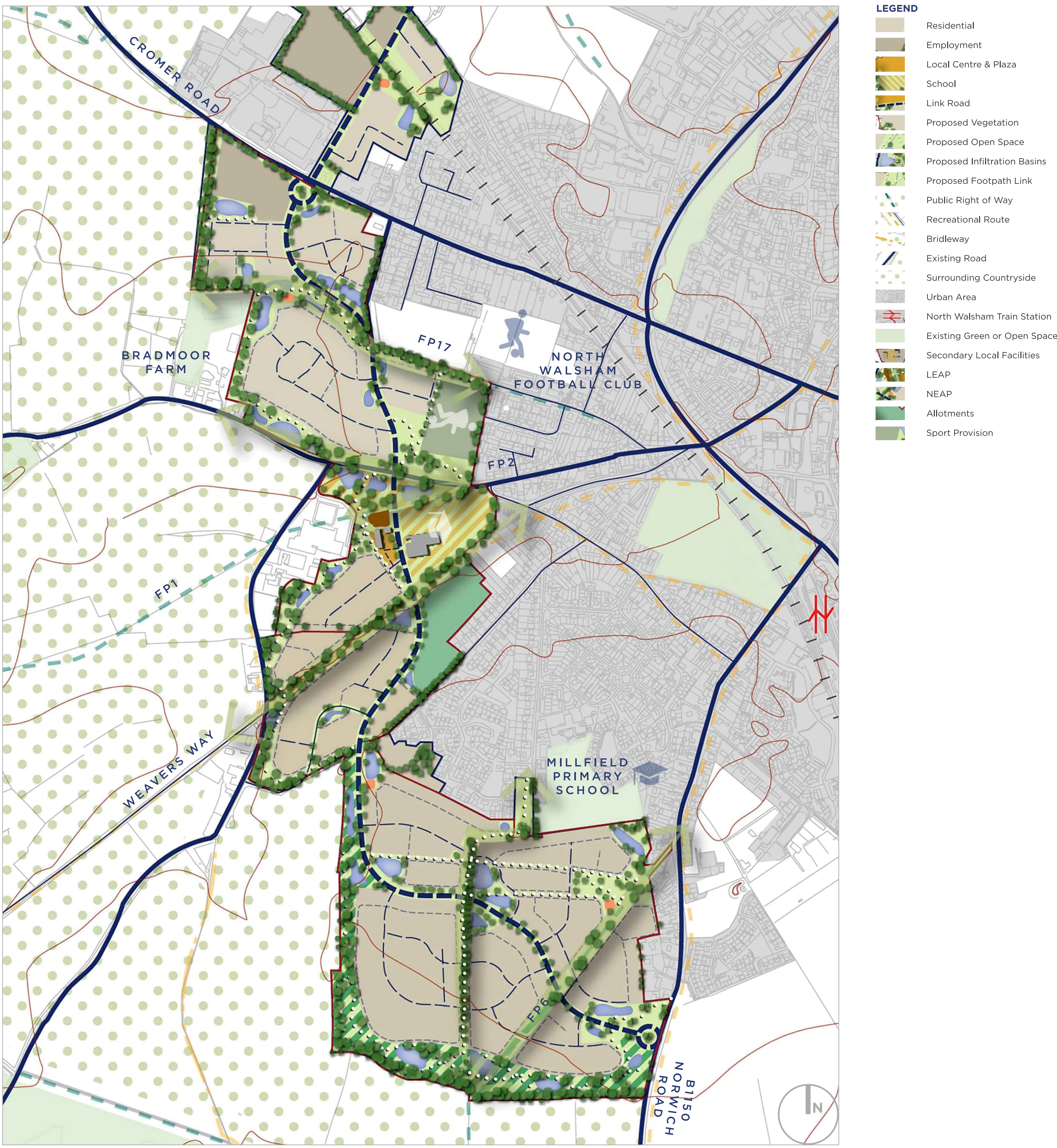
Appendix A – Masterplan


CROMER ROAD
BRADMOOR FARM
FP17
NORTH WALSHAM FOOTBALL CLUB
FP2
FP1
WEAVERS WAY
MILLFIELD PRIMARY SCHOOL
FP6
B1150 NORWICH ROAD
N
LEGEND
Residential
Employment
Local Centre & Plaza
School
Link Road
Proposed Vegetation
Proposed Open Space
Proposed Infiltration Basins
Proposed Footpath Link
Public Right of Way
Recreational Route
Bridleway
Existing Road
Surrounding Countryside
Urban Area
North Walsham Train Station
Existing Green or Open Space
Secondary Local Facilities
LEAP
NEAP
Allotments
Sport Provision

Appendix B – Percentage Impact Assessment

% Impact Assessment																														
			AM Peak Hour														PM Peak Hour													
			2029							2036							2029							2036						
			DM		DS		% increase			DM		DS		% increase			DM		DS		% increase			DM		DS		% increase		
			Total Vehicles							Total Vehicles							Total Vehicles							Total Vehicles						
			Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm
Junction 1 - Bradfield Road / Cromer Road Priority Junction / Proposed Road	A to C		0		0		0%			0		13		0%			15		2		-86%			3		21		600%		
	A to B		2		2		3%	0		1		8		700%	53		4		4		-1%			4		16		300%		
	A to D	N Bradfield	0	2	0	2	0%		3%	0	1	33	54	0%		5300%	0	19	0	6	0%	-13	-67%	0	7	32	69	0%	62	886%
	B to A		2		2		-5%			3		19		533%			4		4		0%			5		13		160%		
	B to C		354		354		0%	4		372		293		-21%	63		558		564		1%			571		476		-17%		
	B to D	W Cromer	0	356	4	360	0%		1%	0	375	126	438	0%		17%	0	562	8	576	0%	14	2%	0	576	197	686	0%	110	19%
	C to B		480		478		0%			507		375		-26%			448		428		-5%			475		348		-27%		
	C to A		0		3		0%	8		0		32		0%	1		0		0		0%			0		15		0%		
	C to D	E Cromer	0	480	7	488	0%		2%	0	507	101	508	0%		0%	0	448	27	454	0%	6	1%	0	475	99	462	0%	-13	-3%
	D to A		0		0		0%			0		45		0%			0		0		0%			0		20		0%		
	D to B		0		7		0%	46		0		225		0%	343		0		4		0%			0		185		0%		
	D to C	Link Road	0	0	39	46	0%		-	0	0	73	343	0%		-	0	0	18	22	0%	22	-	0	0	86	291	0%	291	-
	Junction			838		897		59	7%		883		1343		460	52%		1029		1058		29	3%		1058		1508		450	43%
Junction 2 - Cromer Road / Greens Road Priority Junction	A to B		78		69		-12%	43		83		0		-100%	9		93		102		10%			87		0		-100%		
	A to C	W Cromer	277	355	329	398	19%		12%	288	371	380	380	32%		2%	481	574	490	593	2%	19	3%	494	581	580	580	17%	-1	0%
	B to A		132		110		-17%	-14		105		0		-100%	-139		123		84		-32%			90		0		-100%		
	B to C	S Greens	30	161	37	147	27%		-9%	34	139	0	0	-100%		-100%	60	183	66	150	10%	-33	-18%	54	144	0	0	-100%	-144	-100%
	C to B		69		70		1%	34		66		0		-100%	40		81		80		-1%			80		0		-100%		
	C to A	E Cromer	350	419	383	453	10%		8%	402	468	508	508	26%		9%	325	406	378	458	16%	52	13%	380	460	466	466	23%	6	1%
	Junction			935		997		63	7%		978		888		-90	-9%		1163		1200		38	3%		1185		1046		-139	-12%
Junction 3 - B1145 / A149 / A149 Cromer Road / Cromer Road Signalised Junction	A to D		29		29		1%			29		30		3%			54		54		0%			55		53		-4%		
	A to C		250		250		0%	2		263		264		0%	32		298		296		0%			300		324		8%		
	A to B	N B1145	168	447	170	449	1%		0%	171	463	201	495	18%		7%	191	543	193	543	1%	0	0%	194	549	209	586	8%	37	7%
	B to D		55		62		13%			54		53		-2%			137		152		11%			145		143		-1%		
	B to C		174		223		28%	58		176		210		19%	55		263		268		2%			264		276		5%		
	B to A	W Cromer	95	324	97	382	2%		18%	103	333	125	388	21%		17%	141	542	148	568	5%	27	5%	154	563	181	600	18%	37	7%
	C to D		0		0		0%			0		0		0%			23		20		-13%			30		29		-3%		
	C to B		235		265		13%	29		283		285		1%	15		213		264		24%			266		252		-5%		
	C to A	S A149	250	485	249	514	0%		6%	271	554	284	569	5%		3%	258	494	233	517	-9%	24	5%	279	575	283	564	1%	-11	-2%
	D to C		2		2		15%			2		2		0%			9		9		1%			9		9		0%		
	D to B		6		6		0%	0		6		6		0%	0		9		9		2%			9		9		0%		
	D to A	E Cromer	3	11	3	11	2%		3%	3	11	3	11	0%		0%	0	18	0	18	0%	0	1%	0	18	0	18	0%	0	0%
	Junction			1267		1356		89	7%		1361		1463		102	7%		1597		1647		51	3%		1705		1768		63	4%
Junction 4 - Cromer Road / Mundesley Road / Market Street / Aylsham Road Signalised Junction	A to D		140		140		0%			148		148		0%			149		149		0%			148		148		0%		
	A to C		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	A to B	N Mundesley	0	140	0	140	0%		0%	0	148	0	148	0%		0%	0	149	0	149	0%	0	0%	0	148	0	148	0%	0	0%
	B to D		31		34		11%			32		32		0%			97		101		4%			98		99		1%		
	B to C		0		0		0%	8		0		0		0%	-3		0		0		0%			0		0		0%		
	B to A	W Cromer	44	74	48	83	11%		11%	43	75	40	72	-7%		-4%	71	168	82	183	16%	15	9%	74	172	73	172	-1%	0	0%
	C to D		126		124		-2%			134		127		-5%			133		123		-7%			138		140		1%		
	C to B		0		0		0%	-1		0		0		0%	19		0		0		0%			0		0		0%		
	C to A	S Aylsham	249	375	250	374	0%		0%	258	392	284	411	10%		5%	265	398	251	374	-5%	-24	-6%	282	420	295	435	5%	15	4%
	D to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	D to B		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	D to A	E Market	0	0	0	0	0%		0%	0	0	0	0	0%		0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%
	Junction			590		596		7	1%		615		631		16	3%		715		705		-9	-1%		740		755		15	2%
Junction 5 - Aylsham Road / Park Lane Priority Junction	A to B		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	A to C	E Aylsham	0	0	0	0	0%		0%	0	0	0	0	0%		0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%
	B to A		141		144		2%	3		146		172		18%	26		115		100		-13%			115		147		28%		
	B to C	W Aylsham	0	141	0	144	0%		2%	0	146	0	172	0%		18%	0	115	0	100	0%	-15	-13%	0	115	0	147	0%	32	28%
	C to B		150		143		-5%	-12		168		208		24%	30		127		146		15%			133		138		4%		
	C to A	S Park	235	385	230	373	-2%		-3%	247	415	237	445	-4%		7%	284	411	275	422	-3%	10	3%	306	439	288	426	-6%	-13	-3%
	Junction			526		517		-9	-2%		561		617		56	10%		526		522		-4	-1%		554		573		19	3%
Junction 6 - Aylsham Road / Skeyton New Road Priority Junction	A to B		110		104		-6%	-8		123		160		30%	40		93		107		15%			98		105		7%		
	A to C	E Aylsham	39	149	38	142	-3%		-5%	44	167	47	207	7%		24%	34	127	39	146	14%	19	15%	37	135	33	138	-11%	3	2%
	B to A		132		136		3%	4		137		162		18%	26		99		84		-15%			97		130		34%		
	B to C	W Aylsham	2	135	2	138	-2%		3%	2	139	3	165	50%		19%	11	110	7	91	-39%	-19	-17%	10	107	13	143	30%	36	34%
	C to B		3		3		2%	0		3		3		0%	0		5		5		-1%			5		5		0%		
	C to A	S Skeyton	10	13	10	13	-1%		-1%	10	13	10	13	0%		0%	16	21	16	21	0%	0	0%	17	22	17	22	0%	0	0%
	Junction			297		293		-4	-1%		319		385		66	21%		258		258		0	0%		264		303		39	15%
Junction 7 - B1145 Aylsham Road / Aylsham Road / Greens Road / Tungate Road Crossroads Junction	A to D		73		52		-28%			77		0		-100%			86		82		-5%			82		0		-100%		
	A to C		25		32		26%	-9		24		0		-100%	-150		23		32		38%			20		0		-100%		
	A to B	N Greens	50	148	55	139	10%		-6%	49	150	0	0	-100%		-100%	65	174	69	183	6%	8	5%	65	167	0	0	-100%	-167	-100%
	B to D		131		114		-13%			137		194		42%			103		98		-5%			115		201		75%		
	B to C		0		10		0%	0		0		0		0%	23		5		5		3%			6		6		0%		
	B to A	W Aylsham	31	162	37	161	22%		0%	34	171	0	194	-100%		13%	46	154	59	161	26%	7	5%	41	162	0	207	-100%	45	28%
	C to D		34		29		-14%			34		34		0%			19		14		-27%			21		36		71%		
	C to B		4		4		-1%	0		4		4		0%	-5		4		4		-6%			4		4		0%		
	C to A	S Tungate	5	43	10	43	96%		0%	5	43	0	38	-100%		-12%	23	46	23	41	4%	-5	-10%	22	47	0	40	-100%	-7	-15%

Junction	D to C		13		10		-21%			12		38		217%			13		12		-11%			16		31		94%		
	D to B		126		126		0%	-28		142		230		62%	9		81		78		-4%			81		173		114%		
	D to A	E Aylsham	128	267	103	240	-19%		-10%	105	259	0	268	-100%		3%	115	209	67	157	-41%	-52	-25%	82	179	0	204	-100%	25	14%
	Junction			619		582		-37	-6%		623		500		-123	-20%		583		542		-41	-7%		555		451		-104	-19%
Junction 8 - Aylsham Road / Station Road Priority Junction	A to B		90		84		-7%	-7		98		121		23%	33		66		63		-6%			48		81		69%		
	A to C	E Aylsham	12	102	12	96	-4%		-6%	14	112	24	145	71%		29%	18	85	29	91	56%	7	8%	25	73	20	101	-20%	28	38%
	B to A		81		81		0%	-41		85		107		26%	-24		70		58		-17%			74		83		12%		
	B to C	W Aylsham	156	237	115	196	-26%		-17%	162	247	116	223	-28%		-10%	139	209	135	193	-2%	-15	-7%	146	220	100	183	-32%	-37	-17%
	C to B		177		157		-12%	-17		163		109		-33%	-52		144		95		-34%			130		60		-54%		
	C to A	S Station	39	216	42	199	8%		-8%	41	204	43	152	5%		-25%	70	214	50	145	-29%	-69	-32%	58	188	100	160	72%	-28	-15%
	Junction			555		491		-65	-12%		563		520		-43	-8%		507		429		-78	-15%		481		444		-37	-8%
Junction 9 - Station Road / Skeyton New Road Priority Junction	A to B		3		3		0%	0		3		9		200%	-1		2		2		0%			2		2		0%		
	A to C	E Skeyton	46	49	46	49	0%		0%	48	51	41	50	-15%		-2%	44	46	44	46	0%	0	0%	48	50	49	51	2%	1	2%
	B to A		5		5		2%	-40		5		5		0%	-36		3		6		115%			3		3		0%		
	B to C	N Station	162	167	122	128	-25%		-24%	171	176	135	140	-21%		-20%	154	157	158	164	3%	7	5%	170	173	117	120	-31%	-53	-31%
	C to B		214		197		-8%	-16		202		144		-29%	-60		212		143		-32%			186		160		-14%		
	C to A	S Station	10	224	10	208	3%		-7%	13	215	11	155	-15%		-28%	14	225	11	154	-20%	-71	-32%	18	204	17	177	-6%	-27	-13%
	Junction			440		384		-56	-13%		442		345		-97	-22%		428		364		-64	-15%		427		348		-79	-19%
Junction 10 - Station Road / Oak Road / Skeyton Road Crossroads Junction	A to D		1		1		0%			1		1		0%			0		0		0%			0		0		0%		
	A to C		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	A to B	N Oak	2	3	2	3	0%		0%	2	3	2	3	0%		0%	8	8	8	8	0%	0	0%	8	8	8	8	0%	0	0%
	B to D		167		138		-17%			178		163		-8%			152		158		4%			158		149		-6%		
	B to C		42		31		-26%	-40		43		12		-72%	-46		43		41		-5%			57		13		-77%		
	B to A	W Station	0	208	0	169	0%		-19%	0	221	0	175	0%		-21%	3	198	3	202	0%	4	2%	3	218	3	165	0%	-53	-24%
	C to D		28		28		0%			30		22		-27%			20		22		12%			22		33		50%		
	C to B		64		65		1%	1		64		18		-72%	-54		32		33		4%			33		75		127%		
	C to A	S Skeyton	0	92	0	93	0%		1%	0	94	0	40	0%		-57%	0	52	0	56	0%	4	7%	0	55	0	108	0%	53	96%
	D to C		37		36		-3%			43		32		-26%			41		41		0%			38		73		92%		
	D to B		157		140		-11%	-17		151		135		-11%	-28		185		113		-39%			163		95		-42%		
	D to A	E Station	13	207	14	191	11%		-8%	19	213	18	185	-5%		-13%	4	230	4	159	0%	-72	-31%	4	205	4	172	0%	-33	-16%
	Junction			511		455		-56	-11%		531		403		-128	-24%		488		425		-64	-13%		486		453		-33	-7%
Junction 11 - Station Road / Millfield Road / Morris Road Mini-roundabout	A to D		25		20		-17%			25		23		-8%			18		18		-2%			20		20		0%		
	A to C		143		130		-9%	-29		155		146		-6%	-25		132		150		14%			136		137		1%		
	A to B		15		13		-15%			15		15		0%			12		12		-2%			13		20		54%		
	A to A	N Station	12	195	3	166	-76%		-15%	15	210	1	185	-93%		-12%	10	172	1	181	-89%	9	5%	10	179	3	180	-70%	1	1%
	B to D		0		0		0%			0		0		0%			2		2		0%			2		2		0%		
	B to C		21		21		0%	0		23		23		0%	11		2		2		0%			2		2		0%		
	B to A		64		64		0%			65		76		17%			10		10		-1%			10		10		0%		
	B to B	W Morris	0	85	0	85	0%		0%	0	88	0	99	0%		13%	0	14	0	14	0%	0	0%	0	14	0	14	0%	0	0%
	C to D		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to B		9		13		42%	-19		13		12		-8%	-45		4		4		3%			5		5		0%		
	C to A		132		120		-9%			136		102		-25%			168		108		-36%			141		111		-21%		
	C to C	S Millfield	11	152	0	133	-100%		-12%	10	159	0	114	-100%		-28%	3	175	0	112	-100%	-62	-36%	4	150	0	116	-100%	-34	-23%
	D to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	D to B		0		0		0%	4		0		0		0%	12		0		0		0%			0		0		0%		
	D to A		0		4		0%			0		12		0%			43		40		-7%			43		48		12%		
	D to D	E Station	0	0	0	4	0%		0%	0	0	0	12	0%		#DIV/0!	0	43	0	40	0%	-3	-7%	0	43	0	48	0%	5	12%
	Junction			432		388		-44	-10%		457		410		-47	-10%		403		347		-57	-14%		386		358		-28	-7%
Junction 12 - B1150 Norwich Road / Millfield Road Priority Junction	A to B		73		78		7%	28		92		81		-12%	20		56		54		-3%			80		113		41%		
	A to C	N Norwich	311	384	334	412	7%		7%	356	448	387	468	9%		4%	417	472	429	483	3%	11	2%	443	523	516	629	16%	106	20%
	B to A		86		73		-16%	-34		92		119		29%	-25		39		45		15%			55		74		35%		
	B to C	W Millfield	124	210	103	176	-17%		-16%	130	222	78	197	-40%		-11%	71	109	78	123	10%	13	12%	63	118	43	117	-32%	-1	-1%
	C to B		104		78		-25%	13		92		60		-35%	41		141		83		-41%			102		32		-69%		
	C to A	S Norwich	332	436	371	449	12%		3%	356	448	429	489	21%		9%	396	537	395	478	0%	-59	-11%	457	559	431	463	-6%	-96	-17%
	Junction			1029		1037		8	1%		1118		1154		36	3%		1119		1083		-35	-3%		1200		1209		9	1%
Junction 13 - B1150 Norwich Road / Station Road Priority Junction	A to B		25		29		18%	33		25		32		28%	26		42		41		-3%			47		45		-4%		
	A to C	N Norwich	383	408	413	442	8%		8%	447	472	466	498	4%		6%	469	511	481	522	2%	11	2%	516	563	626	671	21%	108	19%
	B to A		71		67		-5%	-4		74		63		-15%	-10		43		41		-5%			49		48		-2%		
	B to C	W Station	0	71	0	67	0%		-5%	0	74	1	64	0%		-14%	4	47	3	44	-11%	-2	-5%	4	53	4	52	0%	-1	-2%
	C to B		2		2		10%	25		1		5		400%	98		10		9		-15%			12		13		8%		
	C to A	S Norwich	410	412	435	437	6%		6%	452	453	546	551	21%		22%	417	427	426	435	2%	8	2%	502	514	494	507	-2%	-7	-1%
	Junction			891		946		55	6%		999		1113		114	11%		985		1001		16	2%		1130		1230		100	9%
Junction 14 - B1150 Norwich Road / A149 / Norwich Road Signalised Junction	A to D		66		64		-3%			76		77		1%			60		60		0%			65		67		3%		
	A to C		219		213		-3%	-11		268		270		1%	10		223		224		1%			257		317		23%		
	A to B	E Norwich	152	437	150	427	-1%		-2%	182	526	189	536	4%		2%	118	401	117	400	-1%	-1	0%	141	463	147	531	4%	68	15%
	B to D		143		151		5%			153		165		8%			279		279		0%			272		288		6%		
	B to C		160		197		23%	49		168		172		2%	27		233		240		3%			238		241		1%		
	B to A	N A149	121	424	125	473	3%		11%	129	450	140	477	9%		6%	63	575	59	577	-7%	2	0%	60	570	70	599	17%	29	5%
	C to D		50		50		0%			56		108		93%			52		53		3%			60		94		57%		
	C to B		154		181		18%	23		184		170		-8%	73		148		171		15%			204		167		-18%		
	C to A	W Norwich	273	477	269	500	-2%		5%	290	530	325	603	12%		14%	253	453	240	465	-5%	11	2%	288	552	280	541	-3%	-11	-2%
	D to C		29		32		10%			36		51		42%			55		59		6%			65		114		75%		
	D to B		179		181		1%	5		184		207		13%	48		228		231		1%			230		244		6%		
	D to A	S A149	126	335	126	340	0%		1%	125	345	135	393	8%		14%	95	378	94	383	-1%	5	1%	95	390	100	458	5%	68	17%
	Junction			1674		1739		66	4%		1851		2009		158	9%		1808		1825		17	1%		1975		2129		154	8%

Junction 15 - Grammar School Road / King's Arms Street Mini-roundabout	A to B		61		63		5%			64		63		-2%			51		50		-1%			78		87		12%		
	A to C		22		24		8%	5		22		32		45%	9		20		20		0%			20		33		65%		
	A to A	N King's	0	82	0	87	0%		6%	0	86	0	95	0%		10%	0	71	0	70	0%	0	0%	0	98	0	120	0%	22	22%
	B to A		196		193		-1%			203		199		-2%			166		172		3%			183		155		-15%		
	B to C		310		314		1%	0		323		384		19%	55		240		220		-9%			257		293		14%		
	B to B	W Grammar	15	521	14	521	-7%		0%	19	545	17	600	-11%		10%	4	411	1	392	-75%	-18	-4%	5	445	3	451	-40%	6	1%
	C to B		364		352		-3%			445		460		3%			351		351		0%			382		441		15%		
	C to A		127		123		-4%	-17		156		181		16%	40		155		160		3%			181		185		2%		
	C to C	E Grammar	0	492	0	475	0%		-3%	0	601	0	641	0%		7%	0	506	0	511	0%	5	1%	0	563	0	626	0%	63	11%
	Junction			1095		1083		-12	-1%		1232		1336		104	8%		987		973		-14	-1%		1106		1197		91	8%
Junction 22 - B1145 / Laundry Loke Priority Junction	A to B		145		148		2%	1		160		183		14%	34		93		90		-3%			99		106		7%		
	A to C	S B1145	203	348	201	349	-1%		0%	216	376	227	410	5%		9%	306	399	292	383	-4%	-16	-4%	336	435	358	464	7%	29	7%
	B to A		77		77		0%	0		83		89		7%	6		165		166		1%			165		187		13%		
	B to C	W Laundry	0	77	0	77	0%		0%	0	83	0	89	0%		7%	8	173	8	174	-1%	1	1%	8	173	8	195	0%	22	13%
	C to B		12		12		0%	1		12		12		0%	27		6		5		-16%			5		5		0%		
	C to A	N B1145	370	382	371	383	0%		0%	380	392	407	419	7%		7%	378	384	378	383	0%	-1	0%	384	389	400	405	4%	16	4%
	Junction			808		809		2	0%		851		918		67	8%		956		940		-16	-2%		997		1064		67	7%
Junction 23 - B1145 / Lyngate Road / Folgate Road Staggered Crossroads	A to D		17		17		0%			19		18		-5%			4		4		0%			4		4		0%		
	A to C		184		184		0%	0		195		207		6%	14		120		121		0%			124		132		6%		
	A to B	N B1145	49	250	49	250	0%		0%	50	264	53	278	6%		5%	39	164	39	164	0%	0	0%	41	169	40	176	-2%	7	4%
	B to D		52		52		0%			54		53		-2%			15		15		1%			16		16		0%		
	B to C		179		180		0%	0		181		194		7%	10		155		155		0%			158		163		3%		
	B to A	E Lyngate	48	280	48	280	-1%		0%	50	285	48	295	-4%		4%	70	240	70	240	0%	1	0%	73	247	72	251	-1%	4	2%
	C to D		26		26		-1%			27		26		-4%			15		14		-10%			16		18		13%		
	C to B		56		56		0%	-17		59		60		2%	-17		150		146		-3%			163		172		6%		
	C to A	S B1145	120	202	119	201	-1%		-1%	131	217	142	228	8%		5%	148	313	140	299	-6%	-17	-4%	161	340	175	365	9%	-17	7%
	D to C		19		19		0%			19		19		0%			109		107		-2%			110		109		-1%		
	D to B		21		21		1%	0		21		21		0%	0		67		67		0%			68		68		0%		
	D to A	W Folgate	13	53	13	53	-1%		0%	13	53	13	53	0%		0%	21	197	21	195	0%	-2	-1%	21	199	21	198	0%	-1	-1%
	Junction			785		784		-1	0%		819		854		35	4%		913		898		-15	-2%		955		990		35	4%

