City of Sydney (COS) Bridges - an Overview & Current Asset Management Practices

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COS Bridges

City of Sydney (COS) LGA

• The City of Sydney LGA covers the Sydney CBD and surrounding inner city suburbs of the greater metropolitan area of Sydney. The CBD is roughly bounded by
  ➢ North – Circular Quay and Sydney Harbour
  ➢ South - Liverpool St & Central railway station
  ➢ East – Macquarie St; West – Darling Harbour

• In 2004, City of South Sydney merged into City of Sydney
  ➢ City of Sydney included CBD, Pyrmont and Ultimo to the west, Haymarket to the south, and other suburbs.
  ➢ South Sydney included Woolloomooloo, Alexandria, Darlington, Erskineville, Newtown, Redfern, Glebe, Waterloo, most of Surry Hills and a portion of Paddington.
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An Overview – City’s Bridges
COS Bridges

An Overview – City’s Bridges

- City currently owns 40 bridges in its LGA
- Worth around $89 million
- Comprise road and pedestrian bridges
- Material includes concrete, steel and timber
- Majority located along roads, some in parks & some shared with neighbouring councils
- More bridges are likely to be added in future
  - from City’s new development works or
  - by acquiring bridges - new lease agreements
  - because of ownership changes

City’s Bridge Inventory: (Total 40)

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian: Timber</td>
<td>4</td>
</tr>
<tr>
<td>Pedestrian: Non-Timber</td>
<td>15</td>
</tr>
<tr>
<td>Local</td>
<td>17</td>
</tr>
<tr>
<td>Regional</td>
<td>4</td>
</tr>
</tbody>
</table>
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Bridge Asset Ownership

• Not all Bridges in City’s LGA are owned by the City

• Many owned by other organisations: RMS, SHFA (currently Property NSW), RailCorp

• For some - City acts as a road manager only. Bridge structures beneath are owned by other organisations

• Harris Street Bridge at Pyrmont is one example of such a bridge
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Bridges Leased to City

The following are some examples of leased bridges located over the Hickson Road; leased to the City by formerly Maritime Authority of NSW (now RMS).

• Bridge-2/3 Pottinger St, Dawes Point
• Bridge 6/7 Pottinger St Near Pier-5, Dawes Point
• Bridge 8/9 Pottinger St, Millers Point
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Bridges over Rail and Light Rail

- Miller Street Bridge (City Owned)
- Point Street Bridge (City owned)
- Harris Street Bridge (RailCorp owned)
- William Henry Street Bridge (owned by RailCorp, COS and probably Property NSW)
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Bridges over light Rail
COS Bridges

William Henry Street Bridge

• Former Two Lane Iron Bridge built in 1886

• Replaced by the William Henry Street Bridge in 1968 – 69. Financed by
  ➢ Dept of Motor Transport
  ➢ Dept of Main Roads
  ➢ Dept of Railways
  ➢ City of Sydney Council

• There is a 1985 maintenance cost share agreement for the Bridge between the City of Sydney and State Rail Authority of NSW
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William Henry Street Bridge

1985 Agreement says, Council will maintain:

• The eastern and western junction piers
• Wearing surfacing of carriageway
• Lights on the overbridge and under
• Stormwater gullies and pipes connections
• Miscellaneous facilities: roadways/approaches including gutters, kerbs, crash rails, balustrades, expansion joints & gully grates
• Later change: Eastern approach – SHFS now Property NSW (currently under investigation)
COS Bridges

What is an Interface?

Means the **assets and systems at the Rail or Road Crossings as are described in Schedule 2 of the Interface Agreement**

**SCHEDULE 2: LIST OF INTERFACES:**

<table>
<thead>
<tr>
<th>SIA Section</th>
<th>RRX Type</th>
<th>Road Location</th>
<th>Asset Owner</th>
<th>Rail Line</th>
<th>Rail Infra Mgr (RIM)</th>
<th>Roads Manager</th>
<th>Road Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.3</td>
<td>OB</td>
<td>Cleveland St &amp; Regent St</td>
<td>Redfern</td>
<td>RailCorp</td>
<td>Sydney Yard</td>
<td>Sydney Trains</td>
<td>Sydney Council &amp; RMS</td>
</tr>
<tr>
<td>2.2.10</td>
<td>UB</td>
<td>Burren St, MacDonnell Town</td>
<td>RailCorp</td>
<td>South Main Line</td>
<td>Sydney Trains</td>
<td>Sydney Council</td>
<td>Local Road</td>
</tr>
</tbody>
</table>
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Interface Agreement

