THE SIGNIFICANCE OF INFRASTRUCTURE IN AUSTRALIAN INVESTMENT PORTFOLIOS

HSU WEN PENG and GRAEME NEWELL
University of Western Sydney

ABSTRACT

Infrastructure has taken on increased investment importance in recent years with the growth in listed and unlisted infrastructure funds, and increased interest in infrastructure as an asset class by superannuation funds. In addition to the traditional listed infrastructure companies, a number of major institutional investors in Australia have become increasingly involved in infrastructure funds; this includes Macquarie, AMP, Babcock and Brown, Hastings and James Fielding. The purpose of this paper is to assess the significance of these infrastructure funds in Australia; particularly highlighting the leading infrastructure funds, types of infrastructure investment and superannuation fund investment in infrastructure. The investment characteristics and performance of infrastructure over 1995-2006 will also be assessed, as well as the potential role of infrastructure in portfolios. Strong performance has been shown by the infrastructure sectors, as well as providing diversification benefits in a portfolio; with infrastructure volatility having reduced in more recent years as the sector has matured.

Keywords: Infrastructure, listed infrastructure, unlisted infrastructure, performance analysis, investment characteristics

INTRODUCTION

Infrastructure has taken on increased investment importance in recent years in Australia and internationally; particularly with institutional investors (via listed and unlisted funds) and with the capital flows from superannuation funds seeking exposure to alternate assets for enhanced performance and diversification benefits. Previously, the asset allocation for infrastructure by many institutional investors and superannuation funds was seen as part of their property allocation. However, recent years have seen significant growth and maturity in the infrastructure sector; such that it is now considered to be a property-related, but separate asset class. This now sees many institutional investors and superannuation funds having a unique and separate asset allocation to infrastructure and the infrastructure sub-sectors.

Given this increased importance of infrastructure as an asset class, the purpose of this paper is to assess the significance of the infrastructure sectors in investment portfolios in Australia, as well as analysing the risk-adjusted performance and portfolio diversification

benefits provided by listed and unlisted infrastructure in a mixed-asset portfolio over Q3:1995 – Q2:2006. Sub-period analyses will assess the changing dynamics of infrastructure performance in Australia, as well as the relationship between the characteristics of property investment and infrastructure investment.

SIGNIFICANCE OF INFRASTRUCTURE

Infrastructure can be classified into economic infrastructure (eg: utilities, toll roads, airports, pipelines, power stations and wind farms) and social infrastructure (eg: healthcare facilities, education facilities and correctional facilities) (RREEF, 2005), with infrastructure having taken on an increased role in investment portfolios in recent years (Kolikias, 2004; Blundell, 2006).

In particular, infrastructure provides some similar investment characteristics to property investment; however, infrastructure also has some significance differences, suggesting it should be treated separately as an asset sector (O'Sullivan, 2005; RREEF, 2005; Blundell, 2006). Table 1 compares the characteristics of infrastructure investment and property investment.

Furthermore, institutional investors have clearly identified the investment characteristics of infrastructure (Mercer, 2005; UBS, 2006; RREEF, 2005); these investment characteristics for infrastructure investment include:

- monopoly characteristics,
- captive customer base,
- predictable earnings and cash flow via regulation and/or long-term contracts,
- high operating margins,
- low volatility of cash-flows,
- high probability of distributions,
- low correlation of returns versus other asset classes,
- long asset life,
- large investment scale.

Table 1: The characteristics of infrastructure and property investments

Characteristics	Infrastructure	Property
Typical investment size	▪ Substantial	▪ Varied
Competition	▪ High competition for quality assets	▪ High competition for quality assets
Asset availability	▪ Asset scarcity; many in unique, monopoly situations	▪ Moderate to deep volumes in most markets
Acquisition dynamic	▪ Competitive tenders, regulatory, environmental, social and political issues, often held for the long term	▪ Competitive tenders, environmental and social issues common
Liquidity	▪ Varied, depending on investment vehicle	▪ Varied, depending on investment vehicle
Debt levels	▪ High	▪ Varied, depending on type of fund
Political risk	▪ Moderate	▪ Low, except if international property included in portfolio

Source: RREEF (2005)

With these unique and attractive characteristics of infrastructure, recent years have seen increased interest given to infrastructure investment (eg: Macquarie Infrastructure Group, Macquarie Airports, Babcock and Brown Infrastructure Group, SP AusNet and Alinta Infrastructure Holdings), as investors seek income-oriented returns and diversification benefits (Blundell, 2005, 2006; DB RREEF, 2005).

With over $1 trillion in funds (APRA, 2007), the rapidly expanding superannuation sector in Australia is one of the key factors which has driven significant increases in capital flowing into the investment markets. Infrastructure investment by superannuation funds accounted for approximately 2% of total fund assets with $8 billion in 2002. By 2012, investment in infrastructure is expected to increase to $65 billion, accounting for 5% of

total superannuation fund assets (Nielson, 2005). Infrastructure has provided a long-term life cycle that matches the demand of investments from superannuation funds. This has seen a number of major industry-based superannuation funds become increasingly involved in infrastructure fund investment, such as MTAA Super Fund (18% of portfolio, with $820 million in assets in infrastructure), WESTSCHEME (12% of portfolio; $170 million), STAsuper (8% of portfolio; $560 million), UniSuper (6% of portfolio; $950 million) and HOSTPLUS (4% of portfolio; $120 million).

In addition to the increasing capital inflow from superannuation funds, the increased interest for investing in infrastructure is also driven by other factors, such as the budgetary pressures on governments to reduce infrastructure spending (Mercer, 2005; RREEF, 2005; McCarthy, 2006). In particular, the Australian government has reduced total spending on infrastructure from around 14% in 1970 to 5% in 2005 (Mercer, 2005).

Currently, except for direct investment in infrastructure projects, there are three major infrastructure investment vehicles in Australia; namely listed infrastructure funds, listed infrastructure companies and unlisted infrastructure funds. Total infrastructure assets under private management currently are approximately $83 billion (listed infrastructure funds: $52 billion; listed infrastructure companies: $27 billion; unlisted infrastructure funds: $4 billion), with more than 290 infrastructure assets (not adjusting for overlap) (Mercer, 2005; ASX 2006a,b; UBS, 2006). Major institutional players in infrastructure investment in Australia include Macquarie, AMP, Babcock & Brown, Colonial First State and James Fielding.

