

Parramatta Light Rail Stage 1 – Today's Design For Tomorrow's Future

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Highlights

- The Transport for New South Wales (TfNSW) Future Transport 2056 is a vision to create a sustainable, modern and connected transport system for its customers and the economy. The philosophy behind these aspirations has driven the design of Parramatta Light Rail Stage 1 and is reflected in the flood assessments undertaken to achieve today's design for tomorrow's future.
- The detailed flood modelling undertaken for the Project was complex with highly urbanised catchments and considered scenarios for climate change and cumulative impacts of wider development plans within the region to future-proof the light rail for the long-term needs of the growing population and evolving climate.

Introduction



Figure 1: Artist's impression of light rail at Macquarie Street. Source: <http://www.parramattalightrail.nsw.gov.au/parramatta-cbd> (2021)

This abstract is to present on how TfNSW's Future Transport 2056 vision has influenced the design outcomes and flooding assessment of Parramatta Light Rail Stage 1 in providing a resilient piece of infrastructure that is future-proofed for the growing needs of the population of NSW.

Stage 1 of the Parramatta Light Rail is a key transport link for Western Sydney forming an important component of the integrated transport network supporting growth in the Greater Parramatta to the Olympic Peninsula priority growth area. The project connects several key locations, including the Westmead Health Precinct, Cumberland Hospital Precinct, the Bankwest Stadium, the new science, technology and innovation museum Powerhouse Parramatta, the proposed town centre at Camellia, Rosehill Gardens Racecourse, the private and social housing redevelopment at Telopea, and three Western Sydney University campuses.

As a result of these considerations, the project has been designed to meet stringent flood impact requirements taking into account climate change and the cumulative impacts of other developments within the locality of the project and community. Advancements in TUFLOW flood modelling techniques and automated processes have been developed to inform the flood impacts of the light rail and supporting infrastructure. These developments have allowed the flood modelling to account for complex, highly detailed underground pit and pipe networks and above ground civil design elements that influence overland flood behavior for a comprehensive range of flooding scenarios within the narrow constraints of the Project's delivery timeframes.

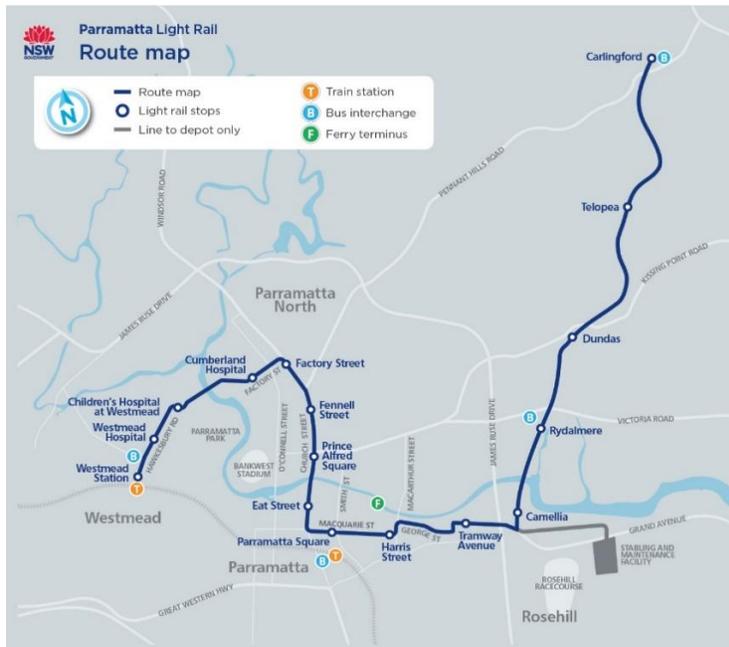


Figure 2: Parramatta Light Rail Alignment. Source: <http://www.parramattalightrail.nsw.gov.au/parramatta-cbd> (2020)

