require significant expensive upgrades.
- Another institution reported that its electrical distribution network, much of which dates to the 1970s, is stretched to capacity. Similarly, sections of its sewerage system are aged and require replacement or remediation. Parts of its landscaping (walls and paving) have been assessed as requiring significant work.

Communications infrastructure

- In general, the communications infrastructures of institutions are in a better state than their building and other non-building support infrastructure.
- However, the situation is variable and some institutions report rising costs, and a critical need for major work to integrate and renew data and voice services.
- The estimated total cost of improving all communications infrastructure rated Fair, Poor and Critical to a Good rating was \$109 million.
- The estimated total cost of improving all communications Infrastructure rated Fair, Poor, and Critical to an Excellent rating was \$178.6 million.

Qualitative responses related to the condition of communications infrastructure

While there were exceptions, compared to the condition of building and non-building support infrastructure, Go8 communications infrastructure appears to be generally in a good state of repair and fit for purpose. This may reflect the relatively short life-cycle for voice and data infrastructure and

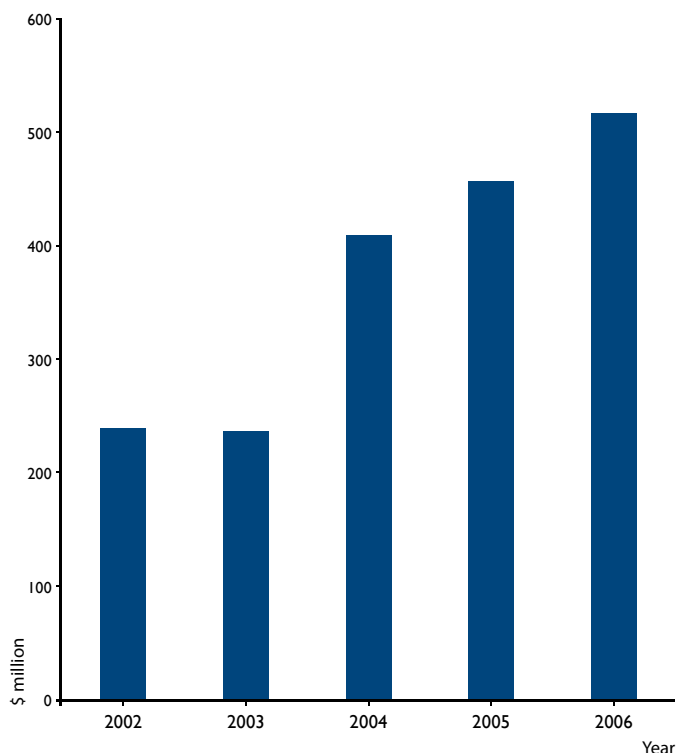
the perceived criticality of IT and communications systems to the efficient functioning of modern universities. However, institutions report that demands on communications infrastructure are ever-increasing and that it is becoming ever more expensive to upgrade. Samples of institutions’ comments about their communications infrastructure include:

- ‘Asset service life cycles range from five to 20 years depending on whether active equipment (switches, phones, servers, etc) or passive infrastructure (optical or copper cable plant, structured comms cabling etc). Fitness for purpose is thus excellently maintained for asset types to meet required service levels through asset life cycles.’
- ‘While still functional the communications infrastructure has evolved over time and is now expensive to maintain and upgrade, and requires a major integrated renewal.’
- ‘The weaknesses or gaps in the current network infrastructure are generally related to infrastructure upgrades required to cater for increasing demands for extra bandwidth or additional services to match those provided in the wider community, redundancy & resilience of critical services, flexibility and ease of usage across a wide range of communication mediums.’
- ‘Data network communications infrastructure is generally in a Poor state to Good state. A significant proportion of the data communications infrastructure does not meet existing standards. Mostly this is in relatively new or recently refurbished buildings. Data and Voice cabling infrastructure is in a Poor state and the cost of rectifying this problem is significant.’
- ‘[Our university] has established communications infrastructure covering most buildings. Most elements of the infrastructure are beginning to reach the end of their useful lives. Whilst currently serviceable in isolation, the overall timing and cost of replacement will limit the university’s ability to fund necessary upgrades. The distribution of the required upgrades is not even, with some parts of the university being overly affected by the poor condition of the infrastructure.’

New capital works

Data were collected about recent and anticipated new capital works activities, along with estimated funding shortfalls. **Figure H** shows trends in total expenditure on new capital works projects (excluding refurbishment and rehabilitation work) between 2002 and 2006.

Figure H. Go8 new capital works expenditure 2002–2006

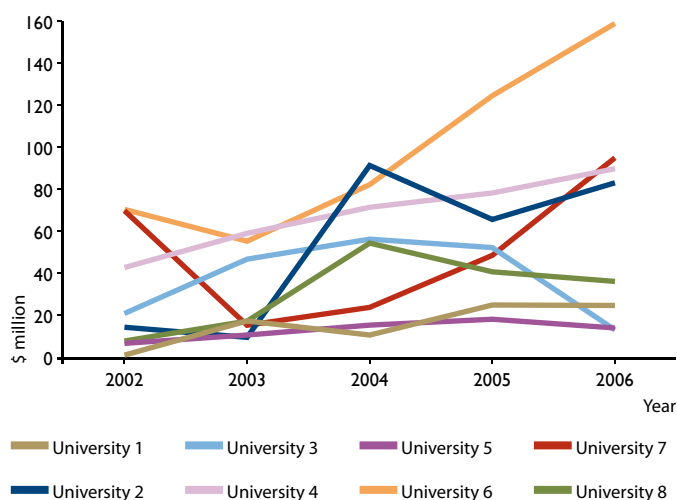


Key findings include:

- Go8 universities reported expenditure on new capital works projects totalling \$1.85 billion over the five years 2002–2006.
- In 2002 average expenditure on new capital works was \$29.1 million rising to \$64.4 million in 2006.
- Expenditure on new capital works represented an average of 4% of total institutional income in 2002, 4.2% in 2003, 7% in 2004, 7.2% in 2005 and 7.3% in 2006.

However, levels of new construction activity, both in dollar terms and as a proportion of institutional income, varied significantly across the group during this period. **Figure I** shows trends in new capital works expenditure for each of the Go8 universities over the period 2002–2006.

Figure I. Go8 new capital works expenditure by institution 2002–2006



- In 2007, on average, revenue for new capital works projects across the Go8 came from the following sources: 23.7% government, 63.7% general university funds, 11.3% borrowings and 1.3% other sources.
- The equivalent figures for 2002 were: 27.1% government, 63.6% general university funds, 2.1% borrowing and 7.2% other sources.
- Institutions indicated that further increases in the proportion of revenue for new capital works sourced from borrowings were likely—the Go8 average for funds sourced for borrowing rising to 34.9% in 2008 and 22% in 2009.
- Institutions estimated the following funding shortfalls anticipated for the five years 2008 to 2012:
 - \$508 million shortfall for essential maintenance costs.
 - \$1.639 billion shortfall for essential refurbishment costs.
 - \$1.437 billion shortfall for essential new capital works.
 - \$2.142 billion shortfall for new capital works projects which, while not essential, are seen as necessary to allow institutions to achieve its strategic objectives.

