

CAMBRIDGE CONNECTIONS

Moving People, Protecting Future Choices and Preparing Cambridge for the Next Generation of Transport

Report to Katie Mayes

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1. Purpose of this report

This report is provided following consideration by the Strategic Planning and Policy Committee on 26 August 2026 of the Cambridge Connections Strategic Transport Network Review and Refined Themed Long List Multi-Criteria Assessment as well as all information made available by Waipā DC on its website, Waikato regional council Transport committee reports, FutureProof, NZTA research, Infrastructure Commission Report, new legislation and local knowledge.

The Committee's decision is an important staging point rather than the conclusion of the Cambridge Connections process. The next significant decision will be consideration on 7 October 2026 of the draft Cambridge Connections Transport Plan for public consultation.

The purpose of this report is therefore not to revisit decisions already made. It is to identify matters which, in our view, should be incorporated into the development of the draft Transport Plan before it is presented to elected members in October 2026 and could/should inform the workshop on 7 September 2026.

The central proposition is simple:

Cambridge Connections should be primarily concerned with moving people efficiently, safely and affordably over the next 30 years. It should protect the ability to construct major transport infrastructure if and when that becomes necessary but should not prematurely define either the form or location of every future crossing before emerging transport technologies and alternative service models have been properly tested.

The opportunity now exists to develop a Transport Plan which is sufficiently robust to accommodate substantial population growth but sufficiently adaptable to respond to changes in technology, land use, regional spatial planning, local-government structure and infrastructure funding.

A 30-year transport plan should not assume 30 years of today's technology, today's planning system, today's council structure or today's funding model.

What we are asking Council to do now

- 1. Protect the western corridor where justified, but expressly as an option for a future general-traffic crossing — not as a predetermined conventional bridge decision.**
- 2. Separately investigate the function and location of a people-moving crossing.**
- 3. Incorporate Cambridge–Leamington–Hautapu mobility cells, distributed park-and-ride and smaller feeder services into the draft Transport Plan.**
- 4. Commence an autonomous mobility trial programme now, drawing directly upon NZTA RR713, Beca's AV/ITS capability, NZTA and credible suppliers.**
- 5. Test a rapid/exponential technology-change scenario alongside conventional modelling before major infrastructure choices are locked in.**
- 6. Develop funding and ownership options in parallel rather than assuming Waipā rates must ultimately fund every element.**

2. The 26 August decision provides an appropriate starting point

The Strategic Transport Network Review provides useful strategic information.

The report itself recognises that the Waikato Regional Transport Model is a large strategic model covering a wide regional area and that forecasting volumes on individual Cambridge streets has limitations. It expressly identifies the WRTM as **one input alongside other technical evidence** and contemplates more detailed modelling of particular intersections and sections of the local network.

The qualification added by Council on 26 August — recognising the regional nature of the modelling and the need for more detailed analysis of actual Cambridge roads — is therefore important. It establishes an appropriate hierarchy:

Regional modelling should inform the strategy.

Detailed local analysis should test the actual network.

Real-world trials should test transport modes which existing models cannot adequately represent.

The qualification should carry forward expressly into the October Transport Plan.

This matters because the WRTM was principally designed to model conventional vehicle movements. It cannot determine with precision what happens if significant numbers of people who would otherwise travel by private car instead walk, cycle, use a small feeder vehicle, park at a mobility hub or travel in a shared autonomous passenger vehicle.

That is not a criticism of the model. It is recognition of what the model is, and what it is not.

3. The transport question should now be framed differently

Much of the Cambridge Connections discussion has inevitably revolved around an additional bridge. There remains good reason to investigate and protect a corridor for an eventual additional general-traffic crossing. But the starting question for a 30-year Transport Plan should not simply be:

Where should the next road bridge be built?

It should be:

How will Cambridge move people, freight and services efficiently as the town grows, and which transport functions actually require major new infrastructure?

That distinction is fundamental. - Freight and people are not necessarily best moved in the same way. An eventual general-traffic crossing may be required for:

- freight;
- network resilience;
- emergency access;
- strategic road movements;
- regional traffic;
- private vehicles which cannot realistically transfer to another mode.

But much of the pressure experienced in central Cambridge and at the river crossings is generated by **people travelling in individual vehicles**, particularly during concentrated morning and afternoon peaks. School pupils, workers, tertiary students, health users, shoppers and people undertaking relatively short local trips do not necessarily require a conventional road bridge in order to cross the river.

Accordingly, in our view, the Transport Plan should distinguish between:

moving vehicles, and

moving people.

That distinction opens considerably more options.

4. Cambridge is changing spatially

The Cambridge of 2055 will not have the same transport geography as Cambridge today.

Residential development is occurring both north and south of the river. The western side of Cambridge is changing materially. Hautapu continues to develop as a major employment and industrial area. Hamilton Airport and Southern Links influence the western and northern approaches. The Waikato Expressway has altered regional movement patterns. The strategic consequence can be expressed simply:

The Waikato Expressway did more than bypass Cambridge. It changed Cambridge's economic geography.

The functional relationship is increasingly:

Hamilton – Airport – Southern Links – Hautapu – Cambridge – Piarere – Tauranga.

That relationship should be much more visible in the Cambridge Connections Transport Plan.

5. The Hamilton–Waikato metropolitan concept must be distinguished from the regional transport model

It is important that two different concepts are not conflated. The **Hamilton–Waikato metropolitan approach** is fundamentally a spatial and functional planning concept. The **Waikato Regional Transport Model** is an analytical modelling tool.

One does not prove the other.

FutureProof's metropolitan work analysis places Cambridge and Hautapu within a broader Hamilton-centred functional urban system. That is relevant because decisions about employment, housing, regional public transport, the Airport, Southern Links and major infrastructure increasingly cross current individual council boundaries.

The metropolitan concept therefore provides an important **strategic context**. It does not mean that regional vehicle modelling should determine the detailed performance of Cambridge's local roads. That is precisely why the Council's 26 August qualification is valuable.

Cambridge Connections should therefore recognise both propositions simultaneously:

Cambridge increasingly forms part of a wider Hamilton–Waikato metropolitan economy and transport system.

and:

Cambridge's local transport solutions still require detailed local evidence and should not be determined solely by regional vehicle modelling.

That distinction should be explicitly stated.

6. Hautapu should become a more prominent part of the Transport Plan

Hautapu should not be treated simply as an industrial destination lying outside the principal Cambridge transport discussion. The decisions on infrastructure to service the area show this. It is increasingly a substantial employment node and is strategically positioned between Cambridge and the Expressway/Hamilton direction.

That makes Hautapu an obvious location to examine for a significant **mobility and interchange hub**. Its functions could include:

- employment access;
- park and ride;
- local feeder services;
- autonomous passenger vehicles;
- connection to Route 20 or its successor;
- future higher-frequency regional public transport connection;
- walking and cycling;
- connection towards Hamilton and the Airport.

The Transport Plan should therefore consider Hautapu as part of Cambridge's developing metropolitan interface rather than merely as a destination generating additional vehicle trips (although it certainly does this).

7. The emerging western crossing corridor

The more western crossing option is now becoming easier to understand in spatial terms. Development between Hamilton Road and the river is establishing a new road structure, including the substantial roundabout already constructed on Hamilton Road. A potential future crossing connecting with that structure may therefore provide a logical long-term general-traffic corridor. If so, there is considerable merit in protecting the opportunity before surrounding development makes it prohibitively difficult or expensive.

We do **not** oppose sensible corridor protection.

The important point is what that protection means.

On 19 August Council advised property owners within the broad areas being investigated that the mapping was for modelling purposes, that no preferred location had been selected and that more detailed work would be required before any precise river crossing and connecting road alignment could be considered. The subsequent 26 August decision expressly retained the need for more detailed local road analysis. Accordingly:

Protection of a western corridor should be described as preserving an option for a possible future general-traffic crossing. It should not be allowed to become, by default, a decision that Cambridge's next crossing must be a conventional road bridge in that location.

If the October Transport Plan advances the western area from broad modelling to a more specifically defined corridor for protection, that change should be identified transparently.

Affected property owners should also be directly advised if the status of the investigation has materially changed from that described to them in August.

8. There may be two different river-crossing questions

We consider this distinction should now be expressly examined.

8.1 Ultimate general-traffic crossing

The relevant criteria include:

- freight;
- strategic traffic;
- resilience;
- connection to the future arterial network;
- heavy vehicle loading;
- SH1/Hamilton connections;
- regional movements;
- substantial future growth.

A western alignment may ultimately prove logical for those functions.

8.2 A people-moving crossing

A crossing principally intended for people should be tested against different criteria:

- where people live;

- where schools are;
- short cross-river trips;
- Cambridge and Leamington centres;
- walking and cycling;
- tertiary and health destinations;
- accessibility;
- gradients;
- staging areas;
- autonomous passenger vehicle routes and geo-fencing;
- public transport interchange;
- land and environmental constraints.

There is no reason to presume that these two assessments must identify the same corridor. Indeed, protecting a sensible long-term western road corridor may make it easier to examine an alternative people-moving crossing objectively because one structure no longer needs to perform every possible future transport function.

9. A future crossing should not yet be defined by today's vehicle

We suggest that the Transport Plan refer to a **future crossing** rather than automatically to a future conventional bridge wherever the eventual function remains unresolved. For the people-moving function, we have used the working description: **Adaptive Enabling Crossing**

The name is less important than the engineering principle. A long-lived river structure should distinguish between **the enduring structure**, and **the transport technology carried by it**.

Foundations, piers and primary structural elements may have a design life measured in many decades. Vehicles, batteries, communications, sensors and fleet technology may change several times during the same period. The objective should therefore be to construct robust **bones**, while allowing the operating systems placed upon them to evolve.

Potential functions could include:

- walking;
- cycling;
- mobility devices;
- utility services;
- lightweight managed passenger transport;
- autonomous pods or future equivalent vehicles.

This is not a proposal for an under-designed or temporary bridge.

It is a proposition to avoid unnecessarily designing a people-moving structure around the loads and geometry of every conventional vehicle simply because those are the vehicles familiar in 2026.

10. Public transport should be considered as a network of functions

Cambridge's public transport debate should not be reduced to whether Route 20 should simply be extended further through the town. Route 20 performs an important **regional/trunk function**, particularly between Cambridge and Hamilton.

Local collection and distribution is a different function.

There has already been local advocacy for smaller-scale feeder services operating within Cambridge rather than relying exclusively on the extension of a conventional regional bus route. We consider that concept warrants serious evaluation. The structure could be:

regional trunk service + mobility cells + local feeders + mobility hubs.

That allows the regional service to perform the task for which a larger bus is most efficient, while smaller vehicles circulate locally. Importantly, this concept does not depend upon autonomous vehicles being immediately available. The initial service could use conventional small electric vehicles. Automation can progressively replace the driving function as the technology proves itself.

That makes the approach technologically neutral and considerably reduces implementation risk.

11. Mobility cells

We recommend that Cambridge Connections initially investigates three broad mobility cells:

Cambridge

Leamington

Hautapu

The boundaries need not be rigid. The point is operational. Most short local journeys occur within or between identifiable activity areas. Smaller vehicles can circulate efficiently inside those areas while linking passengers with:

- schools;
- town centres;

- employment;
- major public transport;
- park-and-ride facilities;
- the river-crossing system.