However, despite this increased interest in infrastructure investment, only limited research (e.g. Mercer, 2005; RREEF, 2005, 2006a, 2006b; UBS, 2006) regarding infrastructure investment has been conducted. As such, the purpose of this paper is to rigorously assess the significance of the infrastructure sector in investment portfolios in Australia; particularly highlighting issues such as the current portfolio levels and the leading infrastructure entities in the infrastructure sector. A listed infrastructure performance index (and sub-indices) is utilised, together with an unlisted infrastructure index and other asset class indices to assess the risk-adjusted performance of infrastructure over Q3:1995-Q2:2006, as well as the portfolio diversification benefits of the infrastructure sectors being assessed.

METHODOLOGY

Infrastructure sector profile

Listed infrastructure funds and companies were identified from ASX (2006a, b), as well as from UBS (2006), recent annual reports and product disclosure statements (PDS). With the infrastructure category of UBS (2006), details determined for each listed infrastructure fund or company were infrastructure sector, year listed, infrastructure type, total assets, number of infrastructure assets and activities. This resulted in 32 listed infrastructure

entities being identified across eight infrastructure sectors including toll roads (5 entities), transmission and distribution (9 entities), integrated utilities (3 entities), airports (2 entities), communication (1 entity), diversified utilities (1 entity) and generation (11 entities).

Unlisted infrastructure fund information was also obtained for seventeen unlisted infrastructure funds from Mercer (2005), as well as from the internet, PDS and annual reports. Details determined per unlisted infrastructure fund were infrastructure sector, fund manager, year established, total assets, number of infrastructure assets and activities.

Infrastructure sector performance analysis

Total returns were obtained for the listed infrastructure funds and companies for Q3:1995-Q2:2006 from UBS. Due to the size and relative maturity of the infrastructure sector, UBS also provides infrastructure sub-sector indices (consisting of the toll roads, airports, ports, rail, communication and diversified infrastructure sub-sectors) and a utility sub-sector index (consisting of integrated utilities, integrated regulated utilities, transmission and distribution, generation, water and diversified utilities sub-sectors). Three infrastructure series were used as the proxy of listed infrastructure sector performance in this study; namely composite infrastructure (including infrastructure and utilities), infrastructure and utilities.

To assess the performance and diversification benefits of unlisted infrastructure, an average-weighted index[(1)] was established using five major unlisted infrastructure fund series available from Mercer over the same time period as the listed infrastructure indices; these five major unlisted infrastructure funds include AMP Infrastructure Equity Fund, CFS Wholesale Infrastructure Income Fund, Perpetual Diversified Infrastructure Fund, Hastings Infrastructure Fund and Hastings Utilities Trust of Australia. This is a valuation-based performance index, similar to the Mercer unlisted property index.

The risk-adjusted performance analysis for the infrastructure sectors was carried out and compared to the other property sectors (ie: direct property and LPTs) and financial assets (ie: stocks and bonds). For this comparison with the other major asset classes, the following performance series were used:

- Direct property: Australian Composite Property (PCA/IPD, 2006)
- Stocks: ASX All Ordinaries
- Bonds: CBA bonds (All Maturities)
- Cash: 90-day bills
- Inflation: adjusted CPI.

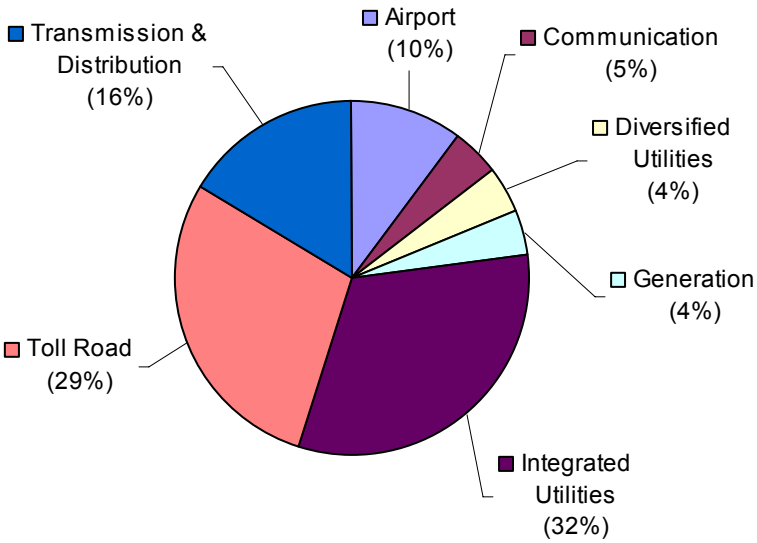
[1] *Resulting unlisted infrastructure index is unweighted not market cap or asset weighted.*

INFRASTRUCTURE PROFILE

Listed infrastructure

Infrastructure investment has experienced significance growth in recent years and has been a strongly performed asset class. The rapid growth is evidenced by the listed infrastructure funds, with market capitalisation of only $5 million in 1997, increasing to $27 billion in 2006. Currently, there are 16 infrastructure funds listed on the ASX, with 16 listed infrastructure companies; accounting for approximately $55 billion in market capitalisation. The following section provides an updated profile of the infrastructure sectors at August 2006, with Figure 1 giving the respective infrastructure sub-sector contributions to the overall listed infrastructure sector market capitalisation.

Figure 1: Listed infrastructure entity capitalisation split



- *Toll roads*

Five toll road infrastructure entities including two infrastructure funds and three infrastructure companies with $16 billion, accounting for 29% in market capitalisation of the infrastructure sector, are currently listed on the ASX. With $22 billion in assets across 20 assets (not adjusting for overlap), local motorways have seen most interest from these listed toll road infrastructure players, such as Macquarie Infrastructure Group (investing in M1, M2, M4, M5 and M7 tollways in Sydney), Transurban (investing in M2, M7 and City Link), Sydney Roads Group (investing in M4 and M5), as well as Connecteast Group (investing in EastLink project in Melbourne). Also, the Macquarie Infrastructure Group with $12.4 billion in asset value has been actively involved in offshore transportation

infrastructure, accounting for 74% in asset value of its portfolio in Canada, US, UK, Germany and Portugal into its infrastructure portfolio. Table 2 lists the various listed infrastructure funds and companies in this toll roads sub-sector, including details of their specific activities and infrastructure assets.