- Interface Agreement “Managing Risks to Safety Due to Rail–Road Crossings” refers to the Clause:

“Part 3, Division 6, Subdivision 2 of the Rail Safety National Law obliges the Rail Infrastructure Managers & the Road Managers to identify, assess and manage, so far as is reasonably practicable, risks to safety that may arise from Railway Operations carried out on Rail Infrastructure, wholly or partly because of the existence of any Rail or Road Crossing that is part of the Road Infrastructure of a Public Road.”
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Interface Agreement - Parties

Rail Infrastructure Manager (RIM)
• Sydney Trains (maintains the Metropolitan Rail Network MRN)

Road Manager (in this agreement)
• City of Sydney Council (COS)

Other Road Managers at some Interfaces – but in separate agreements with Sydney Train
• RMS (State Roads)
• Marrickville & Woollahra Councils (at Joint Border location)
COS Bridges
Number of Interfaces

<table>
<thead>
<tr>
<th>No of Interfaces = 25</th>
<th>Overline Bridge = 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Underline Bridge = 17</td>
</tr>
<tr>
<td>Local Road = 13</td>
<td>Owned by RailCorp = 22 (7-OB; 15-UB)</td>
</tr>
<tr>
<td>Regional Road = 2</td>
<td>Owned by RMS = 2 (UB)</td>
</tr>
<tr>
<td>State Road = 9</td>
<td>Jointly owned by RMS/RailCorp = 1 (OB)</td>
</tr>
<tr>
<td>Declared Rd = 1 (RMS)</td>
<td></td>
</tr>
</tbody>
</table>
COS Bridges

Various COS Asset at Interfaces (Slide-1/2)

Includes:

• Road pavement/surfaces on Bridge & approaches
• RMV traffic control devices including speed limit on the road side of the boundaries
• Pedestrian walkways, barrier, fencing/handrail
• Vegetation control in the road reserve
• On-road markings including for traffic lanes
• Some load limit sign
COS Bridges

Various COS Asset at Interfaces (Slide-2/2)

• Some Smart poles in the vicinity of bridge
• Concrete median traffic divider
• Drainage facilities in the road corridor
• Drainage facilities under some Underline Bridges
• Minor lighting systems in the pedestrian tunnels

• …New items that are identified to be added into the risk register in agreement with the other party
Asset Management
COS Bridges
Asset Management

• The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost effective manner.
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Condition Audit

• Condition Audit, Every 4 – 5 years. Historically by visual inspection
• Last audit in 2013
• Then further higher level inspection and condition assessment
• Condition rating scale 1 – 5
• Condition deterioration model, used in works related to this paper
## COS Bridges – Condition Rating

