Takitimu North Link
Stage 1 — Construction

Expected construction 2021-2026

Road with Shared Path — New 7 km four lane road with adjacent shared path

		Units	Emissions Factor	Unit	Sources and notes
Do Intervention					
Material Quantities Estimate					
Construction Fuel Use					
Diesel	6,364,033	L	0.0027	tCO2e/L	MfE 2020
Construction Materials					
Concrete	67,077	tonnes	0.11	tCO2e/tonne	AECOM derived factor (See assumptions below)
Steel	12,048	tonnes	2.85	tCO2e/tonne	MfE 2020
Road Surface					
Crushed rock or recycled material	1,071,844	tonnes	0.0032	tCO2e/tonne	IS Calculator NZ v2.0
Gravel	-	tonnes	0.0182	tCO2e/tonne	IS Calculator NZ v2.0
Bitumen	-	tonnes	0.3966	tCO2e/tonne	IS Calculator NZ v2.0
Asphalt	21,404	tonnes	0.0542	tCO2e/tonne	IS Calculator NZ v2.0
Project Breakdown Total	63,370	tonnes of CO2e	See Construction Schedule Worksheet		
Best estimate of calculated emissions	63,370	tonnes of CO2e	See Construction Schedule Worksheet		

Assumptions

Emissions for construction have been calculated from data provided by Waka Kotahi for this project. When possible assumptions have been made in a consistent manner to ensure comparability between projects.

Refer to construction schedule worksheet for indicative schedule of quantities of concrete, steel, aggregates, gravels and fuels used during construction, based on estimates provided by the project contractor.

Materials and works related to bridge abutments have been included where relevant.

Fuel used in the construction is assumed to be 2 litres of diesel for every m3 of earth works (AECOM derived fuel-use ratio).

The following were not included in the estimate: emissions from the transportation of construction materials to/from site.

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.

Source: Carbon Resource Usage Report.xls, prepared by project contractor Fulton Hogan HEB. Spreadsheet reviewed by AECOM and emission factors modified to be consistent with other estimates.