- *Airports*

Two airport funds are currently listed on the ASX; namely Macquarie Airports with $9.5 billion in asset value and Australian Infrastructure Fund with $850 million, accounting for 10% of the infrastructure sector with $5.7 billion in market capitalisation. The underlying assets in these two infrastructure funds have seen significant globalisation. Within the sixteen assets with more than $10 billion in asset value, eight offshore international airports were held in these two airport funds; particularly concentrating in European markets such as UK, Denmark, Belgium, Italy, Germany and Greece. Table 2 lists the two airport funds in this airports sub-sector, including details of their specific activities and infrastructure assets.

- *Communication*

Communication infrastructure is defined as a concession, lease or freehold of communications infrastructure, such as broadcasting or mobile phone towers, satellites, fibre optic and copper cables (UBS, 2006). Only one communication infrastructure fund with $2.5 billion in market capitalisation is listed on the ASX; namely Macquarie Communications Infrastructure Group, operating broadcast businesses and infrastructure assets of $4.6 billion in the UK and Australia. Table 2 lists details of the specific activities and infrastructure assets of the Macquarie Communications Infrastructure Group.

- *Integrated utilities*

The integrated utility sector is characterised by operating a vertically integrated utilities business that is more exposed to competitive markets. The industry chain could include energy generation, distribution, transmission and retailing (UBS, 2006). The integrated utility sector is the biggest portion of the listed infrastructure market capitalisation, accounting for 32% of the infrastructure sector with $17 billion. Three integrated utility infrastructure companies, namely Origin Energy (total assets: $8.0 billion), Alinta Limited (total assets: $3.5 billion) and AGL (total assets: $3.3 billion) with $15 billion in total assets are currently listed on the ASX. Particularly, these three infrastructure companies have operated generation and transmission of electricity and gas, as well as doing energy retailing business in Australia. Table 2 lists the various listed infrastructure funds and companies in this integrated utilities sub-sector, including details of their specific activities and infrastructure assets.

- *Transmission & distribution*

The transmission and distribution sector is defined as involving utility businesses that are predominantly exposed to transmission and distribution assets (UBS, 2006). Nine

transmission and distribution infrastructure entities, including seven infrastructure funds and two infrastructure companies, with $9 billion in market capitalisation are currently listed on the ASX. Thirty-nine infrastructure assets with about $20 billion in asset value are held by these infrastructure entities operating the transmission and distribution of gas and electricity in local and offshore markets. SP AusNet and DEUT are the first two largest entities in this transmission and distribution sub-sector, accounting for the majority in asset value ($7.0 billion and $5.8 billion respectively). Table 2 lists the various listed infrastructure funds and companies in this transmission and distribution sub-sector, including details of their specific activities and infrastructure assets.

- *Diversified utilities*

The diversified utilities sector is defined as a portfolio of unrelated utility assets of a business that does not fit into any of other utility sub-sectors (UBS, 2006). Only one listed infrastructure fund, namely the Babcock and Brown Infrastructure Group with $3.0 billion in asset value is classified into the diversified utility sector. The Babcock and Brown Infrastructure Group, with $2.3 billion in market capitalisation, invests in various infrastructure assets across energy-related businesses and seaports. Table 2 lists details of the specific activities and infrastructure assets of the Babcock and Brown Infrastructure Group.

- *Generation*

The generation sector is defined as the generation of electricity, as well as renewable energy (UBS, 2006). With the rapid increase in oil prices, renewable energy is expected to be one of the best solutions and experience high future demand. This has seen eight renewable energy generators listing on the ASX such as Babcock and Brown Wind Partners Group with $1.1 billion in asset value. The generation sector currently consists of eleven listed infrastructure entities with $2.2 billion in market capitalisation, including three infrastructure funds and eight infrastructure companies. While the infrastructure sub-sector has the most entities, the generation sector has only held $2.6 billion in asset value with 105 infrastructure assets due to their relatively small-scale infrastructure activities. Table 2 lists the various listed infrastructure funds and companies in this generation sub-sector, including details of their specific activities and infrastructure assets.

Unlisted infrastructure

Unlisted infrastructure funds provide an alternative infrastructure investment vehicle to listed infrastructure funds and listed infrastructure companies. Typically, most retail investors seek small exposure to infrastructure through listed infrastructure funds and companies, such as Macquarie, AGL, Hastings and Transurban. Larger investors, such as institutional investors and superannuation funds, acquire more sizeable exposure to infrastructure through unlisted infrastructure funds via major infrastructure fund managers such as AMP Capital, ANZ Infrastructure Services, Industry Funds Management and James Fielding (Mercer, 2005).

Table 3 presents the details of these seventeen major unlisted infrastructure funds. These seventeen unlisted infrastructure funds, with $4.5 billion in total asset value invest in 144 infrastructure assets across economic infrastructure (such as airports, toll roads, railways, energy facilities) and social infrastructure (such as healthcare facilities, correctional centres, university accommodation and carparks). Compared to the listed infrastructure entities, the underlying infrastructure assets of unlisted infrastructure funds present more diversity in infrastructure type, as well as smaller asset value. The largest one, Australia Infrastructure Fund, has $1.1 billion in asset value.

In total, across these listed and unlisted infrastructure funds, this sees over $83 billion in total assets being involved in these infrastructure sectors. Institutional investors such as Macquarie, Babcock and Brown, Hastings, AMP Capital, ANZ Infrastructure and James Fielding invest in a variety of infrastructure assets across energy generation, transmission, distribution, retailing, toll roads, airports, communication and social infrastructure to achieve enhanced returns and diversification benefits.

RESULTS AND DISCUSSION

Performance analysis

Table 4 presents the risk-adjusted performance analysis for the infrastructure sector over Q3:1995-Q2:2006, including listed composite infrastructure, the infrastructure and utilities sub-sectors, toll roads, airports, unlisted infrastructure, direct property, LPTs, shares and bonds. Listed composite infrastructure (22.38% p.a.) gave the third highest return over this 11-year period, out-performing unlisted infrastructure (14.11% p.a.), LPTs (13.75% p.a.) and direct property (10.90% p.a.); also exceeding stocks (12.91% p.a.) and bonds (7.20% p.a.). In particular, the toll roads sub-sector contributed the highest annual return (25.65% p.a.) over this period while the listed infrastructure sub-sector had the second highest annual return (24.89% p.a.) and the utilities sub-sector had the fourth highest annual return (21.93% p.a.)[(2)]. In terms of total returns, except for the airport sub-sector with an 8.05% average annual return, the infrastructure sectors significantly out-performed property, shares and bonds during this 11-year period.