Qualitative responses related to the commencement of new capital works projects

At the time the survey was completed, Go8 universities faced the following challenges to commencing and completing new capital works:

- Erosion of cash reserves available to support core activities has reduced funds available for capital works.
- A buoyant economy causing substantial upward pressure on construction and prices.
- Refurbishment and maintenance now competing for a diminishing pool of funds available for all capital works.
- Older buildings out of step with modern building standards and expectations, yet inadequate funds have been available for refurbishment and maintenance over the last 40 years.
- Planning approval delays.
- Site capacity constraints, particularly in city campuses.
- Escalating costs in operating teaching and in particular research facilities due to legislative requirements covering areas such as fire safety, health and safety, asbestos management, building code requirements, lab compliance, plant and equipment maintenance.
- Institutions being required to take over student union asset management due to the introduction of voluntary student unionism.
- Heavy demand for extra capacity from non-building and communications infrastructures that in many cases are fully exploited or have reached the end of their effective life-cycles.
- Environmental issues—electricity, water use, efficiency and cost.

THE SURVEY

Preparation & methodology

The design of the *Go8 Infrastructure Condition Survey 2007* was influenced by a review of the Tertiary Education Facilities Management Association (TEFMA) annual benchmarking report. The survey relied on TEFMA definitions and formulae for determining the status of infrastructure.¹⁷ All Go8 universities have participated in the TEFMA survey to varying degrees since it began in 1997 and are familiar with its terminology.

Preparation of the survey commenced in July 2007 in consultation with facility managers in each Go8 university. The survey was circulated to contact officers on 10 September 2007 with the final survey responses received on 11 November 2007.

An initial confidential report on the survey data was completed in early 2008, and provided to institutions for comment, checking and revision of their data. All institutions had provided responses by October 2008.

Constraints in the use of existing data

While the TEFMA data are detailed and useful, they do not allow the overall status of Go8 buildings, supporting infrastructure (electricity, gas, water & sewerage) constructed during different time periods, to be compared according to consistent criteria.

They do not allow for estimates to be made across key asset types of the costs of the work required to take existing sub-standard infrastructure to an acceptable level. They do not provide quantitative and qualitative information about the challenges institutions face in obtaining capital for investment in existing and new infrastructure considered essential to their missions, or explain how institutions estimate the costs of maintenance, refurbishment or new capital works. Hence, the Go8 survey relied upon the TEFMA definitions but sought to supplement and extend the data available through the TEFMA survey about the infrastructure of Go8 institutions.

¹⁷ Tertiary Education Facilities Management Association (2007) *2006 Benchmark Report*, p.7.

Definitions

The survey makes extensive reference to the following terms:

- Asset Replacement Value (ARV)
- Backlog Maintenance (BM)
- Facility Cost Index (FCI)
- Facility Functionality Index (FFI)
- Gross Floor Area (GFA)
- Not available (NA)
- Not provided (NP)

See *Appendix 2* for full definitions of these terms.

Facility Cost Index rating scales

The FCI is a standard measure of the condition of an asset relative to its 'as new' condition. It is determined by the formula: $FCI = 1(BM/ARV)$. For the purposes of this survey the FCI-based rating scale set out in *Table 1* below was applied.

Table A. Facility Cost Index rating definitions

FCI	0.97–1.00	Rating	Excellent
At the start of its service life, fully functional, compliant with all current building standards, no Backlog Maintenance.			
FCI	0.90–0.97	Rating	Good
In the second quarter of its service life, functional, compliant with most current building standards, limited Backlog Maintenance.			
FCI	0.85–0.90	Rating	Fair
Half way through its service life, serviceable, compliant with some current building standards, manageable Backlog Maintenance.			
FCI	0.80–0.85	Rating	Poor
Near the end of its service life, limited functionality, does not comply with most current building standards, substantial Backlog Maintenance.			
FCI	<0.80	Rating	Critical
At the end or past its service life, unfit for its original purpose, does not comply with most current building standards, requires complete refurbishment or replacement.			

Survey content

The survey questions focused on three distinct areas of university infrastructure:

- buildings
- non-building support infrastructure (in ground services such as electrical, gas, sewerage, water etc)
- communications infrastructure (data and voice).

For each type of infrastructure, institutions were asked to provide:

- A breakdown of the stock completed in each of seven broad time periods: 1850–1900, 1900–1920, 1920–1940, 1940–1960, 1960–1980, 1980–2000 and 2000–2007.
- An estimate of the 2007 Asset Replacement Value of stock completed during each period.
- An estimate of the 2007 Backlog Maintenance liabilities for stock completed during each period.
- An estimate of the proportion of the stock rated Excellent, Good, Fair, Poor or Critical at the time of survey completion.
- A brief description of the overall state of repair and fitness for purpose of the stock at the time of survey completion.
- Estimates of the cost, at the time of survey completion, of improving all stock rated Fair, Poor, and Critical to Good and Excellent ratings.

The following additional information was sought specifically about institutions' existing building infrastructure:

- The Gross Floor Area of all stock completed during each period.
- The average 2006 Facility Cost Index of all stock completed during each period.
- The average 2006 Facility Functionality Index of all stock completed during each period.
- The proportions of all buildings that do not comply with existing building and other relevant statutory compliance standards, and an estimate of the cost of the work required to achieve compliance.

For all existing infrastructure (building, non-building

support and communications) institutions were asked to estimate the anticipated funding shortfall (if any) for essential maintenance and refurbishment costs expected over the next five years.

In addition to questions about the condition of existing infrastructure, the survey asked institutions to provide the following information about new capital works:

- The amount expended on new capital works projects in each year 2002–2006.
- The percentage of total university income that this expenditure represented.
- Examples of projects unable to be commenced over the period 2002–2006 due to funding shortfalls, and estimates of the funds required to allow these projects to proceed.
- A breakdown of the proportion of revenue to support new capital works that has been (2002–2006) or is expected to be obtained from government sources (2007–2012), general university funds, borrowings or other sources.
- A brief description of any financial or other constraints that may be preventing the commencement of new capital works projects planned by the institution over the next five years.
- Estimates of the funding shortfall (if any) for essential new capital works anticipated over the next five years.
- Estimates of anticipated funding shortfalls (if any) for new capital works which, while not essential, are viewed as necessary to allow the institution to achieve its strategic objectives.

Costing methodology

Each institution was asked to briefly describe its cost estimate methodology, and to state its degree of confidence in the overall accuracy of its costings. Institutions differ significantly in the method and frequency of their infrastructure condition audits. These range from using employees to varying usage of independent valuers, quantity surveyors and other specialist consultants.

Estimating maintenance, design, compliance, construction and refurbishment costs at the

institutional level is a difficult and subjective task—particularly in the inflationary and close to full-employment environment at the time the survey was completed.