% Impact Assessment (with Mitigation)

			AM Peak Hour														PM Peak Hour													
			2029							2036							2029							2036						
			DM		DS					DM		DS					DM		DS					DM		DS				
			Total Vehicles				% increase			Total Vehicles				% increase			Total Vehicles				% increase			Total Vehicles				% increase		
			Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm
Junction 1 - Bradfield Road / Cromer Road Priority Junction / Proposed Road	A to C		0		0		0%			0		13		0%			15		2		-86%			3		21		600%		
	A to B		2		2		3%	0		1		8		700%	53		4		4		-1%			4		16		300%		
	A to D	N Bradfield	0	2	0	2	0%		3%	0	1	33	54	0%		5300%	0	19	0	6	0%	-13	-67%	0	7	32	69	0%	62	886%
	B to A		2		2		-5%			3		19		533%			4		4		0%			5		13		160%		
	B to C		354		354		0%	4		372		293		-21%	63		558		564		1%			571		476		-17%		
	B to D	W Cromer	0	356	4	360	0%		1%	0	375	126	438	0%		17%	0	562	8	576	0%	14	2%	0	576	197	686	0%	110	19%
	C to B		480		478		0%			507		375		-26%			448		428		-5%			475		348		-27%		
	C to A		0		3		0%	8		0		32		0%	1		0		0		0%			0		15		0%		
	C to D	E Cromer	0	480	7	488	0%		2%	0	507	101	508	0%		0%	0	448	27	454	0%	6	1%	0	475	99	462	0%	-13	-3%
	D to A		0		0		0%			0		45		0%			0		0		0%			0		20		0%		
	D to B		0		7		0%	46		0		225		0%	343		0		4		0%			0		185		0%		
	D to C	Link Road	0	0	39	46	0%		-	0	0	73	343	0%		-	0	0	18	22	0%	22	-	0	0	86	291	0%	291	-
	Junction			838		897		59	7%		883		1343		460	52%		1029		1058		29	3%		1058		1508		450	43%
Junction 2 - Cromer Road / Greens Road Priority Junction	A to B		78		69		-12%	43		83		0		-100%	9		93		102		10%			87		0		-100%		
	A to C	W Cromer	277	355	329	398	19%		12%	288	371	380	380	32%		2%	481	574	490	593	2%	19	3%	494	581	580	580	17%	-1	0%
	B to A		132		110		-17%	-14		105		0		-100%	-139		123		84		-32%			90		0		-100%		
	B to C	S Greens	30	161	37	147	27%		-9%	34	139	0	0	-100%		-100%	60	183	66	150	10%	-33	-18%	54	144	0	0	-100%	-144	-100%
	C to B		69		70		1%	34		66		0		-100%	40		81		80		-1%			80		0		-100%		
	C to A	E Cromer	350	419	383	453	10%		8%	402	468	508	508	26%		9%	325	406	378	458	16%	52	13%	380	460	466	466	23%	6	1%
	Junction			935		997		63	7%		978		888		-90	-9%		1163		1200		38	3%		1185		1046		-139	-12%
Junction 3 - B1145 / A149 / A149 Cromer Road / Cromer Road Signalised Junction	A to D		29		29		1%			29		30		3%			54		54		0%			55		53		-4%		
	A to C		250		250		0%	2		263		264		0%	32		298		296		0%			300		324		8%		
	A to B	N B1145	168	447	170	449	1%		0%	171	463	201	495	18%		7%	191	543	193	543	1%	0	0%	194	549	209	586	8%	37	7%
	B to D		55		62		13%			54		53		-2%			137		152		11%			145		143		-1%		
	B to C		174		223		28%	58		176		210		19%	55		263		268		2%			264		276		5%		
	B to A	W Cromer	95	324	97	382	2%		18%	103	333	125	388	21%		17%	141	542	148	568	5%	27	5%	154	563	181	600	18%	37	7%
	C to D		0		0		0%			0		0		0%			23		20		-13%			30		29		-3%		
	C to B		235		265		13%	29		283		285		1%	15		213		264		24%			266		252		-5%		
	C to A	S A149	250	485	249	514	0%		6%	271	554	284	569	5%		3%	258	494	233	517	-9%	24	5%	279	575	283	564	1%	-11	-2%
	D to C		2		2		15%			2		2		0%			9		9		1%			9		9		0%		
	D to B		6		6		0%	0		6		6		0%	0		9		9		2%			9		9		0%		
	D to A	E Cromer	3	11	3	11	2%		3%	3	11	3	11	0%		0%	0	18	0	18	0%	0	1%	0	18	0	18	0%	0	0%
	Junction			1267		1356		89	7%		1361		1463		102	7%		1597		1647		51	3%		1705		1768		63	4%
Junction 4 - Cromer Road / Mundesley Road / Market Street / Aylsham Road Signalised Junction	A to D		140		140		0%			148		148		0%			149		149		0%			148		148		0%		
	A to C		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	A to B	N Mundesley	0	140	0	140	0%		0%	0	148	0	148	0%		0%	0	149	0	149	0%	0	0%	0	148	0	148	0%	0	0%
	B to D		31		34		11%			32		32		0%			97		101		4%			98		99		1%		
	B to C		0		0		0%	8		0		0		0%	-3		0		0		0%			0		0		0%		
	B to A	W Cromer	44	74	48	83	11%		11%	43	75	40	72	-7%		-4%	71	168	82	183	16%	15	9%	74	172	73	172	-1%	0	0%
	C to D		126		124		-2%			134		127		-5%			133		123		-7%			138		140		1%		
	C to B		0		0		0%	-1		0		0		0%	19		0		0		0%			0		0		0%		
	C to A	S Aylsham	249	375	250	374	0%		0%	258	392	284	411	10%		5%	265	398	251	374	-5%	-24	-6%	282	420	295	435	5%	15	4%
	D to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	D to B		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	D to A	E Market	0	0	0	0	0%		0%	0	0	0	0	0%		0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%
	Junction			590		596		7	1%		615		631		16	3%		715		705		-9	-1%		740		755		15	2%
Junction 5 - Aylsham Road / Park Lane Priority Junction	A to B		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	A to C	E Aylsham	0	0	0	0	0%		0%	0	0	0	0	0%		0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%
	B to A		141		144		2%	3		146		172		18%	26		115		100		-13%			115		147		28%		
	B to C	W Aylsham	0	141	0	144	0%		2%	0	146	0	172	0%		18%	0	115	0	100	0%	-15	-13%	0	115	0	147	0%	32	28%
	C to B		150		143		-5%	-12		168		208		24%	30		127		146		15%			133		138		4%		
	C to A	S Park	235	385	230	373	-2%		-3%	247	415	237	445	-4%		7%	284	411	275	422	-3%	10	3%	306	439	288	426	-6%	-13	-3%
	Junction			526		517		-9	-2%		561		617		56	10%		526		522		-4	-1%		554		573		19	3%
Junction 6 - Aylsham Road / Skeyton New Road Priority Junction	A to B		110		104		-6%	-8		123		160		30%	40		93		107		15%			98		105		7%		
	A to C	E Aylsham	39	149	38	142	-3%		-5%	44	167	47	207	7%		24%	34	127	39	146	14%	19	15%	37	135	33	138	-11%	3	2%
	B to A		132		136		3%	4		137		162		18%	26		99		84		-15%			97		130		34%		
	B to C	W Aylsham	2	135	2	138	-2%		3%	2	139	3	165	50%		19%	11	110	7	91	-39%	-19	-17%	10	107	13	143	30%	36	34%
	C to B		3		3		2%	0		3		3		0%	0		5		5		-1%			5		5		0%		
	C to A	S Skeyton	10	13	10	13	-1%		-1%	10	13	10	13	0%		0%	16	21	16	21	0%	0	0%	17	22	17	22	0%	0	0%
	Junction			297		293		-4	-1%		319		385		66	21%		258		258		0	0%		264		303		39	15%
Junction 7 - B1145 Aylsham Road / Aylsham Road / Greens Road / Tungate Road Crossroads Junction	A to D		73		52		-28%			77		0		-100%			86		82		-5%			82		0		-100%		
	A to C		25		32		26%	-9		24		0		-100%	-150		23		32		38%			20		0		-100%		
	A to B	N Greens	50	148	55	139	10%		-6%	49	150	0	0	-100%		-100%	65	174	69	183	6%	8	5%	65	167	0	0	-100%	-167	-100%
	B to D		131		114		-13%			137		194		42%			103		98		-5%			115		201		75%		
	B to C		0		10		0%	0		0		0		0%	23		5		5		3%			6		6		0%		
	B to A	W Aylsham	31	162	37	161	22%		0%	34	171	0	194	-100%		13%	46	154	59	161	26%	7	5%	41	162	0	207	-100%	45	28%
	C to D		34		29		-14%			34		34		0%			19		14		-27%			21		36		71%		
	C to B		4		4		-1%	0		4		4		0%	-5		4		4		-6%			4		4		0%		
	C to A	S Tungate	5	43	10	43	96%		0%	5	43	0	38	-100%		-12%	23	46	23	41	4%	-5	-10%	22	47	0	40	-100%	-7	-15%

Junction	D to C		13		10		-21%			12		38		217%			13		12		-11%			16		31		94%		
	D to B		126		126		0%	-28		142		230		62%	9		81		78		-4%			81		173		114%		
	D to A	E Aylsham	128	267	103	240	-19%		-10%	105	259	0	268	-100%		3%	115	209	67	157	-41%	-52	-25%	82	179	0	204	-100%	25	14%
	Junction			619		582		-37	-6%		623		500		-123	-20%		583		542		-41	-7%		555		451		-104	-19%
Junction 8 - Aylsham Road / Station Road Priority Junction	A to B		90		84		-7%	-7		98		121		23%	33		66		63		-6%			48		81		69%		
	A to C	E Aylsham	12	102	12	96	-4%		-6%	14	112	24	145	71%		29%	18	85	29	91	56%	7	8%	25	73	20	101	-20%	28	38%
	B to A		81		81		0%	-41		85		107		26%	-24		70		58		-17%			74		83		12%		
	B to C	W Aylsham	156	237	115	196	-26%		-17%	162	247	116	223	-28%		-10%	139	209	135	193	-2%	-15	-7%	146	220	100	183	-32%	-37	-17%
	C to B		177		157		-12%	-17		163		109		-33%	-52		144		95		-34%			130		60		-54%		
	C to A	S Station	39	216	42	199	8%		-8%	41	204	43	152	5%		-25%	70	214	50	145	-29%	-69	-32%	58	188	100	160	72%	-28	-15%
	Junction			555		491		-65	-12%		563		520		-43	-8%		507		429		-78	-15%		481		444		-37	-8%
Junction 9 - Station Road / Skeyton New Road Priority Junction	A to B		3		3		0%	0		3		9		200%	-1		2		2		0%			2		2		0%		
	A to C	E Skeyton	46	49	46	49	0%		0%	48	51	41	50	-15%		-2%	44	46	44	46	0%	0	0%	48	50	49	51	2%	1	2%
	B to A		5		5		2%	-40		5		5		0%	-36		3		6		115%			3		3		0%		
	B to C	N Station	162	167	122	128	-25%		-24%	171	176	135	140	-21%		-20%	154	157	158	164	3%	7	5%	170	173	117	120	-31%	-53	-31%
	C to B		214		197		-8%	-16		202		144		-29%	-60		212		143		-32%			186		160		-14%		
	C to A	S Station	10	224	10	208	3%		-7%	13	215	11	155	-15%		-28%	14	225	11	154	-20%	-71	-32%	18	204	17	177	-6%	-27	-13%
	Junction			440		384		-56	-13%		442		345		-97	-22%		428		364		-64	-15%		427		348		-79	-19%
Junction 10 - Station Road / Oak Road / Skeyton Road Crossroads Junction	A to D		1		1		0%			1		1		0%			0		0		0%			0		0		0%		
	A to C		0		0		0%	0		0		0		0%	0		0		0		0%			0		0		0%		
	A to B	N Oak	2	3	2	3	0%		0%	2	3	2	3	0%		0%	8	8	8	8	0%	0	0%	8	8	8	8	0%	0	0%
	B to D		167		138		-17%			178		163		-8%			152		158		4%			158		149		-6%		
	B to C		42		31		-26%	-40		43		12		-72%	-46		43		41		-5%			57		13		-77%		
	B to A	W Station	0	208	0	169	0%		-19%	0	221	0	175	0%		-21%	3	198	3	202	0%	4	2%	3	218	3	165	0%	-53	-24%
	C to D		28		28		0%			30		22		-27%			20		22		12%			22		33		50%		
	C to B		64		65		1%	1		64		18		-72%	-54		32		33		4%			33		75		127%		
	C to A	S Skeyton	0	92	0	93	0%		1%	0	94	0	40	0%		-57%	0	52	0	56	0%	4	7%	0	55	0	108	0%	53	96%
	D to C		37		36		-3%			43		32		-26%			41		41		0%			38		73		92%		
	D to B		157		140		-11%	-17		151		135		-11%	-28		185		113		-39%			163		95		-42%		
	D to A	E Station	13	207	14	191	11%		-8%	19	213	18	185	-5%		-13%	4	230	4	159	0%	-72	-31%	4	205	4	172	0%	-33	-16%
	Junction			511		455		-56	-11%		531		403		-128	-24%		488		425		-64	-13%		486		453		-33	-7%
Junction 11 - Station Road / Millfield Road / Morris Road Mini-roundabout	A to D		25		20		-17%			25		23		-8%			18		18		-2%			20		20		0%		
	A to C		143		130		-9%	-29		155		146		-6%	-25		132		150		14%			136		137		1%		
	A to B		15		13		-15%			15		15		0%			12		12		-2%			13		20		54%		
	A to A	N Station	12	195	3	166	-76%		-15%	15	210	1	185	-93%		-12%	10	172	1	181	-89%	9	5%	10	179	3	180	-70%	1	1%
	B to D		0		0		0%			0		0		0%			2		2		0%			2		2		0%		
	B to C		21		21		0%	0		23		23		0%	11		2		2		0%			2		2		0%		
	B to A		64		64		0%			65		76		17%			10		10		-1%			10		10		0%		
	B to B	W Morris	0	85	0	85	0%		0%	0	88	0	99	0%		13%	0	14	0	14	0%	0	0%	0	14	0	14	0%	0	0%
	C to D		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to B		9		13		42%	-19		13		12		-8%	-45		4		4		3%			5		5		0%		
	C to A		132		120		-9%			136		102		-25%			168		108		-36%			141		111		-21%		
	C to C	S Millfield	11	152	0	133	-100%		-12%	10	159	0	114	-100%		-28%	3	175	0	112	-100%	-62	-36%	4	150	0	116	-100%	-34	-23%
	D to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	D to B		0		0		0%	4		0		0		0%	12		0		0		0%			0		0		0%		
	D to A		0		4		0%			0		12		0%			43		40		-7%			43		48		12%		
	D to D	E Station	0	0	0	4	0%		0%	0	0	0	12	0%		#DIV/0!	0	43	0	40	0%	-3	-7%	0	43	0	48	0%	5	12%
	Junction			432		388		-44	-10%		457		410		-47	-10%		403		347		-57	-14%		386		358		-28	-7%
Junction 12 - B1150 Norwich Road / Millfield Road Priority Junction	A to B		73		78		7%	28		92		81		-12%	20		56		54		-3%			80		113		41%		
	A to C	N Norwich	311	384	334	412	7%		7%	356	448	387	468	9%		4%	417	472	429	483	3%	11	2%	443	523	516	629	16%	106	20%
	B to A		86		73		-16%	-34		92		119		29%	-25		39		45		15%			55		74		35%		
	B to C	W Millfield	124	210	103	176	-17%		-16%	130	222	78	197	-40%		-11%	71	109	78	123	10%	13	12%	63	118	43	117	-32%	-1	-1%
	C to B		104		78		-25%	13		92		60		-35%	41		141		83		-41%			102		32		-69%		
	C to A	S Norwich	332	436	371	449	12%		3%	356	448	429	489	21%		9%	396	537	395	478	0%	-59	-11%	457	559	431	463	-6%	-96	-17%
	Junction			1029		1037		8	1%		1118		1154		36	3%		1119		1083		-35	-3%		1200		1209		9	1%
Junction 13 - B1150 Norwich Road / Station Road Priority Junction	A to B		25		29		18%	33		25		32		28%	26		42		41		-3%			47		45		-4%		
	A to C	N Norwich	383	408	413	442	8%		8%	447	472	466	498	4%		6%	469	511	481	522	2%	11	2%	516	563	626	671	21%	108	19%
	B to A		71		67		-5%	-4		74		63		-15%	-10		43		41		-5%			49		48		-2%		
	B to C	W Station	0	71	0	67	0%		-5%	0	74	1	64	0%		-14%	4	47	3	44	-11%	-2	-5%	4	53	4	52	0%	-1	-2%
	C to B		2		2		10%	25		1		5		400%	98		10		9		-15%			12		13		8%		
	C to A	S Norwich	410	412	435	437	6%		6%	452	453	546	551	21%		22%	417	427	426	435	2%	8	2%	502	514	494	507	-2%	-7	-1%
	Junction			891		946		55	6%		999		1113		114	11%		985		1001		16	2%		1130		1230		100	9%
Junction 14 - B1150 Norwich Road / A149 / Norwich Road Signalised Junction	A to D		66		64		-3%			76		77		1%			60		60		0%			65		67		3%		
	A to C		219		213		-3%	-11		268		270		1%	10		223		224		1%			257		317		23%		
	A to B	E Norwich	152	437	150	427	-1%		-2%	182	526	189	536	4%		2%	118	401	117	400	-1%	-1	0%	141	463	147	531	4%	68	15%
	B to D		143		151		5%			153		165		8%			279		279		0%			272		288		6%		
	B to C		160		197		23%	49		168		172		2%	27		233		240		3%			238		241		1%		
	B to A	N A149	121	424	125	473	3%		11%	129	450	140	477	9%		6%	63	575	59	577	-7%	2	0%	60	570	70	599	17%	29	5%
	C to D		50		50		0%			56		108		93%			52		53		3%			60		94		57%		
	C to B		154		181		18%	23		184		170		-8%	73		148		171		15%			204		167		-18%		
	C to A	W Norwich	273	477	269	500	-2%		5%	290	530	325	603	12%		14%	253	453	240	465	-5%	11	2%	288	552	280	541	-3%	-11	-2%
	D to C		29		32		10%			36		51		42%			55		59		6%			65		114		75%		
	D to B		179		181		1%	5		184		207		13%	48		228		231		1%			230		244		6%		
	D to A	S A149	126	335	126	340	0%		1%	125	345	135	393	8%		14%	95	378	94	383	-1%	5	1%	95	390	100	458	5%	68	17%
	Junction			1674		1739		66	4%		1851		2009		158	9%		1808		1825		17	1%		1975		2129		154	8%

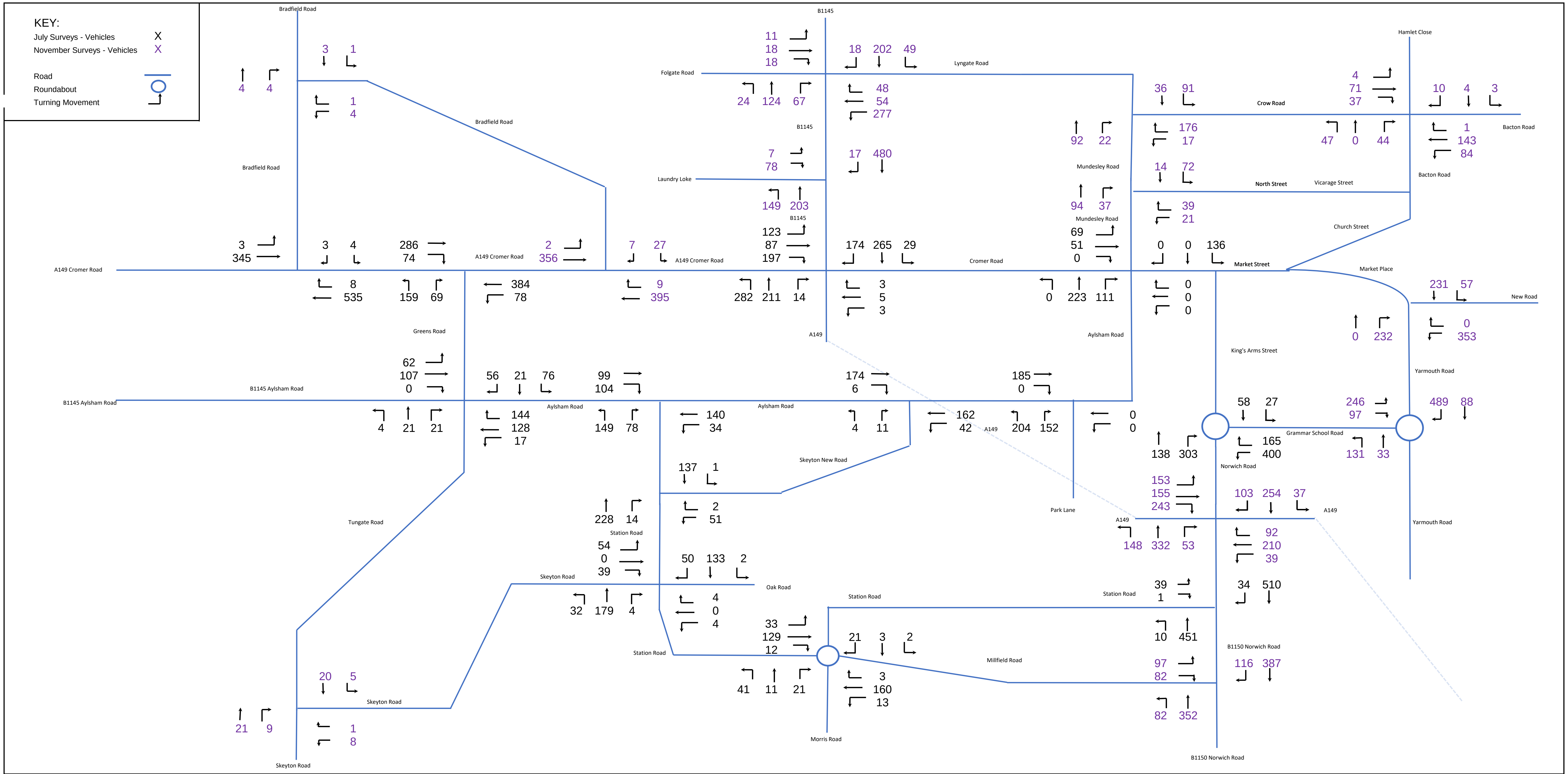
Junction 15 - Grammar School Road / King's Arms Street Mini-roundabout	A to B		61		63		5%			64		63		-2%			51		50		-1%			78		87		12%		
	A to C		22		24		8%	5		22		32		45%	9		20		20		0%			20		33		65%		
	A to A	N King's	0	82	0	87	0%		6%	0	86	0	95	0%		10%	0	71	0	70	0%	0	0%	0	98	0	120	0%	22	22%
	B to A		196		193		-1%			203		199		-2%			166		172		3%			183		155		-15%		
	B to C		310		314		1%	0		323		384		19%	55		240		220		-9%			257		293		14%		
	B to B	W Grammar	15	521	14	521	-7%		0%	19	545	17	600	-11%		10%	4	411	1	392	-75%	-18	-4%	5	445	3	451	-40%	6	1%
	C to B		364		352		-3%			445		460		3%			351		351		0%			382		441		15%		
	C to A		127		123		-4%	-17		156		181		16%	40		155		160		3%			181		185		2%		
	C to C	E Grammar	0	492	0	475	0%		-3%	0	601	0	641	0%		7%	0	506	0	511	0%	5	1%	0	563	0	626	0%	63	11%
	Junction			1095		1083		-12	-1%		1232		1336		104	8%		987		973		-14	-1%		1106		1197		91	8%
Junction 22 - B1145 / Laundry Loke Priority Junction	A to B		145		148		2%	1		160		183		14%	34		93		90		-3%			99		106		7%		
	A to C	S B1145	203	348	201	349	-1%		0%	216	376	227	410	5%		9%	306	399	292	383	-4%	-16	-4%	336	435	358	464	7%	29	7%
	B to A		77		77		0%	0		83		89		7%	6		165		166		1%			165		187		13%		
	B to C	W Laundry	0	77	0	77	0%		0%	0	83	0	89	0%		7%	8	173	8	174	-1%	1	1%	8	173	8	195	0%	22	13%
	C to B		12		12		0%	1		12		12		0%	27		6		5		-16%			5		5		0%		
	C to A	N B1145	370	382	371	383	0%		0%	380	392	407	419	7%		7%	378	384	378	383	0%	-1	0%	384	389	400	405	4%	16	4%
	Junction			808		809		2	0%		851		918		67	8%		956		940		-16	-2%		997		1064		67	7%
Junction 23 - B1145 / Lyngate Road / Folgate Road Staggered Crossroads	A to D		17		17		0%			19		18		-5%			4		4		0%			4		4		0%		
	A to C		184		184		0%	0		195		207		6%	14		120		121		0%			124		132		6%		
	A to B	N B1145	49	250	49	250	0%		0%	50	264	53	278	6%		5%	39	164	39	164	0%	0	0%	41	169	40	176	-2%	7	4%
	B to D		52		52		0%			54		53		-2%			15		15		1%			16		16		0%		
	B to C		179		180		0%	0		181		194		7%	10		155		155		0%			158		163		3%		
	B to A	E Lyngate	48	280	48	280	-1%		0%	50	285	48	295	-4%		4%	70	240	70	240	0%	1	0%	73	247	72	251	-1%	4	2%
	C to D		26		26		-1%			27		26		-4%			15		14		-10%			16		18		13%		
	C to B		56		56		0%	-17		59		60		2%	-17		150		146		-3%			163		172		6%		
	C to A	S B1145	120	202	119	201	-1%		-1%	131	217	142	228	8%		5%	148	313	140	299	-6%	-17	-4%	161	340	175	365	9%	-17	7%
	D to C		19		19		0%			19		19		0%			109		107		-2%			110		109		-1%		
	D to B		21		21		1%	0		21		21		0%	0		67		67		0%			68		68		0%		
	D to A	W Folgate	13	53	13	53	-1%		0%	13	53	13	53	0%		0%	21	197	21	195	0%	-2	-1%	21	199	21	198	0%	-1	-1%
	Junction			785		784		-1	0%		819		854		35	4%		913		898		-15	-2%		955		990		35	4%