Higher returns for the infrastructure sectors also came with higher volatility; the volatility of listed composite infrastructure (16.03%) was above unlisted infrastructure (5.83%), as well as being significantly above the volatility for LPTs (7.92%), direct property (1.46%) and the stock market (10.97%) for this period. Similarly, the listed infrastructure sub-sectors came with higher volatility, particularly airports having the highest volatility of 30.67%.

[2] *Debt funding has a major impact on performance; particularly given the high debt levels employed by infrastructure funds.*

On a risk-adjusted performance basis (using the Sharpe index), unlisted infrastructure was seen to be the second best performing asset class, only exceeded by direct property.[3] Listed composite infrastructure gave the third best risk-adjusted performance, exceeding LPTs, stocks and bonds. In terms of the infrastructure sub-sectors, the utilities sub-sector out-performed the infrastructure sub-sector, toll roads and airports with the fourth best risk-adjusted performance.

[3] *Being valuation-based performance series with assets being valued less frequently, direct property and unlisted infrastructure have low risk levels reported; this impacts on their subsequent higher performance rankings on a risk-adjusted basis.*

Table 2: Listed infrastructure profile: August 2006

Infrastructure	Year Listed	Type	Total Assets	No. of Assets	Activities
Transmission & Distribution (9 entities @ $22.8 billion)					
SP AusNet	2005	Fund	$6,947M	3	Gas Distribution, Electricity Transmission and Distribution
Diversified Energy and Utility Trust	2004	Fund	$5,732M	4	Gas Transmission and Distribution, Electricity Distribution
Envestra Limited	1997	Company	$2,521M	5	Gas Transmission and Distribution
Spark Infrastructure	2005	Fund	$2,395M	3	Electricity Distribution
Alinta Infrastructure Holdings	2005	Fund	$2,300M	9	Gas Transmission, Power Station
GasNet Australia Group	2001	Fund	$965M	10	Gas Transmission
Hastings Diversified Utilities Fund	2004	Fund	$807M	4	Water, Gas Transmission
Challenger Infrastructure Group	2005	Fund	$666M	4	Gas Transmission and Distribution, Broadcast
Australian Pipeline Trust	2000	Company	$453M	6	Gas Transmission
Toll Road (5 entities @ $21.6 billion)					
Macquarie Infrastructure Group	1996	Fund	$12,404M	12	Toll Road
Transurban Group	1996	Company	$6,815M	3	Toll Road
Connecteast Group	2004	Company	$1,106M	1	Toll Road
Sydney Roads Group	2006	Fund	$814M	3	Toll Road
Transurban Cars Trust	2003	Company	$437M	1	Toll Road

Source: Authors' compilation from ASX (2006a, b) and miscellaneous annual reports and PDS reports

Table 2: Listed infrastructure profile: August 2006 (Continued)

Infrastructure	Year Listed	Type	Total Assets	No. of Assets	Activities
Integrated Utilities (3 entities @ $14.7 billion)					
Origin Energy Limited	1961	Company	$8,015M	10	Exploration and Development of Gas and Oil, Energy Retailing, Generation and Network of Gas and Water
Alinta Limited	2000	Company	$3,458M	NA	Gas Distribution, Energy Retailing
Australian Gas Light Company	1871	Company	$3,268M	2	Gas Transmission and Distribution, Electricity Distribution, Energy Retailing
Airport (2 entities @ $10.4 billion)					
Macquarie Airports	2002	Fund	$9,548M	6	Airport
Australian Infrastructure Fund	1997	Fund	$847M	10	Airport, Seaport, Toll Roads Light Rail
Communication (1 entity @ $4.6 billion)					
Macquarie Communications Infrastructure Group	2002	Fund	$4,573M	2	Broadcast
Diversified Utilities (1 entity @ $3.0 billion)					
Babcock and Brown Infrastructure Group	2002	Fund	$3,015	6	Gas & Electricity Transmission and Distribution, Railway, Electricity Generation, Coal Terminal

Source: Authors' compilation from ASX (2006a, b) and miscellaneous annual reports and PDS reports

Table 2: Listed infrastructure profile: August 2006 (Continued)

Infrastructure	Year Listed	Type	Total Assets	No. of Assets	Activities
Generation (11 entities @ $2.6 billion)					
Babcock and Brown Wind Partners Group	2005	Fund	$1,105M	14	Power Generation (Wind Farm)
Energy Developments Limited	1993	Company	$672M	62	Power Generation
Viridis Clean Energy Group	2005	Fund	$520M	6	Clean Energy (Wind, Gas, Hydro)
Energy World Corporation	1988	Company	$105M	9	Power & Gas Generation
Geodynamics Limited	2002	Company	$74M	2	Hot Dry Rock Geothermal Energy
Australian Renewable Fuels Limited	2005	Company	$62M	2	Generation of Biodiesel Fuel
Babcock and Brown Environmental Investment Limited	1998	Fund	$47M	3	Renewable Energy
Australian Biodiesel Group Limited	2005	Company	$24M	2	Generation of Biodiesel Fuel
Pacific Energy Limited	1987	Company	$13M	4	Investment in infrastructure and mineral projects, either in operation or development
Green Pacific Energy Limited	1971	Company	$12M	5	Green Waste
Enviromission Limited	2001	Company	$8M	1	Solar Tower

Source: Authors' compilation from ASX (2006a, b) and miscellaneous annual reports and PDS reports

Table 3: Unlisted infrastructure fund profile: December 2005

Unlisted Infrastructure Fund	Fund Manager	Year Estab.	Total Assets	No. of Assets	Activities
Australia Infrastructure Fund	Industry Funds Management	1995	$1,893M	15	All but Social Infrastructure
Utilities Trust of Australia	Hastings	1994	$746M	16	Airport, Utilities, Seaport, Toll Road, Railway, Timberland
Infrastructure Equity Fund	AMP Capital	1995	$404M	9	Airport, Toll Road, Electricity Transmission and Distribution, Gas Distribution, Water, School Accommodation, Healthcare Facilities
International Infrastructure	Industry Funds Management	2004	$340M	2	All but Social Infrastructure
Global Infrastructure Fund II	Macquarie	2000	$200M	5	Retirement, Seaport, Water, Gas Distribution, Broadcast Transmission, Airport
Social Infrastructure	Industry Funds Management	2003	$149M	3	Social Infrastructure (PPS)
The Infrastructure Fund	Hastings	2000	$143M	7	Airports, Power Transmission, Toll Road, Recycling
Australian Social Infrastructure Fund	Ceramic	2001	$102M	57	Childcare Centre

