

# ARMIDALE REGIONAL DRIVERLESS INITIATIVE (ARDI)

## PROJECT SUMMARY

### What is ARDi?

In response to TfNSW's Regional Automated Vehicle Trials expressions of interest request, Armidale Regional Council (ARC) brought together a range of partners to trial automated transport for the region. The Australian first ARDi trial helped cement Armidale's reputation as a smart, technologically advanced and progressive city.

The trial's EasyMile EZ10 Automated Shuttle is known as ARDi, a battery-powered, 12-person automated electric shuttle. ARDi is a 'last-mile' solution optimised for relatively low-speed travel (15 to 18 kph) in diverse environments.



SAY G'DAY TO ARDi

ARDi pictured in front of Booloominbah, UNE

### PROJECT PARTNERS

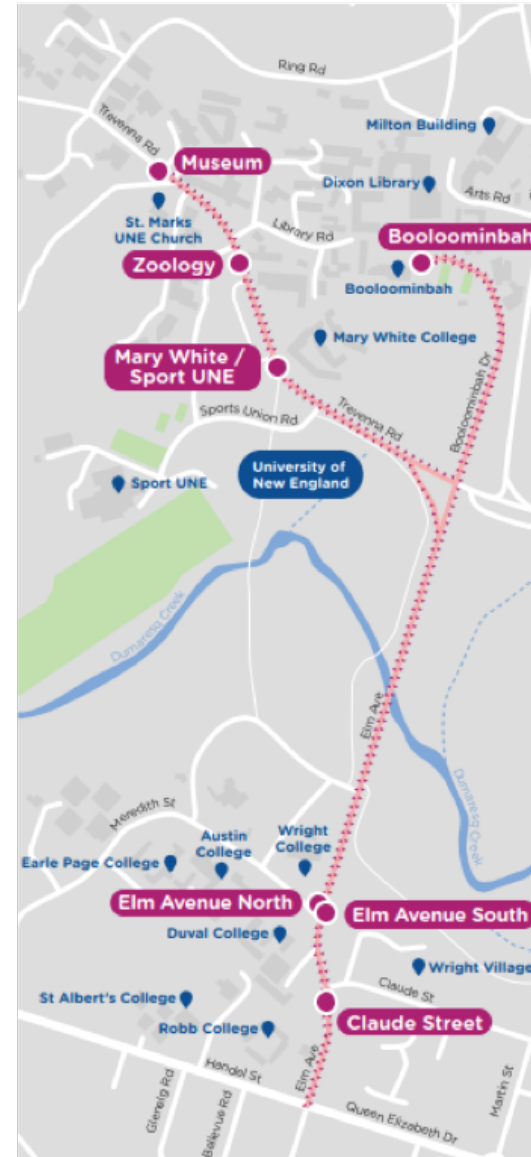
TfNSW	Trial sponsor	
ARC	Local Government Partner	
UNE	Location Partner	
EasyMile	Vehicle & technology	
WSP	Consulting subcontractor	
Transdev	Operations & maintenance	
Edwards Coaches	Operations subcontractor	

### DEPLOYMENT

The following diagram offers an overview of the trial's development, from expressions of interest for the TfNSW Regional CAV initiative through to post-trial assessment. This holistic view of the trial is important for understanding the time taken to safely and successfully deploy this Australian first automated vehicle service.



Phase 2 route map, library extension



Phase 1 route map

### What did we do?

The Armidale trial, February 2019 to February 2020, was split into two phases:

#### Phase 1

- > Where: UNE campus north-east of Armidale CBD
- > When: February to June 2019
- > How far: 4.8 km per trip
- > Operated: 10am to 2pm and 5.30pm to 9.45pm Monday to Friday

Phase 1 had a strong focus on students' transport needs, operating a route between the campus and college accommodation and generating strong technical, infrastructure and regulatory insights.

