

Regional first and last mile pilot project

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Abstract

This project used infrastructure and road use data analyses to inform road upgrade projects in two local government areas in Queensland assessing the benefits that would be gained by the road freight industry and their customers. Road upgrade projects were identified to enable larger, heavier and more productive freight vehicles permitted on adjoining state highways to use these local roads. Benefits come from the lower operating costs per freight tonne-kilometre of High Productivity Vehicles (HPVs), plus from time savings, reductions in accident costs and other externalities. The basis of the analysis focused on the quantity of freight carried on local roads in smaller vehicles, and the proportion of this freight that was estimated to transfer to higher productivity freight vehicles. It also considered existing infrastructure deficiencies that prevented the use of HPVs and the cost of upgrades to meet the agreed vehicle class appropriate for the road. The agreed vehicle class was determined by classes currently approved on adjoining roads, industry preferences and an assessment of the expected economic benefits compared to the upgrade costs.

The results from this pilot assessment are presented, together with suggestions on how the program could be applied more broadly across local government areas and in other jurisdictions.

The study encountered a number of methodological and data issues related to matters such as data concerning road usage, industry engagement, estimating the proportion of freight that would be carried in HPVs if upgrades proceeded and the economic activity generated by businesses located on local roads that would benefit from road upgrades. The approaches used, resulting outcomes and suggestions for future investigation are presented.

1. Introduction

Greater access for HPVs has been a high priority for government, industry, freight operators and end users of freight services due to the productivity gains and cost savings they generate. However, many freight journeys commence and or end on local roads, and an inability to operate HPVs for the entire journey from origin to destination can substantially reduce the gains which would otherwise be achieved.

Previous analysis supporting the Queensland Department of Transport and Main Roads' (TMR) Moving Freight Strategy identified desired HPV access levels across the State-controlled road network. These access levels are aligned with the road network classification levels defined by the Performance Based Standards (PBS) policy as the overarching HPV access framework. PBS is endorsed by the Council of Australian Governments to provide a nationally consistent scheme for heavy vehicle access across the Australian road network.

The underlying objective is to create complete freight routes that extend from the point of origin to the destination which are able to be used by the same, largest appropriately sized HPV for the entire journey. Savings from using more efficient vehicles for most of a freight

trip are rapidly eroded if there is a need to assemble smaller vehicles to form the HPV or break it down to access the destination.

Where the previous TMR analysis identified the critical routes on the State-controlled road network, there is a similar need to examine the first and last mile connection roads to enable complete origin to destination freight journeys in the desired HPV class. These are typically to factories and farm gates on local government roads.

To better understand the options and benefits which could be achieved, the Local Government Association of Queensland (LGAQ) in collaboration with TMR, commissioned Jacobs through the Roads and Transport Alliance to undertake a pilot project to examine these issues. The jurisdictions of Toowoomba Regional Council (TRC) and Western Downs Regional Council (WDRC) were chosen for the pilot. This was on the basis of high levels of resource and agricultural activity, including intensive agriculture such as feedlots in the area, many of whose operations were constrained by lower levels of access on local roads than adjoining highways. The overall area is shown in Figure 1.

Figure 1: Study area – Western Downs and Eastern Downs (Toowoomba Regional Council and Western Regional Council areas)



Source: The Roads and Transport Alliance, Queensland Government 2015 <http://www.tmr.qld.gov.au/-/media/busind/businesswithus/Alliances/RRTG-0815.pdf?la=en> Accessed 17 May 2016

The project was conceptualised as a logical extension of TMR's Heavy Vehicle Action Plan, which aimed to influence road upgrade funding priorities by industry and local government views on where the greatest benefits might be gained as well as aiming for high productivity freight vehicles being able to undertake complete desired journeys from origin to destination without the need to reconfigure trucks.