Source: Authors' compilation from Mercer (2005) and miscellaneous annual reports and PDS reports

Table 3: Unlisted infrastructure fund profile: December 2005 (Continued)

Unlisted Infrastructure Fund	Fund Manager	Year Estab.	Total Assets	No. of Assets	Activities
Energy Infrastructure Trust	ANZ Infrastructure	2003	$95M	5	Gas Pipeline, Power Station, Steam Plant, Biodiesel Produce, Coal Seam Gas, Wind Farm
The Infrastructure Fund of India	AMP Capital	2004	$70M	2	All
CIB Fund	Ceramic	2001	$62M	11	Police Station, Law Court
Strategic Infrastructure Trust of Europe	AMP Capital	2005	$58M	1	Gas Distribution Network, UK Secondary PFI Assets
Australian Sustainable Investment Fund	James Fielding	2004	$52M	1	Forestry Assets, Mining Lands, Renewable Energy
India Infrastructure Fund	AMP Capital	1999	$50M	4	All
Diversified Infrastructure Fund	Perpetual	2004	$36M	2	Airport, Railway, Tunnel
Infrastructure Yield Fund	James Fielding	2004	$32M	2	Carparks, Airport
Wholesale Infrastructure Income Fund	Colonial First State	2003	$20M	2	All; bias towards PPP
Total			**$4,451M**	**144**	

Source: Authors' compilation from Mercer (2005) and miscellaneous annual reports and PDS reports

Table 4: Infrastructure risk-adjusted performance analysis: Q3:1995-Q2:2006

Asset class	Average Annual Return	Annual Volatility[a, b]	Sharpe Index	Performance Rank[c]
Composite Infrastructure	22.38%	16.03%	1.05	3
Infrastructure	24.89%	23.42%	0.83	6
Toll Roads	25.65%	24.39%	0.82	7
Airports	8.05%	30.67%	0.08	10
Utilities	21.93%	15.65%	1.05	4
Unlisted Infrastructure	14.11%	5.83%	1.47	2
Direct Property	10.90%	1.46%	3.67	1
LPTs	13.75%	7.92%	1.04	5
Stocks	12.91%	10.97%	0.67	8
Bonds	7.20%	4.28%	0.39	9

Source: Authors' calculations from UBS (2006), PCA/IPD (2006)
Note:
a Annual volatility is the annualised standard deviation of the respective quarterly returns
b Property volatility and unlisted infrastructure volatility have not be adjusted for valuation-smoothing
c Performance rank is based on the Sharpe index

Portfolio diversification

To assess the portfolio diversification benefits of infrastructure, Table 5 presents the inter-asset correlation matrix over the Q3:1995-Q2:2006 period. The infrastructure sectors, including listed composite infrastructure (r = 0.15), listed infrastructure (r = 0.21), listed utilities (r = 0.01), toll roads (r = 0.14) and unlisted infrastructure (r = 0.06), were not significantly correlated with the stockmarket, with the infrastructure sectors except the airports sector also showing diversification benefits with direct property in a portfolio. This diversification benefit of unlisted infrastructure with direct property (r = 0.26), in conjunction with the earlier average annual returns and volatilities, further highlights the differences between infrastructure and property as separate asset classes for institutional investors and superannuation funds. Unlisted infrastructure also generally showed lower correlation with the other asset classes (r = 0.06 – 0.26) than the listed infrastructure sector with the other asset classes (r = 0.08 – 0.57).

On the other hand, inter-infrastructure-sectors generally showed significant correlations. In particular, listed composite infrastructure was significantly correlated with the other infrastructure sub-sectors (r = 0.31 – 0.86). It is noted the listed composite infrastructure has the lowest correlation with unlisted infrastructure (r = 0.31) amongst the infrastructure sub-sectors. Unlisted infrastructure presented moderate correlation with the airports

(r = 0.26) and utilities (r = 0.16) sub-sectors. Similarly, toll roads showed low correlation with airports (r = 0.26).

Overall, the infrastructure sectors contributed the highest returns to investment portfolios as well as bringing higher volatility in this sample period of Q3:1995-Q2:2006. On the other hand, these empirical results confirm the portfolio diversification benefits of the infrastructure sectors, particularly with unlisted infrastructure.

Sub-period performance analysis

To assess whether the investment dynamics and portfolio diversification benefits for infrastructure have been enhanced in recent years, the two sub-periods of Q3:1995-Q4:2000 and Q1:2001-Q2:2006 were assessed. Table 6 shows the risk-adjusted performance over these two sub-periods. Each of infrastructure sectors except airports showed declining risk-adjusted performance in the Q1:2001-Q2:2006 sub-period, where both average annual returns and volatility decreased. A key factor in this declining risk for the infrastructure sectors in this second sub-period has been the maturing of the infrastructure sector as an asset class; this is in contrast to the already mature stature of the other assets considered (eg: direct property, LPTs). The declined risk-adjusted performance in the second sub-period was characterised by much weaker returns from the infrastructure sectors than seen in the first sub-period of Q3:1995-Q4:2000. This was against most other asset classes, which saw improved annual average returns in the second sub-period of Q1:2001-Q2:2006, while these other asset classes showed similar volatility over the two sub-periods. Contrary to other infrastructure sectors, airports had increased average annual returns by double over these two sub-periods, as well as having higher volatility in the second time period of Q1:2001-Q2:2006. This higher volatility for airports is likely to be attributable to a range of factors including global terrorism, oil price movements, increased airport landing charges and general concerns regarding international tourism.

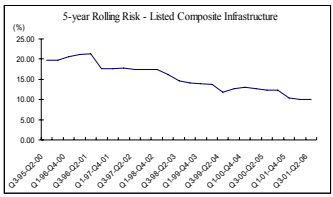
The risk-adjusted performance of unlisted infrastructure is also higher than the performance of listed infrastructure due to more stable average returns and lower volatility. Compared to unlisted infrastructure, the average return of listed composite infrastructure declined dramatically from 31.62% to 13.78% over this period. Similar patterns came with the other listed infrastructure sub-sectors, reflecting moderate returns for investing in listed infrastructure in more recent years.