% Impact Assessment																														
			AM Peak Hour														PM Peak Hour													
			2029							2036							2029							2036						
			DM		DS					DM		DS					DM		DS					DM		DS				
			Total Vehicles				% increase			Total Vehicles				% increase			Total Vehicles				% increase			Total Vehicles				% increase		
			Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm
Junction 1 - Rectory Road / B1150 Norwich Road / Mill Road Mini-Roundabout	A to D	E Norwich	105		105		0%			107		111		4%			146		146		0%			153		158		3%		
	A to C		639		670		5%			660		839		27%			548		553		1%			564		630		12%		
	A to B		7		7		0%			7		8		14%			10		10		-4%			9		9		0%		
	A to A		0	751	0	783	0%	32	4%	4	778	0	958	-100%	180	23%	0	704	0	708	0%	4	1%	4	730	0	797	-100%	67	9%
	B to D	S Millfield	0		0		0%			0		0		0%			3		3		-2%			2		3		50%		
	B to C		10		11		1%			12		12		0%			11		10		-2%			12		11		-8%		
	B to A		10		10		-1%			9		10		11%			7		7		3%			8		8		0%		
	B to B		0	21	0	21	0%	0	0%	0	21	0	22	0%	1	5%	0	20	0	20	0%	0	0%	0	22	0	22	0%	0	0%
	C to D	W Norwich	86		85		-1%			84		87		4%			99		100		1%			100		103		3%		
	C to B		7		8		6%			7		7		0%			2		2		-2%			2		2		0%		
	C to A		571		578		1%			602		659		9%			639		670		5%			672		802		19%		
	C to C		0	664	0	670	0%	6	1%	0	693	0	753	0%	60	9%	0	740	0	771	0%	31	4%	0	774	0	907	0%	133	17%
	D to C	N Rectory	108		108		0%			108		109		1%			80		80		0%			84		82		-2%		
	D to B		3		3		5%			4		4		0%			1		1		15%			0		0		0%		
	D to A		150		151		1%			154		152		-1%			127		126		0%			129		131		2%		
	D to D		0	261	0	263	0%	2	1%	0	266	0	265	0%	-1	0%	0	208	0	208	0%	0	0%	0	213	0	213	0%	0	0%
	Junction			1696		1736		40	2%		1758		1998		240	14%		1673		1708		35	2%		1739		1939		200	12%
Junction 2 - B1150 Norwich Road / B1354 Church Street / High Street / Petrol Station Gyratory	A to D	N High	511		543		6%			524		714		36%			422		426		1%			449		512		14%		
	A to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	A to B		54		54		0%			57		62		9%			42		40		-4%			37		43		16%		
	A to A		0	565	0	597	0%	33	6%	0	581	0	776	0%	195	34%	0	463	0	466	0%	3	1%	0	486	0	555	0%	69	14%
	B to D	E B1354	234		234		0%			237		233		-2%			273		273		0%			273		275		1%		
	B to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	B to A		37		37		1%			35		37		6%			43		44		1%			46		45		-2%		
	B to B		0	271	0	271	0%	0	0%	0	272	0	270	0%	-2	-1%	0	316	0	317	0%	1	0%	0	319	0	320	0%	1	0%
	C to D	S Petrol	0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to B		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to A		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to C		0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%
	D to C	W Norwich	0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	D to B		349		350		0%			368		360		-2%			264		262		-1%			271		274		1%		
	D to A		401		407		2%			407		470		15%			498		527		6%			519		675		30%		
	D to D		0	750	0	758	0%	8	1%	0	775	0	830	0%	55	7%	0	762	0	789	0%	27	4%	0	790	0	949	0%	159	20%
	Junction			1586		1626		41	3%		1628		1876		248	15%		1541		1572		31	2%		1595		1824		229	14%
Junction 3 - High Street / Station Road Priority Junction	A to B	E Station	553		587		6%			574		764		33%			437		441		1%			456		527		16%		
	A to C		1	554	1	588	-4%	34	6%	2	576	2	766	0%	190	33%	1	438	1	442	0%	4	1%	0	456	0	527	0%	71	16%
	B to A	S High	422		428		1%			421		487		16%			522		552		6%			544		704		29%		
	B to C		15	437	16	444	2%	6	1%	15	436	16	503	7%	67	15%	18	540	18	570	-3%	30	6%	17	561	16	720	-6%	159	28%
	C to B	N High	9		8		-1%			9		9		0%			27		27		0%			27		27		0%		
	C to A		2	11	2	10	-3%	0	-1%	1	10	1	10	0%	0	0%	8	36	9	36	1%	0	0%	10	37	10	37	0%	0	0%
	Junction			1002		1043		40	4%		1022		1279		257	25%		1014		1048		34	3%		1054		1284		230	22%
Junction 4 - Church Loke / B1354 / Rectory Road Crossroads Junction	A to D	N Rectory	34		34		0%			30		32		7%			28		28		-1%			25		25		0%		
	A to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	A to B		24	57	24	57	0%	0	0%	25	55	25	57	0%	2	4%	17	45	18	45	1%	0	0%	20	45	18	43	-10%	-2	-4%
	B to D	E B1354	236		235		0%			241		238		-1%			289		288		0%			289		304		5%		
	B to C		2		2		0%			4		4		0%			0		0		0%			0		0		0%		
	B to A		50	288	51	288	1%	0	0%	49	294	50	292	2%	-2	-1%	26	314	26	314	1%	0	0%	23	312	25	329	9%	17	5%
	C to D	S Church	4		4		1%			2		3		50%			2		2		0%			2		3		50%		
	C to B		4		4		0%			4		4		0%			2		2		3%			4		4		0%		
	C to A		0	8	0	8	0%	0	1%	0	6	0	7	0%	1	17%	0	4	0	4	0%	0	1%	0	6	0	7	0%	1	17%
	D to C	W B1354	10		10		3%			13		13		0%			1		1		-17%			1		1		0%		
	D to B		333		332		0%			343		340		-1%			267		264		-1%			268		282		5%		
	D to A		62	404	61	404	-1%	-1	0%	64	420	63	416	-2%	-4	-1%	36	304	36	302	0%	-3	-1%	36	305	37	320	3%	15	5%
	Junction			758		758		-1	0%		775		772		-3	0%		668		665		-3	0%		668		699		31	5%
Link 5 - B1150 Norwich Road, at bridge	A to B	A - to West	743		778		5%			759		948		25%			695		699		1%			720		785		9%		
	B to A	B - to East	751	1494	756	1533	1%	39	3%	784	1543	837	1785	7%	242	16%	762	1457	790	1489	4%	32	2%	800	1520	947	1732	18%	212	14%
	Junction			1494		1533		39	3%		1543		1785		242	16%		1457		1489		32	2%		1520		1732		212	14%
Link 6 - High Street	A to B	A - to North	438		444		1%			438		504		15%			540		569		5%			564		720		28%		
	B to A	B - to South	563	1001	597	1041	6%	40	4%	579	1017	775	1279	34%	262	26%	463	1003	467	1037	1%	33	3%	487	1051	558	1278	15%	227	22%
	Junction			1001		1041		40	4%		1017		1279		262	26%		1003		1037		33	3%		1051		1278		227	22%

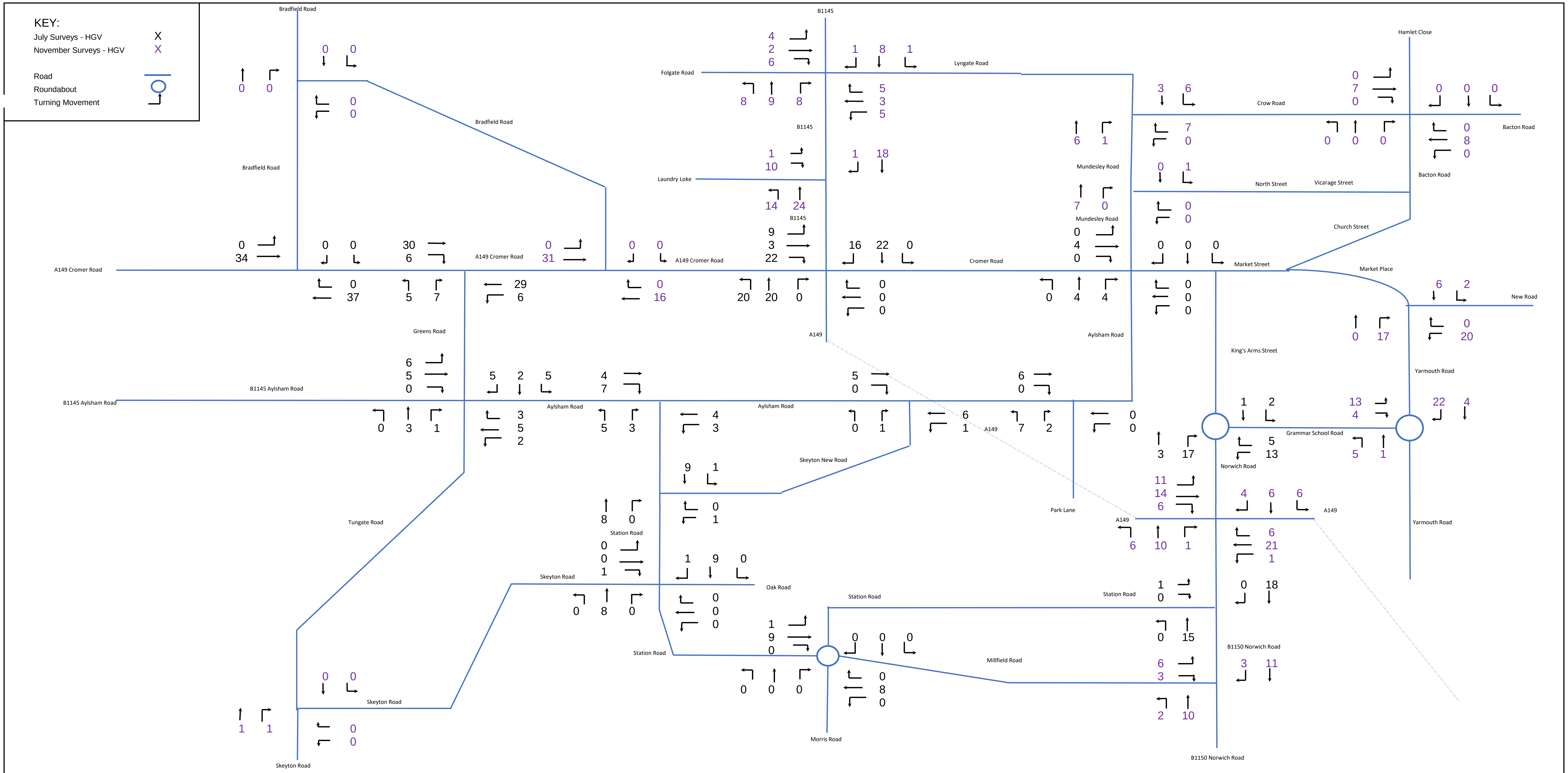
% Impact Assessment (with Mitigation)

			AM Peak Hour														PM Peak Hour													
			2029							2036							2029							2036						
			DM		DS					DM		DS					DM		DS					DM		DS				
			Total Vehicles				% increase			Total Vehicles				% increase			Total Vehicles				% increase			Total Vehicles				% increase		
			Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm	Turn	Arm	Turn	Arm	Turn		Arm
Junction 1 - Rectory Road / B1150 Norwich Road / Mill Road Mini-Roundabout	A to D		105		105		0%			107		111		4%			146		146		0%			153		158		3%		
	A to C		639		670		5%			660		839		27%			548		553		1%			564		630		12%		
	A to B	E Norwich	7		7		0%			7		8		14%			10		10		-4%			9		9		0%		
	A to A		0	751	0	783	0%	32	4%	4	778	0	958	-100%	180	23%	0	704	0	708	0%	4	1%	4	730	0	797	-100%	67	9%
	B to D		0		0		0%			0		0		0%			3		3		-2%			2		3		50%		
	B to C		10		11		1%			12		12		0%			11		10		-2%			12		11		-8%		
	B to A	S Millfield	10		10		-1%			9		10		11%			7		7		3%			8		8		0%		
	B to B		0	21	0	21	0%	0	0%	0	21	0	22	0%	1	5%	0	20	0	20	0%	0	0%	0	22	0	22	0%	0	0%
	C to D		86		85		-1%			84		87		4%			99		100		1%			100		103		3%		
	C to B		7		8		6%			7		7		0%			2		2		-2%			2		2		0%		
	C to A	W Norwich	571		578		1%			602		659		9%			639		670		5%			672		800		19%		
	C to C		0	664	0	670	0%	6	1%	0	693	0	753	0%	60	9%	0	740	0	771	0%	31	4%	0	774	0	905	0%	131	17%
	D to C		108		108		0%			108		109		1%			80		80		0%			84		82		-2%		
	D to B		3		3		5%			4		4		0%			1		1		15%			0		0		0%		
	D to A	N Rectory	150		151		1%			154		152		-1%			127		126		0%			129		131		2%		
	D to D		0	261	0	263	0%	2	1%	0	266	0	265	0%	-1	0%	0	208	0	208	0%	0	0%	0	213	0	213	0%	0	0%
	Junction			1696		1736		40	2%		1758		1998		240	14%		1673		1708		35	2%		1739		1937		198	11%
Junction 2 - B1150 Norwich Road / B1354 Church Street / High Street / Petrol Station Gyratory	A to D		511		543		6%			524		716		37%			422		426		1%			449		510		14%		
	A to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	A to B	N High	54		54		0%			57		62		9%			42		40		-4%			37		43		16%		
	A to A		0	565	0	597	0%	33	6%	0	581	0	778	0%	197	34%	0	463	0	466	0%	3	1%	0	486	0	553	0%	67	14%
	B to D		234		234		0%			237		233		-2%			273		273		0%			273		275		1%		
	B to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	B to A	E B1354	37		37		1%			35		37		6%			43		44		1%			46		45		-2%		
	B to B		0	271	0	271	0%	0	0%	0	272	0	270	0%	-2	-1%	0	316	0	317	0%	1	0%	0	319	0	320	0%	1	0%
	C to D		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to B		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to A	S Petrol	0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	C to C		0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%	0	0	0	0	0%	0	0%
	D to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	D to B		349		350		0%			368		360		-2%			264		262		-1%			271		274		1%		
	D to A	W Norwich	401		407		2%			407		472		16%			498		527		6%			519		674		30%		
	D to D		0	750	0	758	0%	8	1%	0	775	0	832	0%	57	7%	0	762	0	789	0%	27	4%	0	790	0	948	0%	158	20%
	Junction			1586		1626		41	3%		1628		1880		252	15%		1541		1572		31	2%		1595		1821		226	14%
Junction 3 - High Street / Station Road Priority Junction	A to B		553		587		6%			574		764		33%			437		441		1%			456		527		16%		
	A to C	E Station	1	554	1	588	-4%	34	6%	2	576	2	766	0%	190	33%	1	438	1	442	0%	4	1%	0	456	0	527	0%	71	16%
	B to A		422		428		1%			421		488		16%			522		552		6%			544		704		29%		
	B to C	S High	15	437	16	444	2%	6	1%	15	436	16	504	7%	68	16%	18	540	18	570	-3%	30	6%	17	561	16	720	-6%	159	28%
	C to B		9		8		-1%			9		9		0%			27		27		0%			27		27		0%		
	C to A	N High	2	11	2	10	-3%	0	-1%	1	10	1	10	0%	0	0%	8	36	9	36	1%	0	0%	10	37	10	37	0%	0	0%
	Junction			1002		1043		40	4%		1022		1280		258	25%		1014		1048		34	3%		1054		1284		230	22%
Junction 4 - Church Loke / B1354 / Rectory Road Crossroads Junction	A to D		34		34		0%			30		32		7%			28		28		-1%			25		25		0%		
	A to C		0		0		0%			0		0		0%			0		0		0%			0		0		0%		
	A to B	N Rectory	24	57	24	57	0%	0	0%	25	55	25	57	0%	2	4%	17	45	18	45	1%	0	0%	20	45	18	43	-10%	-2	-4%
	B to D		236		235		0%			241		238		-1%			289		288		0%			289		304		5%		
	B to C		2		2		0%			4		4		0%			0		0		0%			0		0		0%		
	B to A	E B1354	50	288	51	288	1%	0	0%	49	294	50	292	2%	-2	-1%	26	314	26	314	1%	0	0%	23	312	25	329	9%	17	5%
	C to D		4		4		1%			2		3		50%			2		2		0%			2		3		50%		
	C to B		4		4		0%			4		4		0%			2		2		3%			4		4		0%		
	C to A	S Church	0	8	0	8	0%	0	1%	0	6	0	7	0%	1	17%	0	4	0	4	0%	0	1%	0	6	0	7	0%	1	17%
	D to C		10		10		3%			13		13		0%			1		1		-17%			1		1		0%		
	D to B		333		332		0%			343		342		0%			267		264		-1%			268		282		5%		
	D to A	W B1354	62	404	61	404	-1%	-1	0%	64	420	63	418	-2%	-2	0%	36	304	36	302	0%	-3	-1%	36	305	37	320	3%	15	5%
	Junction			758		758		-1	0%		775		774		-1	0%		668		665		-3	0%		668		699		31	5%
Link 5 - B1150 Norwich Road, at bridge	A to B	A - to West	743		778		5%			759		949		25%			695		699		1%			720		785		9%		
	B to A	B - to East	751	1494	756	1533	1%	39	3%	784	1543	841	1790	7%	247	16%	762	1457	790	1489	4%	32	2%	800	1520	948	1733	19%	213	14%
	Junction			1494		1533		39	3%		1543		1790		247	16%		1457		1489		32	2%		1520		1733		213	14%
Link 6 - High Street	A to B	A - to North	438		444		1%			438		505		15%			540		569		5%			564		721		28%		
	B to A	B - to South	563	1001	597	1041	6%	40	4%	579	1017	775	1280	34%	263	26%	463	1003	467	1037	1%	33	3%	487	1051	558	1279	15%	228	22%
	Junction			1001		1041		40	4%		1017		1280		263	26%		1003		1037		33	3%		1051		1279		228	22%

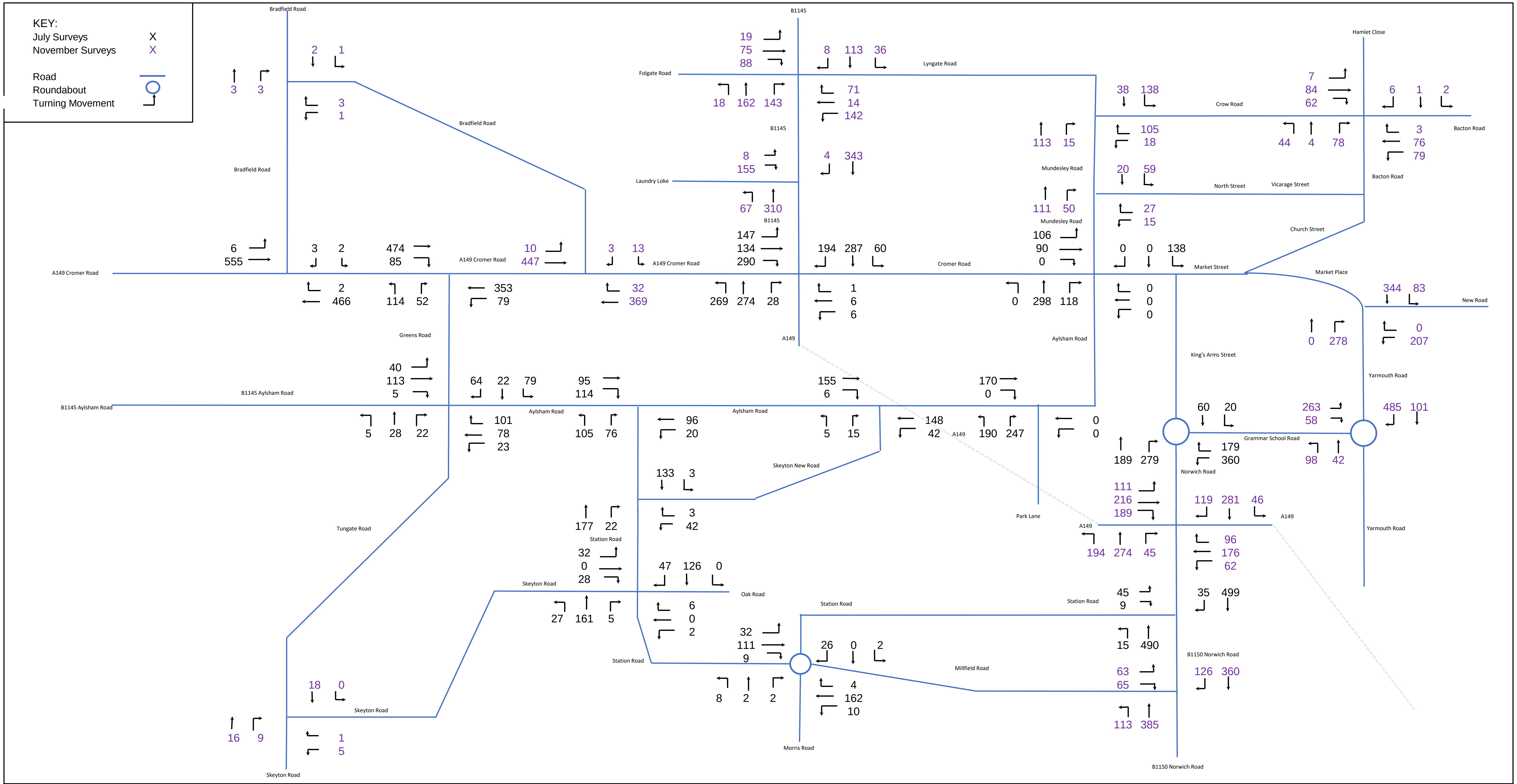
Appendix C – Flow Diagrams



Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 08:00-09:00 PM PEAK HOUR: 16:30-17:30	July surveys used at the Market Place signalised junction and B1145/Cromer Road signalised junction as road closure in November surveys		
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2022 Base AM	BS	TJ	13/10/2023	1

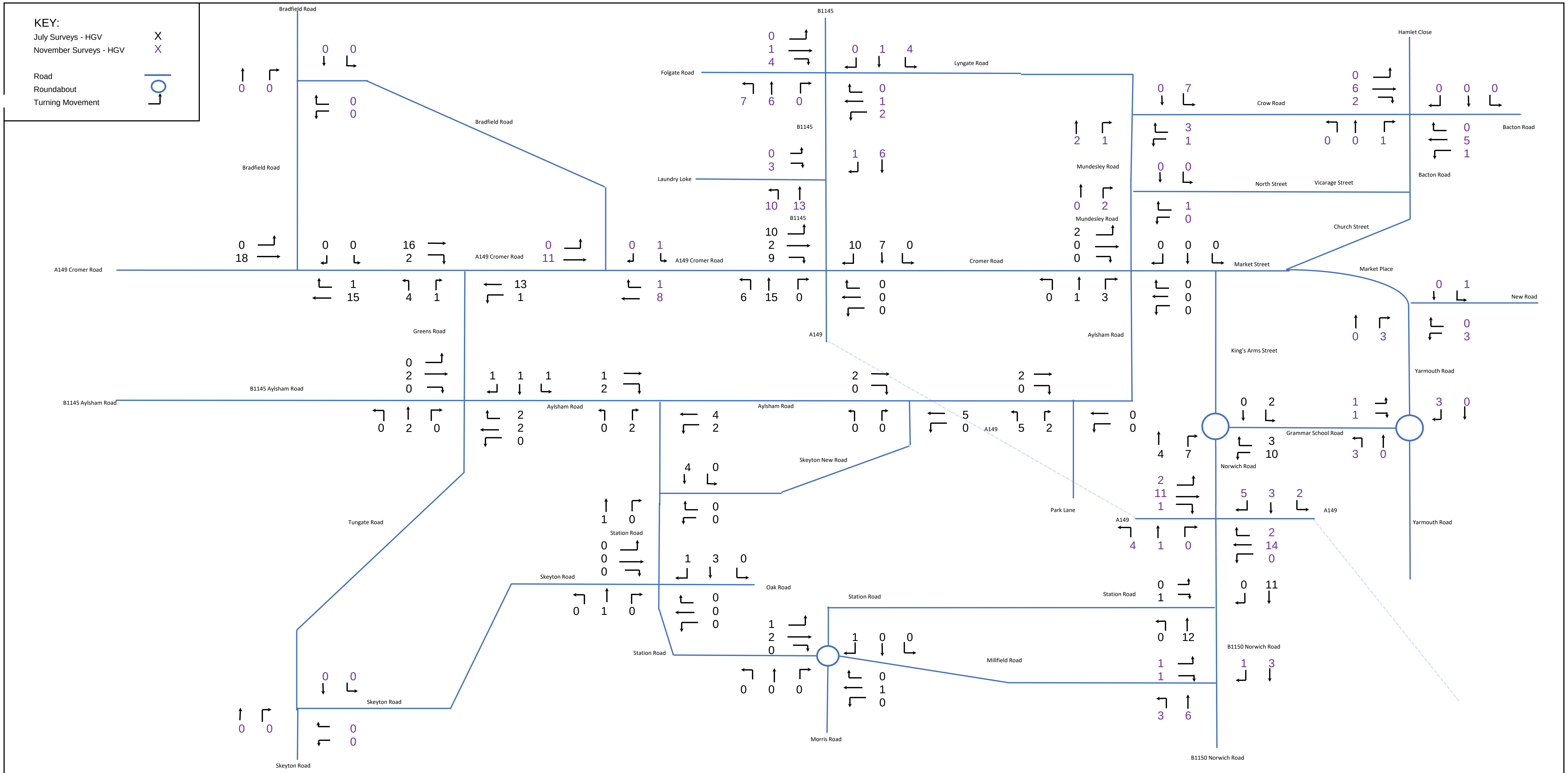


Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 08:00-09:00 PM PEAK HOUR: 16:30-17:30	July surveys used at the Market Place signalised junction and B1145/Cromer Road signalised junction as road closure in November surveys		
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2022 HGV AM	BS	TJ	13/10/2023	2