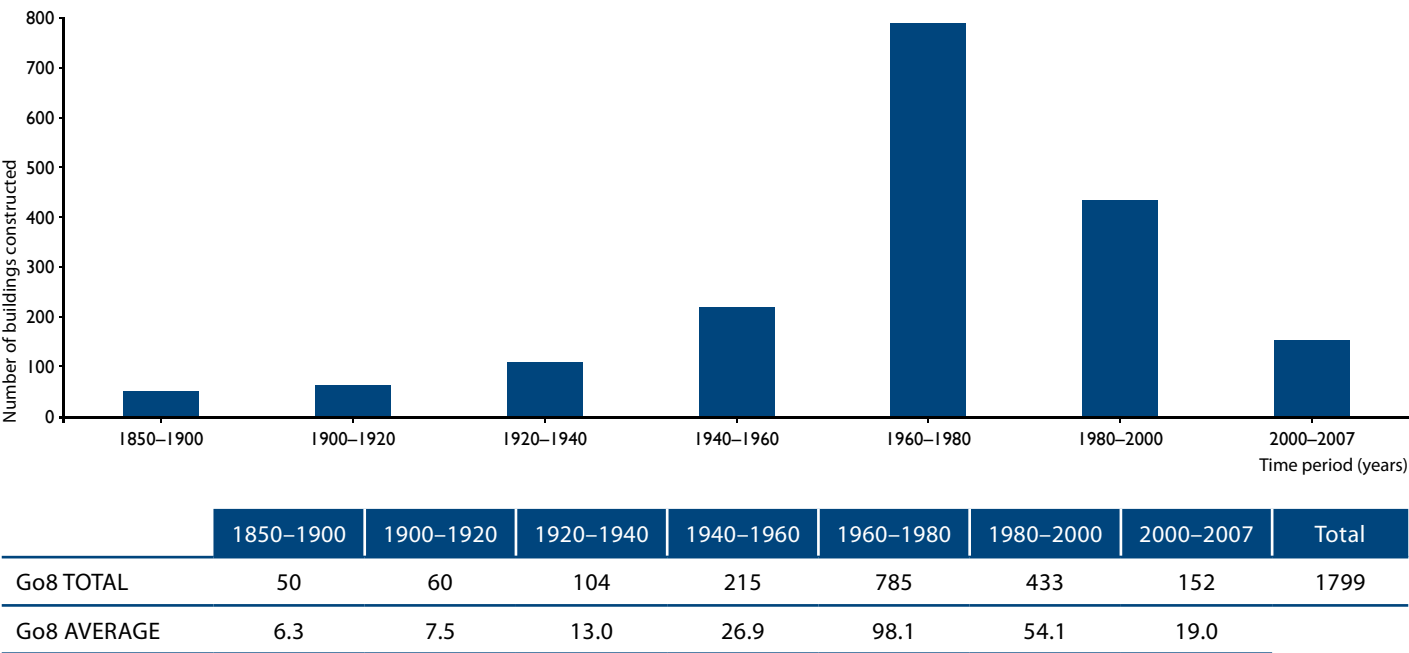
The various cost estimates contained in this report should not, therefore, be considered definitive, but as indicative estimates and pointers to trends, and areas where further analysis may be required to assess actual status.

APPENDIX 1: SURVEY DATA IN AGGREGATE

Buildings

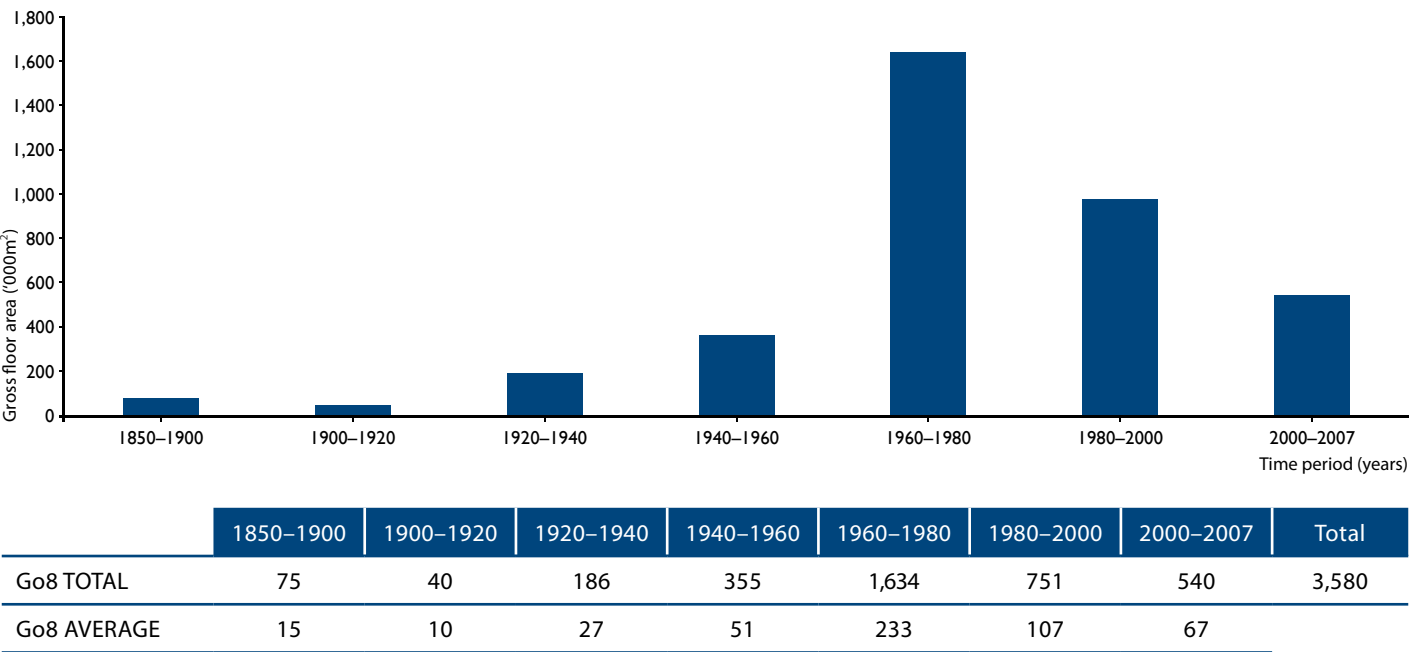
Note: Go8 universities were formally established in the following years: Sydney 1850, UniMelb 1855, Adelaide 1874, UQ 1910, UWA 1911, ANU 1946, UNSW 1949, Monash 1958.

Figure 1. Number of buildings completed during each broad time period 1850–2007



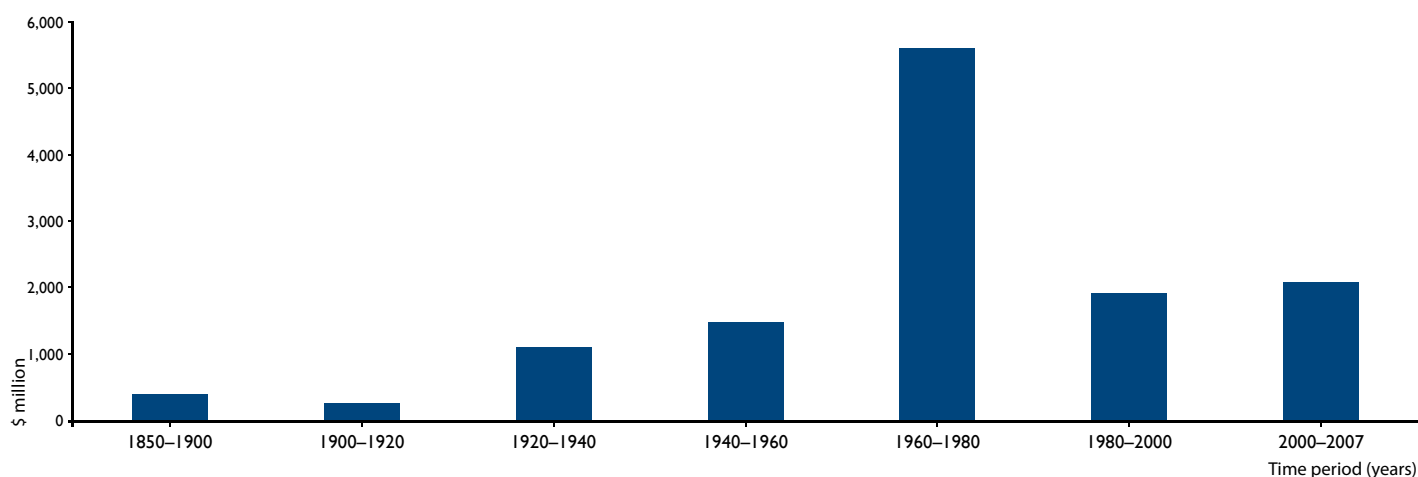
Source: Survey question 2.1

Figure 2. Gross Floor Area of buildings completed during each broad time period 1850–2007 ('000m²)