This is fundamentally different from an autonomous taxi fleet roaming indiscriminately across the town.

It is a **managed public transport system**.

12. Park and ride should be a core component of the cell concept

Park-and-ride has not yet received sufficient emphasis in Cambridge Connections. We suggest investigating, conceptually, **two peripheral park-and-ride/mobility hubs within each major cell**, supplemented by smaller central pickup/drop-off interchanges.

The purpose of the peripheral hubs would be to intercept vehicle journeys **before** they reach the most congested parts of the network. People could reach them by:

- car;
- bicycle;
- walking;
- rural drop-off;
- another feeder vehicle.

From there a smaller passenger vehicle could undertake the higher-productivity movement. The central facilities in Cambridge and Leamington need not themselves become major car parks. They could principally provide:

- passenger pickup/drop-off;
- pod/minibus bays;
- cycle parking;
- shelter;
- mobility-device access;
- short-duration vehicle drop-off.

This distinction is important. A **mobility hub** need not mean a large expanse of asphalt.

13. Town Belt land warrants investigation, but not displacement of existing recreational uses

The distributed nature of Town Belt land means some parcels may warrant investigation for modest mobility facilities. However, the suitability of each parcel must be assessed individually against:

- existing use;
- reserve classification;
- the Reserve Management Plan;
- the Reserves Act;
- accessibility;
- adjoining transport routes.

Leamington Domain illustrates why public ownership alone is not sufficient. The Domain already accommodates the motor camp, netball courts, covered skating facility, playground, bowling club, croquet and the open field/cricket area. Parking associated with Saturday netball is already under pressure. A substantial park-and-ride there would therefore compete with existing recreation rather than complement it. We do not recommend it.

The preferred model should be:

peripheral P&R facilities where spare capacity genuinely exists, together with small central interchanges rather than converting heavily used reserve land into commuter parking.

14. The first year should include a real transport trial

The draft Transport Plan should not consign autonomous transport to a distant technological horizon. New Zealand already has relevant experience. NZTA Research Report 713, prepared principally by Beca with SYSTRA, examined the feasibility of automated public transport in New Zealand. It concluded that local pilots and trials are necessary to understand regulatory impacts, local operating risks, costs, stakeholder response and user experience.

That finding is directly applicable to Cambridge. The trial should begin now, well before any new river crossing is constructed. Existing roads provide the testing environment. We suggest:

Year 1 — define and prepare

- map actual travel demand;
- identify routes;
- select initial use cases;
- engage schools – show pupils visuals;
- establish regulatory pathway;
- determine insurance and safety requirements;
- obtain vehicle and operating-platform proposals;

- establish baseline travel data;
- undertake privacy and cybersecurity assessment.

Year 2 — put the technology into Cambridge

- one or more demonstration vehicles;
- supervised public-road operation;
- community experience;
- school/pupil demonstrations and use;
- emergency-service testing;
- accessibility testing.

Year 3 — genuine passenger operation

Subject to the safety and regulatory gates being satisfied:

- scheduled and/or on-demand public service;
- operation within selected cells;
- connection to mobility hubs;
- selected school passenger service;
- real operating data.

The essential point is:

The vehicle should start on Cambridge public roads within the first year programme.

15. Beca's own expertise should be used

This should be approached positively but directly. The Cambridge Network Review is necessarily influenced by the scope and modelling tools used for that commission. Beca's institutional expertise is substantially broader than the material presently visible in the Cambridge work. Beca was the contracted New Zealand research organisation for NZTA Research Report 713. The study expressly separates vehicle, operating-system, infrastructure and operational costs and was designed to assist public authorities considering real automated-public-transport trials. Beca also has wider ITS and integrated transport-planning expertise.

Accordingly, the next stage of Cambridge Connections should expressly draw upon that capability. We suggest Council ask:

Which members of Beca's automated-public-transport/ITS capability will be involved in the development of the Cambridge Transport Plan, and how will the findings and evaluation framework from NZTA Research Report 713 be applied to Cambridge?

This is not criticism of Beca's expertise. Quite the opposite. **The expertise exists. Cambridge should use it.**

16. Purpose-built passenger vehicles are already emerging

The relevant future vehicle is unlikely to be simply today's private motorcar with the driver removed. Purpose-built autonomous passenger shuttles already exist. New Zealand-developed Ohmio vehicles provide a particularly relevant example. Their significance is not that Cambridge must purchase a particular product. It is that the underlying proposition has already moved beyond theoretical discussion:

- small electric passenger vehicles;
- predefined/geofenced routes;
- remote fleet supervision;
- configurable passenger capacity;
- wheelchair access;
- digital fleet management.

Comparable purpose-built vehicles are being developed and trialled internationally. The technology will continue to change (and this is happening fast). That is exactly why Cambridge should test function rather than attempt to select a final 2055 vehicle in 2026.

Function should precede form.

That is also consistent with the approach adopted in Research Report 713.

17. How much passenger movement might be possible?

The school market provides a useful illustrative test. We understand that approximately seven student levels are relevant to the cross-river school movement from Leamington and surrounding rural-residential areas. If approximately 40–50 pupils per level could reasonably use a shared service, including some pupils from those rural-residential areas travelling to staging points, that produces an indicative potential school cohort of:

280–350 pupils.

Adding other users — including workers, tertiary students, health users and other passengers — suggests that an illustrative peak design scenario of approximately **400 persons in one hour** is worth testing.

This is not presently a forecast. It is a scenario for analysis. At an average occupancy of eight passengers **400 passengers = 50 loaded pod movements.**

If a loaded peak-direction trip takes approximately 20 minutes and the empty vehicle can reposition against the dominant traffic flow without stops in approximately 10 minutes, the full operating cycle is around 30 minutes. Each vehicle could therefore undertake approximately two loaded movements in the peak hour. That implies approximately **25 operating vehicles**, plus an operational reserve.

An indicative mature fleet of approximately **30 vehicles** is therefore within a plausible order of magnitude under those assumptions. If average occupancy increases, the required fleet falls. These numbers must be tested. But they demonstrate why the concept deserves proper analysis.

18. Repositioning must be distinguished from uncontrolled deadheading

Autonomous vehicle modelling elsewhere in New Zealand has demonstrated the risk of additional vehicle kilometres caused by empty vehicles repositioning between jobs. That concern is genuine. But there is an important distinction between **unproductive deadheading**, where vehicles travel substantial distances seeking their next unrelated passenger and **productive repositioning**, where a vehicle returns directly against the dominant flow to a known high-demand origin to carry another group. The school peak is an example of the latter. The appropriate performance measures should therefore include:

- passengers moved per vehicle-hour;
- passengers moved per kilometre;
- average occupancy;
- loaded kilometres;
- repositioning kilometres;
- waiting times;
- car trips displaced.

At peak periods the vehicle should behave more like a lift than a taxi:

fill — move — unload — return — repeat.

19. A meaningful trial requires more than one vehicle.

One or two vehicles can demonstrate the technology. They cannot properly test the network concept. The object being tested is ultimately **the fleet**. An initial multi-vehicle trial in the order of **8–12 vehicles** would provide a much more meaningful basis for assessing:

- simultaneous demand;
- fleet dispatch;
- charging;
- vehicle availability;

- repositioning;
- peak capacity;
- passenger waiting;
- remote supervision;
- operational failure;
- public acceptance.

Thousands of real operating journeys could be accumulated over one school year. That would produce useful Cambridge-specific evidence before much larger capital decisions are made.

20. School transport provides an excellent initial use case

School demand has unusual advantages:

- destinations are known;
- peak times are known;
- demand repeats;
- pupil origin areas can be mapped;
- fixed staging points can be established;
- parent/guardian permissions can be managed.

The model should not be door-to-door autonomous taxi transport. During school peaks, fixed or semi-fixed staging points would allow:

- walking;
- cycling;
- parent drop-off;
- rural-residential transfer;

followed by direct high-occupancy transport. That is likely to produce much greater fleet productivity.

21. The system must accommodate abnormal events

A school timetable is predictable. A school closure is not. Loss of potable water provides a straightforward example. A school may need to close with little warning and several hundred pupils may suddenly require transport. Accordingly, the system must include a formal **School Emergency Transport Protocol**. There should be a fail-safe communication path - **authorised school officer → mobility control centre → fleet → parents/guardians**.

There should be more than one communication method. The system should be capable of:

- fleet recall;

- priority repositioning;
- parent notification;
- confirmation that a pupil is authorised to travel;
- safe destination/handover management;
- temporary prioritisation of school transport over lower-priority demand.

Automation of the vehicle must not mean automation of responsibility.

22. Passenger safety and privacy should be designed together

Removing a driver removes more than the steering function.

Passengers also lose:

- visible supervision;
- reassurance;
- deterrence against antisocial behaviour;
- immediate passenger assistance.

Research Report 713 identified passenger concern about precisely these matters. The service therefore needs to restore those functions through design, potentially including:

- transparent interiors;
- remote supervision;
- emergency communication;
- CCTV;
- safe-stop functions;
- registered school access;
- real-time vehicle monitoring.

At the same time, safety should not become justification for creating an unnecessary permanent surveillance system. New Zealand now has the Biometric Processing Privacy Code 2025. The appropriate principle is:

Collect the least personal information reasonably necessary to operate a safe transport service.

Vehicle location data and passenger identity data should, where practicable, be separated. There is a substantial difference between:

- recording an incident;
- verifying that an authorised pupil has boarded;
- continuously identifying every passenger by facial recognition;

- maintaining a searchable long-term history of every person's movements.

The system should be designed around the first two requirements unless evidence demonstrates that more intrusive measures are genuinely necessary.

23. Cost analysis needs substantial further development

The current strategic cost bands are useful for broad option comparison. They are not sufficient for the decisions which will ultimately be required. The next phase should compare **whole-of-life cost**, not simply initial capital expenditure. At least three public-transport models should be evaluated on a comparable basis:

1. expanded conventional fixed-route bus service;
2. smaller driven cell-based feeder vehicles;
3. purpose-built autonomous passenger vehicles.

We understand that one proposed change to Route 20 has been costed at approximately **\$750,000 per annum**. That figure is useful because it demonstrates that apparently modest conventional-service changes can produce significant recurring expenditure. The relevant comparison is not bus purchase price versus pod purchase price.

It is:

What does it cost over 10, 20 and 30 years to move the required number of people at the required frequency and reliability?

For autonomous transport, the calculation must include:

- vehicles;
- fleet-management platform;
- charging;
- depot;
- communications;
- remote supervision;
- maintenance;
- insurance;
- cleaning;
- software/licensing;
- field response;
- periodic vehicle replacement.

The same discipline should apply to conventional bus services.

24. Major crossing costs also require fuller analysis

Similarly, the capital cost of a future road crossing cannot properly be represented solely by the structure.

The full project may require:

- bridge structure;
- approaches;
- intersections;
- road widening;
- property;
- utility relocation;
- environmental mitigation;
- walking/cycling facilities;
- consequential network upgrades;
- financing;
- maintenance.

The existing strategic assessment indicates that conventional additional-crossing options may fall within very substantial capital bands. Accordingly:

Protecting a corridor is not proof that the eventual project is affordable, funded or the best first investment.

That distinction becomes increasingly important in the present fiscal environment.