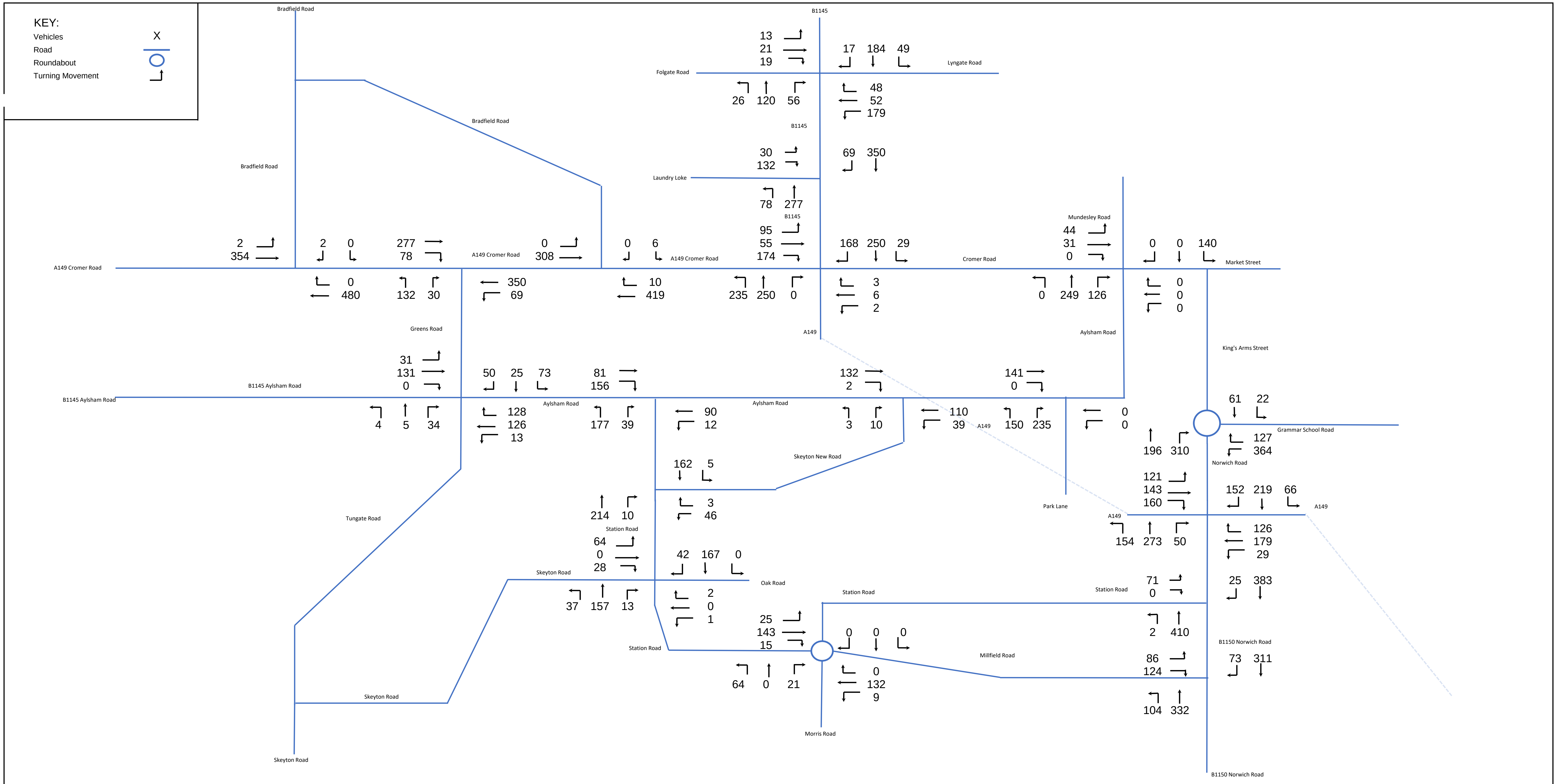
Project		Notes
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 08:00-09:00 PM PEAK HOUR: 16:30-17:30 July surveys used at the Market Place signalised junction and B1145/Cromer Road signalised junction as road closure in November surveys

Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2022 Base PM	BS	TJ	13/10/2023	3

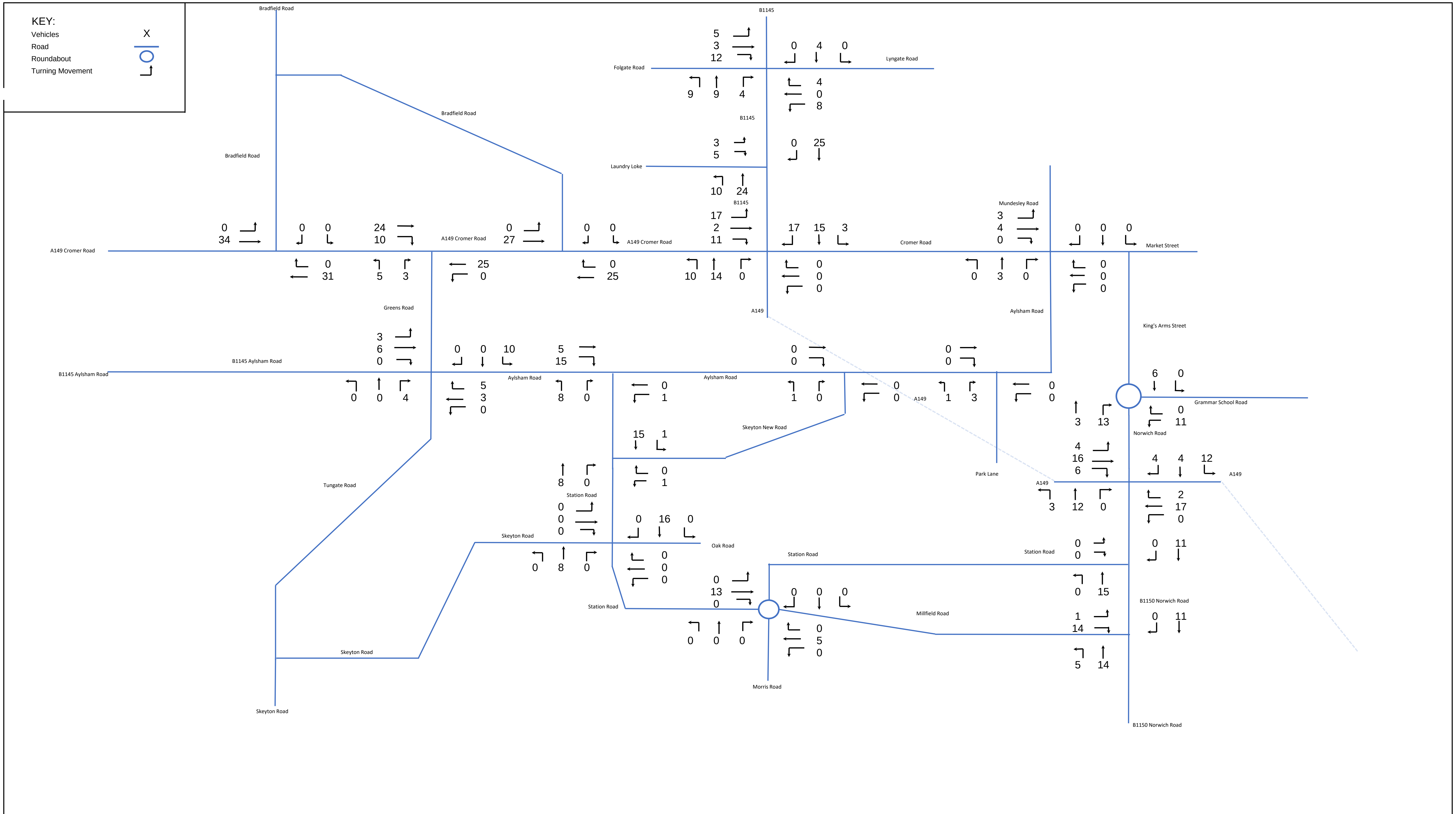


Project		Notes
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 08:00-09:00 PM PEAK HOUR: 16:30-17:30 July surveys used at the Market Place signalised junction and B1145/Cromer Road signalised junction as road closure in November surveys

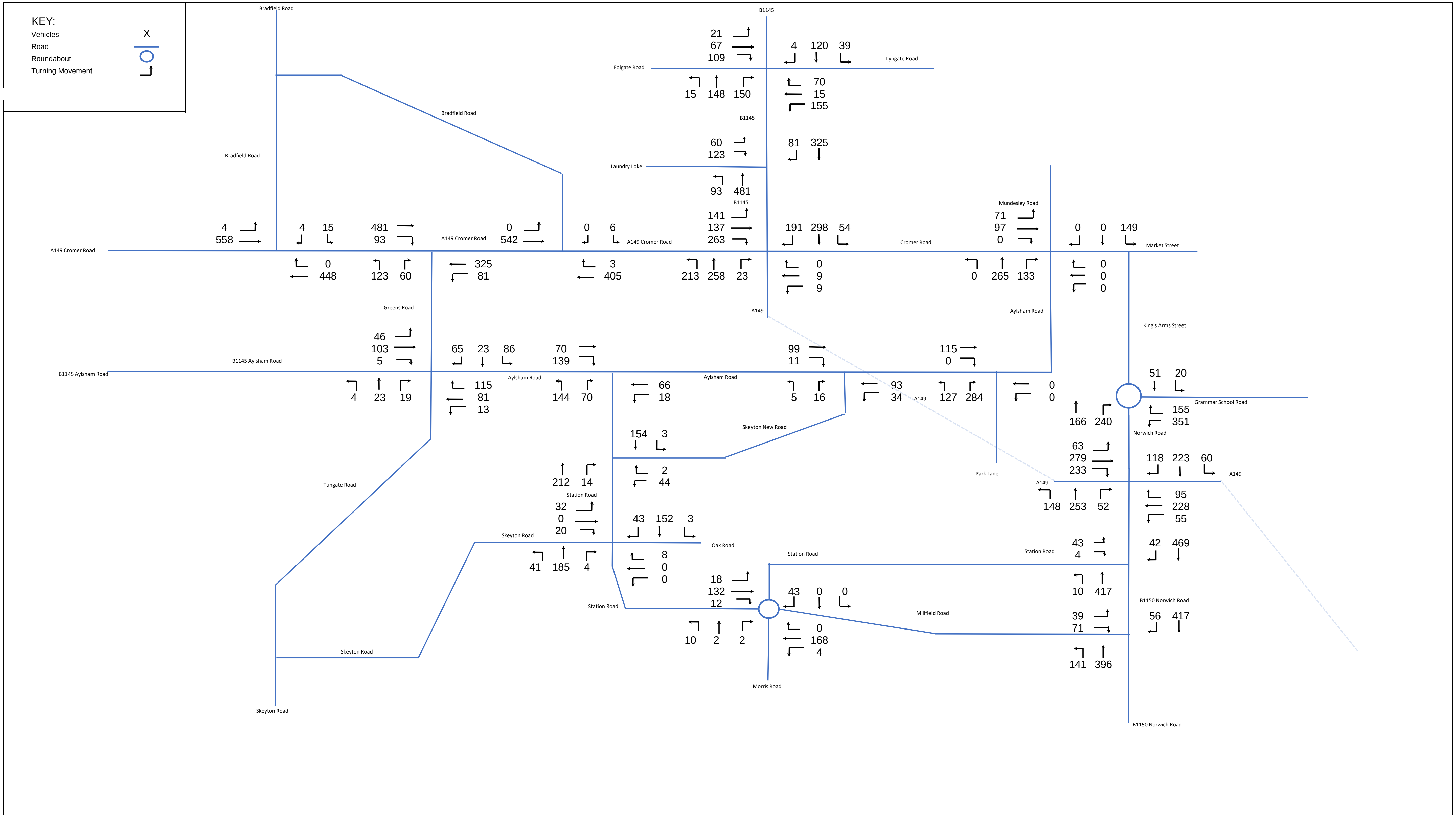
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2022 HGV PM	BS	TJ	13/10/2023	4



Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Minimum AM	BS	TJ	13/10/2023	5

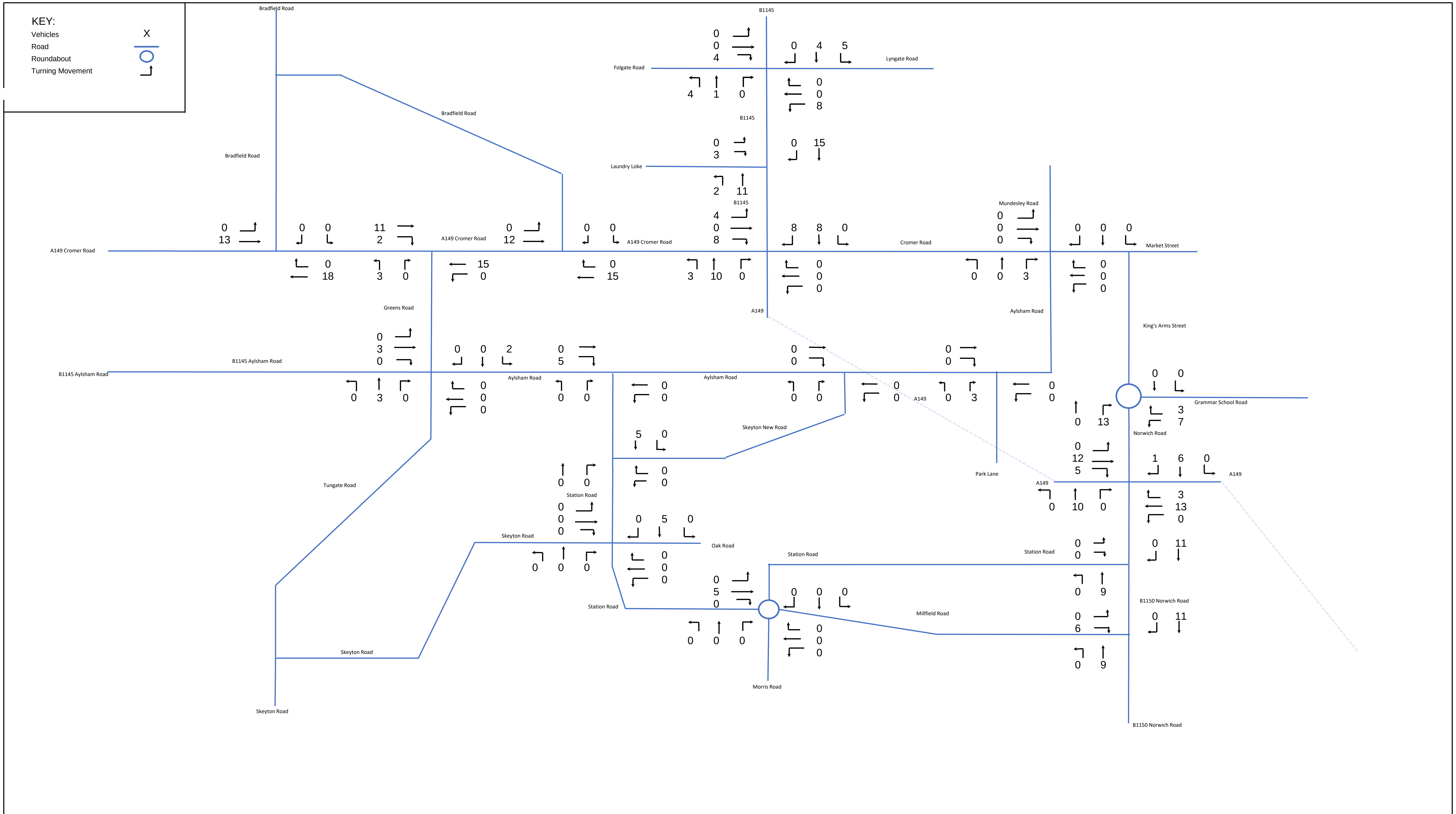


Project				Notes	
60685223 - North Walsham Western Urban Extension					
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Minimum AM (HGV Only)	BS	TJ	13/10/2023	6

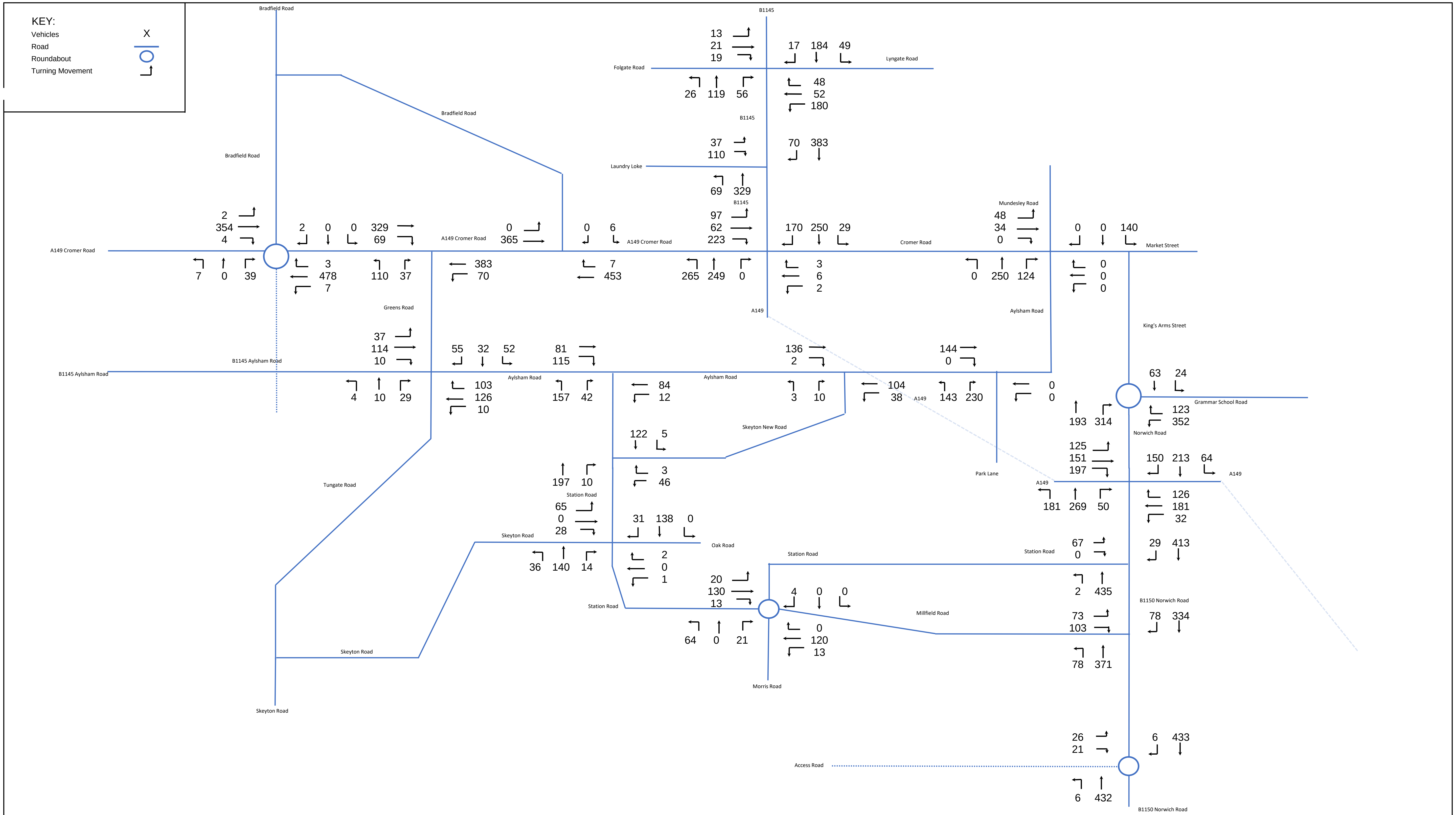


Project		Notes
60685223 - North Walsham Western Urban Extension	AECOM	

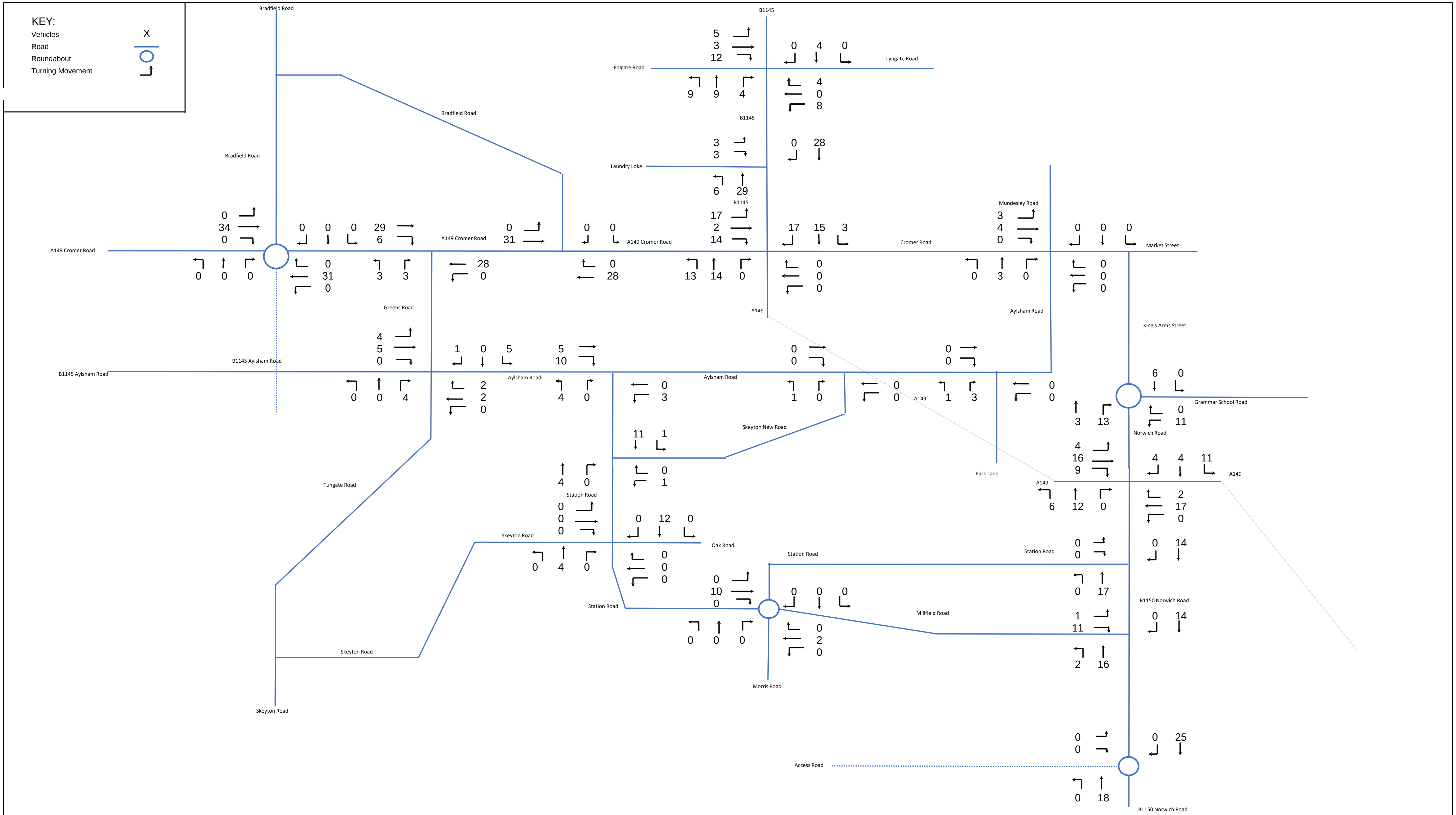
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Minimum PM	BS	TJ	13/10/2023	7



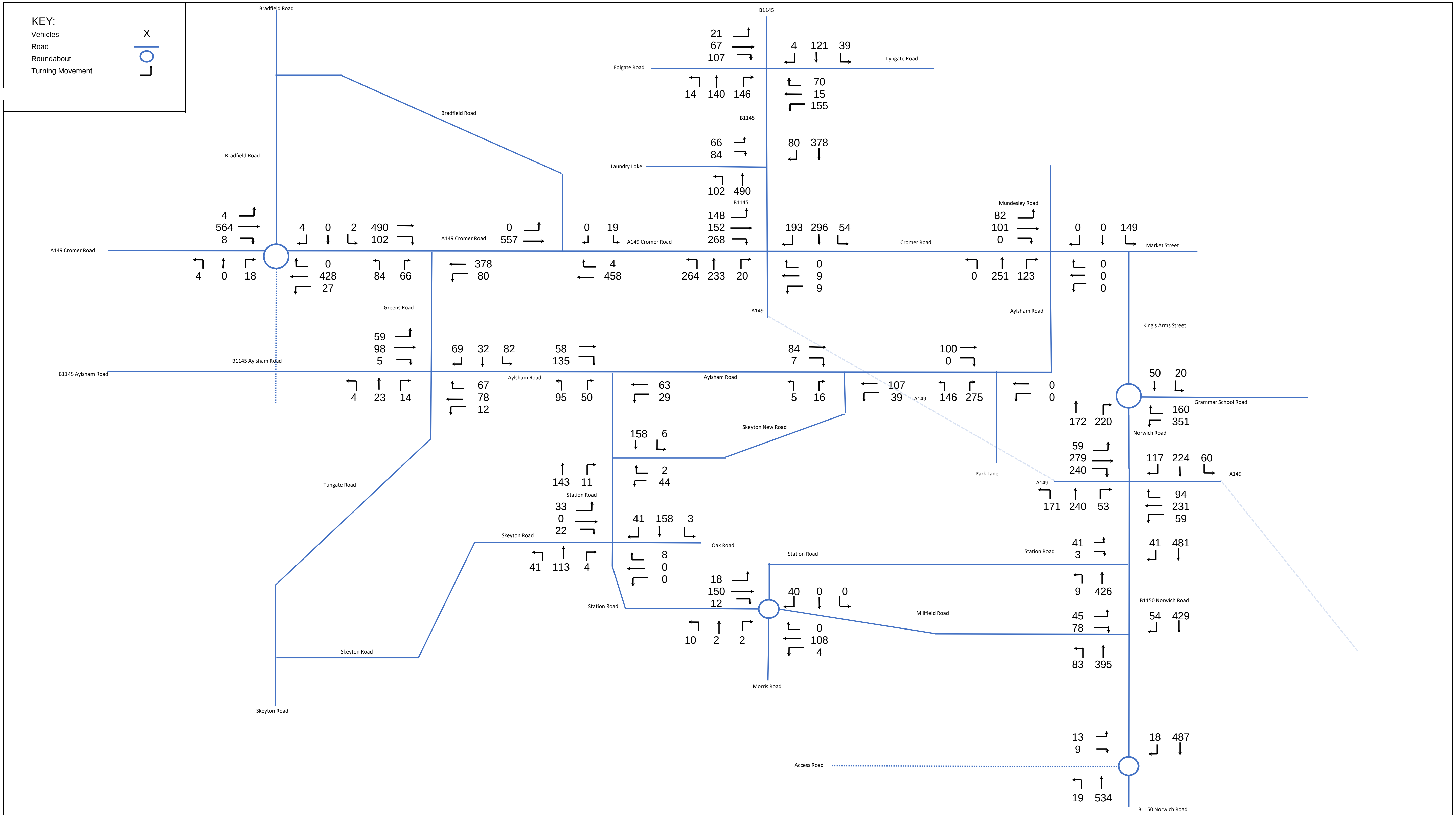
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Minimum PM (HGV Only)	BS	TJ	13/10/2023	8



