SH1 Extension Papakura - Drury South

Summary

Expected construction 2021-2026

Road/Shared Path Third lane plus bus shoulder lanes added to Southern Motorway between Papakura-Drury South; new shared path on northern side of motorway

					Units	Assumptions and notes
Do Minimum						The assessment of the estimated emissions if the intervention is n
Road Length	5.5				km	
Number of lanes	4				#	Total number of lanes in each direction, including shared pathways
Lane kilometres	22				km	Road length multiplied by the number of lanes
Infrastructure Type	State Highway					
Emissions Breakdown						
Construction	0				tCO2e	
Enabled	81,586,498	2024-2053			tCO2e	Cumulative enabled do-minimum over period
Do Intervention						The assessment of the estimated emissions if the intervention is c
Road Length	5.5				km	Length of road for which construction emissions are estimated
Number of vehicle lanes	6					Vehicle lanes in each direction
Number of shared paths	1					Shared paths
Lane kilometres	38.5				km	Road length multiplied by the number of lanes
Infrastructure Type	State Highway with Shared Path					
Emissions Breakdown						
Construction	59,129				tCO2e	Total estimated construction intevention emissions based on the d
Enabled	81,612,525	2024-2053			tCO2e	Total estimated enabled intervention emissions from the vehicle us
Emissions Summary						
Construction	59,129				tCO2e	Total estimated construction intevention emissions based on the d
Construction Emissions per Kilometre	10,751				tCO2e/km	The estimated construction emissions for the intervention option di
Construction Emissions per Lane Kilometre	1,536				tCO2e/lane km	The estimated construction emissions for the intervention option di
Cumulative enabled emissions	2024-2033	2034-2043	2044-2053	2024-2053		
Do minimum vehicle journey emissions	36,628,768	27,626,650	17,331,080	81,586,498	tCO2e	
Do intervention vehicle journey emissions	36,633,743	27,642,268	17,336,515	81,612,525	tCO2e	
Cumulative change in vehicle journey emissions	4,975	15,618	5,435	26,027	tCO2e	

Project Information Summary

Do minimum = current Southern motorway Papakura-Drury South

Do Intervention = additional lane in each direction P2DS, additional bus shoulder lanes, new 9 km shared path PLUS inter-related network changes as set out in Traffic Model Info.

Construction emissions sourced from AECOM Report "SH1 Upgrade between Papakura and Drury South (Construction, Operation, Maintenance and Enabled GHG Emissions Report" 30 May 2021.

Changes in enabled emissions arise from additional traffic on entire southern motorway network and local roads, taking into account mode shift. Refer to Traffic Model Info.

Emissions increase with increased VKT and congestion to circa 2040, then decrease as a result of changes in fleet emissions.

SH1 Extension Papakura - Drury South

ENABLED Emissions

Road/Shared Path

Do Minimum

		Units	Assumptions and notes
Road Length	5.5	km	Linked to Summary sheet
Number of lanes	4		Linked to Summary sheet
Lane kilometres	22	km	Linked to Summary sheet

Calculated Emissions

	2018	2028	2038	2048	Units
From vehicle journeys	3,287,064	3,662,877	2,762,665	1,733,108	tCO2e
From public Transport	0	0	0	0	tCO2e
From cycling	0	0	0	0	tCO2e
From walking	0	0	0	0	tCO2e
Total	3,287,064	3,662,877	2,762,665	1,733,108	tCO2e

Data sourced from May 2021 AECOM Report: SH1 Upgrade between Papakura and Drury South (Construction, Operation, Maintenance and Enabled GHG Emissions)
Note: Refer to Traffic Model Info worksheet for network assumptions; emissions estimates are based on VEPM6.1 (which was current when traffic modelling was undertaken).