25. The fiscal environment has changed

On 25 August the Government announced its proposed rates-capping regime. The initial target range will be **2–4 per cent**, subject to limited exemption mechanisms. Councils are to begin taking the regime into account from 1 July 2027, with full effect from 1 July 2029. Whatever the final implementation details, the direction is clear. Future councils will face stronger constraints upon their ability to respond to major infrastructure requirements simply by increasing general rates.

This does not mean Cambridge should stop planning major infrastructure. It means **optionalities have financial value.**

Protect strategic corridors.

Test cheaper interventions.

Gather evidence.

Determine funding before making irreversible commitments.

26. Funding and cost are separate questions

The Transport Plan should distinguish:

What does the intervention cost?

from:

Who should pay for it?

A transport intervention may be inexpensive relative to a bridge but difficult for Waipā to fund alone. Conversely, a major regional asset may be expensive but appropriately funded by a combination of:

- NZTA;
- Crown;
- regional authority;
- development funding;
- infrastructure financing;
- targeted mechanisms;
- private sector participation.

Funding should therefore be developed **in parallel** with engineering and service design rather than deferred until after a preferred physical project has been selected.

27. The planning system is changing during preparation of Cambridge Connections

This is no longer a remote possibility. The Planning Bill and Natural Environment Bill passed their second readings on 4 August. The Committee of the whole House stage for the Planning Bill concluded on 25 August, with a substantial number of Amendment Papers having been filed during August. Care is needed in interpreting those papers.

Amendments advanced by opposition members such as Rachel Brooking and Lan Pham identify contested policy issues but should not be represented as Government policy. Greater predictive weight should be placed upon ministerial and Government Amendment Papers and upon Government announcements explaining the changes. The Natural Environment Bill, for example, has been subject to a substantial Government Amendment Paper sponsored by Chris Bishop. The precise final legislation remains important. But the strategic direction is already apparent.

28. National Policy Direction changes the planning context further

On 25 August the Government released its illustrative National Policy Direction.

It identifies national directives covering:

- housing and development;
- infrastructure;
- primary production;
- resources;
- public values;

together with broader system-wide direction.

Government describes the intended architecture as one in which National Policy Direction and national standards increasingly determine matters nationally and narrow what remains for repeated debate in regional and local plans.

The implication for Cambridge is not that transport planning should stop until every national standard has been completed. It is:

The Transport Plan should be robust to the planning system that is coming, not merely compliant with the planning system that is leaving.

Current District Plan and Ahu Ake assumptions remain relevant BUT they should not be treated as immutable predictions of Cambridge's 2055 urban form.

29. Tauranga provides a useful New Zealand comparison — but not a template

Tauranga and the Western Bay face similar structural transport problems at a considerably larger scale:

- rapid growth;
- constrained corridors;
- river/harbour geography;
- major freight movements;
- dispersed centres;
- significant greenfield expansion;
- local and regional traffic competing for the same corridors.

Their response is instructive because spatial planning and transport planning have increasingly been integrated. The Connected Centres approach is an integrated land-use and transport concept based upon connected neighbourhoods and multimodal corridors.

Tauranga's current modelling framework also includes a **person-based strategic model**, refreshed in 2025 with forecasts extending to 2073.

That provides a useful methodological comparison with Cambridge. It does not mean Cambridge needs Tauranga's modelling system. It does reinforce the principle that:

strategic vehicle modelling is an input to long-term transport planning, not a substitute for understanding how people move between modes.

30. The Western Bay Regional Deal is an important distinction

Care is required here too. Tauranga/Western Bay has something Waikato presently does not: a formal **City and Regional Deal with central Government**, signed on 14 May 2026. The Deal expressly links spatial planning, land release, transport investment, RLTP prioritisation and alternative funding arrangements. The Deal schedule includes commitments to coordinate housing/commercial land release with enabling roads, prioritise agreed transport projects through the RLTP and explore alternative infrastructure financing mechanisms.

Waikato does **not** presently have an equivalent deal. Accordingly, FutureProof should not be described as providing the same funding and implementation machinery. The distinction is:

Waikato has a metropolitan/spatial framework. Western Bay has both spatial arrangements and an additional formal Crown–local government delivery and funding partnership.

That difference reinforces the need for Cambridge Connections to remain capable of operating under whatever future regional governance and funding arrangements emerge.

31. Local-government structure may also change

Cambridge Connections is a 30-year programme. It should not be designed on the assumption that Waipā District Council necessarily remains the responsible institution throughout that period. Current local-government reform proposals contemplate substantial institutional change.

The appropriate response is not to delay Cambridge planning. It is to distinguish:

the transport outcomes that Cambridge requires

from

the institution which ultimately funds or delivers them.

The Cambridge Connections Transport Plan should therefore be designed to survive a change of council.

32. Infrastructure should enable place outcomes

Recent New Zealand commentary on infrastructure delivery also makes a useful point. Large infrastructure projects often rely upon benefits from subsequent housing, employment and redevelopment, yet those benefits can be delayed where land assembly, development and infrastructure planning are treated separately.

The central lesson is to move from thinking about isolated infrastructure assets towards **place outcomes**. That has direct application to Cambridge.

A future crossing should not be assessed only by how many vehicles it carries.

The Transport Plan should ask:

- which communities it connects;
- what development pattern it supports;
- how it relates to Hautapu;
- how it affects schools;
- whether it strengthens public transport;
- whether it increases or reduces private-car dependence.

33. Decision gates

We recommend that major commitments be controlled through explicit decision gates.

Gate 1

Can a small high-frequency feeder service operate effectively within Cambridge's mobility cells?

Trial it.

Gate 2

Can purpose-built autonomous passenger vehicles operate safely on Cambridge roads?

Test them.

Gate 3

Will people use them?

Measure it.

Gate 4

Can they materially reduce private-car movements during critical peaks?

Measure displaced trips.

Gate 5

Can a managed fleet move several hundred people per hour reliably?

Scale the trial.

Gate 6

Where would a people-moving river crossing deliver the greatest benefit?

Use observed passenger movement rather than assuming the answer.

Gate 7

What function remains for an additional general-traffic crossing after those interventions?

Use updated traffic, freight, resilience and growth evidence.

Gate 8

Who should own and fund each component?

Resolve the institutional and funding model before irreversible commitment.

A trial which demonstrates that an option does not work is not necessarily a failed investment. It is inexpensive information obtained before spending substantially larger sums.

34. Recommended actions before the October draft Transport Plan

We recommend that the Cambridge Connections team:

1. **Carry the 26 August modelling qualification expressly into the draft Transport Plan**, recognising the WRTM as strategic regional evidence rather than a detailed prediction of individual Cambridge roads.
2. **Continue investigating protection of the western future-crossing corridor** where justified by the emerging western road structure but distinguish corridor protection from a decision to construct a conventional road bridge.
3. **Undertake a separate functional and location assessment for a people-moving river crossing**, without presuming it must share the western general-traffic alignment.
4. **Develop the Adaptive Enabling Crossing concept sufficiently to test its engineering feasibility**, particularly the distinction between enduring foundations/primary structure and transport systems which can evolve.
5. **Make mobility cells a substantive part of the Transport Plan**, initially centred on Cambridge, Leamington and Hautapu.
6. **Investigate two appropriately located peripheral mobility/P&R hubs within each principal cell**, together with central pickup/drop-off interchanges in Cambridge and Leamington.
7. **Exclude heavily committed recreation land such as Leamington Domain from any assumption that public land is automatically available for P&R** and assess Town Belt parcels individually.
8. **Elevate Hautapu as a metropolitan employment and mobility node**, including investigation of a substantial interchange connecting local feeder services with regional public transport.
9. **Evaluate smaller cell-based feeder transport alongside any proposed Route 20 expansion**, including driven electric minibuses and progressively autonomous alternatives.
10. **Develop consistent 10-, 20- and 30-year whole-of-life cost comparisons** between conventional bus expansion, small cell-based feeder services and autonomous public transport.
11. **Commence an autonomous public-transport programme within the first three years**, with a vehicle physically operating on Cambridge public roads during that period.
12. **Move beyond a one-vehicle demonstration where initial testing succeeds**, with an indicative multi-vehicle trial capable of testing real fleet operation.
13. **Make school transport an early identified use case**, while also designing the system for employment, tertiary, health and general passenger demand.
14. **Develop a School Emergency Transport Protocol** covering unexpected closure, fleet recall, parent communication and pupil handover.
15. **Require privacy, cybersecurity and remote-supervision architecture to be designed before passenger operation**, rather than added after the technology has been selected.

16. **Request that Beca's automated-public-transport and ITS capability be directly involved in the next phase**, including application of the work undertaken for NZTA Research Report 713.
17. **Obtain indicative commercial information from credible autonomous-shuttle suppliers**, including vehicle costs at several fleet sizes, operating-platform costs, charging requirements and likely production timing.
18. **Treat the new planning legislation, National Policy Direction and national standards as active inputs rather than assuming existing local planning settings remain unchanged for 30 years.**
19. **Develop funding and ownership options in parallel with engineering**, recognising the rates-cap environment and potential restructuring of local government.
20. **If the October draft moves from broad western modelling to a specifically protected corridor, clearly identify that change and directly communicate with potentially affected property owners.**

35. A possible implementation pathway

The overall approach can be expressed simply.

2026–2027

Understand and protect

- detailed local network work;
- western corridor investigation;
- people-crossing study;
- mobility hub identification;
- school and passenger-demand mapping;
- autonomous-vehicle procurement/approval work;
- funding investigation.

2027–2028

Trial and measure

- driven small-cell service if appropriate;
- autonomous vehicle demonstration;
- public-road autonomous trial;
- park-and-ride pilot;
- school and general passenger operation;
- detailed KPI collection.

2029 onward

Expand what works

- larger fleet where justified;
- connect mobility cells;
- enhance regional PT interchange;
- secure crossing land;
- progress an Adaptive Enabling Crossing if supported by the evidence;
- continue protecting the ultimate general-traffic corridor.

Longer term

Build major conventional infrastructure when its remaining function and funding are established.

This is not delay. - It is sequencing.

36. Conclusion

Cambridge is at an unusually important point in its development. Population is growing. Its economic geography is changing. Its relationship with Hamilton, Hautapu, the Airport and the wider upper North Island is becoming stronger.

At the same time, the technology used to move people is beginning to change fundamentally. The planning system is being rewritten. Local-government funding is becoming more constrained. The institutional structure through which infrastructure will ultimately be delivered may itself change.

Those circumstances do not justify postponing decisions.

They justify making the **right decisions now**.

There is good reason to protect a western corridor if detailed investigation confirms its value for a future general-traffic crossing. There is much less reason to assume that protecting that option determines the form or location of every future Cambridge river crossing.

Cambridge also has an immediate opportunity to test whether significant numbers of people can be moved in smaller, more frequent shared vehicles, integrated with walking, cycling, park and ride, mobility hubs and regional public transport. That proposition can be tested on existing roads. It can begin within the first three years. It can generate real Cambridge evidence before substantially larger infrastructure decisions become irreversible.

The recommended philosophy is therefore:

Build the bones.

Design for people.

Trial the technology.

Connect the cells.

Expand what proves itself.

Protect the future road-crossing option.

Cambridge Connections should not simply predict how many more vehicles may use Cambridge's roads in 2055 and then build enough infrastructure to accommodate them.