Source: Survey question 2.1

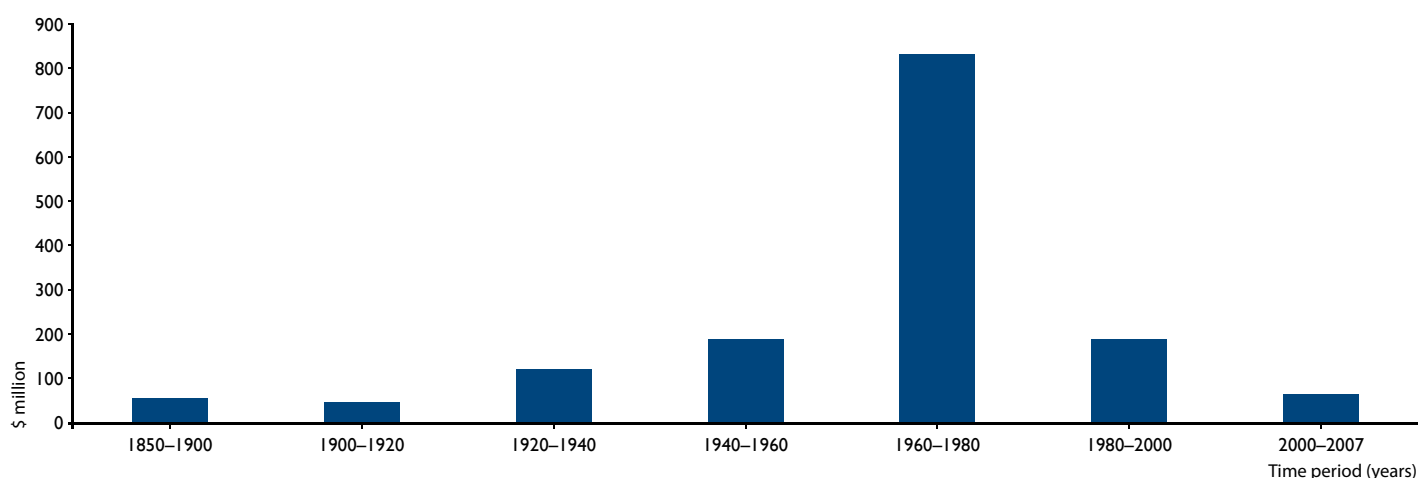
Figure 3. Asset Replacement Value of buildings completed during each broad time period 1850–2007 (\$m)



	1850–1900	1900–1920	1920–1940	1940–1960	1960–1980	1980–2000	2000–2007	Total
Go8 TOTAL	392	237	1094	1460	5604	1892	2059	12,739
Go8 AVERAGE	78	47	137	183	700	236	257	

Source: Survey question 2.1

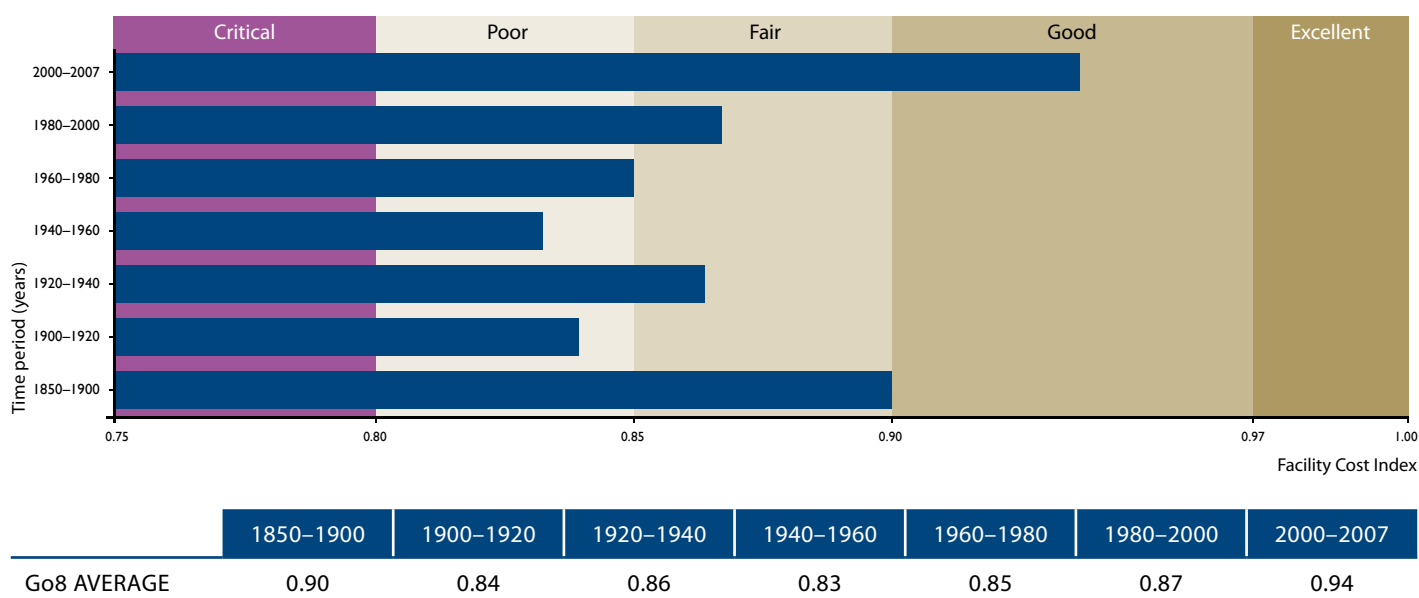
Figure 4. Backlog Maintenance of buildings completed during each broad time period 1850–2007 (\$m)



	1850–1900	1900–1920	1920–1940	1940–1960	1960–1980	1980–2000	2000–2007	Total
Go8 TOTAL	53	45	120	187	831	189	64	1,490
Go8 AVERAGE	11	9	15	23	104	24	8	