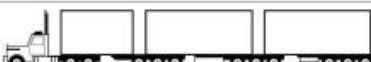

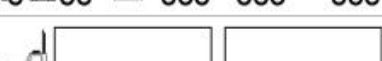
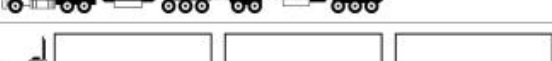
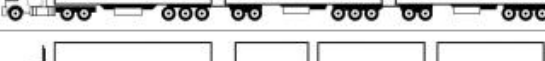
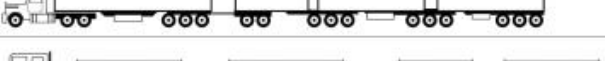
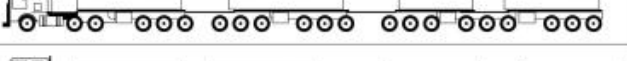
2. Objectives

The objectives of the Regional first and last mile pilot study were:

- To outline the agreed freight routes to be assessed within the study and their desired high productivity vehicle (HPV) access levels
- To assess the infrastructure investment required to maintain existing HPV access and to increase HPV access to desired levels
- To develop a Works Program of projects to meet desired HPV access levels
- To assess the likely costs and benefits from these road upgrades, informing a program of infrastructure projects on the basis of likely benefit to the road freight industry and its customers

The study focused on infrastructure upgrades that facilitate the maximum vehicle combination which can be used for an entire trip. Common HPVs are shown in Figure 2.

Figure 2: Common HPVs in Australia

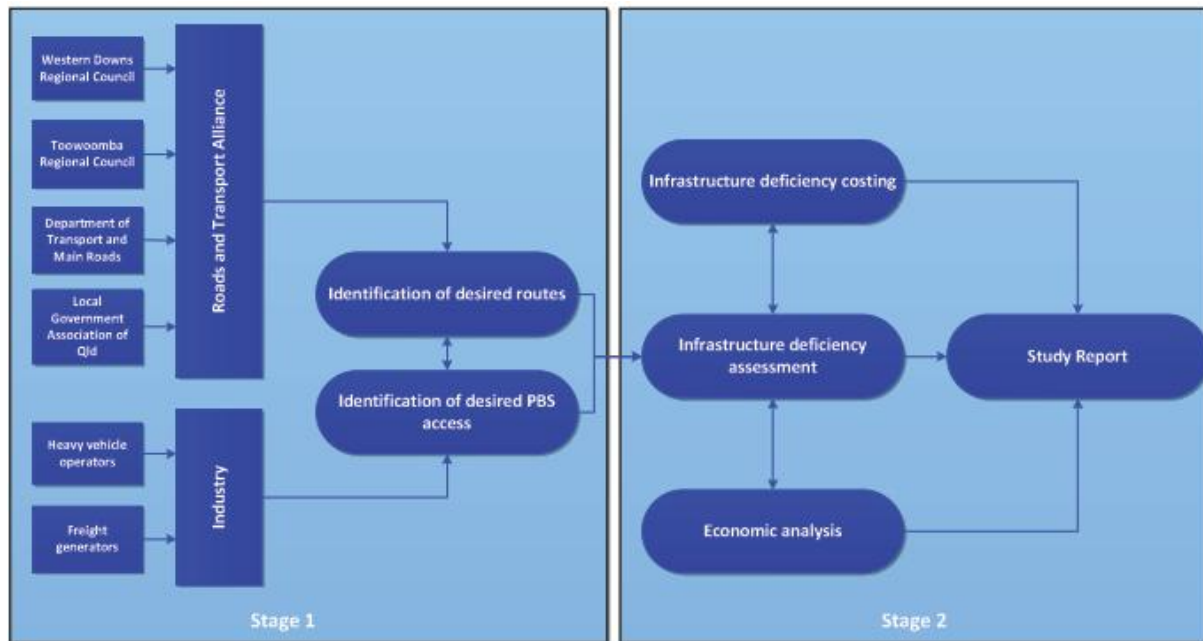
B-Double	
B-Triple	
AB Triple	
A-Double/ Type 1 Road Train	
A-Triple/ Type 2 Road Train	
ABB-Quad	
AAB-Quad	
BAB-Quad	

3. Methodology

The Regional first and last mile pilot study's two stage methodology adopted is summarised in Figure 3. **Stage 1** focussed on route identification and desired PBS vehicle access, which highlighted first and last mile routes where local road classification was lower than on adjoining highways and lower than that desired. **Stage 2** assessed deficiencies on local roads that prevented desired HPV access, costing of upgrade projects to eliminate these deficiencies and economic analysis of the benefits which would result.