Cumulative calculated Emissions	2024-2033	2034-2043	2044-2053	Total	Units
From vehicle journeys	36,628,768	27,626,650	17,331,080	81,586,498	tCO2e
From public Transport	0	0	0	0	tCO2e
From cycling	0	0	0	0	tCO2e
From walking	0	0	0	0	tCO2e
Total	36,628,768	27,626,650	17,331,080	81,586,498	tCO2e

Do Minimum Total Emissions	81,586,498	2024-2053

Do Intervention

		Units	Assumptions and notes
Road Length	5.5	km	Linked to Summary sheet
Number of vehicle lanes	6	#	
Lane kilometres	38.5	km	Linked to Summary sheet

Calculated Emissions

	2018	2028	2038	2048	Units
From vehicle journeys	3,287,064	3,663,374	2,764,227	1,733,651	tCO2e
From public Transport	0	0	0	0	tCO2e
From cycling	0	0	0	0	tCO2e
From walking	0	0	0	0	tCO2e
Total	3,287,064	3,663,374	2,764,227	1,733,651	tCO2e

Data sourced from May 2021 AECOM Report: SH1 Upgrade between Papakura and Drury South (Construction, Operation, Maintenance and Enabled GHG Emissions)
Note: Refer to Traffic Model Info worksheet for network assumptions; emissions estimates are based on VEPM6.1 (which was current when traffic modelling was undertaken).

Cumulative calculated Emissions	2024-2033	2034-2043	2044-2053	Total	Units
From vehicle journeys	36,633,743	27,642,268	17,336,515	81,612,525	tCO2e
From public Transport	0	0	0	0	tCO2e
From cycling	0	0	0	0	tCO2e
From walking	0	0	0	0	tCO2e
Total	36,633,743	27,642,268	17,336,515	81,612,525	tCO2e

Intervention Total Enabled Emissions	81,612,525	2024-2053	tCO2e	Total cumlative enabled emissions from implemening the intervention.

CHANGE in emissions

Cumulative calculated enabled emissions	2024-2033	2034-2043	2044-2053	Total	Units
Do minimum vehicle journey emissions	36,628,768	27,626,650	17,331,080	81,586,498	tCO2e
Do intervention vehicle journey emissions	36,633,743	27,642,268	17,336,515	81,612,525	tCO2e
Cumulative change in vehicle journey emissions	4,975	15,618	5,435	26,027	tCO2e

SH1 Extension Papakura - Drury South

Guideline and Supporting information on methodology for transport modelling

Name of Project
Traffic Consultant
Report (if available)
Model Software
Model
Model validation
Time horizons and growth assumptions
Network assumptions and interdependencies
Model Scenario Assumptions **Do Minimum**

Model Scenario Assumptions **Do Intervention/With Project**
Induced Traffic
Interface with Vehicle Emission Prediction Model (Where relevant)
General assumptions/Limitations

FINAL CIPA P2DS 24Aug21

Traffic Modelling Methodology and Assumptions

Waka Kotahi Guidelines for transport model development
Research Report 659 Urban transport modelling in New Zealand – data, practice and resourcing

NZUP P2DS
Beca Limited
Papakura to Drury Project Vehicle Emissions Analysis Final Report 21 May 2021
EMME https://www.inrosoftware.com/en/products/emme/
Auckland Regional Macro Strategic Model (MSM) plus Strategic Active Mode Model (SAMM)
The P2DS assessment utilises a modelling approach the same as that used by Te Tupu Ngatahi - The Supporting Growth Alliance (SGA), for business case and long-term route protection for a programme of network upgrades in this area to support the planned growth over the next 30+
The MSM model was satisfactorily validated to a base year of 2016, with International peer review and SAM was validated to 2016 and 2018 conditions, with peer review by QTP ltd
forecast models for 2028, 2038, 2048 and 2048+ (2048+ is similar to the 2048 but includes full build-out of the growth zones in this southern area, and subsequently represents a period beyond 2048). The SAMM model is only available for 2028,2038 and 2048+, however 2048 results were estimated by interpolation. Land use growth assumptions are based on Scenario I11.5 regional growth assumptions developed by Auckland Council and the AFC. The growth assumptions include development of the planned growth areas, as identified in the Auckland Unitary Plan and Auckland Council's Future Urban Land Strategy Study (FULSS). The same land use growth assumptions are modelled with and without the P2DS project, although the MSM and SAMM models predict change in travel patterns in response to the project.
Assumed wider network projects and timeframes for inclusion in the model. Project Year included from: Mill Road 2028 Paerata and Drury train stations 2028 Opaheke North-South Arterial 2038 Rail 4-track 2038 Drury Arterial upgrades (Jesmond Rd, Bremner Rd, Waihoehoe Rd, SH22) Varies 2028-2038 Pukekohe Expressway 2038 Widening of SH1 Takanini-Manukau 2048 Widening of SH1 Drury South to Bombay 2048