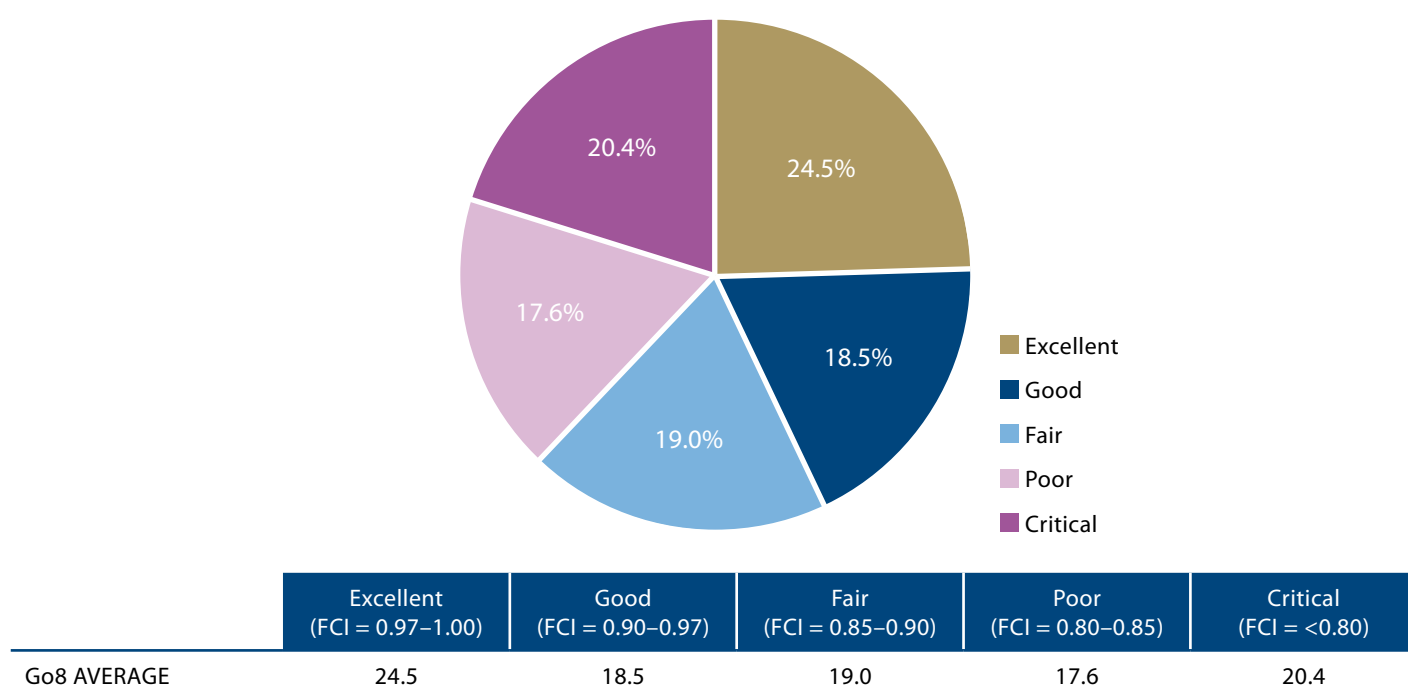
Source: Survey question 2.1

Figure 5. Average Facility Cost Index of buildings completed during each broad time period 1850–2007 (0.0–1.0)



Source: Survey question 2.1

Figure 6. Proportions of all Go8 building infrastructure rated Excellent, Good, Fair, Poor & Critical



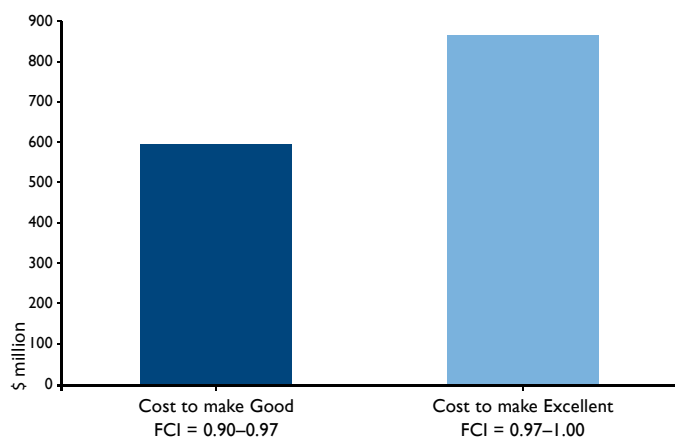
Source: Survey question 2.3

Facility Cost Index rating definitions

FCI	0.97–1.00	Rating	Excellent
At the start of its service life, fully functional, compliant with all current building standards, no Backlog Maintenance.			
FCI	0.90–0.97	Rating	Good
In the second quarter of its service life, functional, compliant with most current building standards, limited Backlog Maintenance.			
FCI	0.85–0.90	Rating	Fair
Half way through its service life, serviceable, compliant with some current building standards, manageable Backlog Maintenance.			

FCI	0.80–0.85	Rating	Poor
Near the end of its service life, limited functionality, does not comply with most current building standards, substantial Backlog Maintenance.			
FCI	<0.80	Rating	Critical
At the end or past its service life, unfit for its original purpose, does not comply with most current building standards, requires complete refurbishment or replacement.			

Figure 7. Cost estimates to make Good or Excellent all buildings rated Critical (\$m)



Cost estimates to make Good all buildings rated Critical (\$m)

University	Cost (\$m)
TOTAL	591.6
Go8 AVERAGE	74.0

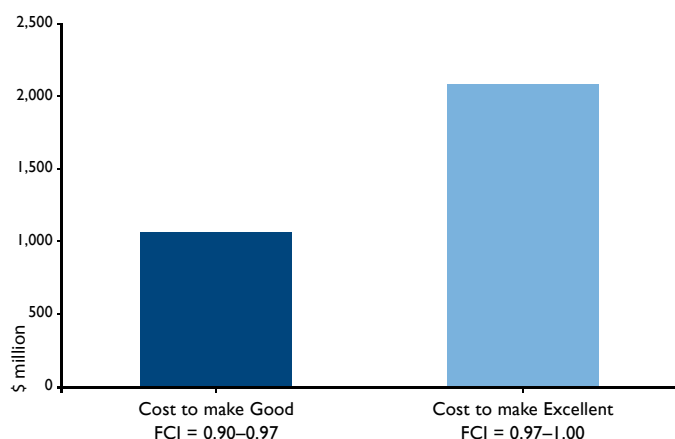
Source: Survey question 2.5.1

Cost estimates to make Excellent all buildings rated Critical (\$m)

University	Cost (\$m)
TOTAL	864.9
Go8 AVERAGE	108.1

Source: Survey question 2.5.2

Figure 8. Cost estimates to make Good or Excellent all buildings rated Poor & Fair (\$m)



Cost estimates to make Good all buildings rated Poor & Fair (\$m)

University	Cost (\$m)
TOTAL	1,066.8
Go8 AVERAGE	133.3

Source: Survey question 2.6.1

Cost estimates to make Excellent all buildings rated Poor & Fair (\$m)

University	Cost (\$m)
TOTAL	2,089.9
Go8 AVERAGE	261.2

Source: Survey question 2.6.2

Figure 9. Proportion of all buildings considered unlikely to comply with modern building standards (%)

	%
Go8 AVERAGE	61.6

Source: Survey question 2.7.1

Figure 10. Cost estimates to achieve compliance with modern building standards (\$m)

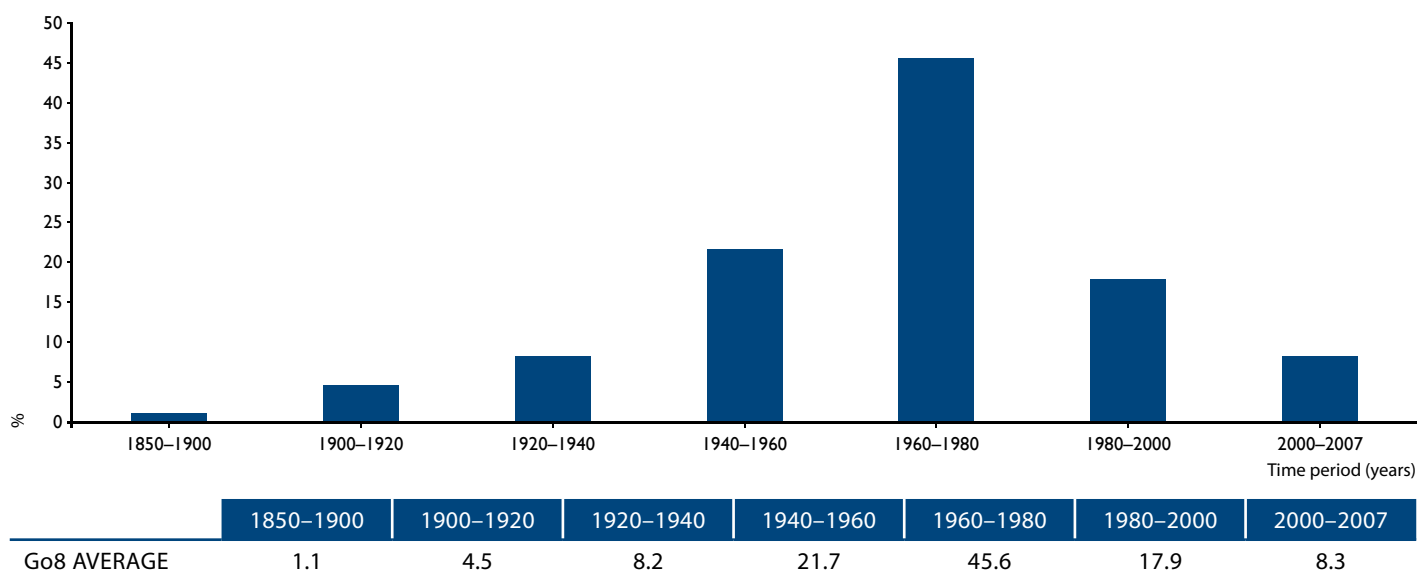
	Cost (\$m)
Go8 TOTAL	788.3
Go8 AVERAGE	112.6