It should help determine **how people will choose to move in the first place.**

That is the opportunity now available before the draft Transport Plan is presented to Council in October.

Protecting tomorrow's road-crossing option and testing today's alternatives are complementary decisions, not competing ones.

APPENDIX 1

Recent Advances in Autonomous Vehicle Technology

Why Cambridge should plan for rapid and potentially exponential change

1. Purpose of this appendix

This appendix records significant developments in autonomous vehicle technology, manufacturing, regulation and commercial deployment which have occurred during the period immediately preceding completion of the Cambridge Connections Transport Plan. Its purpose is not to predict which manufacturer, autonomous-driving system or vehicle type will ultimately succeed. Nor is it suggested that Cambridge should select any particular overseas vehicle. The purpose is to establish a more fundamental planning point:

Autonomous mobility is not a distant technology which can safely be placed in a “later” basket. It is developing now, and its rate of development is accelerating.

That matters because Cambridge is preparing a transport strategy extending approximately 30 years. Major transport infrastructure identified through that strategy may take years to protect, consent, fund, design and construct. During that same period, passenger vehicle technology and transport operating models may change several times. Accordingly, the prudent planning response is not to predict one technological future. It is to ensure that Cambridge:

- understands what is happening now;
- trials relevant technology early;
- accumulates local evidence;
- protects infrastructure flexibility; and
- avoids irreversible decisions based upon an assumption that 2026 vehicle technology will remain substantially unchanged.

The central proposition is:

A 30-year transport plan cannot assume 30 years of today's technology.

2. The speed of change is itself the issue

Technological change is rarely linear. The history of television, mobile communications and more recently artificial intelligence demonstrates a familiar pattern. For a period, a new technology can appear expensive, specialised or peripheral. Several enabling developments then begin to reinforce one another:

- computing capability improves;
- component costs fall;
- infrastructure develops;
- manufacturing scale increases;
- regulation catches up;
- public familiarity increases;
- commercial applications multiply.

Once that occurs, change can become very rapid.

A mobile telephone which was primarily a voice device became, within a remarkably short period, a camera, navigation system, payment device, communications platform and portable computer.

Artificial intelligence provides an even more contemporary example. Capabilities which appeared specialised only a few years ago have become available to hundreds of millions of ordinary users.

Autonomous mobility may now be approaching a similar point of convergence. The development is not occurring in only autonomous-driving software. It is occurring simultaneously in:

artificial intelligence + sensors + batteries + purpose-built vehicle design + manufacturing + remote supervision + fleet management + regulation + commercial deployment.

For planning purposes, it is therefore reasonable to contemplate **exponential rather than linear change**. This does not require every element to improve according to a mathematically precise exponential formula. It means that improvements in several interdependent technologies can compound upon one another and produce a rate of practical change considerably faster than conventional transport planning cycles normally assume. The appropriate question for Cambridge is consequently not:

Will this technology be important in 20 or 30 years?

It is:

How much could it change within the next few years, and what should Cambridge do now to preserve the opportunity to use it?

3. NZTA Research Report 713 — the New Zealand starting point

The appropriate New Zealand starting point remains **NZTA Research Report 713, *Feasibility study on commercial deployment of automated public transport vehicles in New Zealand***.

It is important to understand its date. The report was **published in May 2024**, but the research itself was undertaken principally between **May 2021 and May 2022**.

That chronology is significant. The study is 4.5 years old. RR713 therefore examined an international autonomous-transport environment that was substantially less mature than that which exists in September 2026. Yet the report already concluded that New Zealand pilots and trials were necessary in order to establish local evidence concerning:

- regulation;
- safety and risk;
- operating requirements;
- passenger acceptance;
- infrastructure;
- costs;
- appropriate transport applications.

It also adopted the important principle that **transport role and function should take precedence over vehicle form**, recognising that vehicle form would continue to evolve.

The report was prepared principally by Beca with SYSTRA.

This matters directly to Cambridge because the professional expertise required to examine automated public transport is therefore not foreign to Council's transport adviser. The important chronology is:

2021–22 — research undertaken.

May 2024 — RR713 published and local trials recommended.

2025–26 — commercial deployment, fleet scale and purpose-built vehicle development accelerate substantially.

The technology case for undertaking the local trial contemplated by RR713 has therefore become **stronger**, not weaker - see Appendix 2.

4. What has changed since the RR713 research was undertaken

When the research underlying RR713 was undertaken in 2021–22, much of the international experience concerned:

- relatively small demonstration fleets;

- low-speed autonomous shuttles;
- controlled campuses and precincts;
- experimental permissions;
- limited commercial cost information;
- substantial uncertainty about scalable operating models.

By September 2026 the position is materially different. Autonomous passenger services are now operating commercially in major cities. Purpose-built vehicles without conventional driver controls are entering passenger service. Commercial fleets are measured in hundreds and, in some cases, thousands of vehicles. Manufacturers are designing vehicles specifically around autonomous operation. Regulators are developing or applying pathways for vehicles which do not resemble conventional cars. Ride-hailing businesses are incorporating autonomous vehicles into ordinary consumer applications. Manufacturing cost and scale have become central competitive questions.

The development has therefore moved from - **Can the technology work?**

Towards - **How quickly, cheaply and at what scale can it be deployed?**

That distinction is highly relevant to Cambridge.

5. Waymo — autonomous mobility at commercial scale

Waymo presently provides some of the strongest evidence that autonomous passenger transport has moved beyond the demonstration stage. In May 2026 Waymo reported that its autonomous driving system had completed more than **20 million fully autonomous passenger trips** across more than 11 cities. By August 2026 it was preparing fully autonomous operation in additional cities including:

- Denver;
- Las Vegas;
- San Diego;
- Tampa.

Waymo stated that more than 10 cities were already at or approaching the point where a member of the public could download an application and hail a fully autonomous Waymo vehicle. The significance is not simply geographic expansion.

It is repetition.

A technology which works only in one carefully selected city remains an experiment.

A system which is being progressively replicated across many different cities begins to demonstrate a scalable operating model.

6. Waymo Ojai — the vehicle itself is changing

Waymo's new **Ojai** vehicle is particularly relevant to the Cambridge discussion. It has been designed as a passenger-first platform for fully autonomous ride-hailing rather than as a conventional manually driven vehicle which has subsequently been automated.

Features include:

- a flat passenger floor;
- low-step entry;
- accessibility integrated into the vehicle design;
- simplified passenger interfaces;
- fleet-oriented charging;
- Waymo's sixth-generation autonomous-driving system.

Waymo stated in May 2026 that it was scaling manufacturing capability towards **tens of thousands of Waymo-enabled vehicles per year**. By 19 August 2026 approximately **300 Ojai vehicles were already in Waymo's commercial fleet**, with ordinary passengers able to encounter them in Los Angeles, Phoenix and San Francisco.

This is an important transition. The commercial question is increasingly not simply whether an autonomous system can safely complete an individual journey.

It is - **Can purpose-built autonomous vehicles be manufactured, operated and maintained at fleet scale and at progressively lower cost?**

That is exactly the issue which matters to Cambridge.

7. Tesla Cybercab — a significant development occurring while this report is being written/considered

Tesla's **Cybercab** provides an unusually immediate illustration of the pace of change. On **3 September 2026**, while this Cambridge report was itself being developed, Tesla commenced limited public Cybercab rides in Austin, Texas. The Cybercab is a purpose-built two-person autonomous vehicle without:

- a steering wheel;
- pedals; or
- conventional driver controls.

Texas registration data reported immediately before the launch indicated approximately **45 Cybercabs within Tesla's 420 registered autonomous vehicles in Texas**. The significance is not that Cybercab is the vehicle Cambridge should use. It plainly is not an appropriate high-capacity school vehicle. Its significance is architectural. The manufacturer is no longer asking:

How do we make today's car drive itself?

It is asking:

What vehicle should be built if there is no driver at all?

That is a fundamentally different design question.

8. Tesla Robovan — a more relevant signal for Cambridge

Tesla has also publicly displayed and discussed a larger autonomous **Robovan** concept intended for group passenger and goods movement. The concept has been presented as potentially carrying approximately 20 people.

Unlike Cybercab, that vehicle class begins to resemble the scale relevant to:

- school transport;
- local feeder services;
- mobility-cell circulation;
- park-and-ride connections.

Again, there is no suggestion that Cambridge should select Tesla or that the Robovan is presently a commercially available Cambridge product.

It is evidence of a wider industry direction.

Autonomous vehicles are beginning to be designed in **different sizes for different transport functions**. That supports an important Cambridge proposition - **The future fleet may not have one standard vehicle size**. A future mobility network could potentially contain:

- smaller vehicles at low-demand times;
- medium passenger pods for ordinary cell operation;
- larger autonomous minibuses during school or commuter peaks.

Autonomy may therefore allow passenger capacity to be managed dynamically at fleet level rather than requiring one large vehicle type to perform every service.

9. The Cybercab launch also illustrates why regulation must be part of the trial

The Cybercab story also provides an important caution. On 4 September, immediately following the Austin launch, the US National Highway Traffic Safety Administration commenced scrutiny of Tesla's certification of the vehicles because Cybercab lacks conventional controls required by existing Federal Motor Vehicle Safety Standards.

It demonstrates that technological progress and regulation do not always advance at precisely the same rate. For Cambridge the lesson is constructive:

regulatory engagement must begin at the start of an autonomous mobility project, not after a vehicle has been selected.

It also reinforces the approach proposed in Appendix 2:

- controlled operating domain;
- staged testing;
- NZTA involvement;
- safety case;
- progressive expansion.

The Tesla development is therefore evidence both of **rapid technological progress** and of the importance of disciplined regulatory implementation.

10. Zoox — a purpose-built vehicle crosses a regulatory threshold

A particularly important US regulatory development occurred on **30 July 2026**. Zoox announced that it had received the first NHTSA commercial exemption for a purpose-built autonomous robotaxi. The exemption gives Zoox federal regulatory authority to charge passengers for operation of a vehicle which was designed from inception without conventional driver controls. That represents an important regulatory transition.

The question has moved from:

Can a steering-wheel-free vehicle be experimentally demonstrated?

towards:

Under what conditions can such a vehicle lawfully provide a commercial passenger service?

Zoox began paid service in Las Vegas during August and announced further expansion to Houston and San Diego, bringing its operating and development footprint to 12 locations.

This is evidence that purpose-built autonomous passenger vehicles are beginning to cross the boundary between prototype, trial and commercial transport service.

11. WeRide — Level 4 fleets are now measured in thousands

The development is not confined to US companies. On 12 August 2026 WeRide reported that, as at 31 July:

- its global Level 4 fleet comprised approximately **3,400 vehicles**;
- more than **1,800 were robotaxis**.

The company also reported substantial growth in overseas revenue and continued international deployment. These are company-reported figures and should be treated as such. But their scale is significant. Only a few years ago autonomous transport trials were frequently discussed in terms of a handful of vehicles. By 2026 some commercial operators are discussing autonomous fleets in **thousands**. That scale is relevant because large fleets create:

- more operating data;
- faster learning;
- greater manufacturing volume;
- more mature fleet-management systems;
- stronger commercial incentives to reduce cost.

Those factors can themselves accelerate subsequent development.

12. London — autonomous rides enter a complex European city

On **2 September 2026**, Uber and UK autonomous-driving company Wayve commenced supervised autonomous passenger rides in London.