•The P2DS project is considering managed lane operational strategies for the additional capacity, such as priority for freight and high-occupant vehicles. For the purposes of this analysis, the additional capacity is assumed to be available to all vehicles. Managed lane policies that limit access to low-occupant vehicles could have reduced increases in VKT, and hence lower vehicle emission impacts than estimated under this assumption.
Induced traffic was included, via the MSM multi-modal model responses. These include mode shift, trip re-distribution and trip re-timing
The method used is the same as the Auckland Forecasting Centre (AFC), whereby VEPM is used to get emissions rates (g/km) for each 1km speed band between 10 and 100 kph. Those rates are then applied to each individual link in the model based on its estimated speed, and separately for cars, trucks and buses. VEPM6.1 was used for this model round (early 2021). The emissions on each link are then summed across the whole network
cases) is not complete •Assessment is based on growth assumptions aligned with Unitary plan, yet the pace and type of growth remains uncertain. We have not considered a 'constrained growth' scenario •Assumptions used on future vehicle fleet assumptions that have inherent uncertainty (albeit based on VEPM forecasts) •The whole-system solution involves land use, multi-modal and demand management interventions, yet this assessment isolates only the one element of that system. In particular, it assumes that the desired and use type and location could occur regardless of the planned network system solution •The assessment measures change in emission against a theoretical future counter-factual, rather than current-day conditions. While this is considered valid, it is important context

[Transport model development guidelines (nzta.govt.nz)](https://www.nzta.govt.nz/assets/resources/research/reports/65)
https://www.nzta.govt.nz/assets/resources/research/reports/65

SH1 Extension Papakura - Drury South

CONSTRUCTION EMISSIONS

Expected construction 2021-2026

Road/Shared Path

	Units			Emissions Factor	Unit	Sources and notes
Do Intervention						
Material Quantities Estimate						
Construction Fuel Use						
Diesel	0	L		0.0027	tCO2e/L	MfE 2020
Construction Materials						
Concrete	0	tonnes		0.11	tCO2e/tonne	AECOM derived factor (See assumptions below)
Steel	0	tonnes		2.85	tCO2e/tonne	MfE 2020
Road Surface						
Crushed rock or recycled material	0	tonnes		0.0032	tCO2e/tonne	IS Calculator NZ v2.0
Gravel	0	tonnes		0.0182	tCO2e/tonne	IS Calculator NZ v2.0
Bitumen	0	tonnes		0.3966	tCO2e/tonne	IS Calculator NZ v2.0
Asphalt	0	tonnes		0.0542	tCO2e/tonne	IS Calculator NZ v2.0
Project Breakdown Total	59,129	tonnes of CO2e	See Construc ion Schedule Worksheet			
Calculated Emissions						
Best estimate of calculated emissions	59,129	tonnes of CO2e	See Construc ion Schedule Worksheet			

Assumptions

Emissions for construction have been calculated by AECOM as part of a detailed study of emissions from this project: May 2021 AECOM Report: SH1 Upgrade between Papakura and Drury South (Construction, Operation, Maintenance and Enabled GHG Emissions).

The report considered emissions associated with the original NZUP Scope (Stages 1 and 2); the revised scope of the project excludes Stage 2. This estimate is for Stage 1 only, based on total lanekm. See Construction Schedule worksheet.

Estimate includes all emission sources, including concrete, steel, asphalt, ear hworks as well as cabling, timber, waste.

Emissions from the transporta ion of construction materials and waste to/from site have been included.

Emission factors are sourced from MfE's 2020 Guide (see link below) where appropriate, or from the ISCA-IS Calculator v2.0.

https://environment.govt.nz/publications/measuring-emissions-detailed-guide-2020/

The ISCA-IS Calculator v2.0 is available for ISCA members at https://www.isca.org.au/Tools-and-Resources

The emission factor for concrete is based on MfE 2020 guidance and is based on a standard concrete mix.

SH1 Extension
Papakura - Drury South Construction Schedule

Source: AECOM detailed study of Papakura to Drury Stages 1a, 1b, and 2 (per repo

Summary of Emissions
Stage 1a Original NZUP Scope

Construction Activity	t CO2-e
Construction Fuel	674
Materials	11,077
Materials transport to site	563
TOTAL	**12,313**

Stage 1b and 2 Original NZUP Scope

Construction Activity	t CO2-e
Construction Fuel	15,854
Materials	74,371
Materials transport to site	10346
TOTAL	**100,570**

REVISED scope excludes Stage 2

TOTAL, Original NZUP Scope	**112,883**
ESTIMATE Revised NZUP Scope	**59,129**

The totals for the original scope were calculated as follows using the ISCA-IS Calculator v2.0.

