

3 Why Local Arterials are Necessary

The need for a north-south arterial within the district results from poor accessibility and a reliance on SH1 for local trips. At present, only SH1 links the towns of Paraparaumu and Waikanae. To an extent the coastal link (Rosetta Road, Marine Drive etc) provides for north-south connectivity. It does not, however, provide a Waikanae River crossing.

This lack of connectivity focuses motor traffic on SH1 and the east - west arterials. This results in congestion and delays. Local arterials such as Kapiti Road are close to capacity because traffic is focused on a limited number of arterials.

SH1 currently provides the only Waikanae River crossing suitable for motor vehicles. A local arterial bridge over the Waikanae River could improve route security by providing an alternative crossing for inter-regional traffic in the event that the SH1 bridge was to close.

Urban design reviews commissioned by KCDC¹ have concluded that there are several areas of land within the district that are not realising their growth potential. KCDC are designing the WLR to optimise the economic return that development at these sites could bring to the District. The Council are promoting the WLR as a social and economic catalyst that will re-energise the Kapiti Coast economy and communities.

The Kapiti SH1 Strategy scoping report presented the principles for providing an expressway in Kapiti. This chapter presents the results of tests designed to challenge these principles and to quantify the benefits of local arterials. Tests were undertaken using the Kapiti SATURN Model. This chapter presents the tangible benefits for combinations of a generic SH1 expressway and an additional north-south local arterial.

The tests represent an expressway option that follows the rail corridor through Paraparaumu and Waikanae. Between these two towns the existing SH1 alignment would become an eastern arterial. Grade separated intersections would be created somewhere south of Paraparaumu (south facing ramps), at Otaihanga Road (full diamond interchange) and north of Waikanae (south facing ramps). Half diamond interchanges reinforce the roading hierarchy and discourage motorists from using the expressway for local trips within the district. If the WLR is not built it becomes necessary to construct full diamond interchanges to maintain local access. The roads tested are shown schematically in Figure 3.1. The two-lane WLR with local level of service was used to represent an additional north-south arterial.

The tests were completed before alignment options were scoped. This means that the results are only illustrative. They are, however, adequate for showing how an expressway and an additional local arterial could work together. The three scenarios are:

- Scenario 1: SH1 Expressway Only;
- Scenario 2: WLR Only (Local Level of Service); and
- Scenario 3: WLR and SH1 Expressway.

¹ Urban Design Framework – Integrated Land Use and Transport Report, Common Ground, June 2009

Figure 3.1 – Generic SH1 Expressway and Local Arterial Road Option



3.1 Do Minimum Scenario

The do minimum scenario includes permitted developments (see section 2.3) in both the 2016 and 2026 forecast years. The do minimum model includes new internal roads associated with each of the proposed developments. It also includes the Ihakara Road extension that links the town centre development with the airport development. No WLR or expressway elements are included in the do minimum model.

3.2 Network Summary Statistics

Table 3.1 and Table 3.2, overleaf, show the network summary statistics for each of the three scenarios in the 2016 and 2026 forecast years respectively. The tables present average travel speed for all trips undertaken within the network. They also present total travel time, delayed time and queued time for each scenario.

Scenario One: SH1 Expressway Only

In this scenario, the old SH1 becomes an eastern arterial. Motorists making inter-regional trips would use the new expressway. Those making short local trips would continue to use the old SH1. Local trips would be able to cross the Waikanae River using the existing bridge on the old SH1 (which is becoming an eastern arterial) while a new crossing would be provided as part of the expressway for inter-regional trips. Someone driving from Kapiti Road to Waikanae would use a new underpass below SH1 and the railway to reach Ruapehu Street. From here they would drive along Ruahine Street before joining the old SH1 just south of Lindale and crossing the Waikanae River on the existing bridge. No new north-south routes are provided in the west of the district.

The tables show that introducing a SH1 expressway increases the network travel speed by 5km / hour in 2016 and reduce travel times from the do minimum scenario. These improvements result from eliminating all queuing on SH1. Motorists using the new expressway would be able to drive in uninterrupted traffic conditions. There would be no at-grade intersections to create queues on SH1. Providing two lanes in each direction would also allow motorists to overtake slow moving vehicles.