Ordinary Uber customers requesting UberX, Uber Electric or Uber Comfort can be matched with an electric Ford Mustang Mach-E equipped with the Wayve AI Driver. A trained private-hire driver remains onboard during the present supervised phase. This is important for several reasons. London is a substantially more complex environment than the controlled airport and campus locations associated with many early autonomous-shuttle trials. It contains:

- dense pedestrian activity;
- cyclists;
- buses;
- complex intersections;
- old and narrow streets;
- highly variable urban environments.

It also demonstrates a different commercial pathway. Wayve provides autonomous-driving technology. Uber provides:

- the customer platform;
- bookings;
- payment;
- passenger demand;
- fleet interface.

This supports one of the central Cambridge concepts:

The future transport asset may increasingly be the operating platform and managed fleet rather than simply the individual vehicle.

13. Ohmio — particularly relevant because it is New Zealand-developed

For Cambridge, **Ohmio** remains especially significant. This is not simply because it is a New Zealand-founded technology. It is because its vehicle form and operating philosophy are much closer to the type of shared passenger transport Cambridge may require than a two-person robotaxi.

Ohmio's LIFT is a purpose-built electric autonomous shuttle designed for shared passenger operation. Its international deployments include airports, urban precincts and first/last-mile applications. The company has been associated with autonomous-shuttle development in New Zealand since Christchurch Airport and Paerata Rise.

At Paerata Rise in Auckland, an Ohmio shuttle was tested as a community transport service operating around a predefined circuit, including an on-demand “Hail” function and connection with park-and-ride and rail.

That is conceptually very close to the Cambridge mobility-cell model.

14. Ohmio Birmingham — fleet operation and a 7 km real transport corridor

The UK **SCALE** project is even more relevant. It uses three Ohmio LIFT autonomous shuttles on a route of approximately **7 kilometres** connecting:

- Birmingham International Station;
- the National Exhibition Centre;
- Resorts World;
- Birmingham Business Park.

The accessible electric vehicles can carry up to approximately 16 passengers. The project examines not merely the technology but:

- commercial viability;
- passenger experience;
- insurance;
- maintenance;
- fleet operation.

In February 2026 the full 7 km route entered its next testing phase with a real-time mobility platform assisting with:

- passenger scheduling;
- dynamic routing;
- live tracking;
- shuttle coordination.

The Cambridge parallels are obvious:

rail/public transport connection + major employment destination + defined corridor + shared autonomous shuttles + central fleet control.

The scale is also highly relevant to the proposed Cambridge–Hautapu and mobility-cell distances.

15. Ohmio platooning — July 2026

In July 2026 Ohmio demonstrated coordinated **autonomous vehicle platooning** in Riverside, California. Multiple vehicles travelled together while communicating with one another in real time to maintain spacing and coordinated movement. The Cambridge relevance is again not that platooning must be adopted. It demonstrates another way in which autonomous fleets may change capacity.

Traditional public transport increases peak capacity principally by:

- increasing vehicle size; or
- increasing frequency.

Autonomous fleets may eventually have a third possibility:

coordinating several smaller vehicles as a single high-capacity movement where demand requires it and separating them again when demand disperses.

That is potentially important for school peaks and river crossings.

16. Aurigo — autonomous platforms are diversifying

Aurigo announced on 10 August 2026 that it had received **£1.43 million** of UK Government funding to apply its Auto-Shuttle platform to airport safety and operational tasks.

Those tasks include:

- security patrol;
- perimeter inspection;
- runway and taxiway inspection.

The immediate airport application is not directly relevant to Cambridge passenger transport. The broader lesson is that Autonomous platforms are increasingly becoming adaptable tools rather than single-purpose demonstration and Vehicle architecture can be configured around particular functions. That reinforces the principle:

function first, vehicle form second.

17. EasyMile — an important warning

Not every development supports an uncritical optimistic view. That is useful. In July 2026 autonomous-vehicle company EasyMile published a candid retrospective on its experience with early autonomous shuttle programmes. Its essential conclusion was that many early shuttle projects did not develop sustainable businesses once public demonstration funding ceased. The issue was not simply whether the vehicles technically worked. The difficulty was creating an operating model which remained commercially useful after the trial ended.

EasyMile itself has subsequently placed greater emphasis on autonomous heavy-duty and industrial operations, where the business case can be clearer. This evidence is highly relevant to Cambridge. It argues strongly **against** purchasing one impressive autonomous shuttle merely so that Council can say it has conducted an AV trial. The Cambridge trial must instead measure whether an actual transport service works.

That means measuring:

- passenger numbers;
- occupancy;
- vehicle utilisation;
- charging;
- remote supervision;
- maintenance;

- empty vehicle kilometres;
- passenger acceptance;
- cost per passenger;
- private car trips displaced.

The lesson is:

Do not trial the technology in isolation. Trial the transport service.

That principle is incorporated into Appendix 2.

18. The direction of development is more important than any individual manufacturer

No one knows today whether Tesla, Waymo, Zoox, WeRide, Wayve, Ohmio or another entrant will ultimately dominate autonomous transport. Cambridge does not need to know right now.

The important evidence is that **different companies, using different technologies and operating in different regulatory systems, are moving in substantially the same direction.**

The development can be summarised as follows:

Development	Recent evidence
Purpose-built autonomous vehicles	Cybercab, Zoox, Waymo Ojai
Removal of conventional driver controls	Tesla Cybercab, Zoox
Shared passenger shuttles	Ohmio LIFT and comparable systems
Commercial regulatory pathways	Zoox NHTSA exemption
Commercial passenger operation	Waymo, Zoox, Tesla
Large fleets	Waymo and WeRide
Fleet manufacturing scale	Waymo Ojai, Tesla Cybercab
Complex urban deployment	London/Wayve, multiple Waymo cities
Dynamic routing/fleet platforms	Ohmio SCALE, Uber/Wayve
Vehicle coordination/platooning	Ohmio Riverside
Regulatory scrutiny	Tesla Cybercab
Business-model learning	EasyMile

The importance of the table lies in its breadth. This is not one company making one optimistic announcement.

It is an **industry movement occurring along multiple technological and commercial fronts simultaneously.**

19. The vehicle itself is being redesigned

One of the most significant developments is easy to overlook. Transport planning has traditionally assumed that the future vehicle will look broadly like today's vehicle. That assumption is becoming less secure. Purpose-built autonomous vehicles are removing or redesigning features which exist principally because a human driver needs them. Examples include:

- steering wheel;
- pedals;
- conventional driver's seat;
- forward-facing passenger configuration;
- traditional dashboard;
- driver visibility requirements.

Once those constraints disappear, designers can reconsider:

- entry and exit;
- wheelchair access;
- internal passenger space;
- seating configuration;
- vehicle length;
- vehicle capacity;
- loading;
- charging;
- turning characteristics;
- fleet maintenance.

This has a direct infrastructure consequence.

Cambridge should be cautious about designing every future transport asset around the dimensional and operating assumptions of today's conventional private motor vehicle.

That is particularly important when considering a future people-moving river crossing.

20. Manufacturing scale could materially alter cost

Early autonomous shuttles have been comparatively expensive. That is unsurprising. They have generally been:

- low volume;
- specialised;
- heavily engineered;

- dependent upon expensive sensor suites;
- operated within small pilot programmes.

The emerging market is different. Tesla intends Cybercab to be a high-volume production vehicle. Waymo is scaling Ojai manufacturing towards tens of thousands of vehicles annually. Zoox is developing purpose-built vehicles for wider production. The precise future purchase prices remain uncertain and manufacturer cost claims should be treated cautiously.

But one planning proposition is reasonable:

Today's low-volume autonomous shuttle price should not automatically be treated as the long-term price of an autonomous passenger vehicle.

If production moves from hundreds to tens of thousands of units, manufacturing economics can change materially and quickly. That is one reason the Cambridge financial assessment should be periodically updated rather than freezing 2026 unit prices throughout the Plan.

21. Fleet economics may change even more than vehicle cost

The more important economic change may not be the purchase price of the vehicle. It may be the operating model. A conventional bus generally requires one driver for one vehicle. A mature autonomous fleet may instead require:

- remote supervisors;
- operations controllers;
- field-response staff;
- maintenance staff;

supporting **multiple vehicles simultaneously**.

The actual safe supervisor-to-vehicle ratio remains a matter to be established and should not be assumed. But the possibility changes the economic structure. This is particularly relevant to smaller vehicles. Historically, operating a small bus carrying relatively few passengers can be expensive because driver cost remains largely fixed regardless of vehicle size. If one operations team can safely supervise multiple autonomous vehicles, it becomes more practical to match vehicle size to demand.

That is potentially transformative for the Cambridge cell model.

22. Public acceptance can also change rapidly

Technology adoption is not determined only by engineering. People must be willing to use it.

Early autonomous-shuttle research identified understandable passenger concern about:

- absence of a driver;
- safety;
- security;
- accessibility;
- unfamiliarity.

But public attitudes can change quickly once people experience a technology directly. Waymo has now completed millions of fully autonomous passenger journeys. In London, ordinary Uber users can now encounter a Wayve autonomous vehicle through the same application they already use for conventional trips. Ohmio has similarly reported that passengers' attitudes often change once they actually experience a driverless shuttle.

That is relevant to Cambridge's proposed early school involvement.

For a younger generation, autonomous transport may cease to be novel considerably faster than conventional planning assumptions suggest. An autonomous ride experienced by a pupil today may simply be regarded as an ordinary transport option by the time that pupil reaches adulthood.

This is another reason Cambridge should create opportunities for its community to **experience** the technology rather than merely debate it in the abstract.

23. Why the next few years matter

This appendix deliberately does not use a long distant timeframe for technological change. The evidence does not support treating autonomous transport as something which need only be reconsidered far into the future. During a period measured in **months**:

- purpose-built vehicles have entered or approached public service;
- new commercial regulatory approvals have been issued;
- major operators have entered additional cities;
- new vehicle platforms have entered commercial fleets;
- supervised autonomous passenger services have commenced in London;
- fleet sizes have continued to increase;
- autonomous shuttle systems have developed more sophisticated scheduling and platooning capability.

The appropriate Cambridge planning horizon for testing the technology is therefore: **the next few years**. Not some distant stage of the 30-year Plan. The technology may move faster than the planning, designation, funding and construction process for conventional major infrastructure.

That is precisely why the trial needs to begin now.

24. An exponential-change scenario should be tested

The Cambridge Transport Plan should therefore contain an explicit **technology-change scenario**. It need not become Council's preferred forecast. It should test what happens if, within the next few years:

- purpose-built autonomous passenger vehicles become increasingly available;
- vehicle costs decline;
- vehicle capacity becomes more varied;
- remote supervision improves;
- regulatory pathways mature;
- public familiarity increases;
- fleet-management platforms improve;
- small shared vehicles become a commercially credible public transport mode.

That scenario should then ask:

- what happens to school car trips?
- what happens to cross-river peak demand?
- what happens to park-and-ride?
- what happens to Route 20 and local feeders?
- what happens to the required capacity of a people-moving crossing?
- what residual demand remains for a future general-traffic crossing?

The purpose is not to assume the answer. It is to ensure that Council understands the consequences **if the technology continues developing at anything like its present rate**.