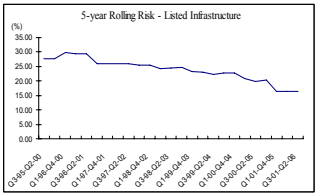
To assess the changing portfolio diversification benefits for infrastructure, Table 7 shows the inter-asset correlations over the two sub-periods. Listed infrastructure sectors were not significantly correlated with the stockmarket in these two sub-periods, as seen in the analysis of the full period. However, unlisted infrastructure showed increased correlations with the property sectors (unlisted properties: r = 0.16 increasing to 0.55; LPTs: r = 0.08 increasing to 0.53) in the second sub-period of Q1:2001-Q2:2006.

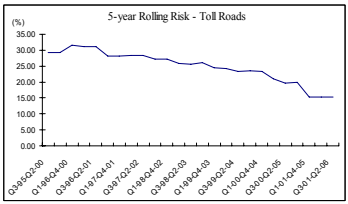
In particular, the listed infrastructure sectors showed decreased correlation with LPTs (r = 0.72 reducing to r = 0.28) and with bonds (r = 0.61 reducing to r = 0.40) in the second sub-period of Q1:2001-Q2:2006, while they were seen to be significantly correlated with LPTs and bonds in the first sub-period of Q3:1995-Q4:2000, reflecting increased diversification benefits. It also sees the listed infrastructure sectors showing low correlation with unlisted infrastructure over these two sub-periods, indicating diversification benefits for investment portfolios involving both listed and unlisted infrastructure,

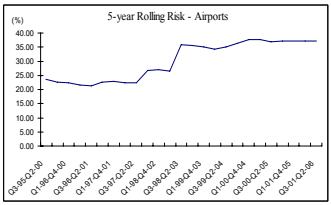
To more fully assess the infrastructure investment dynamics over the Q3:1995-Q2:2006 period, rolling five-year periods were assessed regarding their changing volatility and portfolio diversification profiles. Figure 2 presents the rolling risk analysis for the infrastructure sectors. Each of listed composite infrastructure, listed infrastructure, toll roads, listed utilities and unlisted infrastructure has experienced decreasing volatility over this period of Q3:1995-Q2:2006; particularly composite infrastructure and listed utilities. On the other hand, airports were seen increased rolling risk against the other infrastructure sectors. Other asset classes, except the direct property sector with significantly increased volatility, presented stable volatilities during this eleven year period.

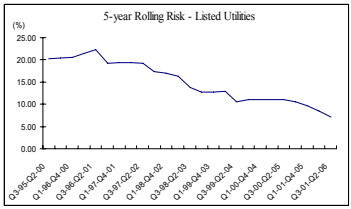
Figure 2: Rolling annual risk: Q3:1995-Q2:2006

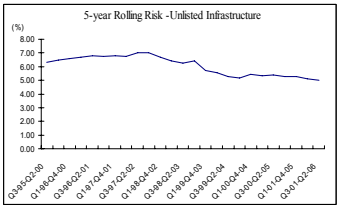


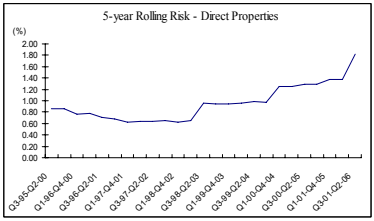


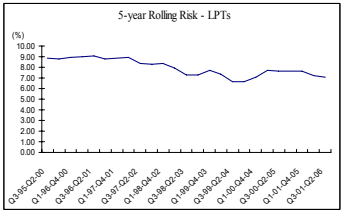


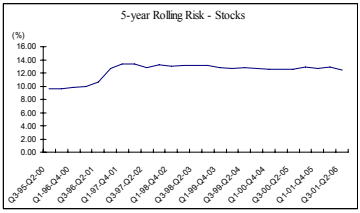












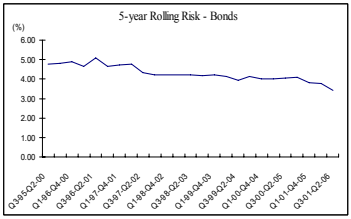
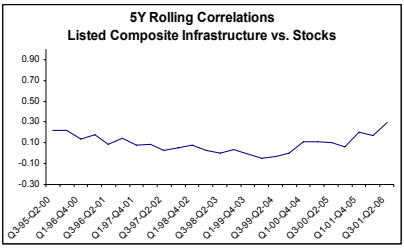
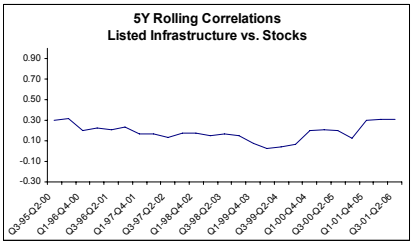
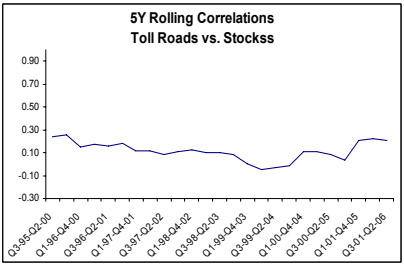
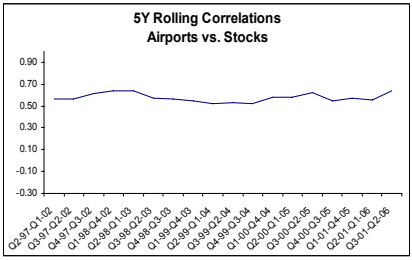


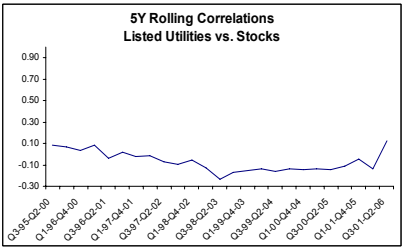
Figure 3: Rolling correlation (with stocks): Q3:1995-Q2:2006

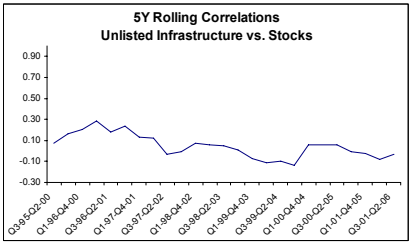


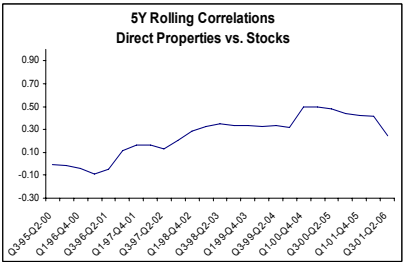












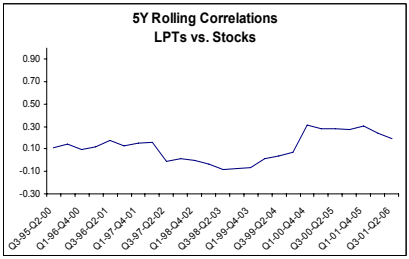


Figure 3 shows the rolling correlation for the infrastructure sectors with the stockmarket. With the listed infrastructure sectors, recent years have seen increases in these correlations, consistent with LPTs. On the other hand, unlisted infrastructure has seen reducing correlated with stocks over this period, reflecting improved diversification benefits.