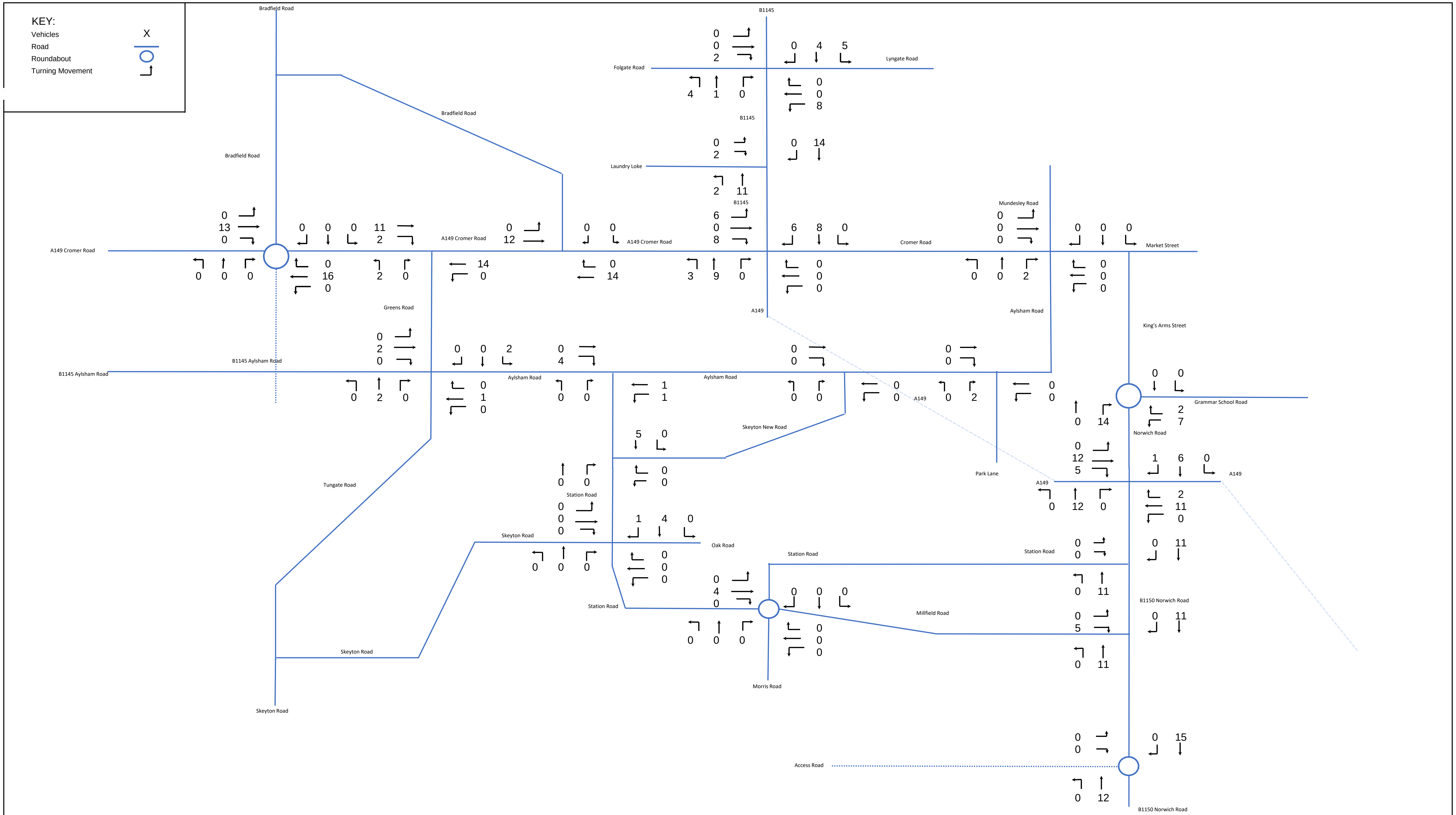
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Something AM	BS	TJ	13/10/2023	9



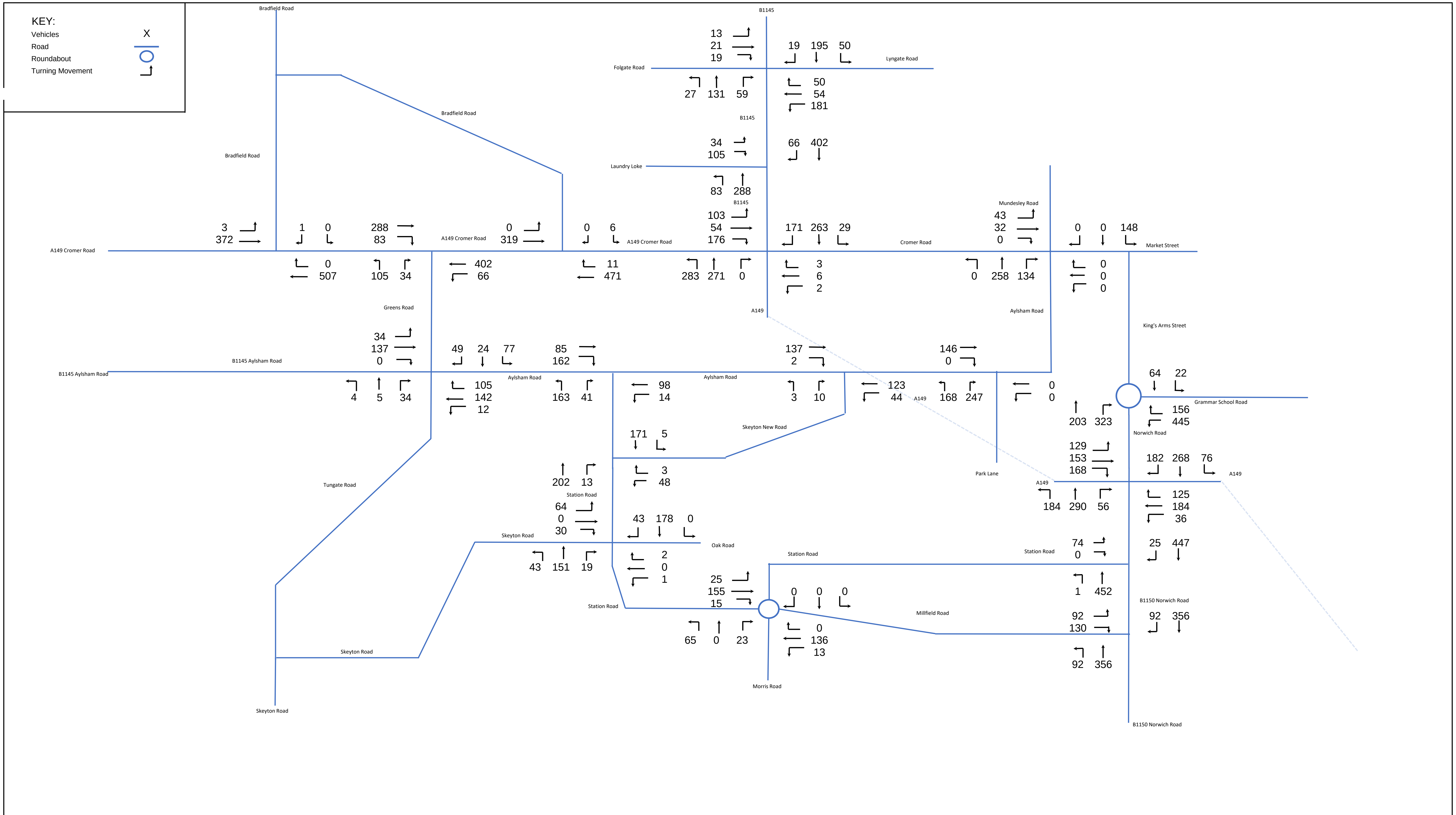
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Something AM (HGV Only)	BS	TJ	13/10/2023	10



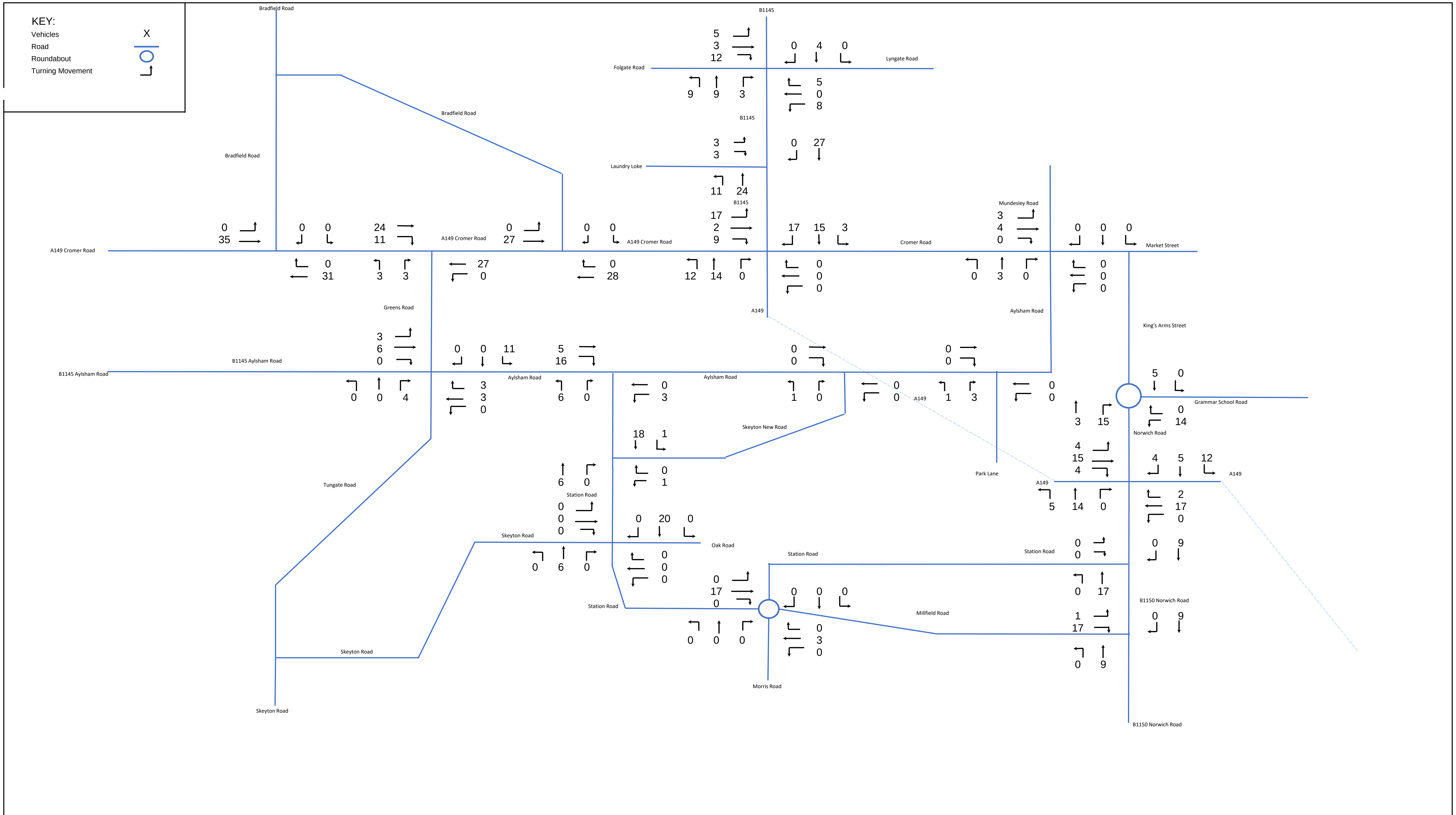
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Something PM	BS	TJ	13/10/2023	11



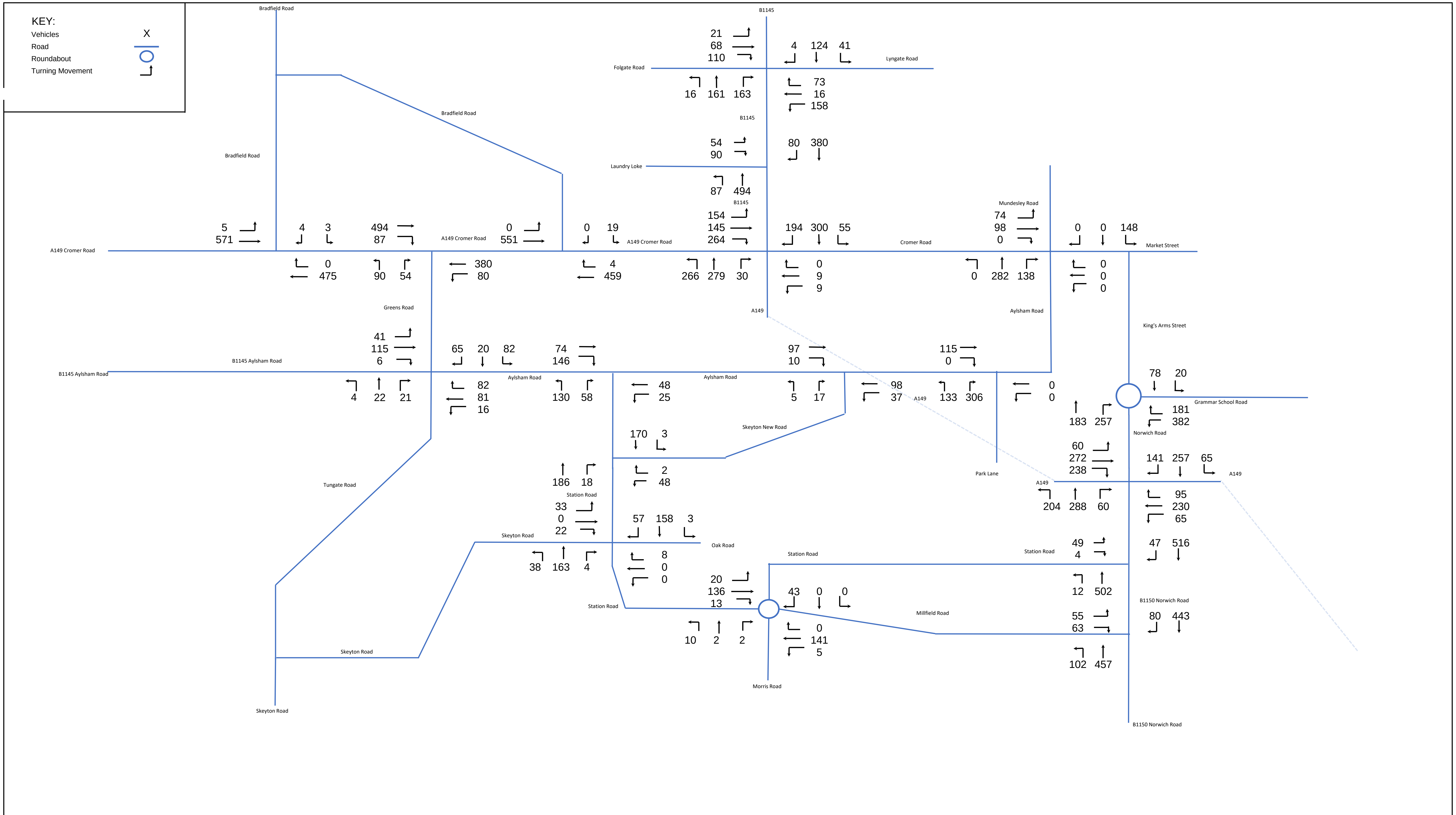
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Something PM (HGV Only)	BS	TJ	13/10/2023	12



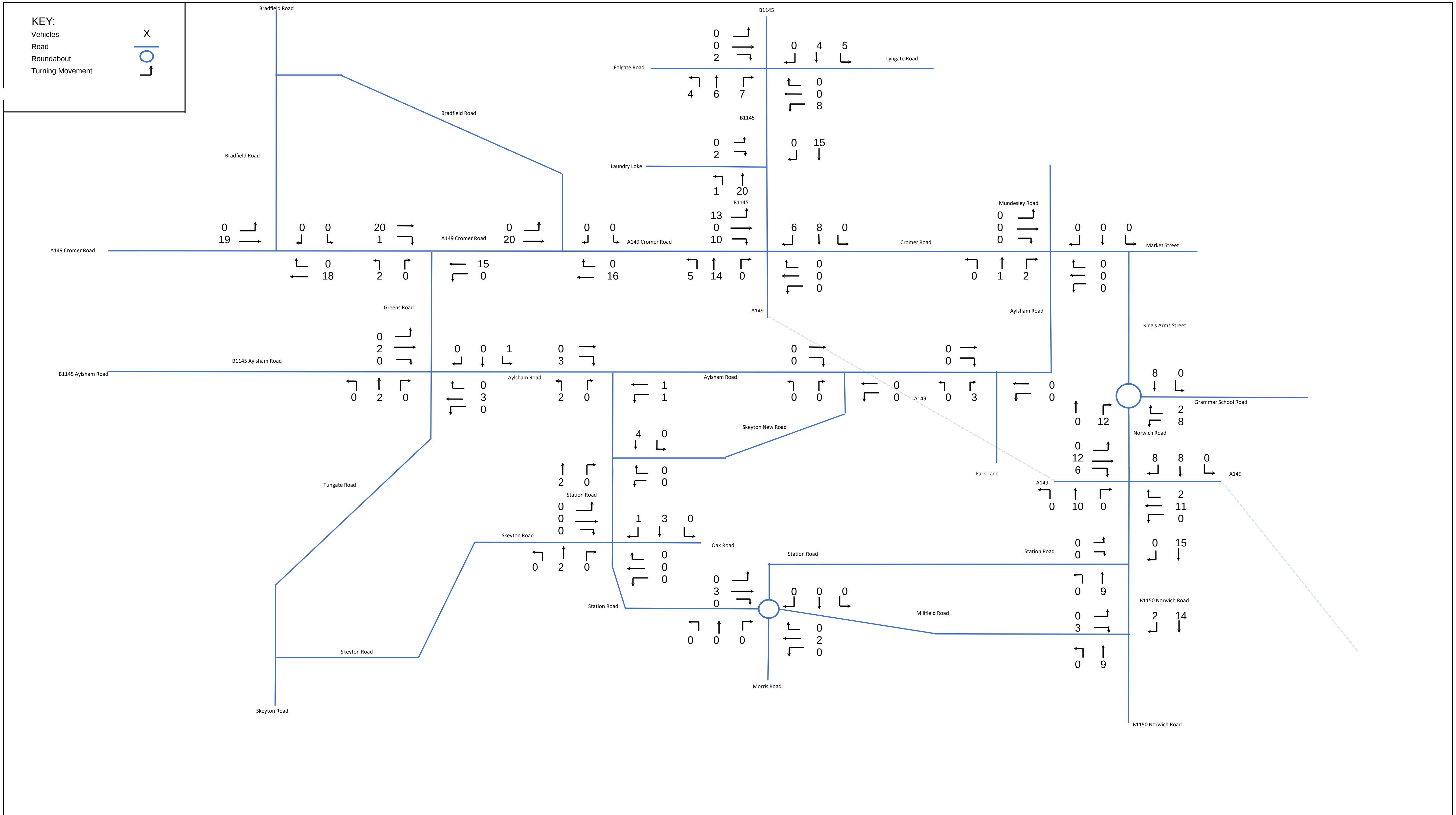
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Minimum AM Demand Flows	BS	TJ	13/10/2023	13



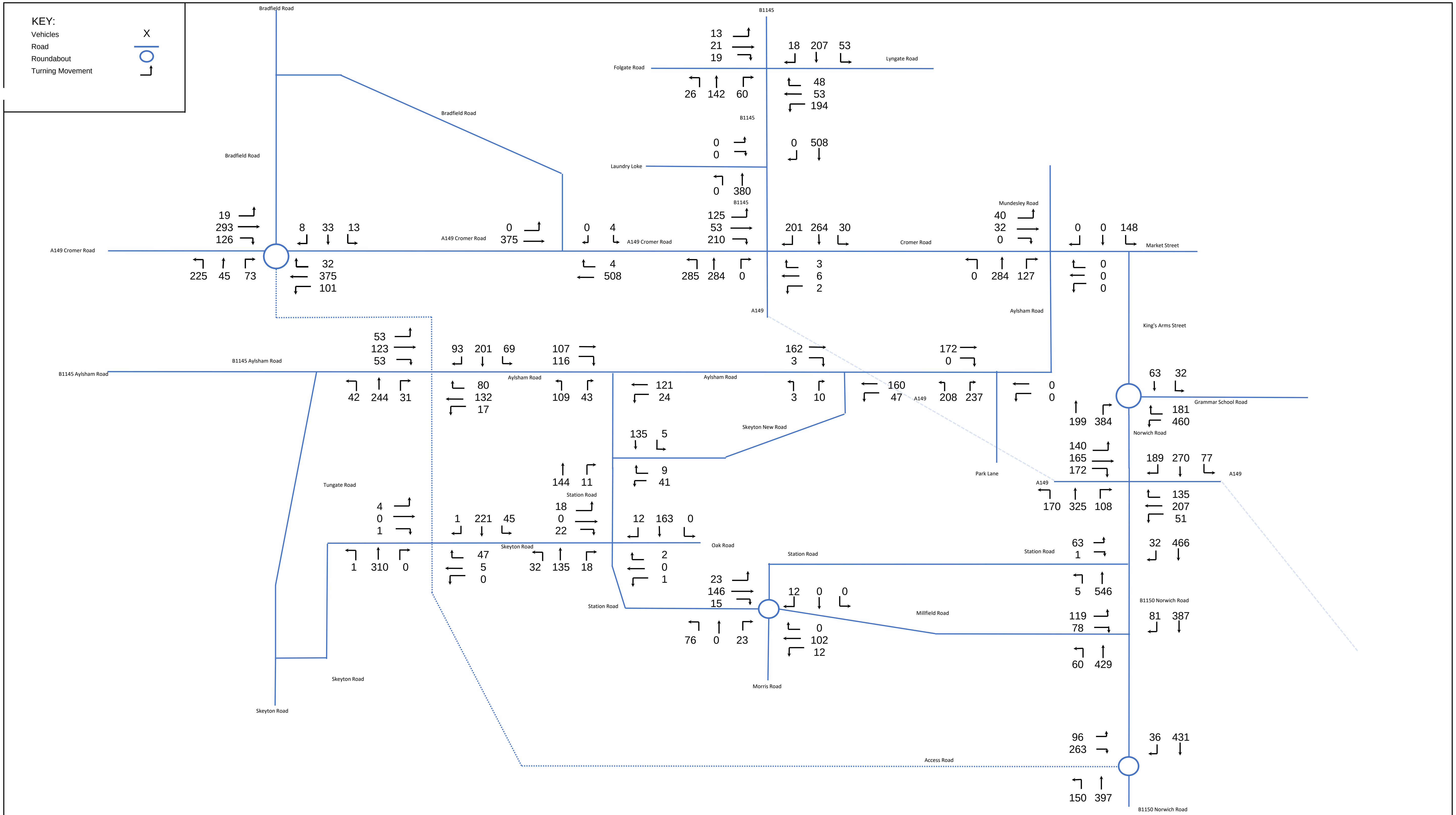
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Minimum AM Demand Flows (HGV Only)	BS	TJ	13/10/2023	14



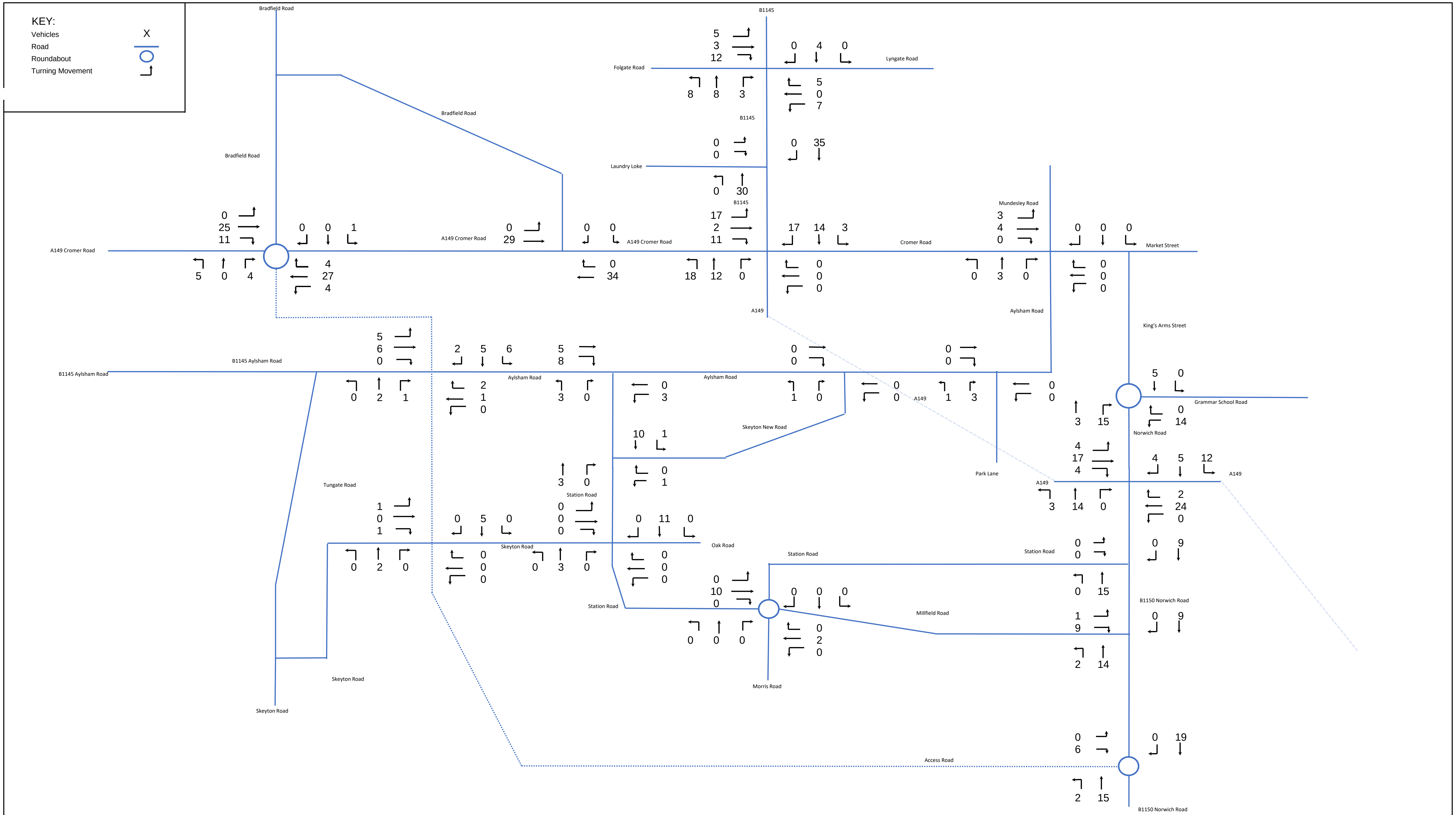
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Minimum PM Demand Flows	BS	TJ	13/10/2023	15