<table>
<thead>
<tr>
<th>Condition Index</th>
<th>Condition</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Element or component which shows no defects; condition excellent</td>
<td>Concrete: The element shows no deterioration. No cracks &lt; 0.15mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel: Paintwork on steel in excellent condition.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timber: Timber in sound condition, no decay or splinters.</td>
</tr>
<tr>
<td>2</td>
<td>Element or component which shows minor defects; condition good</td>
<td>Concrete: The element shows no deterioration. There may be discolouration, efflorescence, and/or superficial cracking. Hairline Crack &lt; 0.15mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel: Isolated steel surface corrosion and minor pitting. Paint work on steel components with &lt; 5% spot rusting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timber: Timber in sound condition, minor decay or splinters. Minor surface rust on connection bolts and brackets. Less than 10% defects.</td>
</tr>
<tr>
<td>3</td>
<td>Element or component which shows moderate defects; condition fair</td>
<td>Concrete: Minor cracks and spalls may be present but there is no evidence of corrosion of the reinforcement. Crack width between 0.15 mm - 0.3mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel: Extensive surface corrosion, minor pitting. Paint work on steel components has spot rusting 5 to 10% of coated area. Section loss of 1-5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timber: Timber in moderate condition, reasonable amount of decay or splinters. Moderate surface rust on connection bolts and brackets. Cross sectional loss 10 to 15%.</td>
</tr>
<tr>
<td>4</td>
<td>Element or component which shows substantial defects; condition poor</td>
<td>Concrete: Some delamination or spalls or cracks or corrosion of the reinforcement are prevalent. Corrosion of reinforcement may be present but section loss is minor. Crack width &gt; 0.3 mm and &lt; 2.0 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel: Active surface corrosion and deep pitting. Section loss to 5-10%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timber: Timber in poor condition, extensive amount of decay or splinters. Exhaust surface rust on connection bolts. Cross sectional loss to 15 to 30%.</td>
</tr>
<tr>
<td>5</td>
<td>Element or component which is potentially unsafe for traffic and requires reconstruction; condition very poor.</td>
<td>Concrete: Delamination or spalls or cracks or corrosion of the reinforcement are prevalent. Corrosion of reinforcement is present and section loss is major. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge. Cracks &gt; than 2mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel: Severe corrosion loss and extreme pitting. Metal section loss &gt; 10%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timber: Timber in unsafe condition, severe amount of decay or splinters. Loos or completely missing fixings. Cross sectional loss &gt; 30%.</td>
</tr>
</tbody>
</table>
COS Bridges
Bridge Condition

- Condition profiles shown in these Figures
- These reflect overall condition
- Some component may be in worse condition than the overall condition
- Those components are given higher repair priority even though the overall condition is satisfactory
COS Bridges
Further Investigation and Inspection

• Since the last condition audit, the City gradually undertook further inspection and assessment works for some bridges e.g.
  ➢ Booth street bridge
  ➢ Burton street viaduct
  ➢ Cutler footway
  ➢ Point street bridge
  ➢ Miller street bridge
  ➢ Euston road bridge
  ➢ Burrows road bridge
  ➢ Bourke street bridge
  ➢ Western approach of Pier street bridge
  ➢ Wyndham street bridge

• Having more risk with durability & safety requirements or heavier traffic loads
• City also undertook a project to check compliance of bridge barriers
• These works lead to some future bridge remediation and upgrade works
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Remediation and Upgrade Plan

• Remediation Plan:
  ➢ Booth Street Bridge, Annandale: Stages 1 and 2
  ➢ Burton Street Viaduct, Darlinghurst
  ➢ Domain Link Bridge, Sydney
  ➢ Timber Truss Bridge at Bicentennial Park, Glebe
  ➢ Wigram Road Bridge, Forest Lodge
  ➢ Miller Street Bridge, Pyrmont
  ➢ Point Street Bridge, Pyrmont
  ➢ Rushcutters Bay Park pedestrian bridge
  ➢ Heritage Balustrades of Various Bridges
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Booth Street Bridge Remediation

BOOTH ST BRIDGE - CRACK MAP

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North East End to Rozelle Bay

Quarter Point
Crown Point
Quarter Point

Voids Under Render
Micro-cracks with Efflorescence

300mm Approx to Road Level

10mm Lateral Displacement

Spalled Render
Plant Root

24
Figure  Indicative Spandrel Wall reconstruction with cycleway and barrier upgrade
COS Bridges
Barrier Upgrade - Wigram Rd Bridge, Forest Lodge
COS Bridges

Barrier Upgrade - Wigram Rd Bridge, Forest Lodge

Wigram Road Bridge, Forest Lodge
Figure shows condition deterioration model that is used. Model is consistent with industry asset management & financial standards/guidelines. The overall value of Council’s bridge assets is as follows:-

- Current Replacement Cost $88,597,086
- Depreciable Amount $88,597,086
- Depreciated Replacement Cost $45,538,902
- Annual Depreciation Expense $885,971
COS Bridges – Condition Rating