The rolling correlation for the listed infrastructure sectors with unlisted infrastructure was also assessed. Figure 4 presents the correlations between the listed infrastructure sectors and unlisted infrastructure. With increased correlation in the later periods, the diversification benefits of investment portfolios involving both listed infrastructure and unlisted infrastructure were seen to have been reducing, although these correlations remain relatively low in absolute terms. Currently, these correlations typically stand at around 0.30; above the correlations of around zero seen in 2003; reflecting some loss of diversification benefits in more recent years.

Figure 4: Rolling correlation (with unlisted infrastructure): Q3:1995-Q2:2006

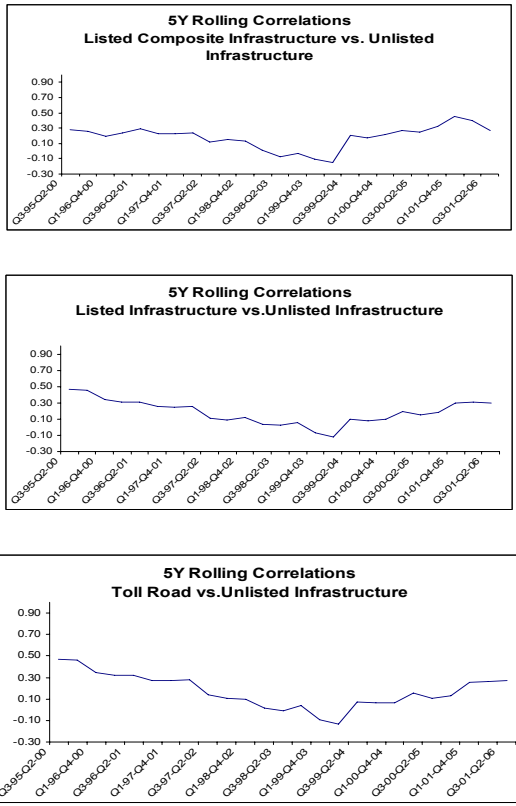
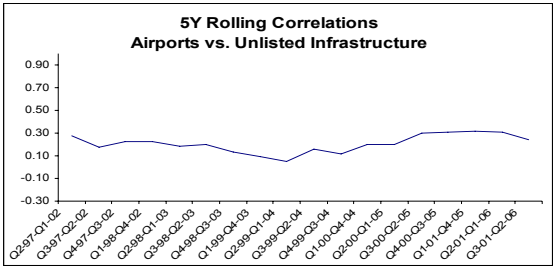


Figure 4: Rolling correlation (with unlisted infrastructure): Q3:1995-Q2:2006 (Continued)



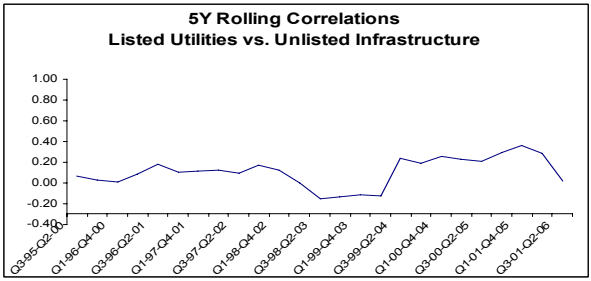


Table 5: Inter-asset correlation matrix: Q3:1995-Q2:2006

	Composite Infrastructure	Infrastructure	Toll Roads	Airports	Utilities	Unlisted Infrastructure	Direct Property	LPTs	Stocks	Bonds
Composite Infrastructure	1.00									
Infrastructure	0.86*	1.00								
Toll Roads	0.85*	0.99*	1.00							
Airports	0.38*	0.40*	0.26	1.00						
Utilities	0.82*	0.42*	0.42*	0.14	1.00					
Unlisted Infrastructure	0.31*	0.36*	0.36*	0.26	0.16	1.00				
Direct Property	-0.08	0.03	-0.01	0.36*	-0.21	0.26	1.00			
LPTs	0.52*	0.40*	0.39*	0.06	0.47*	0.24	0.19	1.00		
Stocks	0.15	0.21	0.14	0.54*	0.01	0.06	0.14	0.17	1.00	
Bonds	0.57*	0.38*	0.38*	-0.03	0.57*	0.17	-0.12	0.49*	-0.21	1.00
Inflation	-0.20	-0.22	-0.21	-0.23	-0.12	-0.27	0.10	-0.13	-0.09	-0.25

*: significant correlation (P<5%)

Table 6: Infrastructure sub-period performance analysis: Q3:1995-Q2:2006

Asset Class	Q3:1995-Q4:2000			Q1:2001-Q2:2006		
	Average Annual Return	Annual Volatility	Sharpe Index	Average Annual Return	Annual Volatility	Sharpe Index
Composite Infrastructure	31.62%	19.63%	1.31 (3)	13.78%	10.22%	0.84 (5)
Infrastructure	36.78%	28.50%	1.08(6)	14.03%	15.80%	0.56 (7)
Toll Roads	39.98%	30.16%	1.13(5)	12.78%	14.88%	0.51(8)
Airports	5.09%	22.35%	-0.04(10)	10.12%	35.67%	0.14(9)
Utilities	29.49%	19.58%	1.21(4)	14.82%	9.63%	1.00 (4)
Unlisted Infrastructure	16.57%	6.37%	1.68(2)	11.71%	5.13%	1.27 (3)
Direct Property	9.72%	0.85%	4.52(1)	12.09%	1.74%	3.98 (1)
LPTs	12.00%	8.59%	0.71(7)	15.54%	7.31%	1.42 (2)
Stocks	12.63%	9.50%	0.71(8)	13.20%	12.50%	0.64 (6)
Bonds	9.02%	4.71%	0.67(9)	5.41%	3.69%	0.06 (10)