#### Phase 1 Objectives

- > Introduce an automated shuttle to regional NSW
- > Operate an automated shuttle in a mixed traffic road environment
- > Provide students safe and secure transport within campus
- > Test interactions between vehicle and passengers to allow full driverless operation
- > Test the collection of real-time passenger data

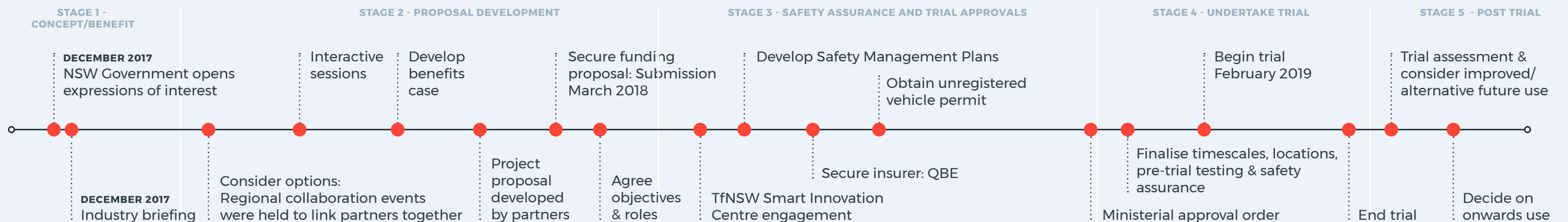
#### Phase 2

- > Where: Armidale CBD
- > When: October 2019 to February 2020
- > How far: 822-meter loop
- > Operated: A timetabled service 9am to 5pm Monday to Friday and 9am to 12pm on Saturdays

Phase 2 focussed on testing the technology supporting ARDi, maximising site suitability vs the technology's operating domain.

#### Phase 2 Objectives

- > Provide a dedicated route around and through Armidale CBD
- > Improve services for elderly and those with mobility needs
- > Support proposed CBD developments and ARC's smart city strategy
- > Test ARDi's interactions with other vehicles and road infrastructure
- > Start testing the Operational Control Centre's CAV operations
- > Test the integration of real-time passenger data



## Operational Summary



ARDi helped 956 people move around UNE's campus over Phase 1. In Phase 2, ARDi shuttled 1,459 people around Armidale CBD



ARDi covered a lot of ground in Phase 1: over 3,400 km. Phase 2 brought ARDi a little respite, with a much shorter (but more challenging) route, where it travelled a total of about 1,800 km



ARDi spent nearly the equivalent of 40 days in service across both trial phases: 521 hours in Phase 1 and 432 hours in Phase 2

## Customer Feedback



Passengers who completed the survey were overwhelmingly satisfied with the service: 91% and 96% of respondents felt partly satisfied or satisfied in Phases 1 and 2 respectively



Passengers' responses to safety questions were positive: 92% in Phase 1 and 100% (of 21 respondents) in Phase 2 were satisfied/partly satisfied



Negative perceptions of ARDi's slow speed (during the very low-speed mapping phase) reduced once people had a chance to ride ARDi. Passengers then noted the speed felt more appropriate from inside the shuttle

### ARDI'S AUSTRALIAN FIRSTS

- Australia's longest automated shuttle route providing service nine hours per day up to 10pm at the UNE's campus
- First automated shuttle to operate in a mixed traffic CBD environment
- First automated shuttle to integrate public transport trip planner software and real time passenger information



## Key Learnings

### OPERATING ENVIRONMENT



ARDi is designed for lower speed shared traffic environments that aren't prevalent in Australia. However, through detailed safety assurance activities the vehicle was able to operate in mixed traffic environments. This enabled the project team to understand the benefits and challenges of operating CAVs from customer, technological, infrastructure and regulatory perspectives.

#### > Key software developed

Over the course of the trial, EasyMile developed the ideal and edge-case operating environments, helped identify key risks and competencies in new deployments, and streamline the path to deployment and operation.

More robust software has been developed to help map steeper grades, enabling more accurate localisation in such scenarios across the EasyMile automated vehicle fleet.

#### > Accounting for operator fatigue

During Phase 1, a single round trip could take up to 40 minutes, making this the longest CAV trial route in Australia. ARDi required the operator to stand during operation, with opportunities for rest between stations and services. Such prolonged standing challenged a few operators.

Future trials should assess the impact on operators of standing, and factor this into resourcing plans. The vehicle and technology partner can guide, e.g. EasyMile can state a maximum of 2 shifts of 2 hours, per day.