Stage 1a

Material	Type	Amount
Asphalt & Bitumen	Asphalt	19,927
Noise Wall Piles	Ready Mixed Concrete	535
Bridge Piles	Ready Mixed Concrete	2,052
Retaining Wall	Ready Mixed Concrete	950
Gantries	Ready Mixed Concrete	600
Site Concrete and Misc.	Ready Mixed Concrete	2,540
Safety Barriers	Precast Concrete	4,754
Noise Wall Panels	Precast Concrete	2,042
Retaining Wall Panels	Precast Concrete	1,190
Bridge	Precast Concrete	3,147
L-Shaped Retaining walls	Precast Concrete	430
GAP 65, AP40	Aggregates	17,000
Cement and Lime binders	Cement and Lime binders	1,355

Reinforced Concrete 225mmD, 300mmD, 375mmD, 450mmD, 525mmD, 600mmD, 675mmD, 750mmD	Piping	559
Steel (reinforcement products)	Steel	1,007
Steel products	Steel	106
Timber	Timber	20
Cabling (signalling)	Cabling	750
Cabling (communications) - Fibre	Cabling	650
Power cables, low voltage	Cabling	1,622
Total Materials		

Extra/Unknkown:		
Soil	Waste From Site (Aggregates)	16,200
General Material	Waste From Site (Aggregates)	55,000
Diesel	Diesel	250,000

Stage 1b and 2

Material	Type	Amount
AC20	Asphalt	48,570
SMA	Asphalt	1,585
EMOGPA	Asphalt	7,296

AC10	Asphalt	327
AC14	Asphalt	2,875
Red Chip	Asphalt	1,716
Bridge concrete	Ready Mixed Concrete	25,831
Concrete Barriers 40Mpa	Ready Mixed Concrete	2,220
Kerb and Channel 30Mpa	Ready Mixed Concrete	1,429
Other 17.5 Mpa	Ready Mixed Concrete	40
Other 20Mpa (piles)	Ready Mixed Concrete	88,581
Other 30Mpa	Ready Mixed Concrete	1,460
Other 35 Mpa	Ready Mixed Concrete	8,679
Other 50 Mpa	Ready Mixed Concrete	999
Precast concrete panels (assume 200mm thick)	Precast Concrete	4,644
Bridge Precast concrete barriers	Precast Concrete	654
Bridge concrete panels (assume 150mm thick)	Precast Concrete	521
300mm Dia Concrete Pipe	Precast Concrete	9,370
375mm Dia Concrete Pipe	Precast Concrete	3,690
450mm Dia Concrete Pipe	Precast Concrete	763
450mm Dia Concrete Pipe	Precast Concrete	112
1200mm Dia Manhole including lid and base	Precast Concrete	475
GAP7	Aggregates	12
GAP20	Aggregates	270
AP40	Aggregates	11,282
GAP65	Aggregates	976,314
GAP100	Aggregates	797,884
SPR	Aggregates	484,779
GAP150	Aggregates	19,137
Topsoil	Aggregates	5,791
Sand	Aggregates	55,443
Bridge - brown rock and GAP65 for piling/ crane platform	Aggregates	30,910
Various	Steel	1,668

Bridges (rebar)	Steel	5,374
Bridge Beams, casings, temp works	Steel	1,762
Lighting cable and duct	Cabling	9,361
ITS duct and cable	Cabling	22,000
Other duct and cable	Cabling	2,860
110kv cable	Cabling	1,590
Total Materials		

Extra/Unknkown:		
Various Plant	Diesel	5,381,510
Bridges - Cranes	Diesel	287,250
Bridges - Plant, excavators, generators	Diesel	216,000
Soil and General Material	Waste From Site (Aggregates)	-

ort May 2021).