Source: Authors' calculations from UBS (2006), PCA/IPD (2006)

Table 7: Sub-period inter-asset correlation matrices: Q3:1995-Q2:2006

Panel A: Q3:1995-Q4:2000

	Composite Infrastructure	Infrastructure	Toll Roads	Airports	Utilities	Unlisted Infrastructure	Direct Property	LPTs	Stocks	Bonds
Composite Infrastructure	1.00									
Infrastructure	0.85*	1.00								
Toll Roads	0.84*	0.99*	1.00							
Airports	0.27	0.23	0.15	1.00						
Utilities	0.86*	0.46*	0.45*	0.23	1.00					
Unlisted Infrastructure	0.25	0.38	0.39	0.30	0.06	1.00				
Direct Property	-0.10	0.05	0.10	-0.05	-0.19	0.16	1.00			
LPTs	0.72*	0.54*	0.56*	-0.07	0.68*	0.08	-0.07	1.00		
Stocks	0.13	0.18	0.13	0.50*	0.04	0.20	-0.07	0.07	1.00	
Bonds	0.61*	0.42*	0.41*	0.01	0.61*	0.02	-0.17	0.76*	0.04	1.00
Inflation	-0.10	-0.14	-0.14	-0.19	-0.06	-0.30	0.02	-0.17	-0.16	-0.20

Panel B: Q1:2001-Q2:2006

	Composite Infrastructure	Infrastructure	Toll Roads	Airports	Utilities	Unlisted Infrastructure	Direct Property	LPTs	Stocks	Bonds
Composite Infrastructure	1.00									
Infrastructure	0.85*	1.00								
Toll Roads	0.82*	0.97*	1.00							
Airports	0.61*	0.68*	0.50*	1.00						
Utilities	0.63*	0.13	0.12	0.14	1.00					
Unlisted Infrastructure	0.35	0.23	0.18	0.30	0.29	1.00				
Direct Property	0.15	0.27	0.17	0.42*	-0.15	0.55*	1.00			
LPTs	0.28	0.24	0.20	0.14	0.17	0.53*	0.32	1.00		
Stocks	0.23	0.32	0.23	0.57*	0.00	-0.05	0.22	0.27	1.00	
Bonds	0.40	0.20	0.21	-0.04	0.44*	0.32	0.03	0.19	-0.48*	1.00
Inflation	-0.47*	-0.45*	-0.37	-0.45*	-0.22	-0.15	0.11	-0.11	0.00	-0.34

*: significant correlation (P<5%)

CONCLUSION

The infrastructure sectors have experienced strong performance over many years. In particular, recent years have seen increased attention given to the infrastructure investment opportunities for enhanced returns available from the infrastructure privatisation via listed infrastructure funds, listed infrastructure companies and unlisted infrastructure funds. Currently, 32 listed infrastructure funds and companies with $55 billion in market capitalisation are operating in Australian infrastructure markets. The major players include Macquarie, Babcock and Brown, Hastings, Alinta and Challenger, investing in a variety of infrastructure assets across energy generation, transmission, distribution, retailing, toll roads, airports and communication. On the private side, more than 17 unlisted infrastructure funds with $4.5 billion in asset value provide an alternative investment vehicle for infrastructure investors such as superannuation funds. The major players include AMP Capital, ANZ Infrastructure, James Fielding, Hastings and Macquarie. Compared to the public side, unlisted infrastructure funds provide more variety in infrastructure assets to wholesale investors who typically embraced more sizeable exposure in infrastructure investments.

By assessing the listed infrastructure funds, listed infrastructure companies and unlisted infrastructure funds, the risk-adjusted performance and portfolio diversification benefits of these infrastructure sectors were evaluated over the eleven years for Q3:1995-Q2:2006 and benchmarked against the performance of other major asset classes. To fully assess whether the investment dynamics and portfolio diversification benefits for infrastructure have been enhanced in recent years, the two sub-periods of Q3:1995-Q4:2000 and Q1:2001-Q2:2006 were assessed.

The empirical results (see Table 4) showed the infrastructure sectors contributing the highest returns to investment portfolios, as well as having higher volatility in this period of Q3:1995-Q2:2006. On the other hand, the portfolio diversification benefits for investment portfolios from the infrastructure sectors were confirmed, particularly with unlisted infrastructure (see Table 5).

Sub-period analyses showed the moderate returns and volatility from infrastructure sectors in the more recent period of Q1:2001 – Q2:2006 (see Table 6). Whilst not being highly correlated with other asset classes, the listed infrastructure sectors confirmed their diversification benefits in investment portfolios in recent years. Unlike the listed infrastructure sectors, unlisted infrastructure presented increased correlation with the property sectors, reflecting moderate diversification benefits with the property sectors (see Table 7). In terms of dynamic analysis, the listed infrastructure sectors generally have seen increased correlation with the stockmarket and unlisted infrastructure, suggesting declining diversification benefits with these asset classes.

This paper has only focused on the Australian infrastructure market, assessing the significance and performance for these infrastructure investments. There are further research issues to be considered. Firstly, the full spectrum of infrastructure investments can be assessed, particularly other infrastructure sectors such as communication, generation, transmission and distribution. This can provide deeper insights into infrastructure investments. Secondly, as the infrastructure investment market is maturing around the world, the significance and performance for infrastructure investments in other countries or areas can be assessed; particularly the European and US markets. This can then see a comparison of regional/global infrastructure investment markets and their potential for enhanced returns and portfolio diversification benefits.

Finally, infrastructure investment still has potential for growth both in local and international markets (Blundell, 2006), particularly as investors have sought new markets for these significant capital inflows. With the rapidly expanding market in recent years, the strong performance and volatility of infrastructure investment has been moderate, reflecting a maturing market. Knowledge and experience in the infrastructure investment markets is also essential; this has clearly been achieved in both the listed and unlisted infrastructure sectors in Australia in recent years as the infrastructure sectors have significantly enhanced their maturity and stature as separate asset classes for Australian institutional investors in infrastructure.

The ongoing issue of the strategic relationship between infrastructure and direct property also needs to be fully assessed to enable a fuller understanding of the ongoing role of infrastructure in a portfolio; particularly with infrastructure now being seen as a property-related but separate asset class by many investors.

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