25. Why this matters to the strategic modelling

The Waikato Regional Transport Model remains useful strategic evidence. But a conventional strategic traffic model cannot by itself answer a technology-disruption question of this kind. It principally models future vehicle movement on assumptions supplied to it. It cannot independently predict the emergence of a new transport system which is not represented in those assumptions.

That is not a weakness peculiar to the WRTM. It is inherent in modelling. This is why Cambridge Connections should combine **regional strategic modelling** with **detailed local analysis** and **real-world trials**.

A computer model can estimate what happens if future Cambridge residents continue travelling according to a defined set of assumptions. A real trial can establish what people actually do when they are offered a transport option which did not previously exist.

Those two forms of evidence are complementary.

26. Beca's existing expertise should be brought directly into Cambridge

There is an important point concerning Council's advisers. The issue is **not** that Beca lacks autonomous-transport expertise. RR713 demonstrates that it possesses relevant expertise. The issue is whether that capability has yet been brought sufficiently into the Cambridge Connections work. The appropriate question is therefore constructive but direct:

Given that Beca's own NZTA research, published in May 2024 from work undertaken principally in 2021–22, recommended local automated-public-transport trials, how have the substantial technological, commercial and regulatory developments since that research been incorporated into the Cambridge Connections Transport Plan?

And:

Which members of Beca's automated-public-transport and Intelligent Transport Systems capability will be involved in the next stage?

That would allow Council to make use of expertise which is already available to it.

27. Cambridge has an opportunity which larger cities may not

Cambridge does not need to compete with Los Angeles, London or San Francisco in autonomous driving complexity. That may actually be an advantage. It has:

- a relatively compact urban area;
- identifiable mobility cells;
- repeatable school demand;
- identifiable employment destinations;
- manageable route lengths;
- growth areas where transport patterns can still be influenced;
- a river which concentrates movement;
- potential mobility-hub locations;
- a substantial but not overwhelming traffic environment.

This makes Cambridge potentially suitable for a deliberately controlled autonomous public-transport trial. The objective would not be to prove that a vehicle can drive anywhere. It would

be to prove that it can perform useful Cambridge transport tasks. That is a much more achievable and valuable objective.

28. The opportunity is to shape the system rather than retrofit it later

There are two possible approaches. The first is to continue conventional infrastructure planning, wait until autonomous transport becomes commonplace elsewhere, and then ask whether Cambridge can retrofit the technology into infrastructure already selected and designed.

The second is to begin learning now. That means:

- establish mobility cells;
- identify passenger demand;
- engage schools;
- investigate mobility hubs;
- engage NZTA;
- engage suppliers;
- put vehicles on Cambridge roads;
- measure actual results;
- allow that evidence to inform subsequent infrastructure.

The second approach does not require Council to gamble on autonomous vehicles. It avoids gambling **against** them. The distinction can be put simply:

The opportunity is not to wait until autonomous transport has matured elsewhere and then retrofit Cambridge around it. The opportunity is to begin using and testing it now so that Cambridge's transport system evolves with the technology.

29. A current snapshot — September 2026

The speed of development can be illustrated simply by looking at events occurring immediately around preparation of this report.

30 July 2026

Zoox receives the first NHTSA commercial exemption for a purpose-built autonomous robotaxi.

4 August 2026

Waymo reports further expansion and preparation for fully autonomous operation in Denver, Las Vegas, San Diego and Tampa.

10 August 2026

Aurigo receives further UK Government funding for autonomous vehicle deployment.

12 August 2026

WeRide reports a global L4 fleet of approximately 3,400 vehicles, including more than 1,800 robotaxis.

19 August 2026

Waymo's next-generation Ojai enters wider ordinary passenger use in three major US markets, with approximately 300 vehicles already in commercial service.

25 August 2026

Waymo announces preparation for Munich, bringing its autonomous system into another major European market.

2 September 2026

Uber and Wayve commence supervised autonomous passenger rides for ordinary Uber users in London.

3 September 2026

Tesla commences limited public Cybercab rides in Austin using a purpose-built vehicle without conventional driver controls.

4 September 2026

US regulators commence scrutiny of the Cybercab certification approach — illustrating that regulation is developing alongside the technology.

That is a remarkable amount of movement in approximately **five weeks**. It is now very difficult to reconcile that pace of development with an assumption that autonomous mobility belongs in a distant future planning category.

30. Conclusion

The autonomous vehicle market remains uncertain. Some technologies will fail or be discontinued for finance or other reasons. Some manufacturers will disappear. Some cost predictions will prove optimistic. Regulation will continue to impose constraints. There will undoubtedly be setbacks.

None of that alters the principal planning conclusion. The relevant question is not whether every current autonomous vehicle proposal succeeds.

It is whether the **combined trajectory of the industry is sufficiently significant that Cambridge should test it now rather than ignore it.**

The evidence strongly suggests that it is.

Since the research underlying RR713 was undertaken in 2021–22:

- autonomous passenger journeys have grown from trials towards millions of commercial journeys;
- fleets have grown from handfuls towards hundreds and thousands of vehicles;
- purpose-built autonomous vehicles have entered commercial service;
- regulators have begun accommodating vehicles designed without conventional controls;
- manufacturing is scaling;
- autonomous transport is entering more complex cities;
- shared shuttle systems are developing increasingly sophisticated fleet-control capability.

The pace is accelerating. In our view, there is a real prospect that technological development over the **next few years** will materially alter the transport choices available to Cambridge. That does not justify abandoning conventional transport planning.

It justifies making conventional planning **adaptive**.

Accordingly - **Cambridge should not place autonomous mobility in a later basket.**

It should:

trial it now;
measure it locally;
understand its limitations;
exploit its advantages;
preserve infrastructure flexibility; and
expand what proves itself.

The planning choice is not between believing in autonomous vehicles and rejecting them. It is between **learning from the technology while Cambridge still has choices** and waiting until those choices have already been narrowed by infrastructure decisions made on today's assumptions.

The opportunity exists now.

Cambridge should use it.

APPENDIX 2

How an Autonomous Mobility Trial Could Work in Cambridge

Controlled operation, safety systems and progressive implementation

1. Purpose

This appendix explains how a practical autonomous mobility trial could be undertaken in Cambridge. The proposal does not require an autonomous vehicle to be capable, at the outset, of travelling anywhere in New Zealand, on every type of road, in every weather condition or in every conceivable traffic situation.

The opposite approach is proposed.

A Cambridge trial would begin with deliberately defined operating conditions: selected roads, routes, speeds, operating hours, passenger groups and safety controls. Those conditions could then be expanded as operating evidence is obtained, and the technology demonstrates that it can safely perform more demanding tasks.

The underlying question is therefore not:

Can an autonomous vehicle drive everywhere?

It is:

Can this particular vehicle safely and economically perform this particular Cambridge transport task, on these particular roads, under these particular conditions?

That is a substantially more manageable proposition.

It is also consistent with the approach identified in NZTA Research Report 713, published in **May 2024** following research undertaken principally during **2021–22**. That research recommended New Zealand pilots and trials to establish local regulatory, operating, cost and passenger experience. Since that research was undertaken, autonomous mobility has advanced significantly. As discussed in Appendix 1, that development is now accelerating across vehicle design, fleet scale, manufacturing, regulation and commercial deployment.

The objective for Cambridge should therefore be:

Start now with useful mobility. Control the operating environment. Accumulate evidence. Automate progressively. Expand as quickly as safety, regulation and evidence permit.

2. This is a mobility-service trial, not a technology demonstration

The purpose of a Cambridge trial should not be to purchase an autonomous vehicle merely so that it can be demonstrated to the public. The purpose is to determine whether a new form of transport can solve identifiable Cambridge mobility problems. The service should therefore be designed first around **actual passenger needs**. Those needs include:

- school travel;
- connections between Leamington and Cambridge;
- access to Hautapu employment;
- connections with regional public transport;
- park-and-ride;
- older and mobility-impaired passengers;
- health and shopping trips;
- first- and last-mile journeys;
- transport during concentrated morning and afternoon peaks.

A successful trial is therefore not one in which a vehicle drives around Cambridge without incident. It is one which demonstrates whether passengers can be moved:

- safely;
- reliably;
- conveniently;
- at acceptable cost;
- with good vehicle utilisation;
- while reducing private vehicle trips.

This distinction is fundamental.

The experiment would be a designed transport-service experiment, not a technology exhibition.

3. Controlled autonomy

The central operating principle should be **controlled autonomy**. The existing draft concept correctly recognised that an autonomous service is not simply a vehicle which has been given the ability to “drive itself”. It is a system of interlocking controls, of which the vehicle is only one component. For the initial Cambridge trial, the vehicle would only operate autonomously where the system had already determined that the environment was suitable. That could mean initially limiting operation by:

- geography;
- particular streets;

- maximum speed;
- time of day;
- road type;
- weather;
- traffic conditions;
- communications availability;
- passenger use;
- intersection type.

The objective is to **control complexity**, rather than demand that the autonomous-driving system immediately solves every possible road situation.

4. Operational Design Domain — defining where the vehicle may operate

The technical term for the operating conditions within which an automated-driving system is designed to function is its **Operational Design Domain**, or **ODD**.

For a Cambridge service an initial ODD could specify:

- approved streets and routes;
- maximum speeds;
- authorised operating hours;
- acceptable weather conditions;
- approved intersection types;
- passenger pickup and drop-off locations;
- communications requirements;
- particular roadworks or other temporary conditions;
- routes or circumstances in which autonomous operation is not permitted.

The ODD can then be expanded progressively. A school route could be validated before another neighbourhood is added. A connection to Hautapu could be tested separately. A future river crossing could have its own operating conditions. A difficult intersection could initially be excluded and introduced later when the evidence justified doing so.

This is one of the most important ways in which the risk can be controlled.

Cambridge does not need to solve autonomous driving for New Zealand. It needs to solve useful autonomous mobility for Cambridge.

5. Geofencing — controlling geography digitally

Geofencing allows the geographical component of the ODD to be defined digitally. A Cambridge geofence would not need to be a simple circle around the town. It could follow individual roads and apply different rules to different places. For example:

- a residential street might permit operation only at lower speed;
- a school precinct might impose additional restrictions during pupil arrival and departure;
- a particular difficult intersection could initially be excluded;
- State Highway operation could be excluded;
- a future controlled river crossing could operate under its own rules.

The automated service would only be authorised to operate within the approved digital operating area. That substantially narrows the problem which the automated-driving system is required to solve.

6. Dynamic geofencing

Cambridge's road network will not remain static during the day. There will be:

- crashes;
- flooding;
- roadworks and road closures;
- sporting events;
- school activities;
- emergency incidents;
- temporary congestion;
- unusual pedestrian activity.

A **dynamic geofence** allows the permitted operating area to be changed as those circumstances arise. If roadworks create an unusual environment on a particular street, autonomous operation can be temporarily removed from that street and the fleet rerouted. If a school event places unusually large numbers of pedestrians in a precinct, the operating rules for that area could be temporarily altered.

That produces an important operating principle:

If an unusually difficult situation can reasonably be avoided, the system should avoid it rather than require the vehicle to solve every possible situation autonomously.

The objective is not technological bravado. It is safe transport.