Financial Statement and Projections

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Current Replacement Cost (CRC) ($)</th>
<th>Useful Life (Years)</th>
<th>Asset Average Condition</th>
<th>Operations (Audit, Investigation, Load Assessment, etc. per Year) ($)</th>
<th>Maintenance Cost per year ($)</th>
<th>*Budgeted Renewal cost per year ($)</th>
<th>**Projected Renewal cost per year (based on 10 yr projecton) ($)</th>
<th>Annual Depreciation ($/yr)</th>
<th>Life Cycle Cost/yr</th>
<th>Life Cycle Expenditure (budgeted)/yr</th>
<th>Life Cycle Expenditure (projected) /yr</th>
<th>Funding Shortfall ($/yr)</th>
<th>Ratio between budgeted and projected Life Cycle Expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Bridges (43 Nos)</td>
<td>88,597,086</td>
<td>100</td>
<td>2.62</td>
<td>107,500</td>
<td>50,000</td>
<td>979,000</td>
<td>1,150,000</td>
<td>885,971</td>
<td>1,043,471</td>
<td>1,136,500</td>
<td>1,307,500</td>
<td>-171,000</td>
<td>87</td>
</tr>
</tbody>
</table>

Note:
1. *Budgeted renewal cost per year is based on a 10 year forward estimates starting from 16-17 and taking the average.
2. **For improving minimum average asset condition to 2.6 or less.
3. A negative funding shortfall indicates a financing gap, a positive shortfall indicates a surplus for that year.
COS Bridges – Condition Rating
Bridge Asset Financial Forecast

Note: Renewals (Sustainable Asset Case) shown are to maintain a min average condition of less than 2.6 and an abs min condition of 4.0
COS Bridges – Condition Rating

Bridge Asset Financial Forecast

Note: Renewals (Sustainable Asset Case) shown are to maintain a min average condition of less than 2.6 and an abs min condition of 4.0
COS Bridges – Condition Rating

Financial Statement and Projection

• Asset Renewal Funding Ratio: The ratio of the net present value of asset renewal funding accommodated over a 10 year period in a long term financial plan relative to the net present value of projected capital renewal expenditures identified in an asset management (AM) plan for the same period [AIFMG Financial Sustainability Indicator No 8].

Asset Renewal Funding Ratio = 85%
COS Bridges – Condition Rating

Life Cycle Cost and Expenditure

• Life cycle costs are
  – Average costs required to sustain service levels over the asset life cycle.
  – Incl. operations & maintenance expenditure and asset consumption (depreciation expense).
  – Over the 10 year planning period it is $1,043,471 per year (avg. expense).

• Life cycle expenditure
  – includes operations, maintenance and capital renewal expenditure.
  – It will vary depending on the timing of asset renewals.
  – Over the 10 year planning period it is $1,136,500 per year (avg. expenditure).

• Life cycle gap: A shortfall between life cycle cost and life cycle expenditure. The life cycle gap for services covered by this paper is ($1,043,471 - $1,136,500) = - $93,029 per year. This is around 9%.
COS Bridges – Condition Rating
Projected vs Est. Budgeted Expenditure

• The projected operations, maintenance and capital renewal expenditure required over the first 10 years of the planning period is $1,307,500 on average per year.
• Estimated (budget) operations, maintenance and capital renewal funding is $1,136,500 on average per year.
• This indicates that Council expects to have approximately 87% of projected expenditures required to provide the services shown in the draft AM Plan over the next 10 years.
COS Bridges – Condition Rating

Valuation Forecasts

• Current replacement cost (CRC) is the cost the entity would incur to acquire the asset on the reporting date. Refer to Fig.

• Depreciation expense values are forecast in line with asset values, refer to same Figure.

• Depreciated replacement cost (DRC) is the CRC of an asset less, where applicable, accumulated depreciation calculated on the basis of such cost to reflect already consumed or expired future economic benefits of the asset.

• DRC will vary over the forecast period depending on the rates of addition of new assets, disposal of old assets and consumption and renewal of existing assets. Forecast of DRC is in Figure.
COS Bridges – Condition Rating

Conclusion

• The paper has presented an overview on City of Sydney’s bridge assets, along with an overview on its condition summary, bridge remediation plan as well as limited information from the draft asset management (AM) plan that include asset valuation, financial statements and projections.

• As the AM plan is yet to be finalised therefore various valuation, results and comment in this paper are indicative only. These are likely to be refined further before adopting into the Council’s financial planning and asset management strategy.

• This strategy will assist in justifying requirements for increased funding to maintain the bridge assets in a functional and safe standards. Also to produce a meaningful long term financial plan.