Methodology

Parramatta Light Rail Stage 1: Today's design for tomorrow's future

In-built into the design framework of the Project are the key drivers of TfNSW's 10 Year Plan in "Making NSW a better place to live, work and visit" for Customers, for Communities and for the people of NSW



Figure 3: TfNSW 10 Year Blueprint (2020). Source: <https://www.transport.nsw.gov.au/about-us/who-we-are/our-transport-vision>

The following are the key Project actions that answer to the Blueprint's Strategic Priorities (See Figure 3):

1. Working in Partnership with the Client and stakeholders including TfNSW
2. Data-driven decision making in designing the light rail to achieve the required flood immunity taking into consideration climate change and cumulative impacts from works by others for all land developments approved at the time of the design phase. These works by others were considered in the design process through a combination of external flood model data and 3D designs for these projects.

3. Technology and Innovation using latest rainfall on grid methods for the hydrologic analysis and automation tools for quick and accurate conversion of fine detail 3D designs (e.g. box/ tram drains, pit and pipe trunk drainage, road and rail breaklines) to TUFLOW format.
4. Place-based integrated service design by providing the light rail service through major health and entertainment precincts in Parramatta CBD, North Parramatta and Westmead, and will form part of the larger transport network connecting to the future Sydney Metro West, heavy rail in Westmead and Parramatta, ferry services in Parramatta, and bus services at Westmead, Parramatta and Carlingford. The design also considers the wider development strategy for the region and has incorporated several significant land developments that were approved at the time of the Project. These include the recent Hawkesbury Road Widening which caters to the Westmead Health Precinct and Parramatta Square.

Results and discussion

1. Resilience to climate change: TfNSW considered the predicted worsening in flood behaviour due to climate change and set requirements for design resilience to account for long-term maintenance and operations of the light rail.
2. Detailed consideration of the wider region's plan for growth: All recent and approved developments current at the time of design have been incorporated into the flood assessment to investigate the cumulative impact of the wider development strategy for the region. Mitigation measures have been incorporated into the light rail design accounting for the cumulative impact of these and will be validated via heat maps demonstrating the value to the wider community of including these external developments and the vision of an integrated approach to 'place' and community.
3. Automation processes from 12D to TUFLOW: The automation tools developed for this project have decreased processing times by at least 4x. This allowed for multiple design options to be quickly and accurately extracted and tested in the flood models thus allowing for a wide range of mitigation strategies to be explored to inform the final design outcome of the project. Innovation has the ability to make design 'future ready' and more agile and adaptive to change.
4. Inclusion of the complete detailed drainage design: The flood models incorporated the complex details of the drainage design including non-standard representation of small continuous open grated drains (e.g. ACO Drains) and pit inlet capture curves. This allowed for the flood assessment to accurately assess the 1d hydraulic performance of the proposed drainage strategy with interface of 2d overland flow behaviour from the wider contributing catchment.

Conclusions and future work

TfNSW's Future Transport 2056 vision has influenced the design outcomes and flooding assessment of Stage 1 of the Parramatta Light Rail in providing a resilient infrastructure that is future-proofed for the growing needs of the population of NSW. This is reflected in the stringent flood impact criteria adopted for the Project alight rail operations to be resilient for climate change and integration with the region's wider development strategy.

Automation tools have been created for the Project to facilitate quick and accurate detailed modelling of the drainage networks and civil design to facilitate the flood assessment and optioneering process. These tools reduced processing times between the 3D design model into TUFLOW by up to 4 times. There is future opportunity for the automation tools to be further developed to work in reverse, i.e. from TUFLOW format to 3d design for quick and accurate design options to be tested in the flood model and fed directly back to civil design software to further smoothen the integration of flood assessments in the design process.

References

1. Parramatta Light Rail. Available at <http://www.parramattalightrail.nsw.gov.au/parramatta-cbd> (Accessed 30/07/2021)
2. TfNSW: Our Transport Vision. Available at <https://www.transport.nsw.gov.au/about-us/who-we-are/our-transport-vision> (Accessed 16/03/2020)