Level	Type	Cost Code Description	Resource Description	Unit	Bill No Off Usage*	Carbon kg/unit	Carbon Total (kg)	AECOM Review Assumptions/ Comments
2			MATERIALS - CONCRETE				9 690 869	
3			CONCRETE - ADMIXTURES & GROUTS					
3			CONCRETE - GROUTS CURING					
	M		Grout 20mpa (335kg Cement) small loads	m3	261.45			Excluded as likely to be immaterial based on previous research for Waka Kotahi.
	M		Sika 212 non shrink grout (25kg bag)	ea	727.83			Excluded as likely to be immaterial based on previous research for Waka Kotahi.
	M	Grout	Epoxy mortar 4l container	/ea	107.86			Excluded as likely to be immaterial based on previous research for Waka Kotahi.
	M		Sikaflex 11FC Joint Sealant	/lt	25			Excluded as likely to be immaterial based on previous research for Waka Kotahi.
	M		Sikaflex PEF Backing Rod 25mm	/m	4			Excluded as likely to be immaterial based on previous research for Waka Kotahi.
	M		Epoxy - Sika Anchorfix (300ml)	ea	949.72			Excluded as likely to be immaterial based on previous research for Waka Kotahi.
3			CONCRETE - STRUCTURAL					
	M	Structural Concrete	Concrete 20 MPa 19mm Agg. Structural	/m3	1 263.69	260	328 558	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M	Structural Concrete	Concrete 30 MPA 19mm Agg. Structural	/m3	1 613.84	320	516 428	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M	Ready Mix Concrete	Concrete 40 MPA 19mm Agg. Structural	/m3	237.32	360	85 436	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Site Concrete 10MPA 19mm Agg. Pump	/m3	587.61	240	141 026	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Concrete 40MPA 19mm Agg. Pump/tremmie	/m3	5 123.66	360	1 844 519	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Concrete 40MPA 19mm Agg. Pump/Abut/colum	/m3	6 621.63	360	2 383 786	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Concrete 40MPA 19mm Agg. Pump/ Deck	/m3	6 804.02	360	2 449 446	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Concrete 40MPA 19mm Agg. River columns	/m3	3 945.19	360	1 420 269	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Concrete 50MPA 13mm Pump/ barriers	/m3	469.86	380	178 547	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M	Special Concrete	Concrete mixed on site. Small quantities	/m3	23.74	350	8 308	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M	Ready Mix Concrete	Concrete Slump Tests ($80/hr/2trx/hr)	/hr	2 449.91			
	M	Ready Mix Concrete	Concrete Cylinder Tests ($45/Cylinder)	/set	1 125.12			
2			MATERIALS - QUARRY PRODUCTS					
3			QUARRY - BEDDING - DRAINAGE MATERIALS					
	M	Drainage Metal	Bedding AP10 del T&T	/t	20 814.92	0.0016	33 304	General aggregate emission factor used.
	M	Drainage Metal	Bedding AP20 del T&T	/t	31 905.51	0.0016	51 049	General aggregate emission factor used.
	M		Hard Fill Drainage GAP 65 del T&T	/t	37 371.28	0.0016	59 794	General aggregate emission factor used.
	M		Drainage AGG 40/20 del T&T	/t	42 646.99	0.0016	68 235	General aggregate emission factor used.
	M		Sand del T&T	/t	126.05	0.0016	202	Sand and gravel emission factors used instead of aggregate.
3			QUARRY - FILTERS					Pre-calculated emissions
	M		Sand Drainage (Blanket Tauriko) del	/m3	425 946.71			
	M		Sand For SIL (Allport RD)	/m3	159 937.31		319 875	Assuming density of 1800kg/m3 (CI AECOM). Earthworks @ 2l diesel at per m3 moved
	M	Drainage Metal	40/20 filter/drainage del	/t	1 609.90	0.0016	2 576	
3			QUARRY - GAP General EWks Quality					Pre-calculated emissions
	M	GAP 20	General Earthworks Quality del	/t	-188 082.00		-208 980	Assumed to be recycled material used on site.
	M	GAP 20	Gap 20 General Earthworks Quality del	/t	10 815.65	0.00269	29 0	Assuming density of 1800kg/m3 (CI AECOM). Earthworks @ 2l diesel at per m3 moved
	M	Gap 40 Basecourse	Gap 40 General Earthworks Quality del	/t	8 017.45	0.00269	21 567	Assuming density of 1800kg/m3 (CI AECOM). Earthworks @ 2l diesel at per m3 moved
	M	GAP 65	Gap 65 General Earthworks Quality del	/t	114 126.57	0.00269	307 000	Assuming density of 1800kg/m3 (CI AECOM). Earthworks @ 2l diesel at per m3 moved
	M	GAP 65	Gap 65 General Earthworks Quality del	/t	23 947.00	0.00269	64 417	Assuming density of 1800kg/m3 (CI AECOM). Earthworks @ 2l diesel at per m3 moved
	M	GAP 100	GAP 100 General Earthworks Quality del	/t	203 879.16	0.00269	548 435	Assuming density of 1800kg/m3 (CI AECOM). Earthworks @ 2l diesel at per m3 moved
3			QUARRY - PAVEMENT AGG					Pre-calculated emissions
	M		Pumice Sand - Hi Lab Pavement	/m3	68 765.70		137 531	Assuming density of 1800kg/m3 (CI AECOM). Earthworks @ 2l diesel at per m3 moved
	M		AP 65 Subbase(Type1A)- Lowest del HL	/t	67 556.0	0.0069	466 136	Sand and gravel emission factors used instead of aggregate.
	M		AP 65 Subbase - Lowest del	/t	52 688.80	0.0 69	363 553	Sand and gravel emission factors used instead of aggregate.
	M		AP 65 Subbase TDC - Highest del	/t	10 210.69	0.006	70 454	Sand and gravel emission factors used instead of aggregate.
	M	GAP 65	AP 65 Hi Lab Subbase - Tauhei del	/t	121 646.62	9.19	1 117 932	Pre-calculated emissions
	M		AP100 Lower Subbase - Leach del	/t	308 403.88	4.8	1 480 339	Pre-calculated emissions
	M	M4 AP40	AP 40 TNZ M4 - Highest del	/t	8 182.17	0.0069	16 364	Sand and gravel emission factors used instead of aggregate.
	M		AP 40 TNZ M4 - Lowest del	/t	66 583.32	069	133 167	Sand and gravel emission factors used instead of aggregate.
	M		PAP7 Aggregate - HL	/t	5 615.42	0.0069	11 231	Sand and gravel emission factors used instead of aggregate.
3			QUARRY - ROCK - Rip Rap For Drainage					
	M		D50= 100mm Riprap (based on 56/ton)	/m3	04.2			
	M	Rip Rap	D50 =100mm riprap del	/t	1 06 73	0.0016	17 705	Aggregate emission factor used
	M	Rip Rap	D50 =200mm riprap del	/t	3 225.98	0.0016	5 162	Aggregate emission factor used
	M	Rip Rap	D50 =300mm Riprap del	/t	6 499.24	0.0016	10 399	Aggregate emission factor used
	M		D50 =500mm rip Rap del	/t	8 19.41	0.0016	13 151	Aggregate emission factor used
	M	Rip Rap	600mm RipRap Boulder del (0.75tn e)	/each	1 682.10			
3			QUARRY - Bulk Fill					
	M		Topsoil Import del	/m3	1 084.38	2.75	5964.09	Earthworks @ 2l diesel at per m3 moved