Even though the SH1 expressway is shorter than the existing SH1 route, Scenario One actually increases the total travel distances by 3,000 PCU - km in each 2016 peak hour. This is because motorists making local trips would travel longer distances to make the same journeys. Reasons for this include:

- (a) the lack of connectivity to the SH1 expressway means that some trips (e.g. from Kapiti Road to Waikanae) will be slightly longer. However the large number of people making this journey means that the cumulative increase in travel distance is large.
- (b) The lack of connectivity to the expressway in Paraparaumu means that motorists are forced to use local roads to drive within the town. Rimu and Kapiti Roads are already congested. The additional trips associated with new development exacerbate the situation and motorists travel further to bypass congested roads such as these.

Table 3.1– Network Summary Statistics 2016

Time Period	Do Minimum			Scenario One SH1 Expressway Only			Scenario Two WLR Only			Scenario Three WLR & SH1 Expressway		
	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Network Speed (km / hr)	43	45	39	48	46	41	49	48	46	54	50	45
Travel Distance (PCU-kms/Hr)	65,558	60,053	78,583	68,597	62,933	81,363	61,706	56,916	74,633	61,433	56,177	73,016
Travel Time (PCU Hrs / Hr)	1,533	1,328	2,016	1,445	1,373	1,982	1,257	1,199	1,637	1,135	1,120	1,621
Delayed Time (PCU Hrs)	88	88	106	2	1	3	41	31	62	1	1	2
Queued Time (PCU Hrs)	395	395	605	323	3	607	223	237	347	142	180	404

Table 3.2 – Network Summary Statistics 2026

Time Period	Do Minimum			Scenario One SH1 Expressway Only			Scenario Two WLR Only			Scenario Three WLR & SH1 Expressway		
	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Network Speed (km / hr)	39	41	33	45	43	39	49	48	44	54	47	43
Travel Distance (PCU-kms/Hr)	71,494	65,299	84,138	73,606	68,815	89,050	67,647	62,567	81,262	67,197	61,570	79,562
Travel Time (PCU Hrs / Hr)	1,826	1,593	2,616	1,656	1,603	2,271	1,392	1,311	1,862	1,250	1,307	1,841
Delayed Time (PCU Hrs)	110	71	127	3	1	4	52	40	74	2	1	3
Queued Time (PCU Hrs)	561	458	979	453	445	764	254	248	445	165	278	518

Notes

PCU		= Passenger Car Unit (1 Car = 1 PCU, 1 HCV = 2 PCU etc)
Network Speed	km / hr	= the average speed of all trips from origin to destination
Travel Distance	PCU-kms / Hr	= the total distance travelled for every trip (PCU) from origin to destination within the modelled hour
Travel Time	PCU Hrs / Hr	= the total travel time for every trip (PCU) from origin to destination within the modelled hour
Delayed Time	PCU Hrs	= the total delay between intersections caused by high volumes for every trip (PCU) within the modelled hour
Queued Time	PCU Hrs	= the total queuing delay for every trip (PCU) within the model hour

Table 3.1 and Table 3.2 show that Scenario One is forecast to have lower total travel time and queued time than the do minimum. Removing local trips from a SH1 expressway and providing additional capacity means that there would be a substantial reduction in delays between intersections (delayed time).

Examination of the tangible traffic benefits for Scenario One indicates that the dis-benefit associated with increased travel distances for motorists making local trips outweighs the travel time savings for motorists using a SH1 expressway. The tangible benefits for Scenario One (SH1 expressway only) were approximately -\$230M². A negative benefit indicates that traffic efficiency would be worse for this scenario than for the do minimum.

Scenario Two: WLR Only (Local Level of Service)

Creating an additional north-south local arterial in the west of Kapiti District increases accessibility. It provides more direct routes for the journeys that motorists want to make. It also provides an alternative to driving on SH1. In this scenario there are two crossings of the Waikanae River: as part of the WLR and the existing crossing on SH1. Scenario Two is forecast to reduce the total travel distance in the modelled area by approximately 4000 PCU km / hour from the do minimum in each of the 2016 peak hours. Inter peak (IP) travel distances are forecast to decrease by just over 3000 PCU km / hour in 2016.

As well as reducing total travel distance and hence vehicle operating costs, Scenario Two is also forecast to reduce total travel time. The travel time reductions associated with this option for the 2016 AM peak are forecast to be around three times as great as for Scenario One. In the 2016 PM peak, total travel time reductions are more than 10 times as great as for Scenario One.