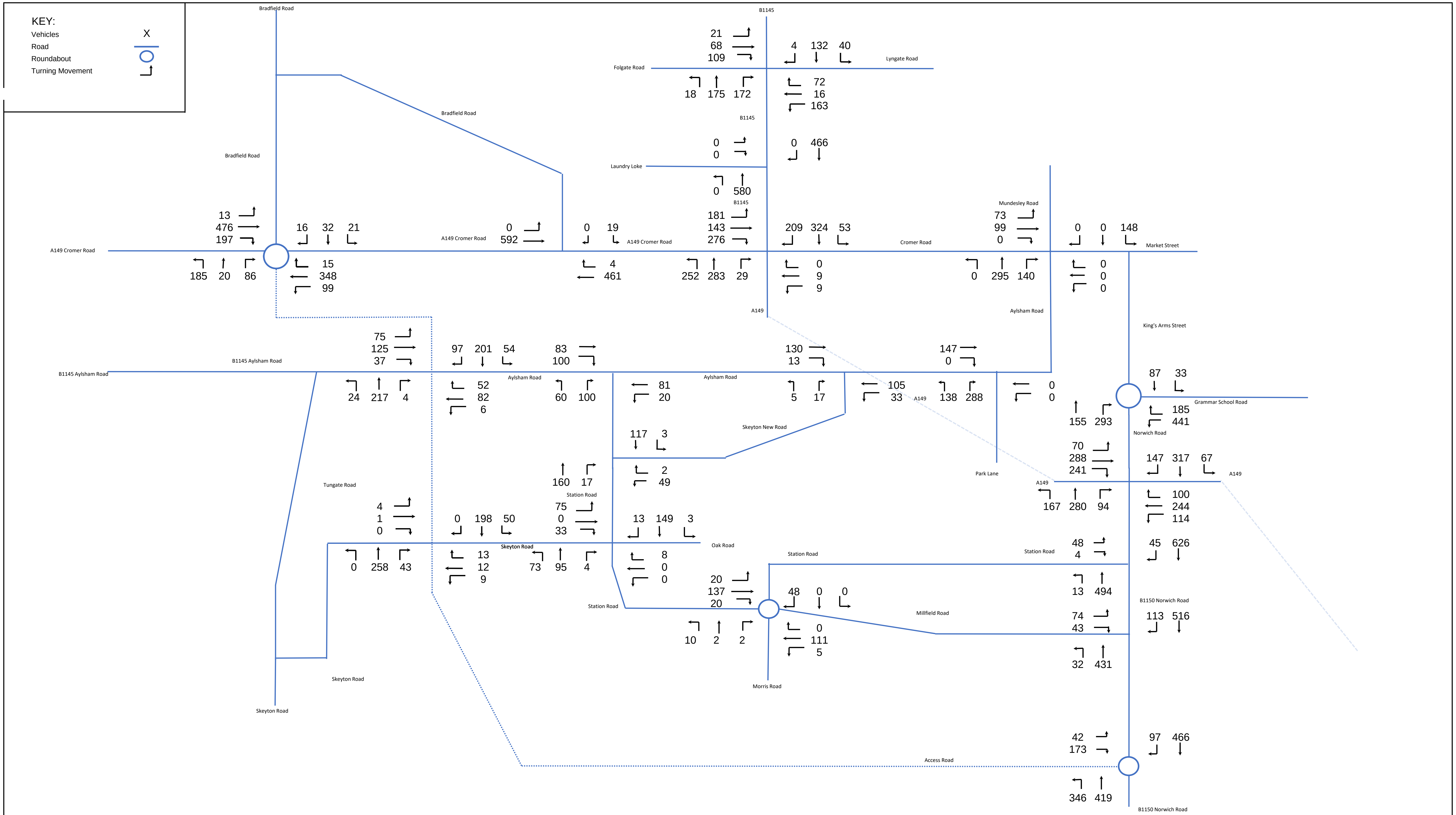
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Minimum PM Demand Flows (HGV Only)	BS	TJ	13/10/2023	16



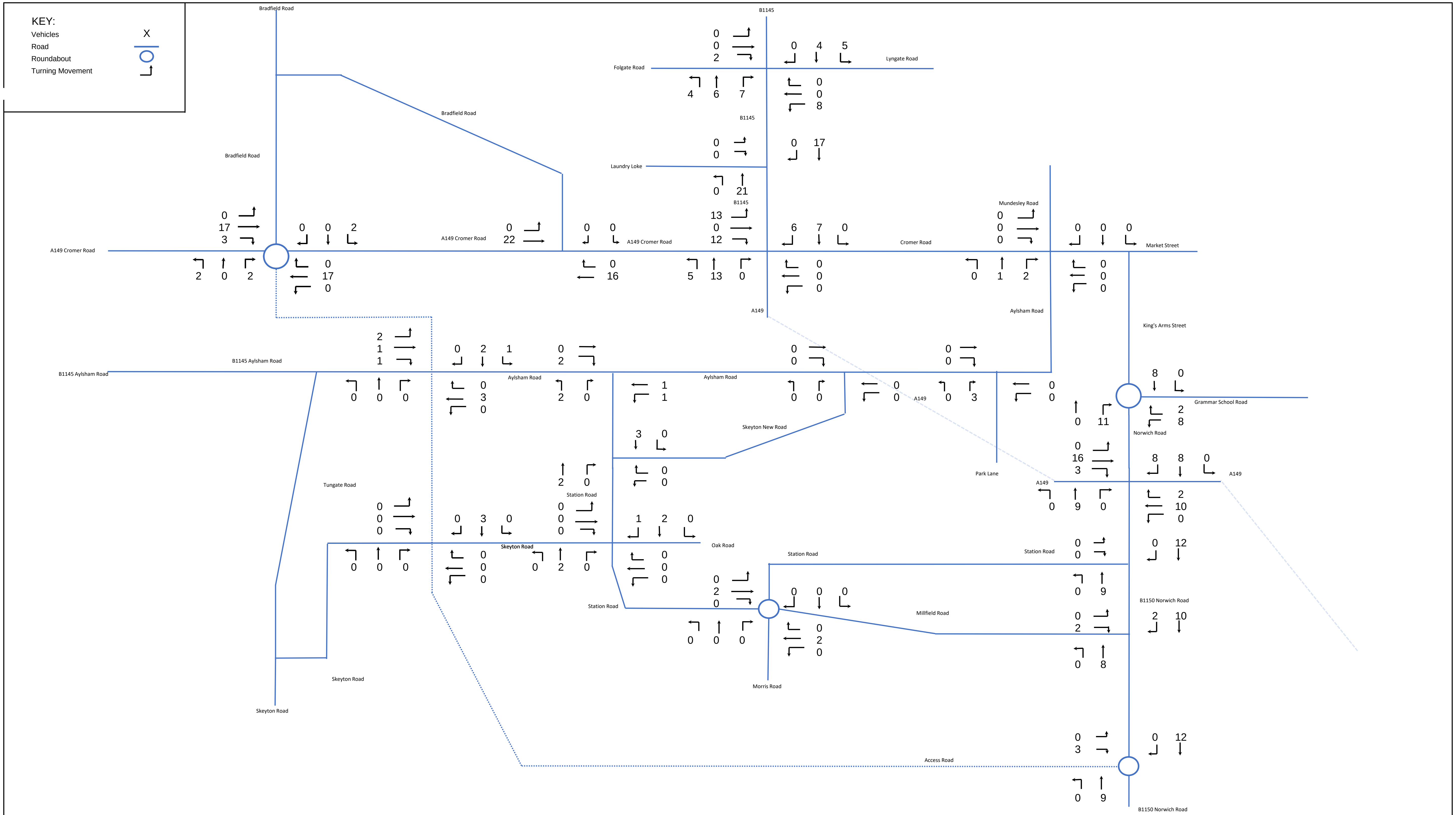
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something AM Demand Flows	BS	TJ	13/10/2023	17



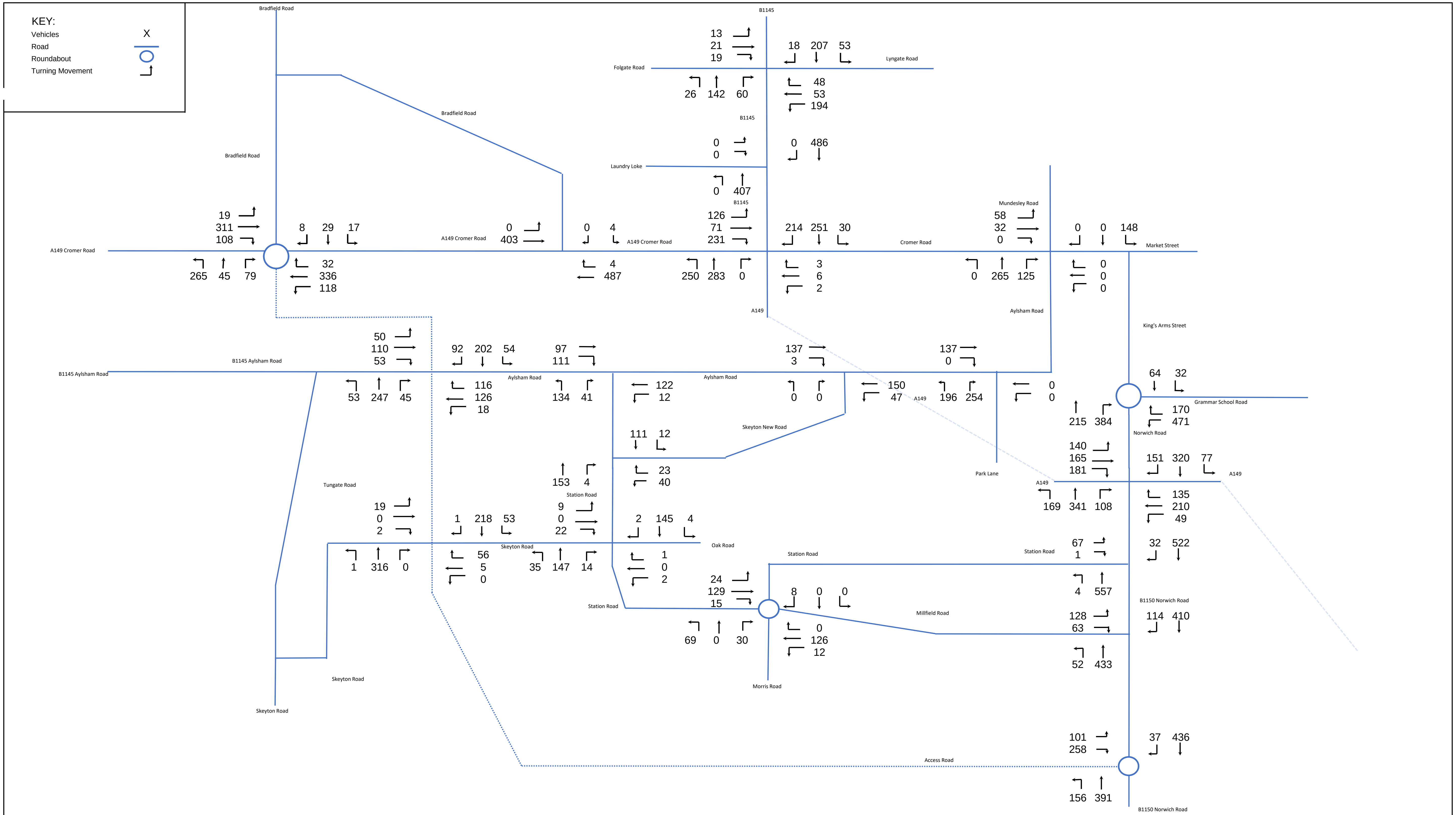
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something AM Demand Flows (HGV Only)	BS	TJ	13/10/2023	18



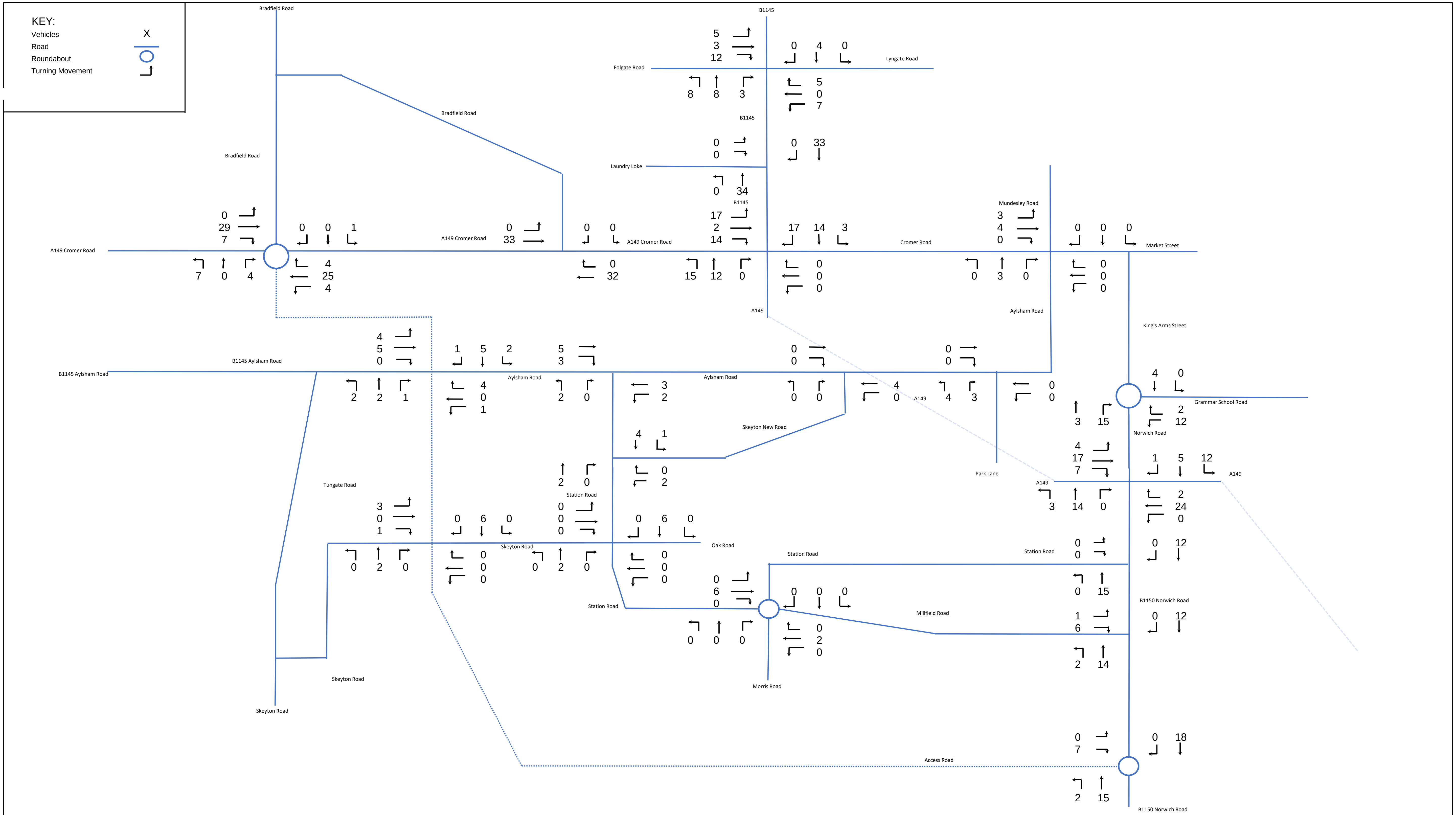
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something PM Demand Flows	BS	TJ	13/10/2023	19



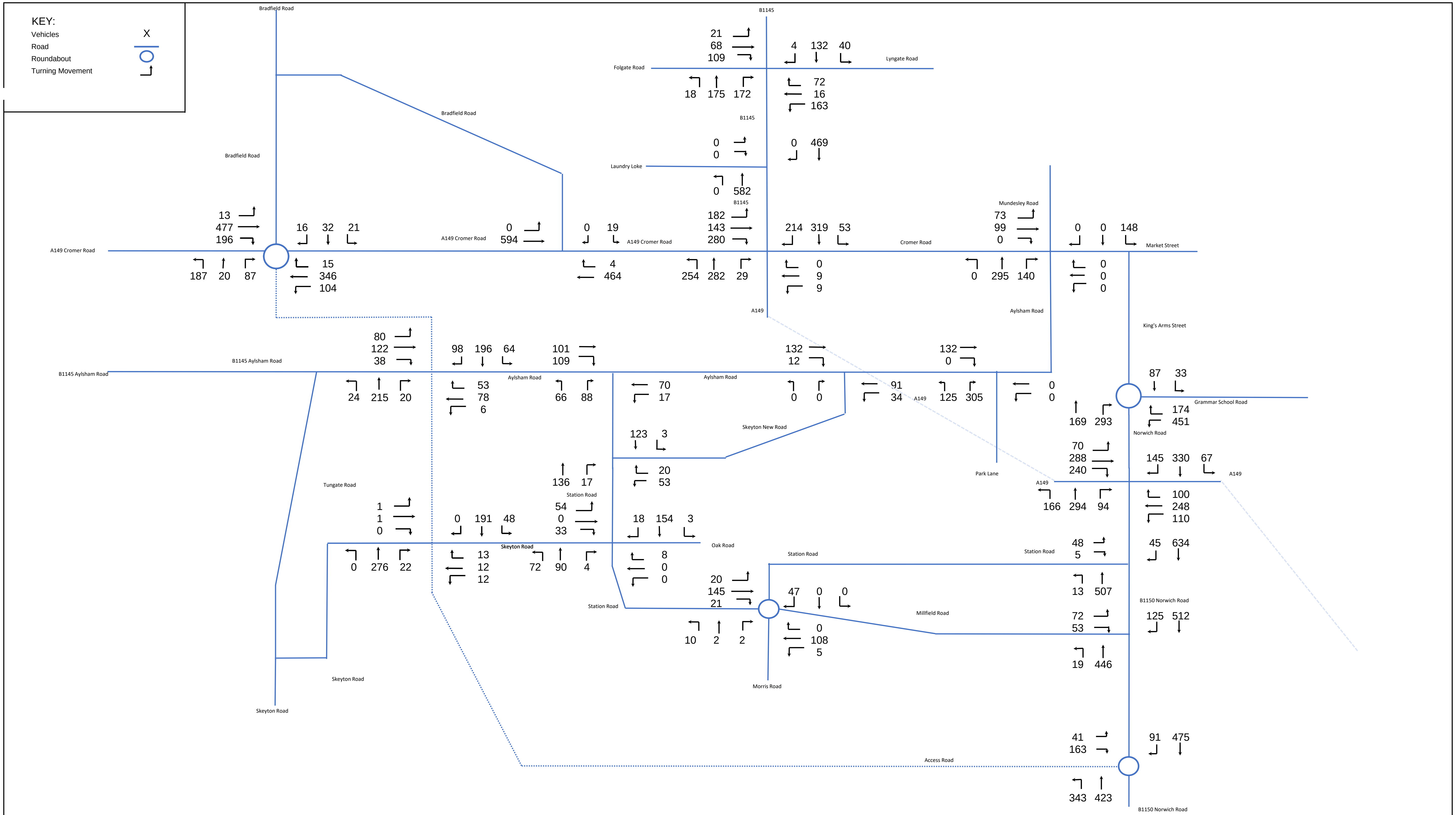
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something PM Demand Flows (HGV Only)	BS	TJ	13/10/2023	20



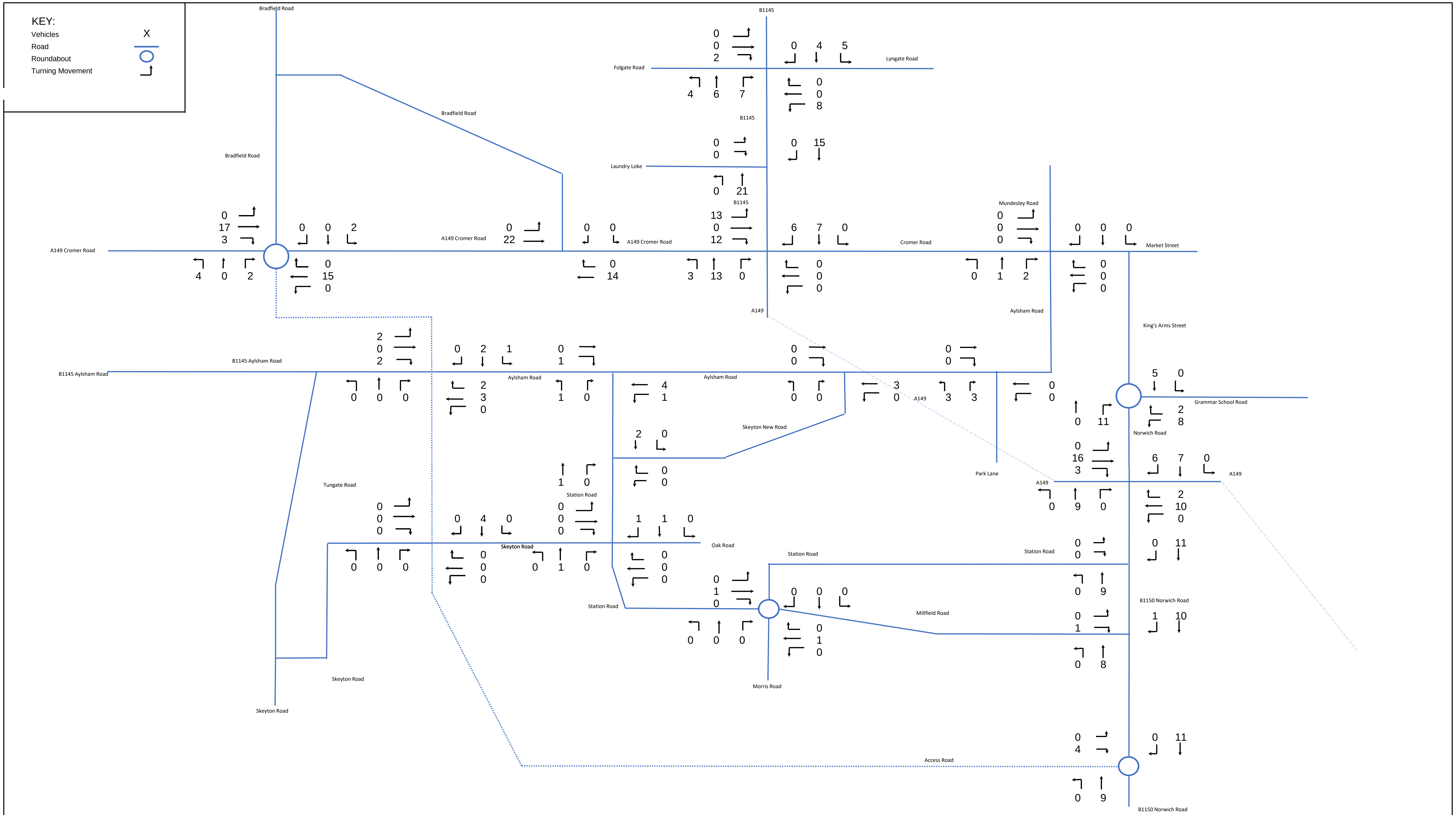
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something AM Demand Flows (Mitigation Scenario)	BS	TJ	13/10/2023	21



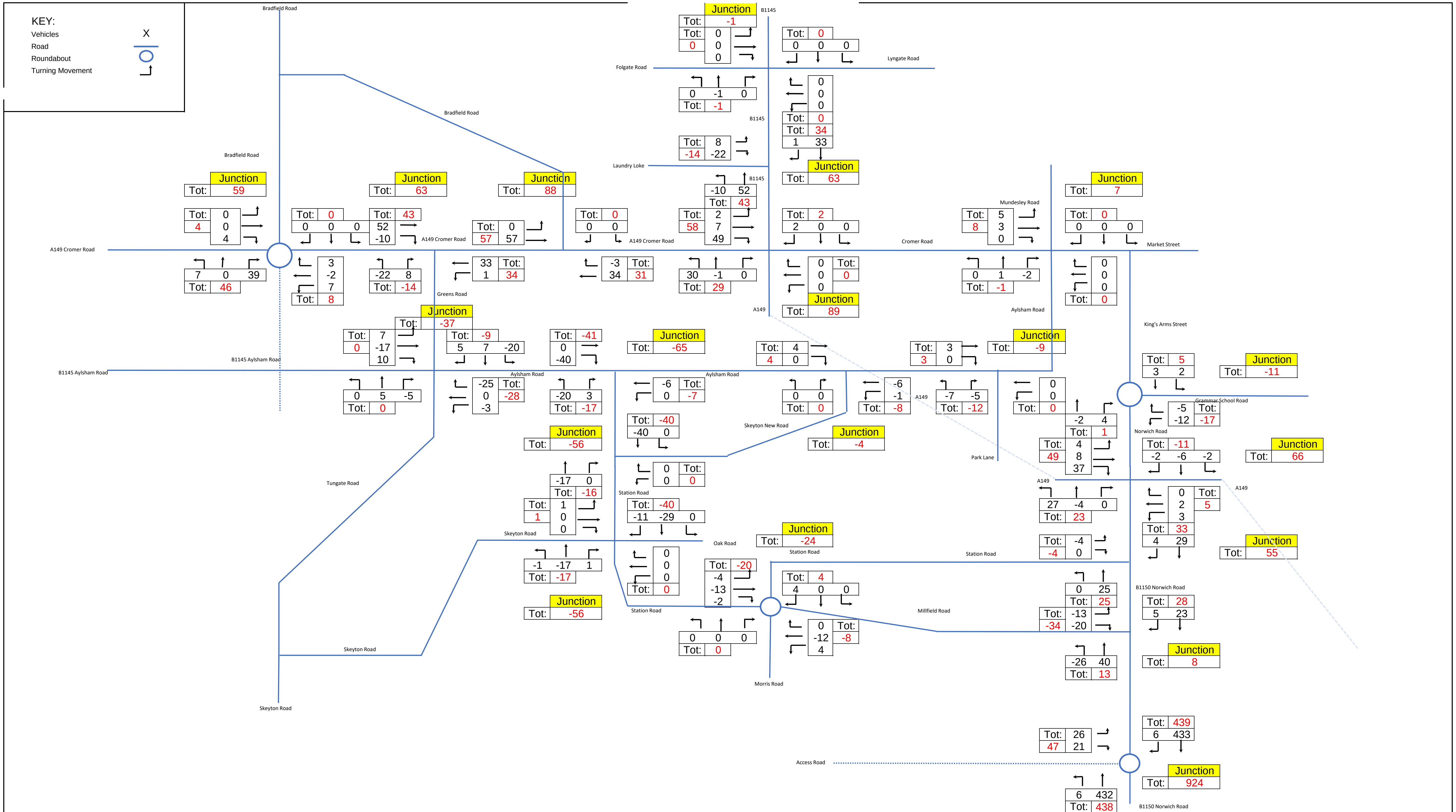
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something AM Demand Flows (Mitigation Scenario, HGV Only)	BS	TJ	13/10/2023	22