The methodology largely mirrored Jacobs' previous study into the efficiency and effectiveness of the Victorian Government's Local roads to market program. This program was designed to improve the efficiency and competitiveness of agricultural and horticultural producers by strategically upgrading local roads to enable access by larger and heavier trucks, which have lower operating costs per freight per tonne kilometre than smaller and lighter alternatives that would otherwise be used. The study found that benefits were around twice the costs of investment on the road sections upgraded.

Figure 3: Methodology



The Pilot, with funding assistance provided through the Roads and Transport Alliance, was managed by a Central Coordination Group comprising of Roads and Transport Alliance representatives and Jacobs. The Pilot was overseen by a Steering Committee comprising the Central Coordination Group, and the Eastern Downs and Western Downs Regional Roads and Transport Groups.

4. Issues with first and last mile roads in regional areas

The first and last mile concept dictates that the same level of HPV access extends from origin to destination, and recognises that local roads are ultimately connected to State-controlled arterial roads and national highways. Components of the freight route may be under the control of multiple road owners who base access decisions on local circumstances. From an efficiency perspective, the first or last segment of a route that restricts end-to-end freight movements means a break in the supply chain link. At best, HPVs need to decouple trailers at the point of restriction and undertake additional trips. At worse, a less productive vehicle combination will be adopted for the entire journey. Both add costs through increased vehicle kilometres, travel time, labour, vehicle operating costs and at times the need to purchase additional vehicles to complete the additional trips incurred. Ultimately these costs are passed on to the community as the final consumer of the goods.

The routes assessed in this study were deemed as either (a) providing access to a discrete location such as a feedlot, or (b) providing a connection between two major roads. On face value it can be argued that the former better illustrates the first and last mile concept. However, this argument can only hold if the first / last mile is the sole barrier to increased access. At times it is prior infrastructure that is deficient, and the first / last mile infrastructure is not the barrier to overall connectivity. By keeping within the overall objective of promoting freight efficiency, discrete location access and connector routes were equally considered.

Local government road infrastructure is often representative of available funding applied to a region wide road network. Accordingly networks are frequently characterised by:

- Pavements close to failure
- Narrow shoulders
- Low skid resistance on seals
- Unsealed roads
- Timber bridges subject to mass loading limitations
- Weak culverts
- Tight curves and limited turning paths
- Disrupted access during wet weather and adverse environmental conditions
- Minimal overtaking opportunities for other vehicles.

Establishing and maintaining fitness-for-purpose condition is a sound asset management strategy, particularly with low volume roads. However budget constraints often mean that infrastructure standards are not currently being met to enable safe and productive freight movements. Increasing opportunities for freight efficiency commonly amplifies the impact of deficiencies that already exist.

The objective of this study was to maintain HPV access on existing routes and establish HPV access on routes with lower access standards. While existing fitness-for-purpose can be maintained through limiting HPV access by journey or operator specific permits, this comes at a cost. The administrative burden of seeking permit approvals may be a deterrent, but a higher cost comes at the uncertainty of permanent access. There is little incentive to invest in expensive vehicles that are safer and more productive if access can be withdrawn at any time.

This project was undertaken to align with the road development plans of other organisations for adjoining roads forming part of complete end to end journeys. The main ones were:

- TMR, through plans and programs to achieve desired HPV access levels on the State-controlled road network, based on industry consultation and an assessment of current and potential future freight transport needs¹
- The Council of Australian Governments' Transport and Infrastructure Council (TIC) which published maps defining nationally significant road and rail freight routes connecting significant locations as guides for infrastructure owners and managers to achieve consistency².

Road networks are classified within four levels of network access. Each level represents a specific road's capacity to meet a particular heavy vehicle's performance requirements. Whilst PBS allows for innovative vehicle design, the scheme also classifies common heavy vehicle types within each access level as shown in Table 1.