An additional north-south local arterial reduces congestion at intersections and hence queuing time. However because no additional capacity is provided for SH1 traffic, delays on SH1 links (delayed time) are not reduced as much as they were in Scenario One. Any reduction in delayed time is as a result of reduced traffic flows on SH1. The reductions in delayed time result from fewer motorists using the existing SH1 for local trips. This improves traffic flow for people making inter-regional trips.

The tangible benefits for the WLR alone were approximately +\$390M².

Scenario Three: SH1 Expressway and WLR

Providing a SH1 expressway and an additional north-south local arterial brings benefits for both motorists using the SH1 expressway and people making shorter trips within the district. This scenario provides three points where motorists can cross the Waikanae River: on the WLR, on the SH1 expressway, and on the old SH1 (which would become an eastern arterial). In the 2016 and 2026 AM peak periods the difference between total travel distance for this scenario and the do minimum, is forecast to be similar to that for Scenario 2, at around 4000 PCU km / hour. For the PM peak, Scenario Three is forecast to bring travel distance savings that are about 50% more than for Scenario Two.

² These benefits assume a 30 year return period and are based purely on travel time and vehicle operating costs. Crash costs are not included.

The additional capacity provided on the SH1 expressway means that delays on SH1 links are reduced by a similar amount as in Scenario One. The new local arterial allows traffic to be more widely dispersed around the road network. This results in a reduction of queued time of a similar magnitude to Scenario Two.

There is a substantial degree of synergy between providing both a SH1 expressway and an additional north-south arterial for local traffic. We use the word synergy here because the total economic benefits achieved by building both the WLR and state highway expressway is significantly greater than the sum of benefits calculated by providing each as a stand alone scheme. The tangible benefits for a SH1 expressway with a supporting WLR are approximately +\$470M. This is primarily because both inter-regional and local traffic would benefit.

3.3 Inter-Regional Travel Time Savings

Table 3.3, overleaf presents forecast travel times on SH1 for the three test scenarios. If neither the SH1 expressway nor the WLR are introduced, AM peak hour travel times are forecast to increase by up to 25% from 2016 to 2026. In the PM peak do minimum scenario travel times are forecast to increase by up to 70% between 2016 and 2026.

All three scenarios reduce travel times for inter-regional trips on SH1. Scenario 2 is forecast to reduce SH1 travel times by between 50 and 250 seconds per trip. In scenarios where a SH1 expressway is provided (Scenarios One & Three) the savings could be up to six times as much than for Scenario Two. It is also evident that SH1 travel time savings where both an expressway and the WLR are constructed are no greater than if only the expressway were provided.

3.4 Inter-Regional Traffic Volumes

Comparing traffic volumes in each of the scenarios illustrates the degree that local traffic is forced or encouraged onto local roads. Table 3.4 presents forecast traffic volumes across four screen lines –as shown in Figure 3.1.

Restricting access to SH1 (Scenarios One and Three) reduces its attractiveness relative to the alternative routes because some journeys (e.g. Paraparaumu to Waikanae) would be longer using the expressway. Providing a new arterial in the west of the district (Scenarios Two and Three) reduce traffic flows on SH1 because some trips would be shorter using the new arterial.

Table 3.4 shows that Scenarios One and Three result in the lower traffic volumes using the SH1 than Scenario Two. SH1 traffic flows for Scenario One and Scenario Three are up to 50% lower than the do minimum. For Scenario Two, the largest reduction from the do minimum is 30%. The SH1 traffic reduction is smaller for Scenario Two because the old SH1 retains a large number of local connections allowing people to continue to use it for some of their trips.

Table 3.3 – Forecast SH1 Travel Times between MacKays Crossing and Peka Peka (Seconds)

Time Period	Do Minimum			Scenario 1 - Expressway Only			Scenario 2 – WLR Only			Scenario 3 – WLR & SH1 Expressway		
	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
2016 Northbound	964	896	1,178	567 (-397)	567 (-329)	571 (-607)	886 (-78)	833 (-63)	885 (-293)	566 (-398)	566 (-330)	570 (-608)
2016 Southbound	1088	836	840	569 (-519)	567 (-269)	567 (-273)	838 (-250)	789 (-47)	787 (-53)	568 (-520)	566 (-270)	566 (-274)
2026 Northbound	1,197	1,036	1,278	568 (-629)	567 (-469)	573 (-705)	911 (-286)	846 (-190)	975 (-303)	566 (-631)	567 (-469)	571 (-707)
2026 Southbound	1,258	860	1,434	570 (-688)	567 (-293)	567 (-867)	867 (-391)	809 (-51)	800 (-634)	569 (-689)	566 (-294)	567 (-867)

