

### Problem Description

| Question  | Response   |
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| <p><b>Description of the problem and purpose of the proposed research</b></p> | <p>In addition to its existing infrastructure asset portfolio, over the next 20 years, Transport for NSW (TfNSW) will be responsible for overseeing infrastructure assets valued at approximately \$260 billion. The impacts of climate change are likely to influence and shape the ongoing delivery of TfNSW’s projects and management of its asset portfolio.</p> <p>The <i>NSW Climate Change Policy Framework (2016)</i> seeks to ensure that NSW is more resilient to a changing climate. The Framework sets the whole of government program to embed climate change in government decision-making.</p> <p>TfNSW addresses climate change through several key policy documents. TfNSW’s <i>Environment and Sustainability Policy Statement</i> has as a key theme, “to plan and deliver transport infrastructure and operations that are resilient to the effects of climate change.”</p> <p>TfNSW’s <i>Future Transport Strategy 2056</i> identifies ‘managing a resilient transport system’ as a key outcome and acknowledges that transport assets have long economic lives and are vulnerable to the direct impacts of climate change. Future directions to prepare for extreme weather events are a focus area for TfNSW.</p> <p>While TfNSW has a documented commitment to addressing climate change resilience in the design and delivery of its new infrastructure assets, a best practice approach to address climate change resilience in the existing infrastructure asset portfolio is not yet advanced.</p> <p>A potential incentive to advance climate change resilience actions for the existing infrastructure asset portfolio is to evaluate the baseline case of the ‘do nothing’ scenario to address climate change in existing assets. Specifically, the proposed research will focus on designing a ‘do nothing to address climate change’ scenario. Having a baseline case would allow for more informed decision-making on the costs and benefits to address an ‘all of infrastructure asset portfolio’ strategy for climate change resilience, which includes both existing assets and new assets.</p> |

# Hypothesis & Variables

| Question   | Response   |
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| <p><b>For explanatory research, please describe a clear hypothesis with variables for testing</b></p> <p><b>For exploratory research, please describe how the proposed research will contribute to future explanatory research</b></p> | <p>The intended research would involve the design of a feasible ‘do nothing to address climate change in existing assets’ scenario. This may be achieved via modelling or simulation and TfNSW’s SME will work with the investigators and researchers in building a feasible design.</p> <p>It is hypothesised that testing/modelling of the ‘do nothing’ scenario will lead to better informed decision-making on the costs and benefits of a climate change resilience strategy.</p> <div> <p>Better informed decision-making on the costs and benefits of a climate change resilience strategy</p> <p>Testing/modelling of ‘do nothing’ scenario</p> </div> |

# Strategic Criteria & Alignment

| Question  | Response   |
|---|--|
| <p><b>Alignment with strategic theme</b></p> <p><b>External driver of change analysis</b></p> <p><b>Outline how the research will better position TfNSW to respond proactively to macro drivers of change</b></p> | <p>Climate Risk, Adaptation and Resilience is a theme identified in the research theme ‘Sustainability’.</p> <hr/> <p>TfNSW uses PESTLE analysis to identify and describe the external drivers of change that this research would help TfNSW be in a better position to respond to.</p> <p>The increased frequency and intensity of severe weather is likely to impact the environment and communities in every part of the state, including transport infrastructure and services essential to moving people and goods around NSW. For example, in June 2016, weather events along the NSW coast caused widespread rainfall, damaging winds and flash flooding, and many roads, bridges and wharfs were significantly damaged as a result. The Insurance Council of Australia estimated costs from this event to be in excess of \$304 million.</p> <p>According to <i>Future Transport Strategy 2056</i>, by 2050, NSW will have more than 12 million residents, meaning NSW’s transport networks will need to handle 28 million trips a day and double the current metropolitan freight loads.</p> <p>In light of this growth and the subsequent increasing demands on services, understanding the impacts of climate change to the transport network will be critical to maintaining a reliable transport system – one that meets passenger and freight needs.</p> <p>In particular, TfNSW requires a clearer understanding of weather-related risks and the associated financial risk and service disruptions to transport assets and services. As well as the key interdependencies of other types of transport, energy, water and telecommunications infrastructure also need to be understood and managed.</p> |