Source: Survey question 2.7.2

Note: Seven institutions only provided estimates for survey questions 2.7.1 & 2.7.2

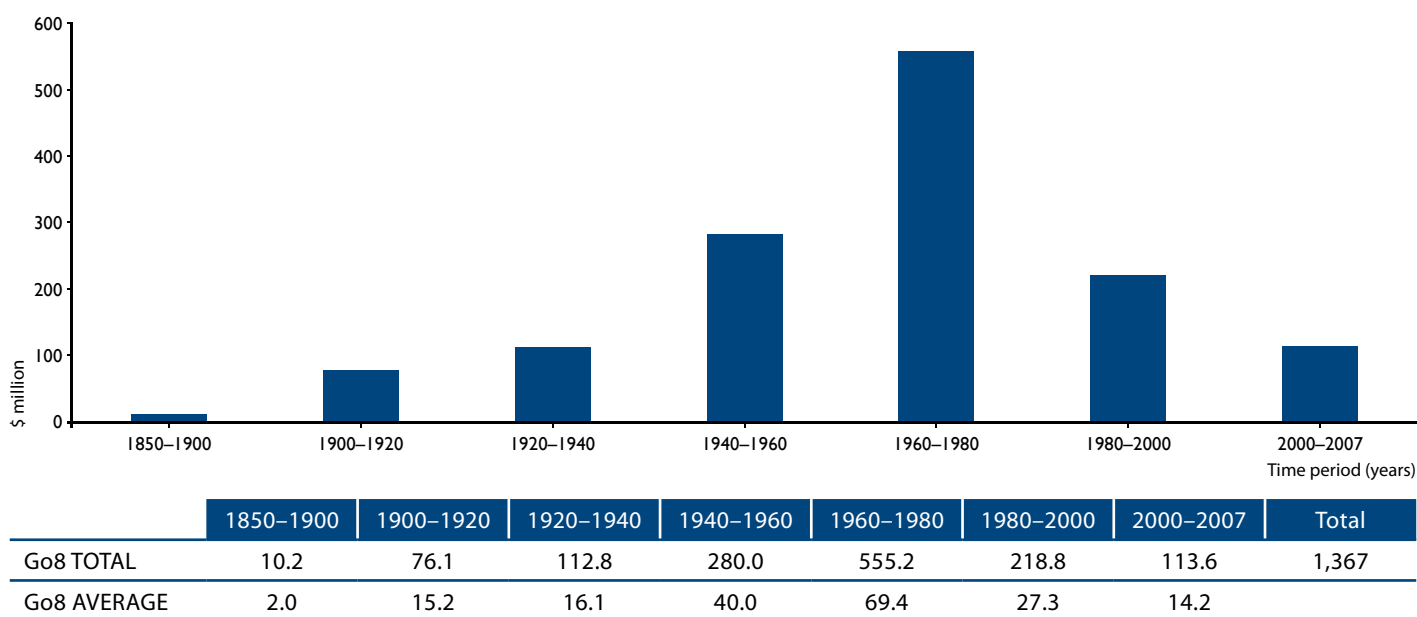
Non-building support infrastructure (electrical, gas, sewerage, stormwater etc but not communications infrastructure)

Figure 11. Proportions of all non-building support infrastructure completed during each broad time period 1850–2007 (%)



Source: Survey question 3.1

Figure 12. Asset Replacement Value and estimated Backlog Maintenance liabilities of all non-building support infrastructure completed during each broad time period 1850–2007 (\$m)



Source: Survey question 3.1

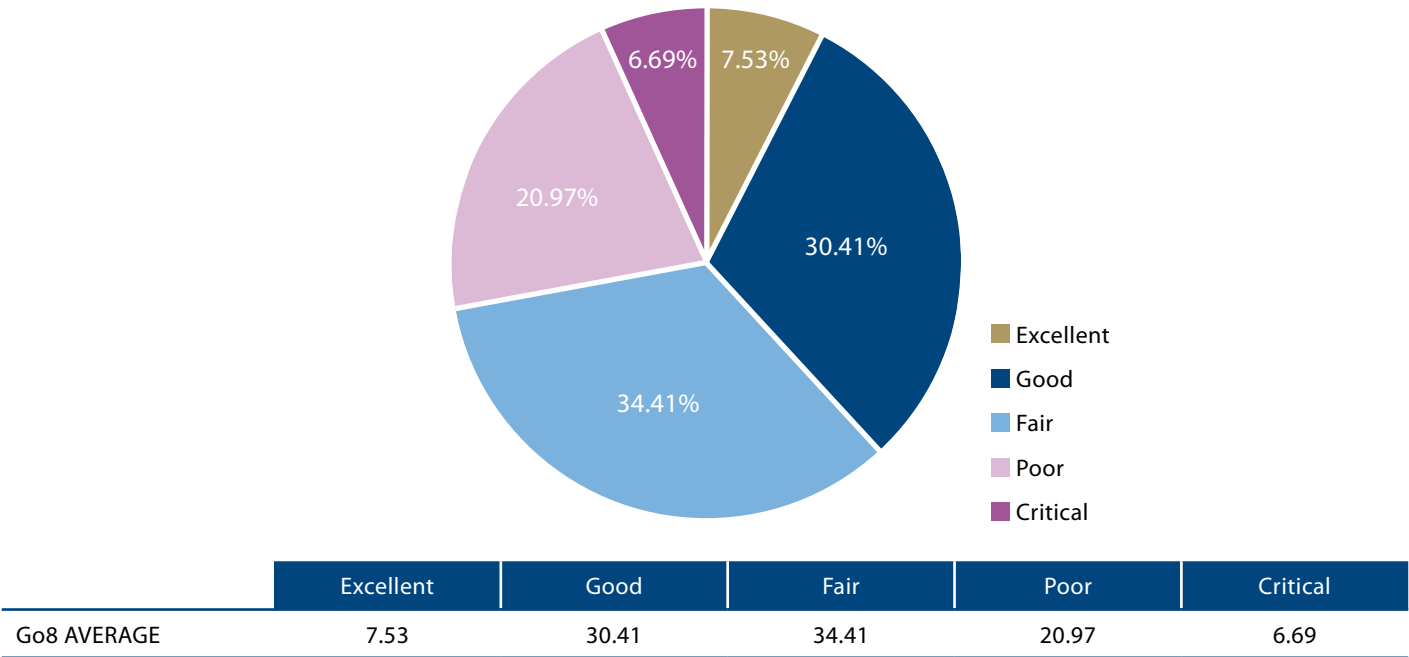
Backlog Maintenance of all non-building support infrastructure completed during each broad time period 1850–2007 (\$m)

	1850–1900	1900–1920	1920–1940	1940–1960	1960–1980	1980–2000	2000–2007	Total
Go8 TOTAL	0.49	11.0	26.4	62.4	107.7	32.4	15.0	255.4
Go8 AVERAGE	0.1	2.2	4.4	8.9	13.5	4.6	2.1	

Source: Survey question 3.1

Note: Not all universities were able to provide Backlog Maintenance estimates for all time periods.