2			MATERIALS - REINFORCING					
3			REINFORCING - REBAR					
	M		Reinforcing Steel S/P	/t	353.5	2 680.00	947 382	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 250kg/m3 Piles	/t	1 140.19	2 680.00	3 055 709	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 250kg/m3 AbutPier	/t	1 422.44	2 680.00	3 812 145	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 300kg/m3 Deck	/t	832.12	2 680.00	2 230 082	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 225kg/m3 Deck	/t	845.64	2 680.00	2 266 309	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 350kg/m3 Deck	/t	674.88	2 680.00	1 808 678	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 150kg/m3 Ftpth	/t	47.57	2 680.00	127 487	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 350kg/m3 brrier	/t	152.98	2 680.00	409 981	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P	/t	86.89	2 680.00	232 864	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Reinforcing Steel S/P 175kg/m3 Clmn /MG	/t	76.2	2 680.00	204 212	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
3			REINFORCING - MESH					
	M	Reinforcing Steel	663 Mesh	/m2	2 915.04			
3			REINFORCING - SUNDRIES					
	M		FRP Equvalent of LX12	/t	486			
	M		Short Lengths i.e. Starter Bars	/t	0.69			
2			MATERIALS - DIESEL FUEL LUBES GET					
3			Diesel/Lube/GETS					
	M	Diesel	Diesel	/lt	152 459.49	2.75	419 264	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M	Diesel	Minifuel Diesel Delivery	/lt	380 809.06	2.75	1047.225	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
3			Fuels Earthworks					
	M		Earthworks Diesel	/lt	4 998 342.64	2.75	13 745 442	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Earthworks Add Blue	/ls	45 818.19			
	M		Earthworks GET	/ls	537 417.46			
	M		Earthworks Tyres or Tracks	/ls	549 531.72			
	M		Drainage Diesel	/lt	830 253.26	2.75	2 283 197	Pre-calculated emissions. Assumed emission factor is in kg not tonnes.
	M		Draiange GET	/ls	53 824.21			
	M		Draiange Tyres and Tracks	/ls	50 085.88			
2			Structural Steel					
	S		Structural Steel Supply/Sub - Onramp	/T	411.6	2 680.00	1 103 088	Used same as above for consistency with pre-calculated emissions
	S		Structural Steel Supply/Sub - OFFramp	/T	415.8	2 680.00	1 114 344	Used same as above for consistency with pre-calculated emissions
	S		Structural Steel Supply/Sub - Mainline	/T	1 142.40	2 680.00	3 061 632	Used same as above for consistency with pre-calculated emissions
	S		Struct Steel Sup/Sub - Paint TSZ300S	/T	1 480.50	2 680.00	3 967 740	Used same as above for consistency with pre-calculated emissions
	S		Struct Steel Sup/Sub - Paint TSZ200S	/T	1 480.50	2 680.00	3 967 740	Used same as above for consistency with pre-calculated emissions
	S		Structural Steel Supply - WRB Steel	/T	1 480.50	2 680.00	3 967 740	Used same as above for consistency with pre-calculated emissions
	S		Structural Steel Sup/Sub	/T	4	2 680.00	10 720	Used same as above for consistency with pre-calculated emissions
3			SUBCONTRACT - DRAINAGE - GENERAL					
	S		Concrete Works for Wingwalls	m3	279.35	0.11	73.75	Assuming density of 2400 kg/m3 (CI AECOM)
	S		Concrete Works Slabs on Ground	m3	71.26	0.11	18.81	Assuming density of 2400 g/m3 (CI AECOM)
2			Surfacing					
	P		AC10 - 35mm Thick Surfacing Material	m2	165 985.00	0.0542	566 772.38	Assumed 1.8t/m3. Asphalt emission factor used
	P		SMA 10 - 40mm Thick Surfacing Material	m2	152 036.00	0.0542	519 142.13	Assumed 1.8t/m3. Asphalt emission factor used

			Fulton Hogan plus AECOM Calculation		AECOM-only Calculation
	Material totals	**Unit**	**kgCO2**	**tCO2**	**tCO2**
Concrete total	67 077	Tonnes	9 356 416	9 356	7 378
Steel total	12 048	Tonnes	32 287 853	32 288	34 6
Asphalt total	21 404	Tonnes	1 085 915	1 086	1 160
Aggregate total	1 071 844	Tonnes	6 440 550	6 441	376
Diesel total	6 364 033	Litres	16 448 950	16 449	7 119
Overall totals			**65,619,684**	**65 20**	**63,370**