¹ Department of Transport and Main Roads (Queensland) 2016 Delivering heavy vehicle safety solutions together: Queensland's heavy vehicle action plan 2016-2018

² Department of Infrastructure and Regional Development (Commonwealth) 2014 National key freight routes map

Table 1: PBS road classification levels

Vehicle performance level	Network access limit vehicle length limit (m)		Equivalent heavy vehicle
	Class A	Class B	
Level 1	< 20 (general access)		<ul style="list-style-type: none"> • Semitrailer • Rigid truck and dog trailer • B-double < 20 m
Level 2	< 26	< 30	<ul style="list-style-type: none"> • B-double < 26 m (class 2A) • A-double < 30 m (Class 2B)
Level 3	< 36.5	< 42	<ul style="list-style-type: none"> • Type 1 road train • B-triple • AB-triple
Level 4	< 53.3	< 60	<ul style="list-style-type: none"> • Type 2 road train • AAB-quad • ABB-quad • BAB-quad

Source: National Heavy Vehicle Regulator <https://www.nhvr.gov.au/road-access/performance-based-standards/pbs-road-and-bridge-access>

5. Route identification and assessment

Increasing HPV access is dependent on the road network being able to safely accommodate their use whilst mixing with other road users. Infrastructure upgrades are usually required, with the magnitude of costs generally relative to the increase in HPV access being sought.

The principle of efficient infrastructure investment dictates that the expenditure matches the demand of users of the infrastructure. This means there is an imperative to simultaneously consider the willingness of road owners to invest along with the heavy vehicle industry's intention to use the improved network.

5.1. Industry engagement

The study identified routes for potential upgrade by engaging with local representatives of the heavy vehicle industry and major freight generators and end users, such as feedlots, meat works and grain storage facilities. First hand information was sought on current impediments to HPV operation on local roads and priorities for removal of these restrictions. This was done through the following initiatives:

1. An interactive web based mapping tool enabling identification of roads and locations where limitations in access caused productivity losses, and capture of the specific reason and possible solutions.
2. Two workshops held in convenient regional centres to which industry representatives were invited
3. An online survey distributed to transport companies seeking information on known problem locations restricting the size or weight of vehicles which can be operated
4. A program of market research telephone calls to transport companies and major freight generating and controlling organisation.

The last initiative proved to be the most successful approach for obtaining industry perspectives and access needs. It is however more resource intensive than the other approaches.

5.2. Road owner engagement

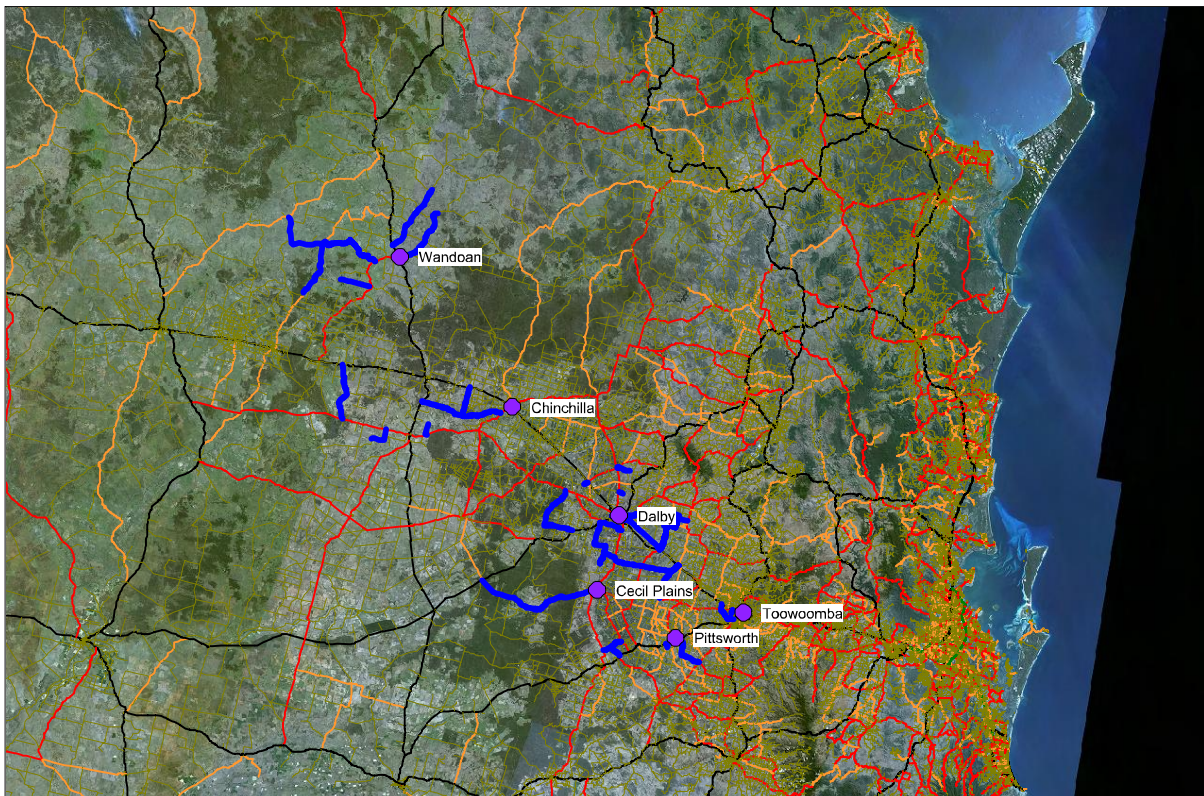
Engagement with representatives from the participating RRTGs, including council officers and elected officials refined the routes identified by industry by aligning with broader transport strategies and land uses. Aspects such as economic development opportunities, community amenity, engineering and road asset management have each been brought into play in determining those routes assessed for increased HPV access