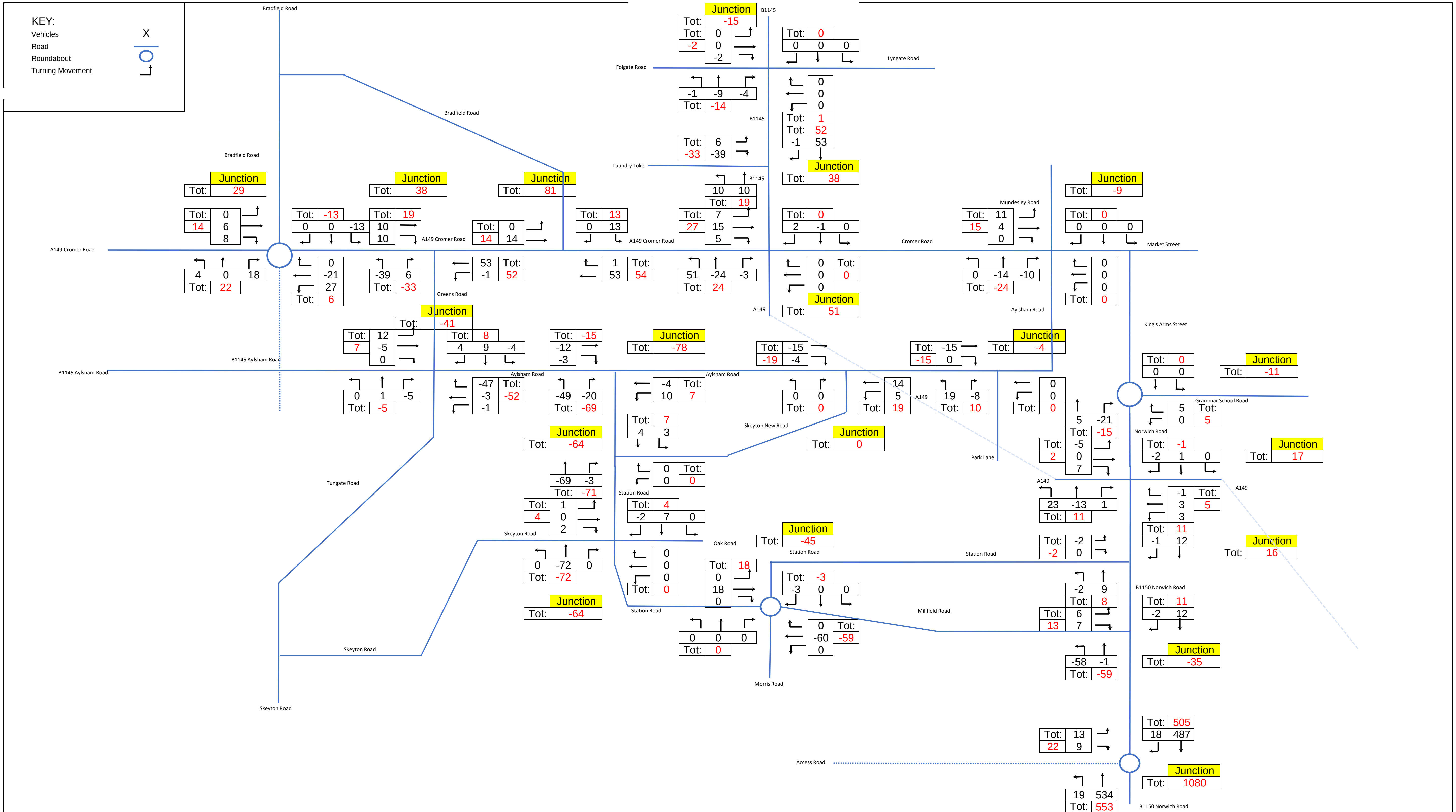
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something PM Demand Flows (Mitigation Scenario)	BS	TJ	13/10/2023	23



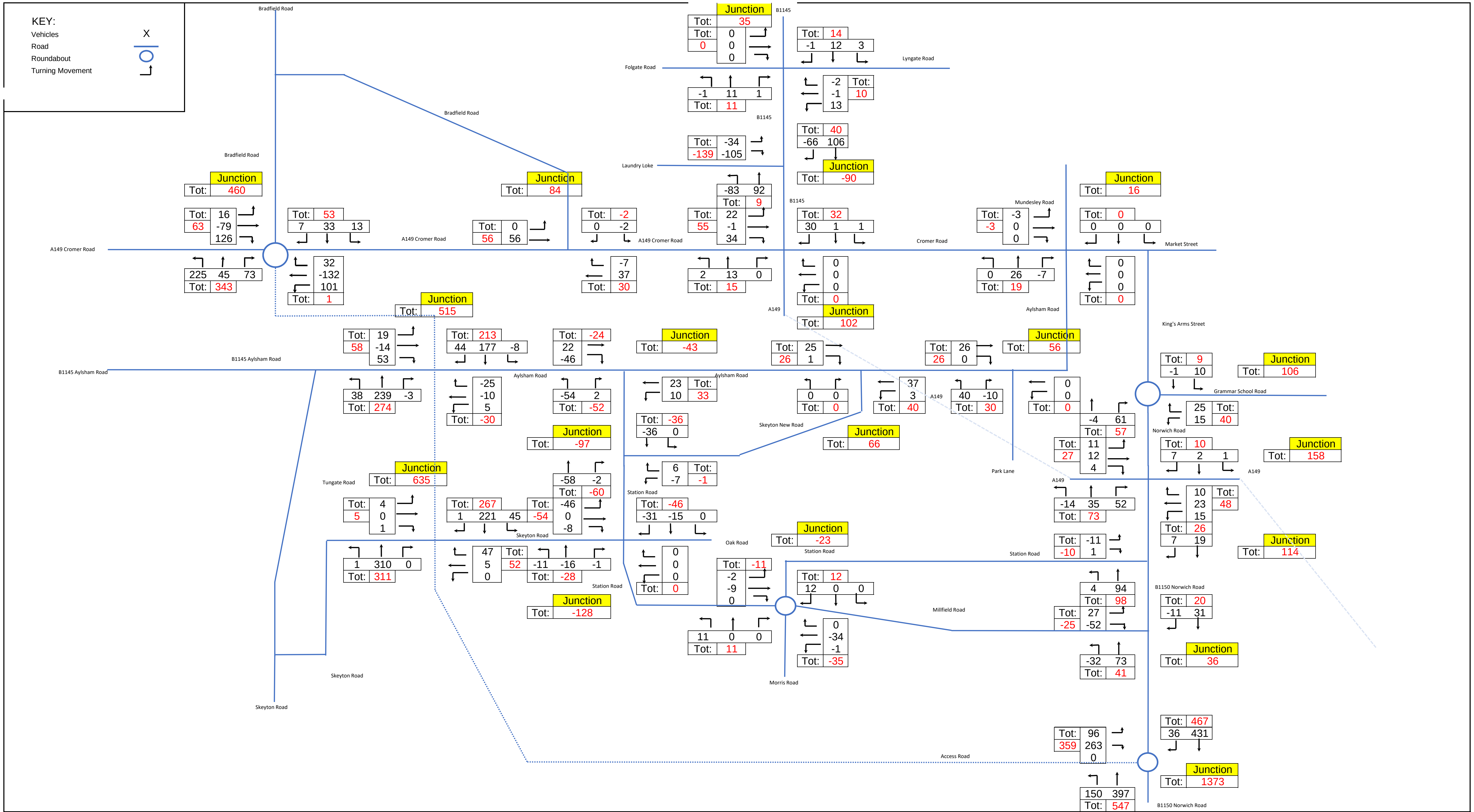
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something PM Demand Flows (Mitigation Scenario, HGV Only)	BS	TJ	13/10/2023	24



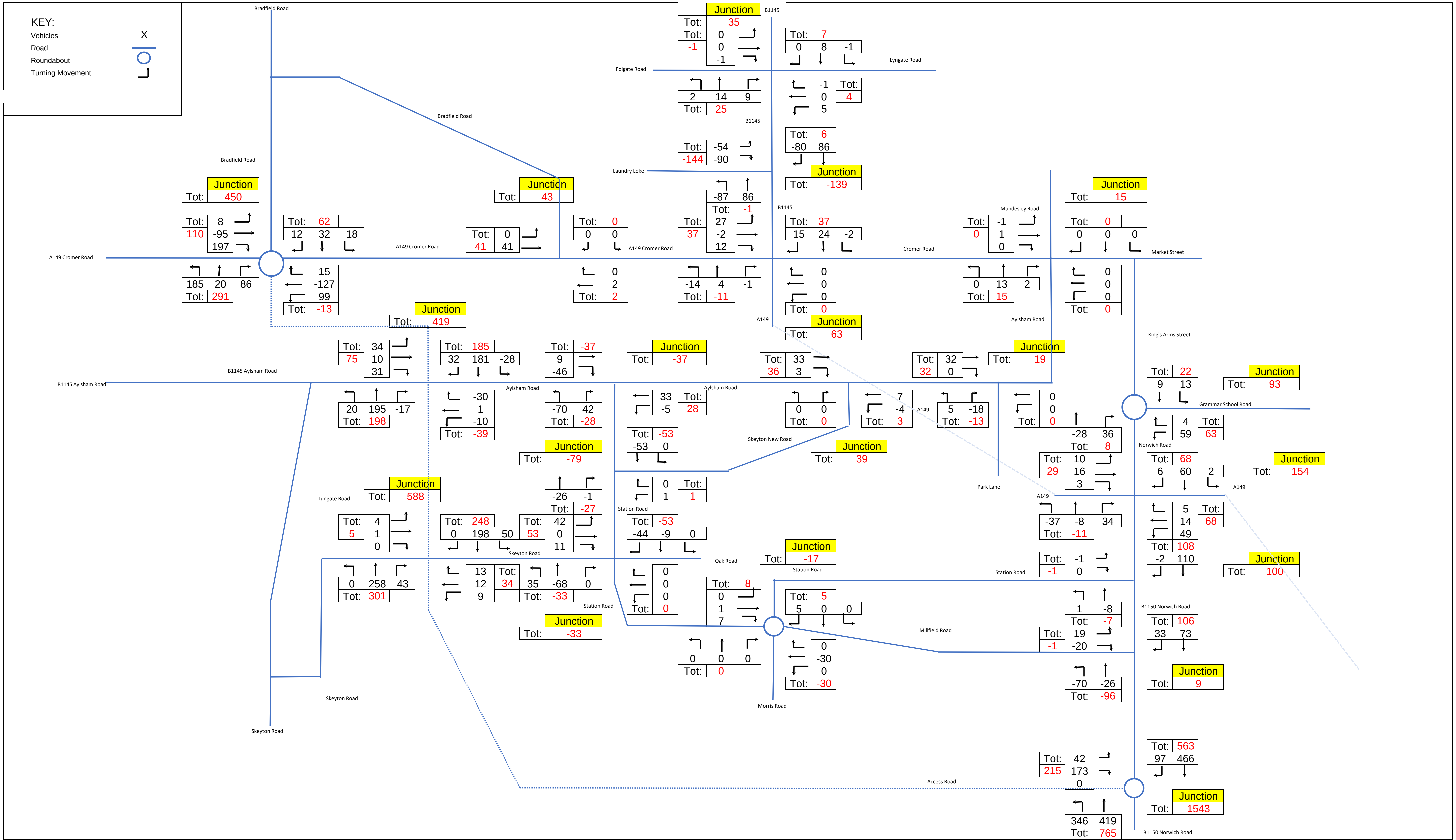
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Something Minus Do Minimum AM	BS	TJ	13/10/2023	25



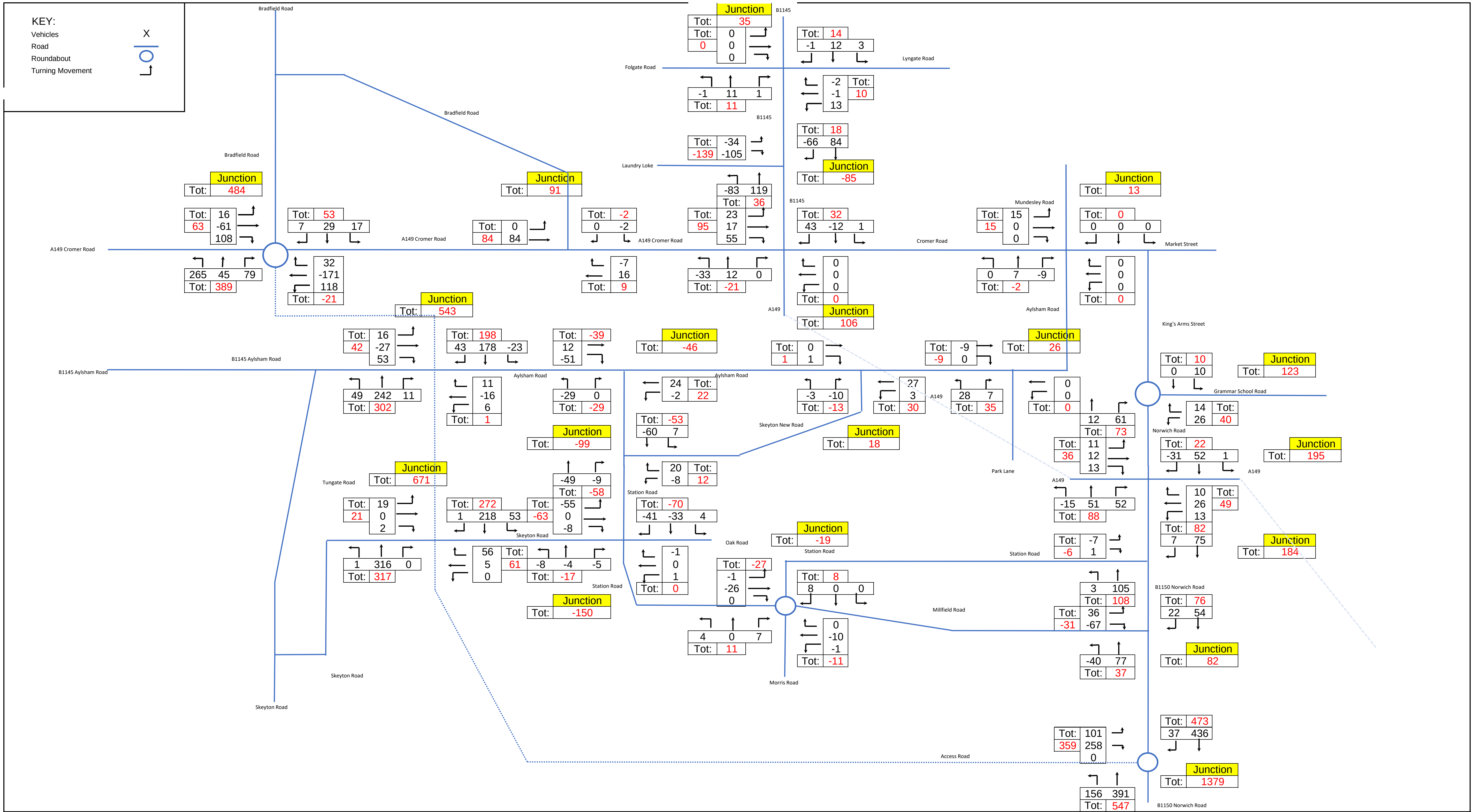
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2029 Do Something Minus Do Minimum PM	BS	TJ	13/10/2023	26



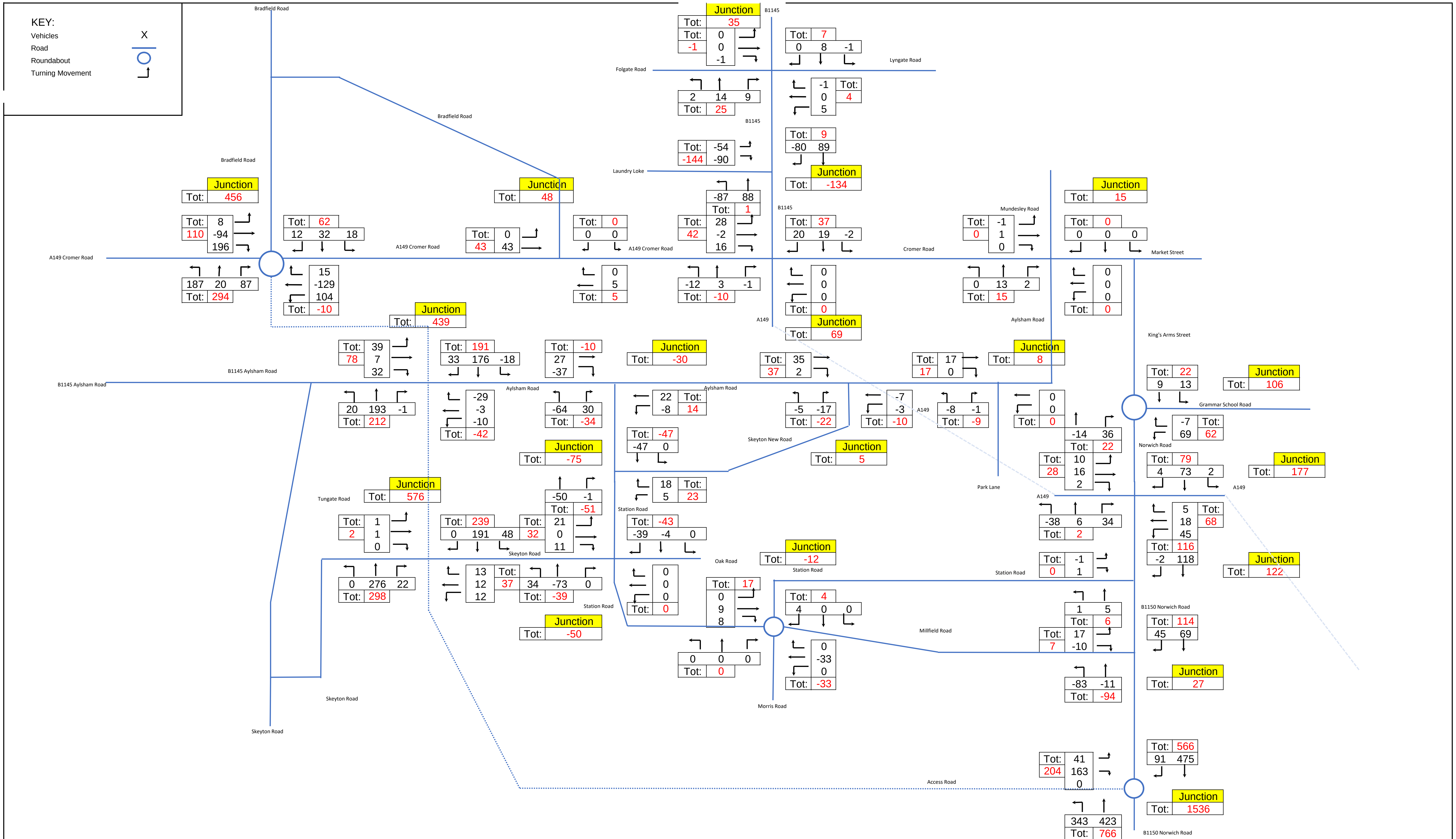
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something Minus Do Minimum AM Demand Flows	BS	TJ	13/10/2023	27



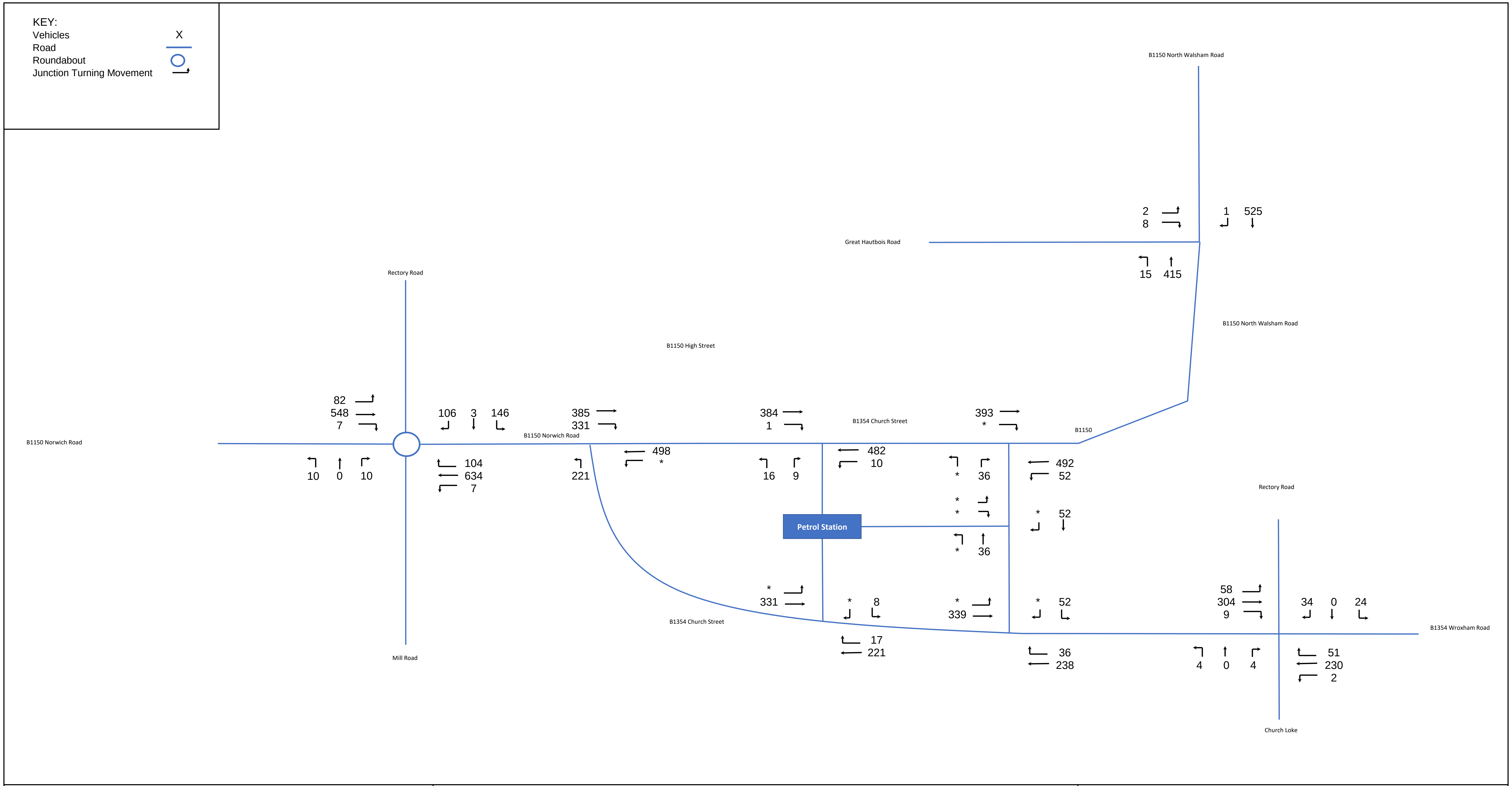
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something Minus Do Minimum PM Demand Flows	BS	TJ	13/10/2023	28



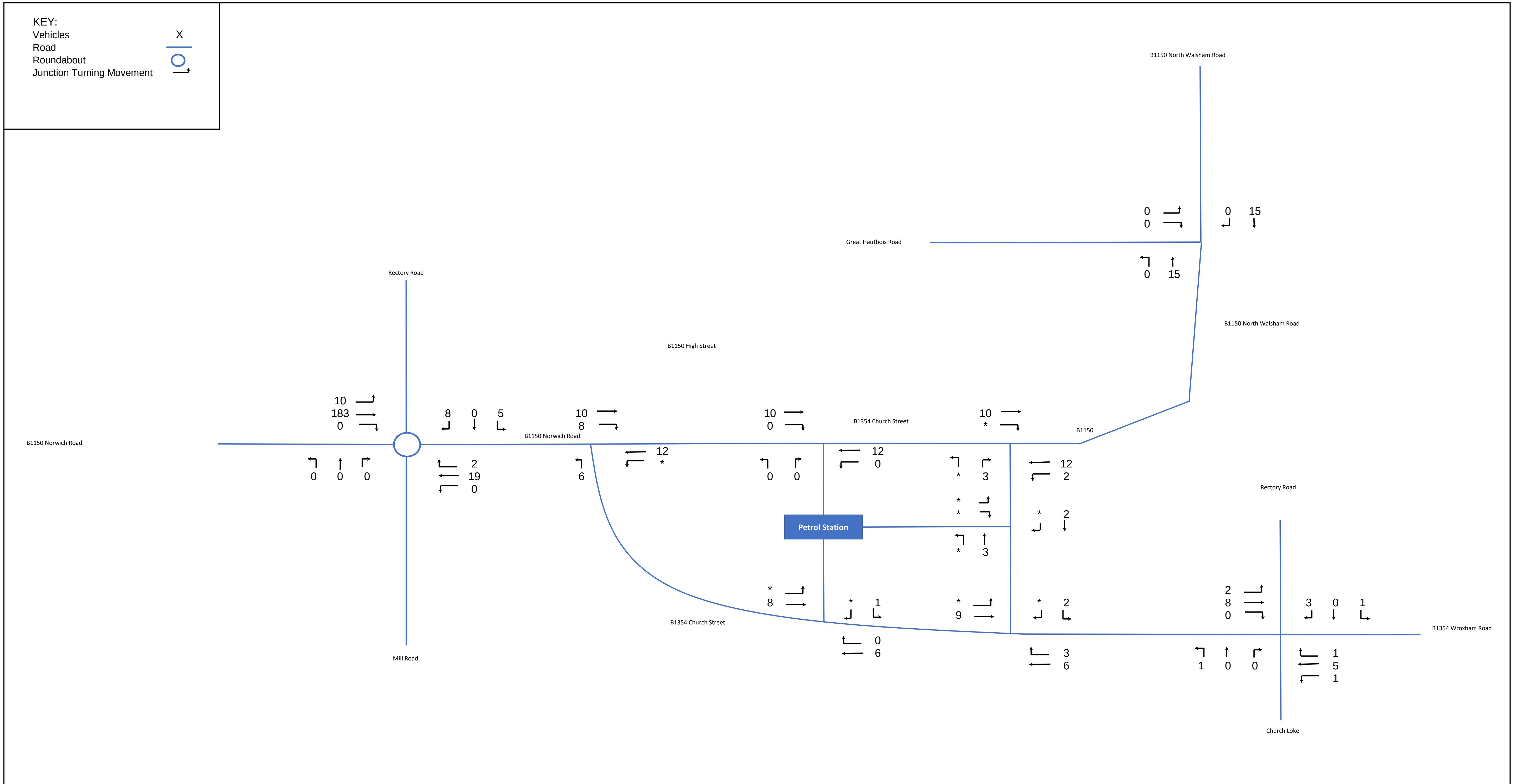
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something Minus Do Minimum AM Demand Flows (Mitigation Scenario)	BS	TJ	13/10/2023	29