7. An early focus on pupils aged 11 years and over

School travel should form part of the initial Cambridge programme rather than being deferred to a later stage. The proposed initial target cohort is pupils aged **11 years and over**. There are several reasons why school travel is particularly suitable for an early trial:

- origins can be mapped;
- destinations are known;
- morning and afternoon demand is concentrated;
- travel patterns repeat;
- parents and schools can be directly engaged;
- designated collection points can be created;
- the effect upon private vehicle trips can be measured.

School precincts could also operate under additional digital controls during morning and afternoon peaks. These could include:

- automatic lower speeds;
- approved access streets;
- designated stopping locations;
- restrictions upon unscheduled kerbside stops;
- exclusion of particularly difficult streets;
- enhanced remote monitoring.

School transport is therefore not simply another passenger market. It provides a highly structured environment within which Cambridge can accumulate useful operating evidence.

8. Neighbourhood Mobility Points

The proposed system should not be based upon an assumption that every passenger is collected from his or her front door. That would unnecessarily increase route complexity and empty vehicle movement. A network of **Neighbourhood Mobility Points** could aggregate passengers at safe and convenient locations. For the initial 11+ pupil cohort, walking and cycling distances should remain flexible. Depending upon:

- age;
- accessibility;
- urban form;
- road safety;
- footpath and cycle provision;
- local geography;

a suitable mobility point may be only a few hundred metres from home or, in appropriate circumstances, around **one kilometre** away. The correct principle is:

The appropriate distance should be determined by safe access and local circumstances, not by an arbitrary fixed radius.

The same mobility points could serve different users at different times of the day. A location used by school pupils in the morning might later serve:

- older residents;
- workers;
- shoppers;
- medical trips;
- people connecting to regional public transport.

That increases the productivity of the underlying infrastructure.

9. Cambridge, Leamington and Hautapu as mobility cells

The trial should be considered within the broader **mobility-cell concept** proposed in the main report. The initial cells would be:

Cambridge

Leamington

Hautapu

These are not intended to create rigid administrative boundaries. They are useful operating units. Smaller passenger vehicles could initially circulate within a cell, collecting and distributing passengers between homes, mobility points, schools, employment, shopping and larger transport interchanges. As the service develops, the cells can increasingly connect with one another. This means Cambridge does not need to begin with a highly complex town-wide autonomous network. It can start with individual useful transport tasks and progressively connect them.

10. Mobility hubs and park-and-ride

Larger **Mobility Hubs** would sit above the neighbourhood mobility points. There should be an important distinction between two kinds of hub.

Peripheral Mobility Hub — Park & Ride

These would intercept some private vehicle trips before those vehicles enter the more congested parts of Cambridge. Depending upon location, they could provide:

- parking;
- passenger transfer;
- conventional buses;
- small feeder vehicles;
- autonomous vehicles;
- EV charging;
- secure bicycle and e-bike facilities;
- passenger shelter;
- accessible transport;
- fleet staging and potentially charging.

The main report proposes investigating the feasibility of **two appropriately located peripheral P&R/mobility hubs within each principal cell**, rather than relying upon one very large facility.

That proposition remains subject to actual land, access and demand assessment.

Central Mobility Hub — Interchange

Central Cambridge and central Leamington require a different concept. These need not become large, long-stay car parks. Their principal functions could instead be:

- walking access;
- bicycle access;
- passenger pickup/drop-off;
- pod or minibus interchange;
- accessible transport;
- connection with conventional public transport.

The distinction is important. **A mobility hub is not necessarily a car park.** The overall purpose is to allow people to use a private vehicle where it remains useful without requiring every private vehicle to complete the whole journey. Put simply:

People may still drive to Cambridge without necessarily having to drive through Cambridge.

11. Hautapu

Hautapu deserves particular attention. It is now both a major employment destination and a logical connection between Cambridge and the wider Hamilton–Waikato metropolitan transport system. A Hautapu mobility hub could ultimately integrate:

- local cell transport;

- employment trips;
- park-and-ride;
- Route 20 or its successor;
- future higher-frequency regional public transport;
- autonomous feeder services;
- walking and cycling;
- connections towards Hamilton and the Airport.

This provides an opportunity to intercept travel before it enters central Cambridge and to strengthen Hautapu's role as an employment and transport node. And there is currently land available

12. The trial does not have to wait for full autonomy

The mobility service should not be made dependent upon achieving completely driverless operation before anything happens. The service itself can commence earlier. A practical progression may be:

human-operated small electric vehicle

→ **digitally monitored and driver-assisted operation**

→ **supervised automated operation**

→ **geofenced driverless operation on selected routes**

→ **expanded geofenced demand-responsive operation**

The passenger base, mobility hubs, collection points, digital booking system, route knowledge and operating data obtained at the earlier stages remain useful when further automation is introduced. This greatly reduces technology risk. It also avoids a false choice between:

doing nothing until full autonomy arrives

and

committing immediately to unrestricted driverless operation.

Importantly, these stages are **safety and evidence gates, not prescribed time periods.**

Progressive does not mean slow. Autonomous technology is presently developing at a very rapid rate. As Appendix 1 demonstrates, vehicle design, commercial deployment and regulatory acceptance are advancing now.

Cambridge should therefore be capable of progressing between stages **as quickly as safety, regulatory approval and operating evidence permit.**

13. New Zealand already provides a pathway for testing

New Zealand does not prohibit autonomous-vehicle development and testing. NZTA expressly states that New Zealand welcomes manufacturers and developers wishing to test autonomous vehicle technologies and provides support to help proponents navigate the testing requirements safely. Its current testing pathway includes:

1. contacting NZTA and obtaining a customer-support manager;
2. determining vehicle requirements and any necessary certification;
3. determining the relevant licence requirements for the test vehicle operator; and
4. submitting a safety management plan for on-road testing.

A commercial driverless passenger service would plainly require further detailed legal, regulatory and operational work. But that is not a reason to defer investigation. It means early engagement with NZTA should form part of **Year 1** of the Cambridge programme. One of the first actions should therefore be:

Invite NZTA into the project as a regulatory and safety partner at the outset rather than present it later with a completed vehicle proposal.

14. Remote assistance

A driverless fleet is not the same thing as an unsupervised fleet. A central operations function would remain necessary. **Remote assistance** could allow a vehicle to communicate with a trained operator when it encounters an unusual situation. This does not necessarily mean that somebody remotely “drives” every vehicle.

The distinction matters. The automated driving system remains responsible for the driving task within its approved operating conditions, while the remote operations centre can:

- observe fleet status;
- communicate with passengers;
- respond to exceptions;
- provide operational guidance where the system permits;
- arrange physical assistance;
- remove routes from service;
- suspend a vehicle or the whole service if necessary.

The eventual economic advantage arises if one operations team can safely supervise a number of vehicles rather than requiring one driver in every vehicle. The appropriate operator-to-vehicle ratio must be established from actual evidence rather than assumed.

15. Minimal Risk Condition — planning for failure

No transport technology should be designed on the assumption that it will never fail. The critical question is:

What does the system do when something goes wrong?

An autonomous system should have predetermined responses which allow it to move towards a **Minimal Risk Condition**. Depending upon the circumstances, that might involve:

- reducing speed;
- safely stopping;
- proceeding to a predetermined safe location where this can safely be done;
- alerting the operations centre;
- communicating with passengers;
- terminating the particular journey;
- suspending further passenger operation.

Examples of events requiring a predetermined response could include:

- loss of communications;
- loss of localisation confidence;
- a significant sensor fault;
- braking or steering fault;
- obstruction of the normal route;
- weather outside the ODD;
- an incident inside the vehicle.

The appropriate response should be designed before the event occurs as it has been overseas.

16. Safe Havens

Cambridge could identify a network of predetermined **Safe Havens**. These would be places where an autonomous passenger vehicle can stop safely without unnecessarily obstructing the wider network. Potential locations could include:

- mobility points;
- mobility hubs;

- suitable parking bays;
- Council facilities;
- transport interchanges;
- deliberately designed roadside areas.

If a vehicle detects a developing problem and it remains safe to move, it might proceed at reduced speed to the nearest approved safe haven. If movement itself is unsafe, the correct response would instead be an immediate controlled stop. The important point is that the physical road environment can be designed to assist the technology. Autonomy therefore involves not only intelligence inside the vehicle but an interaction between:

vehicle + road environment + digital controls + operations centre.

17. Vehicle controls and redundancy

Before any autonomous passenger vehicle enters public service, the safety-critical vehicle systems must be sufficiently robust. This includes:

- steering;
- braking;
- propulsion;
- emergency stopping;
- power supply;
- communications;
- localisation;
- vehicle health monitoring.

Safety-critical functions should not depend upon a single component where failure of that component would create unacceptable risk. This is the principle of **redundancy**. The particular engineering solution will depend upon the vehicle selected. Cambridge should specify the required safety performance rather than prematurely selecting a particular sensor or control technology.

18. Perception systems — do not choose the winning technology today

Different autonomous vehicle developers presently use different combinations of:

- cameras;
- radar;
- lidar;
- satellite positioning;
- inertial sensors;
- detailed mapping;

- artificial intelligence.

There is significant international debate about the optimum combination. Cambridge does not need to resolve that debate. Nor should the Transport Plan prescribe that the winning system must use a particular sensor technology. Council's task should be to specify:

- the required safety outcome;
- the ODD;
- the passenger function;
- the required reliability;
- acceptable failure behaviour.

Suppliers should then demonstrate how their technology satisfies those requirements.

Specify the performance, not the winning technology.

This is particularly important given the rate at which sensor technology, AI and computing are changing.

19. The fleet, not the individual vehicle, is the transport asset

A central proposition of the Cambridge model is:

The asset is not the pod. The asset is the fleet – a fleet of different sized vehicles – see below at 20.

A **Fleet Management System** would coordinate:

- bookings;
- passenger demand;
- vehicle position;
- routes;
- available capacity;
- battery condition;
- charging;
- vehicle availability;
- mobility-hub demand;
- road restrictions;
- incidents and exceptions.

This allows the same fleet to perform different transport tasks at different times.

For example:

Morning

school and employment peak.

Middle of the day

shopping, health, mobility and general journeys.

Afternoon

school release and employment movement.

Evening

general passenger demand and connections with regional transport.

The objective is high utilisation of the transport asset. That is fundamentally different from purchasing a vehicle dedicated to one narrow service.

20. A future fleet should be capable of accommodating different vehicle sizes and capacities

The rapidly developing international market suggests that Cambridge should not assume that every future autonomous passenger vehicle will be the same size. A mature service could ultimately contain several vehicle classes.

For example:

- small units for low-demand periods, accessibility or individual connections;
- medium vehicles for normal neighbourhood circulation;
- larger pods or autonomous minibuses for school and commuter peaks.

The fleet-management system could allocate vehicle capacity according to demand. That potentially produces a significant efficiency advantage over a transport system in which one large vehicle size must be operated regardless of whether there are 3 passengers or 30. Cambridge does not need to determine those vehicle sizes now.

The important point is that infrastructure should not unnecessarily foreclose that flexibility. And a fleet- management system should be evaluated, accepted and available

21. Demand-responsive transport

A conventional bus generally follows a fixed route and timetable. A taxi or unrestricted robotaxi responds individually to individual passenger demand. Between those two models is **demand-responsive transport**.

An initial Cambridge service could operate broadly along a defined corridor but vary its exact trip according to passenger bookings and known demand such as school pick-ups.