This generated an initial list of some 68 routes encompassing around 90 roads. There was not as much overlap between industry and local government identified roads and routes as might have been expected.

5.3. Selection of routes for assessment

The initial list was assessed and a subset of 34 routes selected on the basis of consistency of industry and local government views, evidence of use by heavy vehicles and general local needs. This was undertaken through workshops with the Steering Committee, additional TMR and Council representatives and Jacobs.

Figure 4: Selected routes



5.3. Infrastructure deficiency analysis

The infrastructure deficiency assessment outlined the likely investment required to meet each route's desired PBS access level. A strategic level assessment provides a more detailed analysis at a later stage. Identifying the infrastructure deficiencies was undertaken through the following mechanisms:

- Road network data provided by TMR and the councils

- Direct advice and feedback from TMR and the councils through surveys, workshops and ongoing engagement
- Consultation with industry representatives
- Gap analysis of existing road condition data against minimum infrastructure requirements.

The gap analysis was guided by the PBS Network Classification Guidelines originally developed by the National Transport Commission and now administered by the National Heavy Vehicle Regulator. This provides a uniform method to classify a route by PBS level based on its geometric characteristics, load-bearing capacity and traffic volume. It enables a match between a vehicle's performance and its required road characteristics, and avoids excessive engineering design.

5.3.1. Road fitness-for-purpose and access under permit

The Guidelines promote a minimum standard of infrastructure for each PBS access level, and reflect a broad application of standard road design. They do not assess the specific characteristics of any specific road section. Applying the guidelines appropriately requires engineering knowledge and experience.

For example, a particular route's existing PBS access may already be higher than the minimum infrastructure standard required for that level of access. This is common where permit access is allowed, implying that risks to infrastructure, other road users and the community as a whole are acceptable. Further, continued permit access is likely in the absence of evidence indicating undue infrastructure or safety risks.

Similarly establishing and maintaining a fitness-for-purpose condition is a sound asset management strategy, particularly with low-volume roads. A road's condition can be matched according to the service in a practical and affordable way, thereby aligning capacity with intended use at a lower cost to the road owner. In certain circumstances the strict adherence to the Guidelines may result in overly-conservative assessment. Introducing risk mitigation mechanisms such as temporal restrictions can be as effective in meeting safety standards. Subsequently, a pragmatic approach is recommended in the determination of access approvals.

5.3.2. Data limitations

The gap analysis primarily relied on existing road infrastructure condition data provided by the councils and TMR. The ability of Councils to collect infrastructure data is often hampered by resourcing constraints, with high volume roads taking priority. This presents a challenge, as it is lower volume roads that are more likely to be accessed by the larger HPVs. The available data was also somewhat sporadic and only available for specific links rather than a complete route. Data limitations were overcome by developing assumptions for Steering Committee endorsement.

5.3.3. Costings

Road upgrade project costs were estimated on the basis of unit rates for the quantity of specific upgrade works required. Costings for rehabilitation, reconstruction and widening were based on a combination of rates developed by Jacobs and the Queensland Local Government Association.

Costs for each route were estimated based on separate projects, noting that multiple simultaneous or consecutive similar road upgrade projects nearby can reduce costs substantially.