Table 3.4 – Forecast SH1 and WLR Link Flows (AADT): 2016 and 2026

Screen Line		2016				2026			
		Do Minimum	Scenario 1 - Expressway Only	Scenario 2 - WLR Only	Scenario 3 - WLR & SH1 Expressway	Do Minimum	Scenario 1 - Expressway Only	Scenario 2 - WLR Only	Scenario 3 - WLR & SH1 Expressway
Waikanae River	Existing SH1	36,315	12,663	26,221	8,815	39,323	15,195	28,921	10,288
	SH1 Expressway		23,752		16,631		25,795		18,344
	WLR	n/a	n/a	10,893	11,619	n/a	n/a	13,008	13,198
Otaihanga Road	Existing SH1	31,975	8,972	23,725	6,278	37,686	11,305	26,445	7,374
	SH1 Expressway		15,695		15,033		17,126		16,662
	WLR	n/a	n/a	10,340	14,673	n/a	n/a	11,775	16,584
Kapiti Road	Existing SH1	29,034	n/a	25,362	n/a	31,076		26,638	
	SH1 Expressway		15,695		15,033		17,126		16,662
	WLR	n/a	n/a	9,137	9,805	n/a	n/a	9,511	10,677
Raumati Road	Existing SH1	29,966	n/a	21,648	n/a	31,534		23,778	
	SH1 Expressway		16,278		15,216		17,638		16,942
	WLR	n/a	n/a	12,214	12,365	n/a	n/a	11,805	13,061

The largest reduction in hourly traffic flow on SH1 is forecast for Scenario 3 where both the WLR and an expressway would be provided. Traffic flows of approximately 900 PCUs per hour are forecast for 2026 PM peak compared to 1,400 for the do minimum scenario in the same year. Limiting connectivity with local roads and providing an attractive alternative encourages more appropriate use of a Kapiti road hierarchy.

The difference between the scenarios is most evident at the SH1 Waikanae River crossing where the road network is least dispersed. Providing a second river crossing reduces flows on the existing SH1. Many trips, are however, still faster using the existing SH1. Creating a limited access SH1 expressway and removing all connections from the expressway to the local road network in Waikanae forces motorists to use the eastern arterial (i.e. the old SH1 alignment) rather than the SH1 expressway.

3.5 Summary

This chapter has shown that providing a limited access SH1 expressway in Kapiti would reduce travel times for inter-regional traffic. It would also reduce the number of motorists that would use SH1 for local trips.

In Paraparaumu, SH1 is currently the only north-south route within the urban area. Providing Scenario One (SH1 Expressway Only) would result in increased congestion and delays for motorists making local trips. The travel costs associated with these delays are likely to outweigh the savings for inter-regional traffic. A new local arterial providing for access to and movement within Paraparaumu is therefore a fundamental requirement for any proposal to enhance the road network in this part of the study area.

Many motorists travelling between Arawhata Road in Paraparaumu (shaded blue in Figure 3.2) and the north of the district currently join SH1 at the Kapiti Road intersection. If this connection were removed these motorists would need to travel via Marzengarb, Ratanui and Otaihanga Road to access either the expressway or the old SH1. They could also pass under the expressway and along Ruapehu and Ruahine Street before joining the old SH1 south of Lindale. Both of these routes would be longer than at present. Removing connections between Kapiti Road and a SH1 expressway in Paraparaumu would therefore increase local trip lengths and travel times.

The travel costs associated could be avoided by providing a more direct route between Arawhata Road and the old SH1. Figure 3.2 shows the potential desire lines. This movement could be accommodated by providing a new link either:

- (a) between Arawhata Road and Otaihanga Road (i.e. part of the WLR); or
- (b) between Arawhata Road and the old SH1 at Lindale.

Between Paraparaumu and Waikanae a new local arterial is desirable but not essential. In this part of the study area, the old SH1 adequately mitigates the traffic effects of a restricted access SH1 expressway. A new local arterial would nonetheless increase local access, reduce travel times and travel distances. A new local arterial between Paraparaumu and Waikanae would therefore improve traffic efficiency within Kapiti District.

Figure 3.2 - Routes from Arawhata Road