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| <b>Forward looking</b><br><br><b>Potential research impact</b> | <p>The current and proposed investment pipeline managed by TfNSW mandates the rebuilding and reconstruction of large segments of the transport network. This includes introducing new modes and new services, and changing the way legacy transport modes operate into the future.</p> <p>The ability for this infrastructure – both existing and planned – to adapt and respond to the impacts of climate change is particularly critical in the face of the forecast investment. A climate-resilient asset portfolio can deliver extensive sustainability benefits – as economic, environmental and social benefits – spanning reduced operations and maintenance costs, increased economic productivity and reduced health and wellbeing impacts to customers.</p> <hr/> <p>Ensuring that climate change resilience is addressed and considered by TfNSW across its infrastructure asset portfolio will be critical to ongoing delivery of a resilient transport network which is able to respond to a range of climate-related shocks and stresses.</p> |

## Technical Criteria

| Question  | Response  |
|---|---|
| <b>Innovation</b><br><br>Outline how the proposed research will result in new knowledge | <ul style="list-style-type: none"> <li>• Transport has well-defined processes for assessing climate risk in infrastructure projects from the early stages of detailed design. However, there is an opportunity to further unify the approach to quantifying the impacts of climate risk across the transport cluster.</li> <li>• Where guidance and information does exist, it is observed that there are differing approaches and requirements in existence (albeit designed to serve slightly different purposes).</li> <li>• The economic cost of inaction has not been fully defined across the cluster. The research project will be able to explore the parameters that need prioritisation to ensure TfNSW proactively manage adaption in 'managing a resilient transport system' to make NSW more resilient to a changing climate.</li> </ul>   |
| <b>Basis in completed research and/or observed practice</b>                             | <p>Climate change resilience in an infrastructure asset portfolio case will be relevant as an emerging field of practice. While there is some information available, how it may be directly applied in the context of TfNSW is not currently understood.</p> <p>Starting point information sources:</p> <ul style="list-style-type: none"> <li>• NSW Government, <i>Adapt NSW</i>, accessed at <a href="http://climatechange.environment.nsw.gov.au/">http://climatechange.environment.nsw.gov.au/</a></li> <li>• NSW Government, Justice, Office of Emergency Management: 2017 State Level Emergency Risk Assessment. Accessed at: <a href="https://www.emergency.nsw.gov.au/Documents/publications/SLERA-executive-summary.PDF">https://www.emergency.nsw.gov.au/Documents/publications/SLERA-executive-summary.PDF</a></li> <li>• OECD, <i>Adapting to the impacts of climate change</i>, accessed at <a href="https://www.oecd.org/env/cc/Adapting-to-the-impacts-of-climate-change-2015-Policy-Perspectives-27.10.15%20WEB.pdf">https://www.oecd.org/env/cc/Adapting-to-the-impacts-of-climate-change-2015-Policy-Perspectives-27.10.15%20WEB.pdf</a></li> </ul> |
| <b>Feasible data requirements</b>   | <p>In seeking to apply new methodologies in an applied manner, it is anticipated that TfNSW would provide data on its existing approaches to climate change resilience on projects, as well as information on its existing asset portfolio.</p> <p>TfNSW can also facilitate access to internal subject matter experts and links with key NSW government agencies involved in climate change policy i.e. Office of Environment and Heritage.</p>  |

# Level of Collaboration & Resource Requirements

| Question  | Response  |
|---|---|
| <p><b>Level of collaboration</b></p> <p>Please select the level of collaboration required to complete the proposed research</p> | <p><b>1. 'Quick-Fire' Research</b> <input type="checkbox"/></p> <p>Intense bursts of research activity (e.g. under 8 weeks). Intended to make use of 'hackathon'-type environments, where students/researchers work collaboratively and intensely on particular problems involving data interrogation and visualisation.</p> <hr/> <p><b>2. Undergraduate Final-Year Research</b> <input type="checkbox"/></p> <p>Suitable for final-year undergraduate students (e.g. capstone, Honours) as part of the research requirements for their undergraduate degree (i.e. 1 to 2 semesters).</p> <hr/> <p><b>3. Higher Degree Research</b> <input checked="" type="checkbox"/></p> <p>Project may form whole or part of a postgraduate research degree (i.e. Masters, PhD), and contribute to new knowledge (i.e. 1 to 3 years).</p> <hr/> <p><b>4. Major Collaborations and Funded Research</b> <input type="checkbox"/></p> <p>Project may form the basis for a significant collaboration agreement between TfNSW and the relevant research institution, including major competitive grant funding (e.g. Australian Research Council funding with TfNSW as an industry partner).</p> <hr/> <p>This project could form all or part of a PhD or Masters by Research</p> |
| <p><b>Comments</b></p>  | <p>TfNSW will facilitate access to subject matter experts and project support (up to 4 hours per week). TfNSW will also endeavour to help attain required data.</p>   |
| <p><b>Supporting TfNSW resources</b></p>  | <p></p>   |