Figure 13. Proportions of all non-building support infrastructure rated Excellent, Good, Fair, Poor & Critical in terms of fitness for purpose (% in each category)



Source: Survey question 3.2

Figure 14. Cost estimates to make Good all non-building support infrastructure rated Critical (\$m)

	Cost (\$m)
TOTAL	53.9
Go8 AVERAGE	6.7

Source: Survey question 3.4.1

Figure 15. Cost estimates to make Excellent all non-building support infrastructure rated Critical (\$m)

	Cost (\$m)
TOTAL	96.4
Go8 AVERAGE	12.0

Source: Survey question 3.4.2

Figure 16. Cost estimates to make Good all non-building support infrastructure rated Poor or Fair (\$m)

	Cost (\$m)
TOTAL	140.1
Go8 AVERAGE	17.5

Source: Survey question 3.5.1

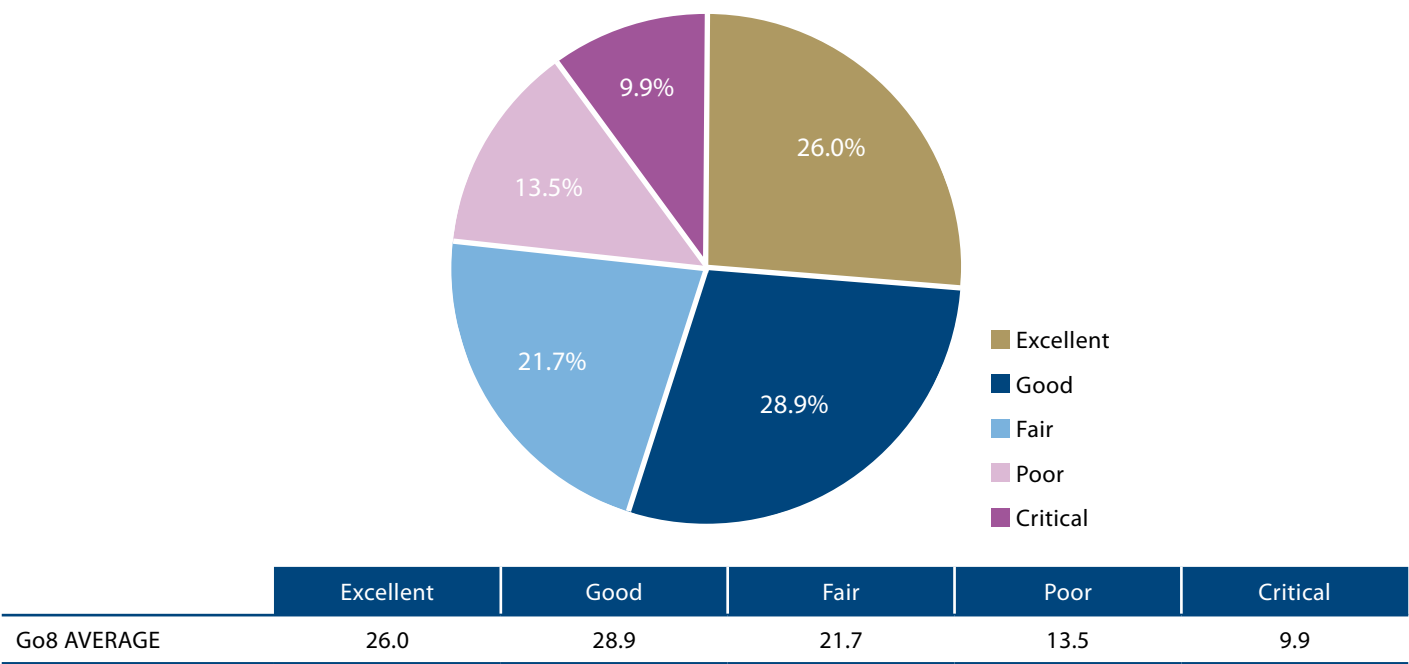
Figure 17. Cost estimates to make Excellent all non-building support infrastructure rated Poor or Fair (\$m)

	Cost (\$m)
TOTAL	324.8
Go8 AVERAGE	40.6

Source: Survey question 3.5.2

Communications infrastructure

Figure 18. Proportions of all communications infrastructure rated Excellent, Good, Fair, Poor & Critical in terms of fitness for purpose (% in each category)



Source: Survey question 4.1

Figure 19. Cost estimates to make Good all communications infrastructure rated Critical (\$m)

	Cost (\$m)
Go8 TOTAL	51.9
Go8 AVERAGE	8.6

Source: Survey question 4.3.1

Figure 20. Cost estimates to make Excellent all communications infrastructure rated Critical (\$m)

	Cost (\$m)
Go8 TOTAL	73.4
Go8 AVERAGE	12.2

Source: Survey question 4.3.2

Figure 21. Cost estimates to make Good all communications infrastructure rated Poor or Fair (\$m)

	Cost (\$m)
Go8 TOTAL	57.0
Go8 AVERAGE	8.1

Source: Survey question 4.4.1

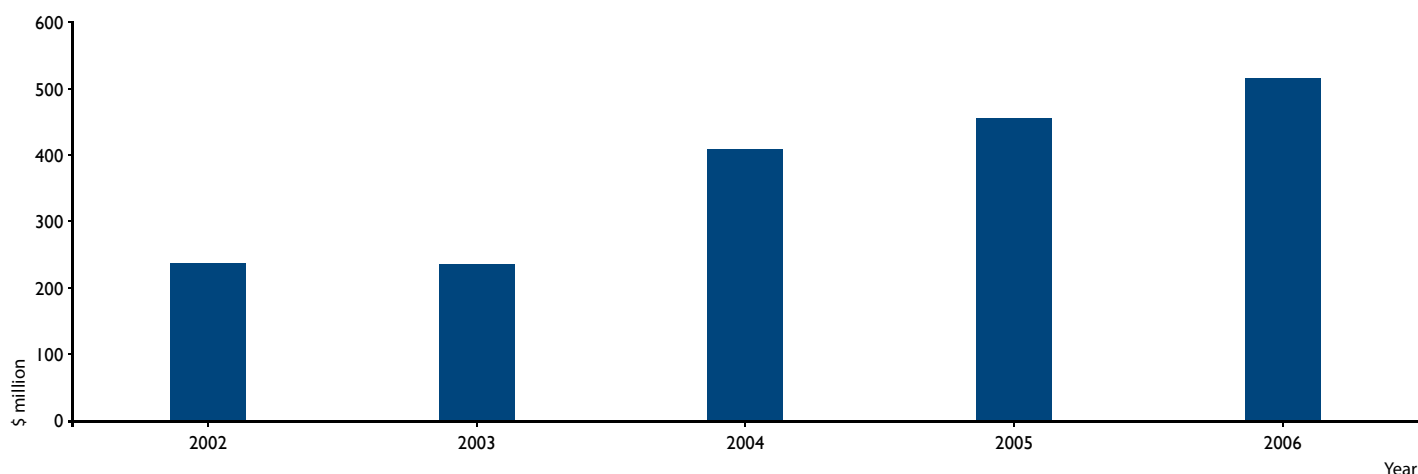
Figure 22. Cost estimates to make Excellent all communications infrastructure rated Poor or Fair (\$m)