% of total
5.5%
90.0%
4.6%
100%

% of total
15.8%
73.9%
10.3%
100%

Lane.km
10.5
5.5

Construction emissions estimate proportionate to lane km

Unit	SCM % (Concretes)	MPA (Concretes)	Assumptions	Data Source
m3	N/A	N/A	Transport distance averaged between FH and Downers asphalt plant	
Tonnes	0	30		
Tonnes	0	40		
Tonnes	0	40		
Tonnes	0	40		
Tonnes	0	20		
Tonnes	0	40	4% steel concrete	
Tonnes	0	40	4% steel concrete	
Tonnes	0	40	4% steel concrete	
m3	0	40	6% steel concrete	
m3	0	40	4% steel concrete	
m3	N/A	N/A	Gravel	
m3	N/A	N/A	900m3 given, converted to tonnes at 1.50574 tonnes per m3. Material will most likely come from Golden Bay Cement in Oakleigh (Whangarei)	Gansen Govender <Gansen. Govender @axellconsultants

Tonnes	N/A	N/A		nsultants. com>
tonnes	N/A	N/A	Steel will be NZ and will either be incorporated into the elements in Auckland, Hamilton or Tauranga.	
tonnes	N/A	N/A	Steel products for the bridge handrail, anti-throw screens and bridge façade will be from NZ, either Auckland or Hamilton.	
tonnes	N/A	N/A		
kg	N/A	N/A	150 kg/km for 5km	
kg	N/A	N/A	116 kg/km for 5.6km	
kg	N/A	N/A	460 kg/km 3.527km	

m3			General Fill, Spoil	Gansen Govender <Gansen.Govender@axellconsultants.com>
m3			Assumed to be innert and sent to cleanfill - categorised as General Fill, Spoil	
litres			I have no idea what plant the contractors are going to use for construction. If I just used the volume of material, piling etc– I would approximate that we are looking at approximately 250,000L.	

Unit	SCM % (Concretes)	Steel Content kg/tonne (Concretes)	Assumptions
m3	N/A	N/A	Hot mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)
m3	N/A	N/A	Hot mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)
m3	N/A	N/A	Hot mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)

m3	N/A	N/A	Hot mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)
m3	N/A	N/A	Hot mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)
m3	N/A	N/A	Hot mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)
m3	30%	N/A	
m3	10%	N/A	
m3	0%	N/A	
m3	0%	N/A	
m3	20%	N/A	
m3	20%	N/A	
m3	20%	N/A	
m3	30%	N/A	
m3	15%	83	40mpa, 200kg/m3
m3	15%	83	40mpa, 200kg/m3
m3	15%	83	40mpa, 200kg/m3
m3	15%	62.3	Assume 50MPa concrete, 350kg/m3 of binder, with 15% flyash. i.e. 53kg/m3 of SCM. 150kg/tonne
m3	15%	62.3	Assume 50MPa concrete, 350kg/m3 of binder, with 15% flyash. i.e. 53kg/m3 of SCM. 150kg/tonne
m3	15%	62.3	Assume 50MPa concrete, 350kg/m3 of binder, with 15% flyash. i.e. 53kg/m3 of SCM. 150kg/tonne
m3	15%	62.3	Assume 50MPa concrete, 350kg/m3 of binder, with 15% flyash. i.e. 53kg/m3 of SCM. 150kg/tonne
m3	15%	62.3	Assume 50MPa concrete, 350kg/m3 of binder, with 15% flyash. i.e. 53kg/m3 of SCM. 150kg/tonne
m3	N/A	N/A	Gravel
m3	N/A	N/A	Gravel
Tonnes	N/A	N/A	Crushed Rock
Tonnes	N/A	N/A	Gravel
Tonnes	N/A	N/A	Gravel
Tonnes	N/A	N/A	Crushed Rock
Tonnes	N/A	N/A	Gravel
m3	N/A	N/A	General fill, Spoil
m3	N/A	N/A	Manufactured Sand
m3	N/A	N/A	Crushed Rock
tonne	N/A	N/A	Assume imported from China - delivered ex Port

tonne	N/A	N/A	Assume mostly imported from Australia, delivered from Steel and Tube or Fletcher Reinforcing
tonne	N/A	N/A	Assume imported from China, fabrication in NZ (Whangarei or Napier)
kg	N/A	N/A	17020m
kg	N/A	N/A	40000m
kg	N/A	N/A	5200m
kg	N/A	N/A	1590m

litres			
litres			
litres			
m3			Estimated based on waste removed in stage 1a. Estimated based on the amount of diesel consumed for each stage.