Passengers might eventually book using:

- an app;
- telephone;
- website;
- school system;
- mobility-hub terminal;
- other accessible channels.

The progression could be:

fixed or semi-fixed service → demand-responsive service → broader zone-based on-demand operation

where the evidence supports it.

That provides much of the convenience of on-demand transport without immediately introducing the network complexity associated with unrestricted door-to-door robotaxis.

22. Empty running — measure it properly

Autonomous vehicles can move without a passenger. That is both an opportunity and a risk. Poorly managed autonomous taxis could increase vehicle kilometres if they continually travel around seeking their next passenger. Accordingly, **empty vehicle kilometres** should be a core Cambridge performance measure. But a distinction must be drawn between two forms of empty running.

Unproductive deadheading

A vehicle wanders or travels a substantial distance between unrelated passenger jobs. This should be minimised.

Productive repositioning

A vehicle deliberately returns against the dominant passenger flow to a known high-demand origin so that it can immediately undertake another loaded trip. A school peak provides the

clearest example. A vehicle carries pupils from a Leamington collection point to a school, unloads, and then immediately returns to collect another group. That empty return is not equivalent economically to uncontrolled robotaxi wandering. It supports another productive movement. At peak periods the operating philosophy should therefore be:

fill → move → unload → return → repeat.

Or more simply:

The vehicle should behave more like a lift than a taxi.

The performance measures should include both empty kilometres and the number of passengers those kilometres enable the fleet subsequently to move.

23. School emergency transport

The system must be capable of dealing with events which do not follow the normal timetable. Consider a simple example. A Cambridge school loses its potable water supply and must close at midday. Several hundred pupils may unexpectedly need transport. A properly designed autonomous mobility system should not depend upon individual telephone calls between drivers, schools and parents.

A formal **School Emergency Transport Protocol** should be created. The communication chain could be:

authorised school officer → mobility operations centre → fleet → parents/guardians

with confirmation and backup channels.

The system should be capable of:

- receiving a verified school closure instruction;
- identifying affected transport users;
- notifying parents or guardians;
- reallocating available vehicles;
- temporarily reducing lower-priority passenger services;
- directing vehicles to approved school collection points;
- confirming pupil travel authority;
- managing destination and handover requirements;
- escalating exceptions to a human operator.

For younger passengers in particular, technology should enhance rather than diminish responsibility for safe handover.

24. Passenger safety — replacing the functions previously provided by the driver

Removing the driver removes more than somebody who turns a steering wheel. A traditional bus driver may also provide:

- passenger reassurance;
- visible supervision;
- assistance;
- deterrence against antisocial behaviour;
- emergency response;
- travel information.

RR713 expressly identified passenger concern about safety in the absence of a driver, including concern about antisocial behaviour by other passengers. A driverless service therefore needs to replace those **functions**, even though it does not replace the individual driver. Possible measures include:

- remote passenger communication;
- emergency call facilities;
- monitored interiors where justified;
- rapid operations-centre response;
- safe-stop arrangements;
- accessibility assistance procedures;
- school-specific travel controls;
- physical field-response capability.

The principle is:

Technology should remove the driver without removing the protective functions the driver previously supplied.

25. Privacy — safety without creating a surveillance system

Passenger safety must also be designed consistently with privacy. A transport system does not automatically need to know everything about every passenger merely because the technology makes that possible. This is now particularly important because New Zealand's **Biometric Processing Privacy Code 2025** is fully operative. The Code was issued in July 2025, came into force in November 2025, and the transition period for existing biometric users ended on **3 August 2026**.

Where biometric processing is proposed, the Code requires matters including lawful purpose, necessity, effectiveness, privacy safeguards and proportionality. Less privacy-intrusive

alternatives must also be considered. Cambridge should therefore design privacy architecture **before** selecting intrusive technology. Potential principles include:

- collect only data required for the transport function;
- separate operational vehicle data from passenger identity data where practicable;
- minimise data retention;
- control access;
- define incident-data procedures;
- undertake a Privacy Impact Assessment;
- avoid biometric identification unless a demonstrated need justifies it;
- establish specific rules concerning school passengers;
- create clear procedures governing disclosure to third parties.

For example, the fleet plainly needs to know **where the vehicle is**.

It does not follow that the system needs a permanent searchable record of **everywhere every identifiable passenger has travelled**.

The objective should be to **Design security without designing an unnecessary surveillance system**.

26. Safety Management System

The entire Cambridge trial should operate within a formal **Safety Management System**. Operating parameters and intervention thresholds should be determined before passenger operation. A readily understandable framework could include:

Green — Normal Operation

Vehicles operate within the approved ODD.

Amber — Restricted Operation

Part of the service remains operational but speed, geography, hours, passenger use or other conditions are restricted.

Red — Suspension

Affected passenger operations cease, and vehicles move to a safe condition.

Investigation and Remediation

The cause of the event is identified and corrective action tested.

Controlled Restart

Operations resume progressively once the agreed safety conditions are satisfied. The ability to suspend a service safely is just as important as the ability to start one. The system should be designed for both.

27. A future people-moving crossing could simplify autonomous operation

The proposed future people-moving crossing should not be considered separately from the autonomous-mobility system. It could ultimately become one of the most controlled parts of the network. A crossing designed principally for:

- pedestrians;
- cyclists;
- mobility devices;
- utilities;
- controlled passenger vehicles;

could potentially provide a considerably simpler autonomous operating environment than an ordinary mixed-traffic arterial road. The crossing could have:

- prescribed vehicle classes;
- controlled speeds;
- known entry and exit points;
- permanent digital mapping;
- communications infrastructure;
- vehicle monitoring;
- restrictions during incidents;
- dedicated safe-stop areas;
- dynamic operating controls.

It could therefore have its own ODD and geofence. That means a future people-moving crossing does more than merely **carry** autonomous vehicles. Its design can actively **enable safer and simpler autonomous operation**. This is one reason why the location and engineering requirements of a people-moving crossing should be evaluated separately from those of an ultimate general-traffic crossing.

28. Trial scale

A single autonomous vehicle can demonstrate that the technology works. It cannot demonstrate that the Cambridge mobility concept works. The ultimate transport system is a fleet. The staged programme might therefore contemplate:

Initial demonstration:

1–2 vehicles.

Operational trial:

approximately 8–12 vehicles if the initial safety and regulatory gates are met.

Expansion:

a larger fleet where observed passenger demand and performance justify it. An 8–12 vehicle trial would permit testing of issues that cannot be understood from a single vehicle, including:

- simultaneous demand;
- dispatch;
- vehicle substitution;
- school peaks;
- charging;
- downtime;
- remote supervision;
- repositioning;
- fleet availability;
- passenger waiting time;
- mobility-hub operation.

The scale should be determined through the procurement and regulatory process rather than treated as a fixed commitment. But Cambridge should aim to test a **transport fleet**, not merely display a vehicle.

29. What should be measured

The trial should establish KPIs before passenger operation begins. At minimum, these should include:

Passenger outcomes

- passenger trips;
- passengers per vehicle-hour;
- passengers per vehicle-kilometre;
- average occupancy;
- waiting time;
- journey time;
- accessibility;
- passenger satisfaction.

Transport outcomes

- private vehicle trips displaced;
- loaded kilometres;
- empty/repositioning kilometres;
- school-peak throughput;
- mobility-hub usage;
- public-transport connections achieved.

Operational outcomes

- vehicle availability;
- charging downtime;
- service interruptions;
- intervention events;
- communications failures;
- route exclusions;
- field-response requirements.

Safety outcomes

- incidents;
- near misses;
- automated-driving disengagements where applicable;
- Minimal Risk Condition events;
- emergency stops;
- passenger-security events.

Financial outcomes

- vehicle cost;
- fleet-platform cost;
- charging and energy;
- remote operations;
- maintenance;
- cleaning;
- insurance;
- field response;
- cost per passenger trip;
- cost per passenger kilometre.

The purpose is to produce **Cambridge evidence**. That evidence can then inform subsequent transport and infrastructure decisions.

30. Proposed first three years – the most important

The programme should commence now.

Year 1 — Design the service and regulatory pathway

- map school and other passenger demand;
- identify the initial Cambridge, Leamington and Hautapu use cases;
- select candidate mobility points and hubs;
- identify initial ODDs;
- engage NZTA;
- engage schools;
- engage credible suppliers;
- undertake engineering assessment;
- establish safety-management architecture;
- complete privacy and cybersecurity work;
- obtain indicative fleet and operating costs;
- record baseline car travel against which the trial can be measured.

Year 2 — Put vehicles into Cambridge

- introduce initial vehicle(s);
- undertake controlled-road testing;
- provide supervised community demonstrations;
- allow school pupils and other prospective users to experience the service under controlled conditions;
- validate mobility points and routes;
- test communications and fleet-management systems;
- progressively undertake public-road operation consistent with approvals.

Year 3 — Operate a real service

Subject to the earlier safety and regulatory gates:

- scheduled or demand-responsive public passenger operation;
- school travel;
- mobility-cell operation;
- P&R/mobility-hub connections;
- multi-vehicle fleet operation;
- measurement of actual passenger and financial performance.

The important commitment is:

Autonomous mobility should not sit in a “later” basket within a 30-year plan. Cambridge should have vehicles operating and producing local evidence within the first three-year programme.

31. Why Cambridge is suited to this approach

Cambridge has characteristics which may make it particularly suitable for a staged autonomous mobility trial. It has:

- a relatively compact urban form;
- clearly identifiable Cambridge and Leamington communities;
- concentrated school demand;
- a river which creates identifiable transport pressure;
- a substantial and growing Hautapu employment node;
- peripheral growth areas;
- significant walking and cycling potential;
- identifiable mobility-hub opportunities;
- strong regional links;
- sufficient transport pressure to create a real problem worth solving without the road complexity of a major international city.

Cambridge does not need autonomous technology capable of negotiating every road environment encountered in Auckland, Los Angeles or London. It needs technology capable of safely serving **selected Cambridge tasks**. That gives it the opportunity to become an appropriate New Zealand demonstration location for practical autonomous public transport.

32. Conclusion

An autonomous transport service should not be understood simply as a vehicle without a driver. It is a **controlled mobility network** comprising:

****passenger demand**

- mobility points and hubs
- booking and demand management
- fleet management
- Operational Design Domain
- geofencing
- automated-driving system
- vehicle controls and sensors
- remote assistance
- safety management

- regulatory oversight. **

The Cambridge proposition does not depend upon solving every autonomous-driving problem before the trial begins.

It depends upon identifying useful transport tasks which the available technology can safely perform and progressively expanding those tasks as evidence is accumulated. The technology itself is advancing rapidly.

That is why Cambridge should begin now.

Start with useful mobility.

Control the operating environment.

Trial on actual Cambridge roads.

Measure the results.

Automate progressively.

Expand as quickly as the evidence permits.

Most importantly:

Progressive does not mean slow.

The opportunity is not to wait until autonomous transport has become commonplace elsewhere and then attempt to retrofit Cambridge around it.

The opportunity is to use Cambridge itself to establish what the technology can do now, and to allow that practical experience to shape the transport infrastructure Cambridge builds next.

That, in our view, is the appropriate way for a 30-year Transport Plan to respond to a technology which is already changing markedly during the period in which the Plan itself is being written.