	Cost (\$m)
Go8 TOTAL	105.4
Go8 AVERAGE	15.1

Source: Survey question 4.4.2

New capital works

Figure 23. Go8 new capital works expenditure 2002–2006 (\$m)



	2002	2003	2004	2005	2006	Total
Go8 TOTAL	239.1	235.9	408.9	455.0	515.3	1,854
Go8 AVERAGE	29.9	29.5	51.1	56.9	64.4	

Source: Survey question 5.1.1

Figure 24. New capital works expenditure funding shortfall estimate 2002–2006

	Shortfall (\$m)
Go8 TOTAL	1,153.7
Go8 AVERAGE	164.8

Source: Survey question 5.2

Note: Seven institutions only provided estimates for survey question 5.2.

Figure 25. Estimates of anticipated funding shortfall for essential maintenance costs expected over the next five years 2008–2012 (\$m)

	Shortfall (\$m)
Go8 TOTAL	508.3
Go8 AVERAGE	63.5

Source: Survey question 6.3.1

Figure 26. Estimates of anticipated funding shortfall for essential refurbishment costs expected over the next five years 2008–2012 (\$m)

	Shortfall (\$m)
Go8 TOTAL	1,639.4
Go8 AVERAGE	204.9

Source: Survey question 6.3.2

Figure 27. Estimates of anticipated funding shortfall for essential new capital works anticipated over the next five years 2008–2012 (\$m)

	Shortfall (\$m)
Go8 TOTAL	1,436.8
Go8 AVERAGE	179.6

Source: Survey question 6.3.3

Figure 28. Estimates of anticipated funding shortfall for new capital works, which while not essential, are seen as necessary to allow the institution to achieve its strategic objectives over the next five years 2008–2012 (\$m)

	Shortfall (\$m)
Go8 TOTAL	2,141.9
Go8 AVERAGE	267.7

Source: Survey question 6.3.4

APPENDIX 2: TEFMA DEFINITIONS

TERM	Asset Replacement Value (Buildings)	Abbreviation	ARV	Unit	\$
	<p>The Asset Replacement Value for buildings, fixed equipment, services and systems is the best estimate of current costs of designing, constructing & equipping for its original use, a new facility providing equal service potential as the original asset & which meets currently accepted standards of construction & also complies with all contemporary environmental & other regulatory requirements. ARV of student housing should be excluded from building ARV. The cost shall include the costs of all building services and associated plant, finishes and built-in furniture but not the cost of relocating into the building (Note: excludes the cost of loose furniture and soft furnishings). The cost excludes all equipment other than that required for the normal functioning of the building. Costs associated with laboratory, scientific and loose equipment are not included in the cost. The cost includes all fees, approvals and other incidental expenditure associated with construction and initial occupation but excludes those costs normally included in the Insured Value such as demolition, site clearing and the provision of temporary accommodation.</p>				

TERM	Asset Replacement Value (Infrastructure)	Abbreviation	ARV	Unit	\$
	<p>Infrastructure is defined as the in-ground services (ie water, gas, sewerage, stormwater, etc) which support normal building operations plus above ground external assets such as street-lighting, roads and footpaths, signage etc. Do not include infrastructure that is maintained from landscaping/grounds budgets (eg sports fields, soft landscaping, unsealed carparks and the like or infrastructure associated with student housing).</p>				

TERM	Backlog Maintenance	Abbreviation	BM	Unit	\$
	<p>Maintenance that is necessary to prevent the deterioration of the asset or its function but which has not been carried out.</p>				

TERM	Gross Floor Area	Abbreviation	GFA	Unit	m ²
	<p>The sum of the Fully Enclosed Covered Area (FECA) and the Unenclosed Covered Area (UCA) of a building in square metres. $GFA = FECA + UCA (m^2)$. Note: Includes all spaces owned or used by the university for university purposes. Do not include space held for investment purposes or non-university purposes (eg investment real estate, shopping centres, technology parks [where the tenants rent space for research activities not related to the institution's teaching and research activities. If you share technology park facilities with commercial tenants you may choose to include your space on a pro-rata basis provided you include the commensurate operating costs]). As a general rule, space leased to others should not be excluded unless it is associated with the primary functions of the university. Therefore, include spaces leased to banks, post offices, cafes, bookshops, newsagents, hairdressers, food outlets, etc if the primary function of these commercial operations is to support teaching, research and the community service obligations of institutions.</p> <p>FECA. Fully Enclosed Covered Area is the sum of all fully enclosed covered areas at all building levels, including basements (except unexcavated portions), floored roof spaces and attics, garages, penthouses, enclosed porches and attached covered ways alongside buildings, equipment rooms, lift shafts, vertical ducts, staircases and any other fully enclosed spaces and useable areas of the building, computed by measuring from the normal inside face of exterior walls but ignoring any projections such as plinths, columns, piers and the like which project from the normal inside face of exterior walls. It shall not include open courts, light wells, connecting or isolated</p>				

covered ways and net open areas of upper portions of rooms, lobbies, halls, interstitial spaces and the like, which extend through the storey being computed. Note: atriums and light wells are only measured at the base level. Do not include the area of the non-existent floor slab at upper level.

UCA. Unenclosed Covered Area is the sum of all such areas at all building floor levels, including roofed balconies, open verandahs, porches and porticos, attached open covered ways alongside buildings, undercrofts and useable space under buildings, unenclosed access galleries (including ground floor) and any other trafficable covered areas of the building which are not totally enclosed by full height walls, computed by measuring the area between the enclosing walls or balustrade (ie from the inside face of the UCA excluding the wall or balustrade thickness). When the covering element (ie roof or upper floor) is supported by columns, is cantilevered or is suspended, or any combination of these, the measurement shall be taken to the edge of the paving or the edge of the cover, whichever is the lesser. UCA shall not include eaves, overhangs, sun shading, awnings and the like where these do not relate to clearly defined trafficable covered areas, nor shall it include connecting or isolated covered ways. Unit of measurement is(m² GFA) and New Building space that comes into service during the reporting period should be included.

TERM	Facility Cost Index	Abbreviation	FCI	Unit	Index
The FCI is the current condition of the Asset measured relative to its as-new condition. The FCI is determined by the formula: $FCI = 1 - (BM / ARV)$. For the purpose of the Go8 survey the following FCI categories have been used:					
Excellent = 0.97–1.00					
Good = 0.90–0.97					
Fair = 0.85–0.90					
Poor = 0.80–0.85					
Critical = less than 0.80					

TERM	Facility Functionality Index	Abbreviation	FFI	Unit	Index
The FFI is a measure of the extent to which an institution’s facilities meet current teaching, research and legislative requirements. The FFI is determined by the following formula: $FFI = 1 - (Backlog\ liabilities - BM) / ARV$. Backlog liabilities = Backlog Maintenance, Backlog Refurbishment (non-statutory), Backlog Refurbishment (statutory), Backlog Access Works and other Backlog Works.					

Source: Tertiary Education Facilities Management Association (2007), *2006 Benchmark Report*.



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