6. Economic analysis

6.1. Approach

The benefits of HPVs are initially realised by the heavy vehicle industry and road agencies, which subsequently extend to the wider economy and the community through the greater efficiency of these vehicles in terms of cost per freight tonne-kilometre carried out, and in reduced numbers of vehicles required to complete any given freight task. The reduced costs of moving freight directly flow through other industries and ultimately consumers, whilst social and environmental benefits are generated through fewer vehicle movements.

The economic analysis methodology adopted is illustrated in Figure 5.

Figure 5: Economic analysis approach



The economic, environmental and social costs of moving a particular freight task with the existing vehicle fleet were estimated, and compared to the estimated costs incurred by the fleet expected to carry out the task fleet if increased HPV access was available. Whilst the road infrastructure is primarily improved to facilitate increased HPV access, the existing fleet and other road users also benefit from improved operating conditions. The specific benefit areas under these scenarios are illustrated in Table 2.

Table 2 Sources of increased HPV access benefits

Infrastructure	HPV fleet	Benefits				
		Reduced travel time	Reduced vehicle operating costs	Crash reduction	Reduced emissions	Reduced pavement wear
Existing infrastructure	Current fleet	Base case				
	Enhanced fleet	P	P	P	P	P
Improved infrastructure	Current fleet	P	P	P		
	Enhanced fleet	P	P	P	P	P

6.2. Data issues

The key data requirements for this analysis are (1) the current fleet composition (2) the freight task for each route and (3) the proportion of the current freight task that would shift to more productive vehicles if access for them was available.

The unavailability of detailed data for each route's freight task meant a number of assumptions were required. The assumptions were initially based on the analysis of available data, and tested for broader applicability with the Steering Committee.

Importantly, the analysis assumed the desired PBS access was available for the entire journey, conforming to the first / last mile principle of removing barriers to HPVs over a complete route. The benefits of first / last mile infrastructure investment are therefore maximised through timing of upgrades with the wider network.

For these reasons, routes within the same general vicinity were assessed together, to minimise the chance of double counting freight activity and upgrade costs. Further, there is potential for benefits to be maximised across separate routes when HPV access is broadened across an area. Promoting an area for investment rather than individual routes presents a case for reducing any perception of bias, and reinforces that the economic analysis is part of a broader decision-making process rather than being the sole argument for investment.

7. Conclusions

The combined routes analysis of all routes estimated benefits to exceed costs overall, with an overall BCR of 1.27.

Routes where economic benefits exceeded infrastructure costs were deemed viable for investment in the near future. From an efficiency perspective, these routes are a priority for investment. However, the economic analysis is only part of a broader decision-making process rather than being the sole argument for investment.

Where infrastructure upgrade costs exceeded benefits, routes were recommended for further consideration of infrastructure standards required to enable HPV access, seeking potential to reduce investment needs. Similarly, consideration can be given to staging investment over a longer time period, particularly to match overall traffic growth or anticipated industrial or intensive agricultural development. Gradual access improvements can provide the impetus for HPVs to adapt accordingly, thereby building the case for larger scale investment.

The Pilot faced a number of unforeseen challenges during its delivery, however the overall quality of the outputs have not been diminished. The collegiate nature of the Steering Committee meant that issues were resolved progressively and logically.

Overall the pilot has produced a mid to long term strategic plan for both Councils to align local freight networks with broader HPV productivity initiatives. It has also provided the justification and reasoning to support external funding for network investments that ultimately connect to major freight generation points. Whilst expenditure is at the local road network

level, the economic growth opportunities can generate benefits across Queensland and the nation.

These outcomes have been generally agreed as identifying the higher priority routes for upgrade funding in the areas studied. Application of the project's approach to other areas will mostly be determined by the success the councils involved in this project have in obtaining external funding to pursue the higher ranked projects.

Most regional councils have very limited available funding for road upgrades, stemming from large territories, many kilometres of local roads, relatively small populations and limited rate bases for core budget funding. In many cases, the majority of road upgrade funding is external, from state and federal governments via various programs and one off project funding.

It is suggested that highlighting the objective basis of assessments used to support funding claims, and showing that the evidence supporting prioritised projects will provide a greater economic development benefit than other projects, notwithstanding potential for greater alignment with shorter term political priorities.

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