### SPEED



ARDi is a last-mile solution, optimised for mid-speed travel in diverse environments, rather than faster (but more controlled) freeway travel.

#### > Low-speed mapping process

Mapping, where ARDi reads and records the pre-determined operating environment, required ARDi to travel at about 5 kph. A traffic management plan and traffic control helped mitigate the speed differential, but it was nonetheless observed to have a negative impact on other road users.

Future trials should consider the low speed required for mapping exercises. Mapping outside peak times offered significant benefits in terms of safety (reducing the likelihood of poor road user behaviour) and public perception of the vehicle (less frustrated road users).

#### > Speed at intersections

Learnings from initial phases informed refinements to latter use cases, including altering plans to cross a high traffic volume, speed and heavy vehicle route which

would have introduced a range of safety and operational challenges which proved difficult to mitigate.

Routes with high traffic volumes, speeds and heavy vehicles should be avoided when route planning, unless this is a specific trial objective with proposed technologies and use cases aligned to such an environment.

#### > Public perception of speed and driver behaviour

Initial responses from other road users (during mapping) to ARDi's relatively low speed (compared to the posted limit) included poor behaviours such as tailgating and cutting back in sharply after overtaking.

ARC and Transdev ran community engagement sessions, which were observed to have a positive impact – road users became more tolerant and public perception improved.

Community engagement sessions should form a key part of any future trial's stakeholder engagement.

### MAINTENANCE



#### > Local maintenance resource

The trial employed a pre-defined, tiered maintenance procedure that operated at three levels; basic (operators), standard (local resource), and specialised (EasyMile). In practice, this trial employed an approach whereby partners collaborated to ensure safe project delivery.

Future trials should have robust and efficient local maintenance processes in place, for example a qualified on-site operator to deal with technical and minor mechanical issues.

### IMPORTATION AND APPROVALS



#### > Partnership

The partnership approach encouraged close working relationships and good communication. TfNSW support was central to overall trial delivery, and particularly important during the vehicle importation and approvals process.

A partnership approach is recommended for future trials, taking care to ensure the breadth and diversity of technical and communications and organisational skills are available.

#### > Understanding Australian Design Rules (ADR)

Any vehicle being imported into Australia must follow ADRs – national standards for vehicle safety, anti-theft and emissions. ARDi required several exemptions and/or modifications to meet these, including rear-view mirrors (one more), seatbelts (needed to be installed) and indicator lights (incorrect size).

The ADR process is not CAV specific. It created challenges for the project team to import the automated shuttle. The time and effort required to meet ADRs, and the impact this may have on future trial timelines, should be considered.

### ENVIRONMENTAL



#### > Leaves

Leaves on the road created challenges for ARDi, resulting in a high percentage of emergency stops over Phase 1 (36% of all emergency stops). Several factors contributed including the high concentration of protected trees along Elm Ave, the deployment time (autumn) and climate (period of drought). EasyMile recognised the high number of e-stops and introduced a filtering algorithm to reduce their frequency.

EasyMile successfully deployed this key software upgrade, and it is now rolled out across the fleet. Feedback from EasyMile operators internationally shows it has reduced such emergency stops by as much as 80%.

### PROCESS



#### > Project Hazard Log and risk discussions

A Project Hazard Log (PHL) identified risks and mitigations for the project and trial. Leveraging EasyMile's technical expertise and previous trial experience to pre-populate the PHL with WSP's support, proved highly effective. It facilitated in-depth discussion around risk scoring. It also encouraged partner collaboration, and harnessed different backgrounds and perspectives to drive a thorough review of project and safety risks.

Future trials should also have a technical partner populate the PHL ahead of discussions with the wider project team, to ensure a structured process is in place to rapidly resolve any safety issues.

#### > Operator recruitment and skill-set

The trial showed that the role of the on board supervisor is critical to successful operations and positive customer experience. In addition to traditional skills associated with public transport operations, drivers and vehicle supervisors will benefit from having 'soft skills', such as IT literacy, technology capability, and demonstrable ability to learn new, technology-based skills.