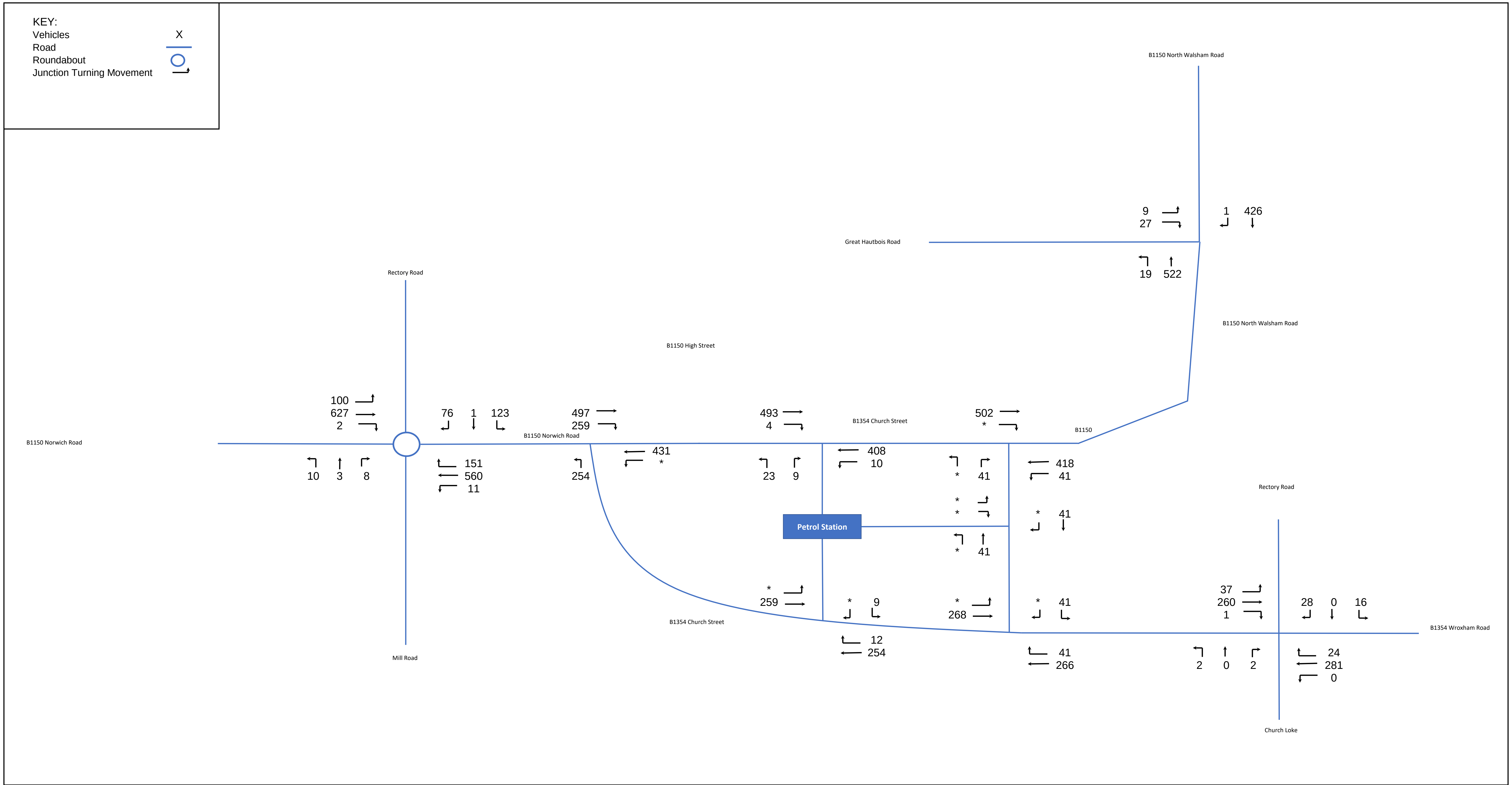
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	North Walsham 2036 Do Something Minus Do Minimum PM Demand Flows (Mitigation Scenario)	BS	TJ	13/10/2023	30



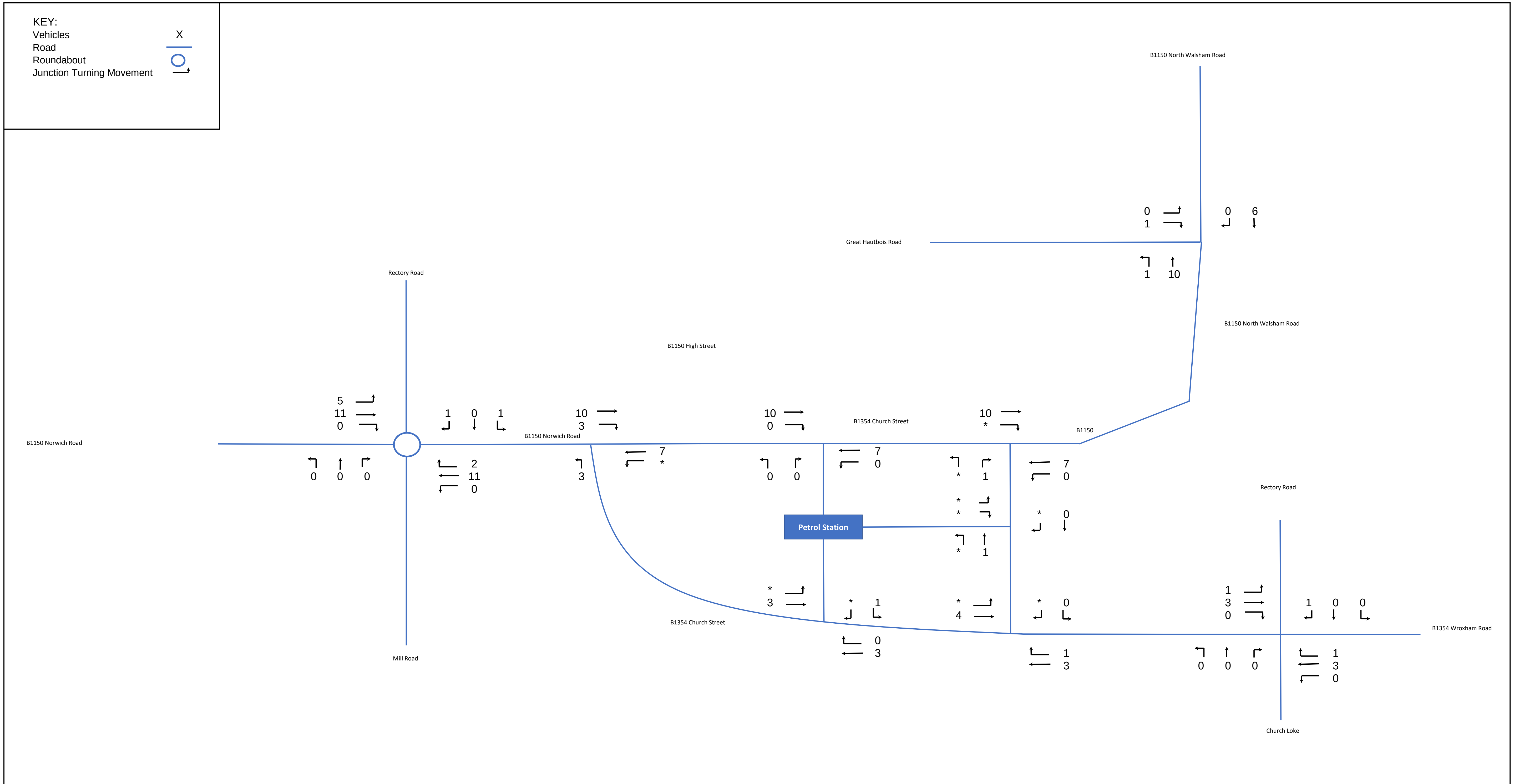
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 07:45-08:45 PM PEAK HOUR: 16:30-17:30	All movements from the petrol station have been captured but it is unknown where the exit and entry points from the different arms are		
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2022 Base AM	BS	TJ	13/10/2023	31



Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 07:45-08:45 PM PEAK HOUR: 16:30-17:30	All movements from the petrol station have been captured but it is unknown where the exit and entry points from the different arms are		
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2022 Base AM HGV	BS	TJ	13/10/2023	32

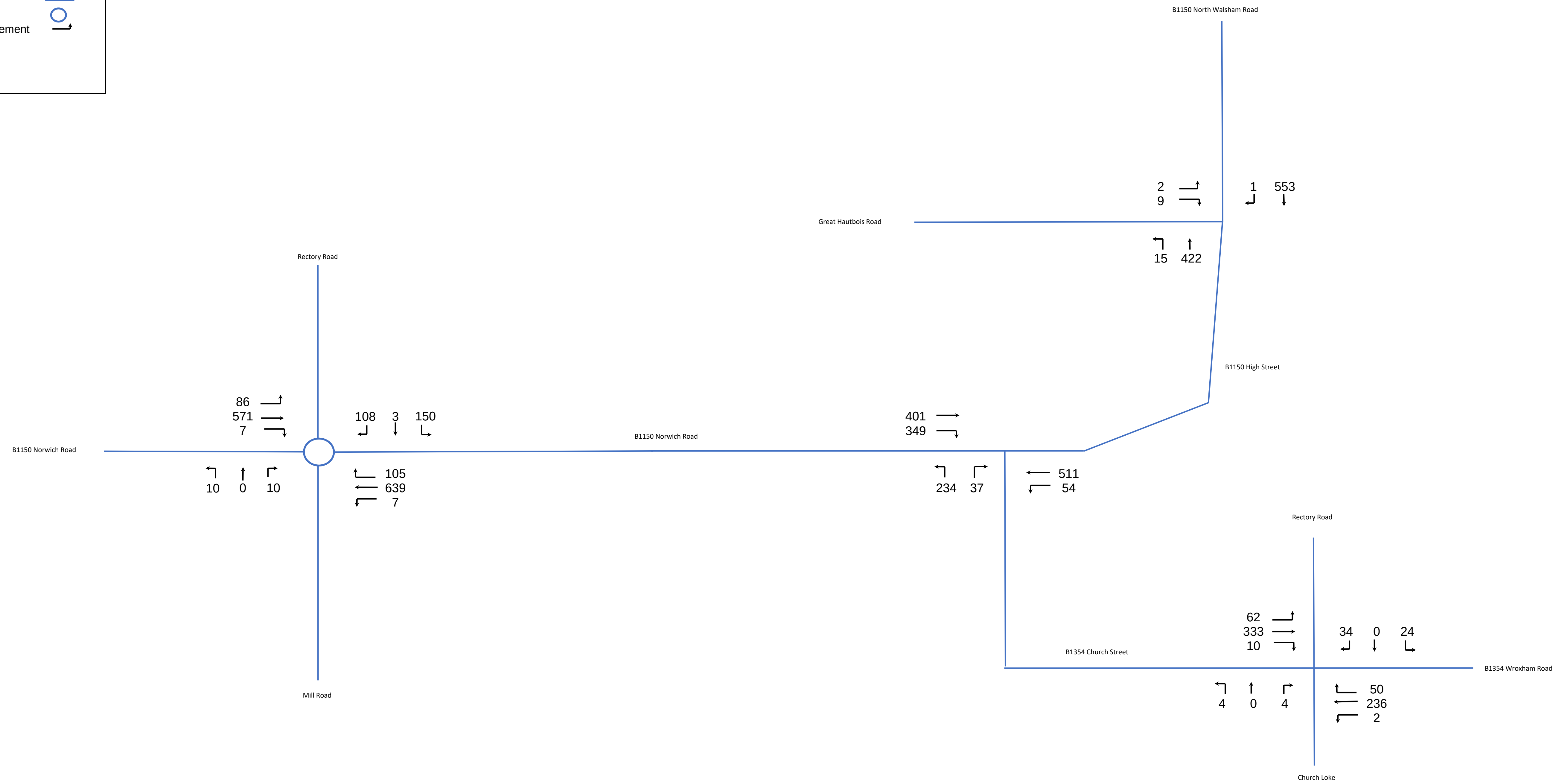


Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 07:45-08:45 PM PEAK HOUR: 16:30-17:30	All movements from the petrol station have been captured but it is unknown where the exit and entry points from the different arms are		
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2022 Base PM	BS	TJ	13/10/2023	33



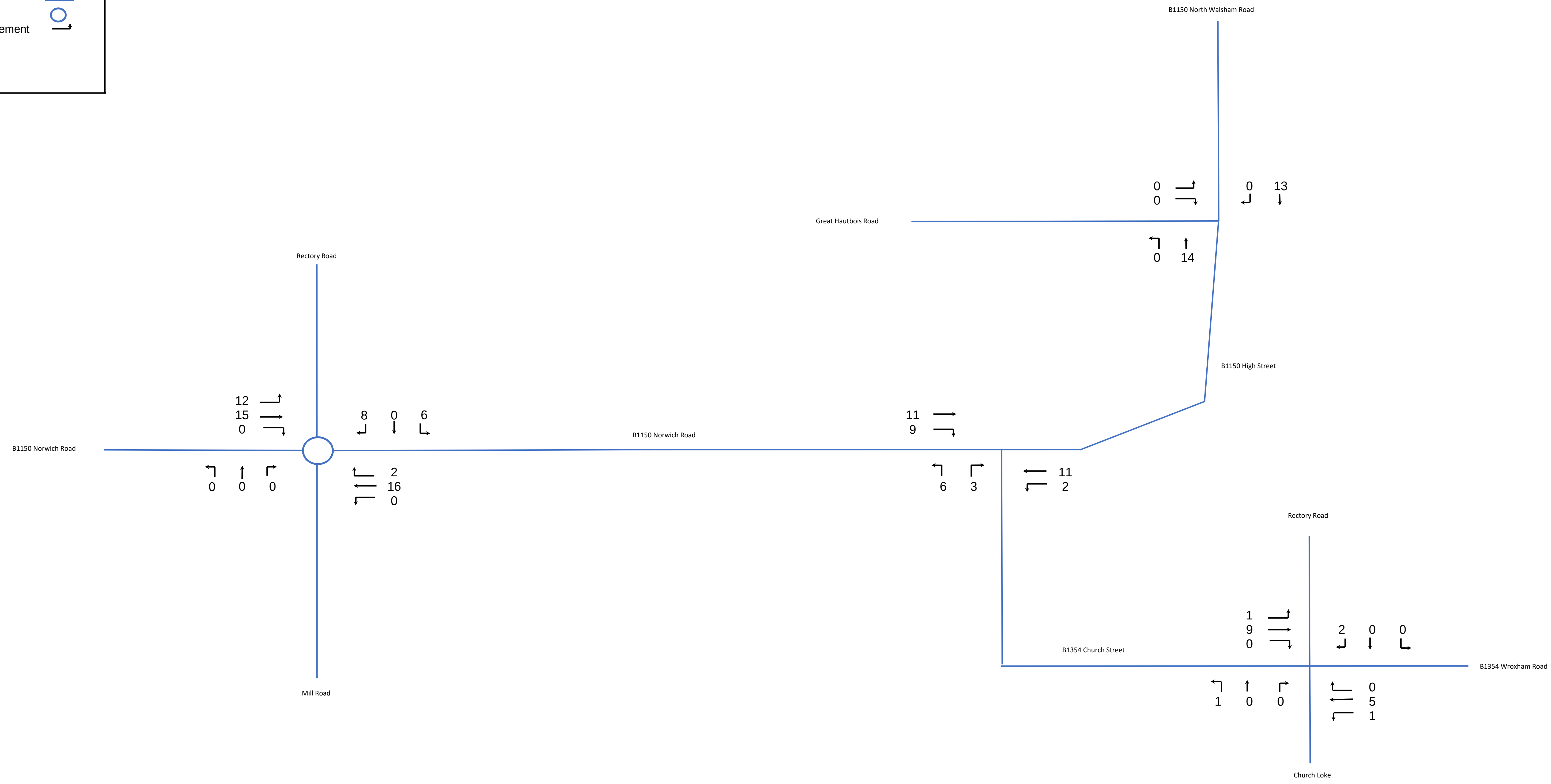
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM	AM PEAK HOUR 07:45-08:45 PM PEAK HOUR: 16:30-17:30	All movements from the petrol station have been captured but it is unknown where the exit and entry points from the different arms are		
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2022 Base PM HGV	BS	TJ	13/10/2023	34

KEY:
Vehicles X
Road
Roundabout
Junction Turning Movement



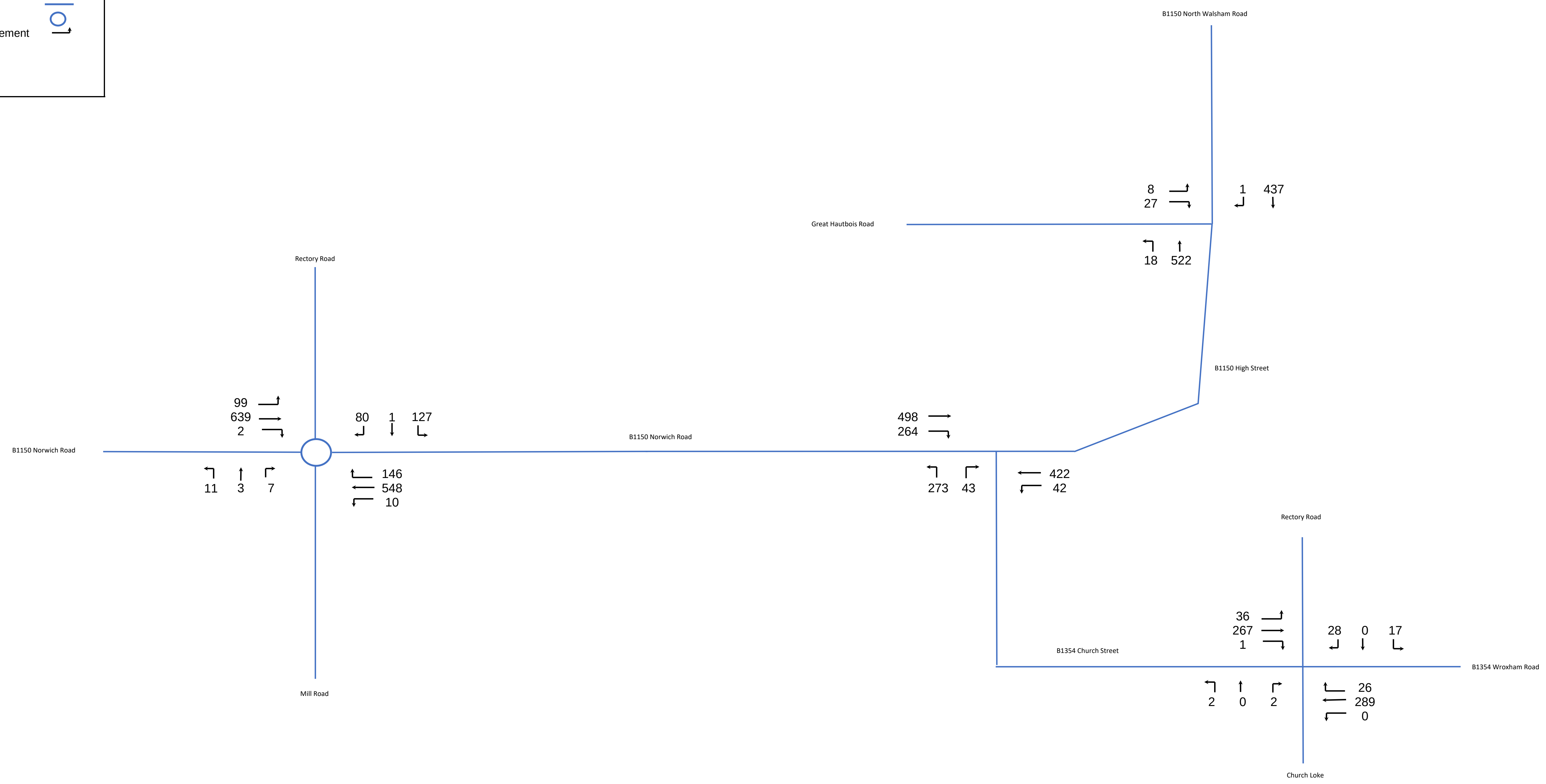
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Minimum AM	WG	TJ	13/10/2023	35

KEY:
Vehicles X
Road
Roundabout
Junction Turning Movement

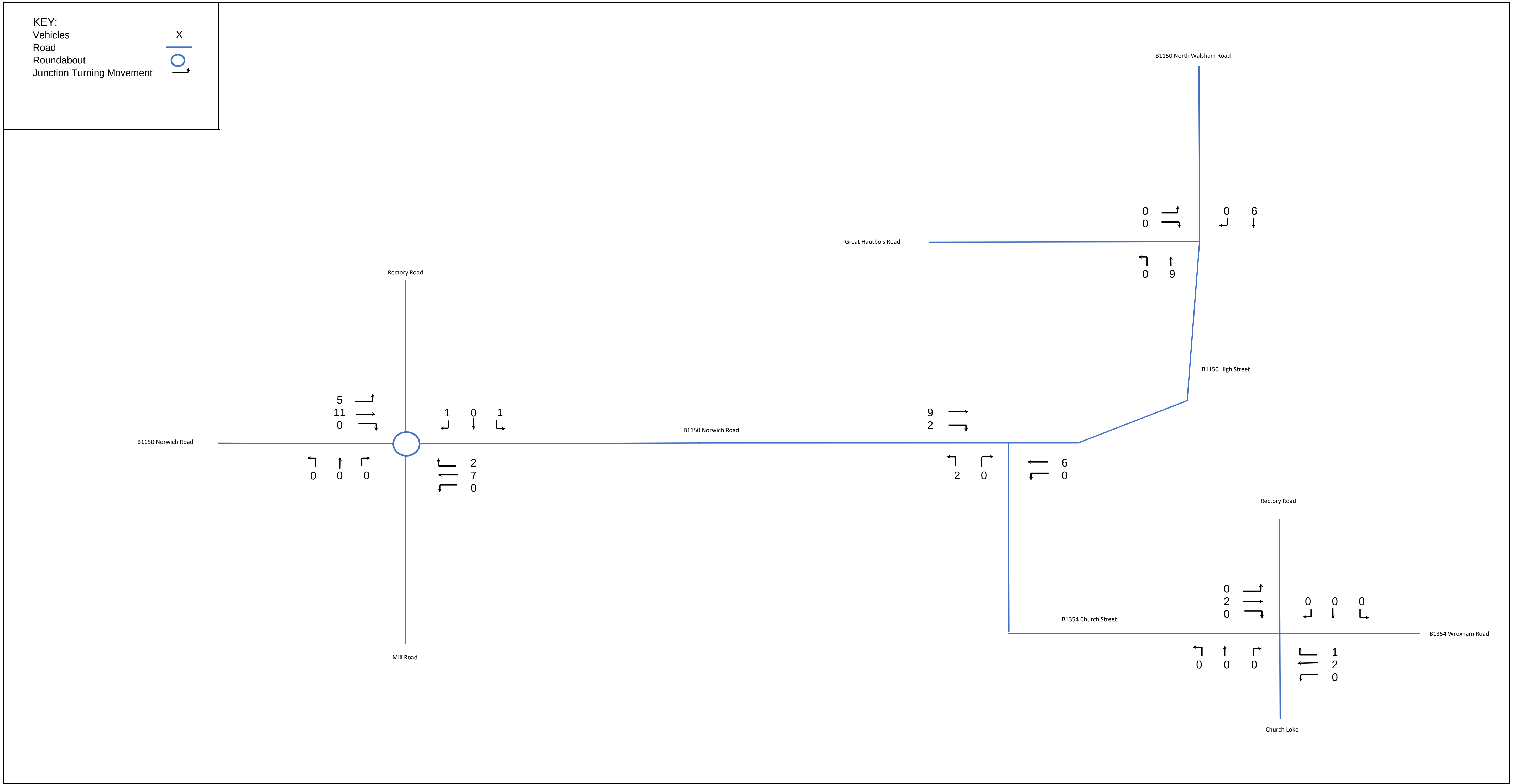


Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Minimum AM (HGV Only)	WG	TJ	13/10/2023	36

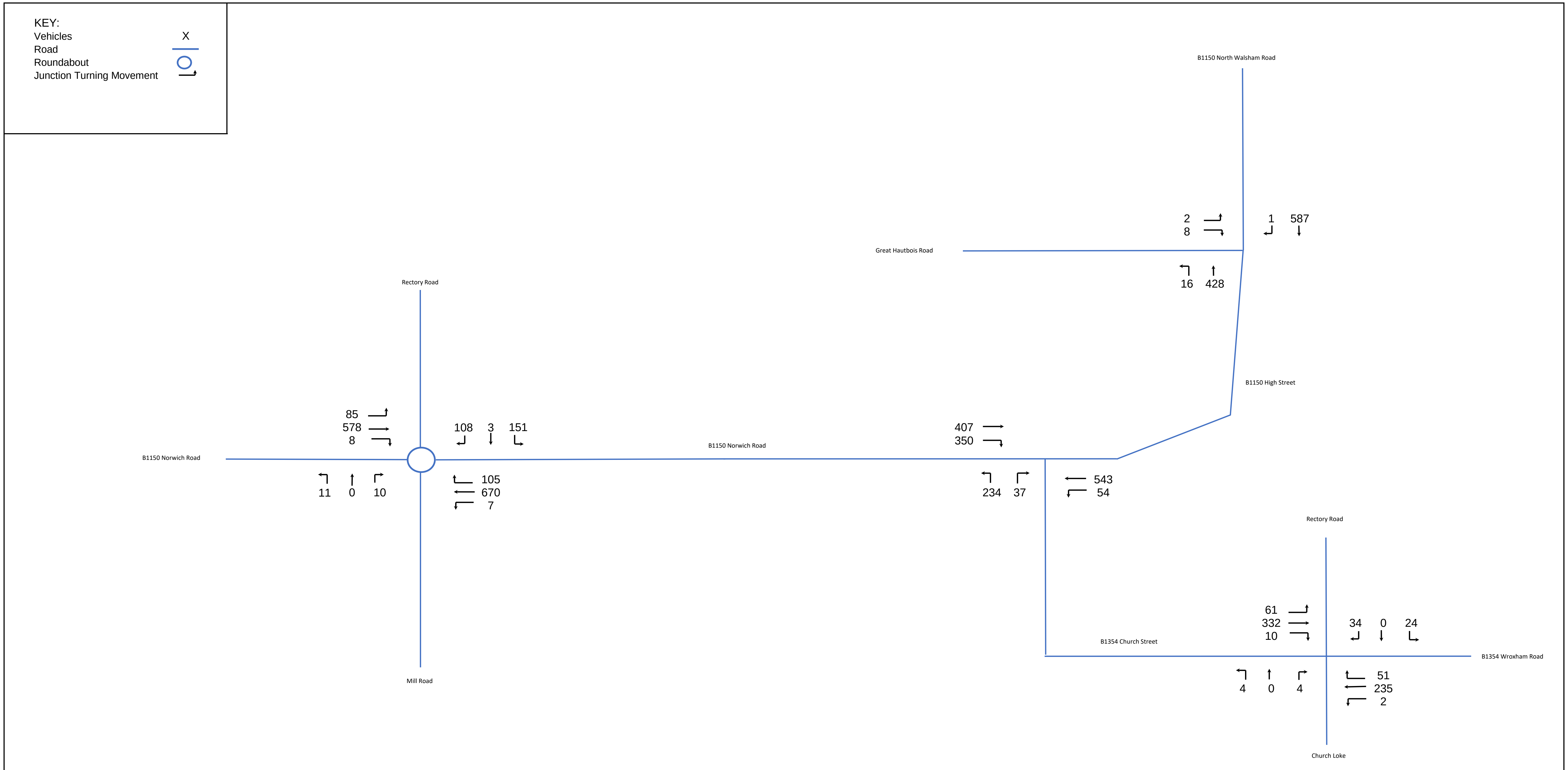
KEY:
Vehicles X
Road
Roundabout
Junction Turning Movement



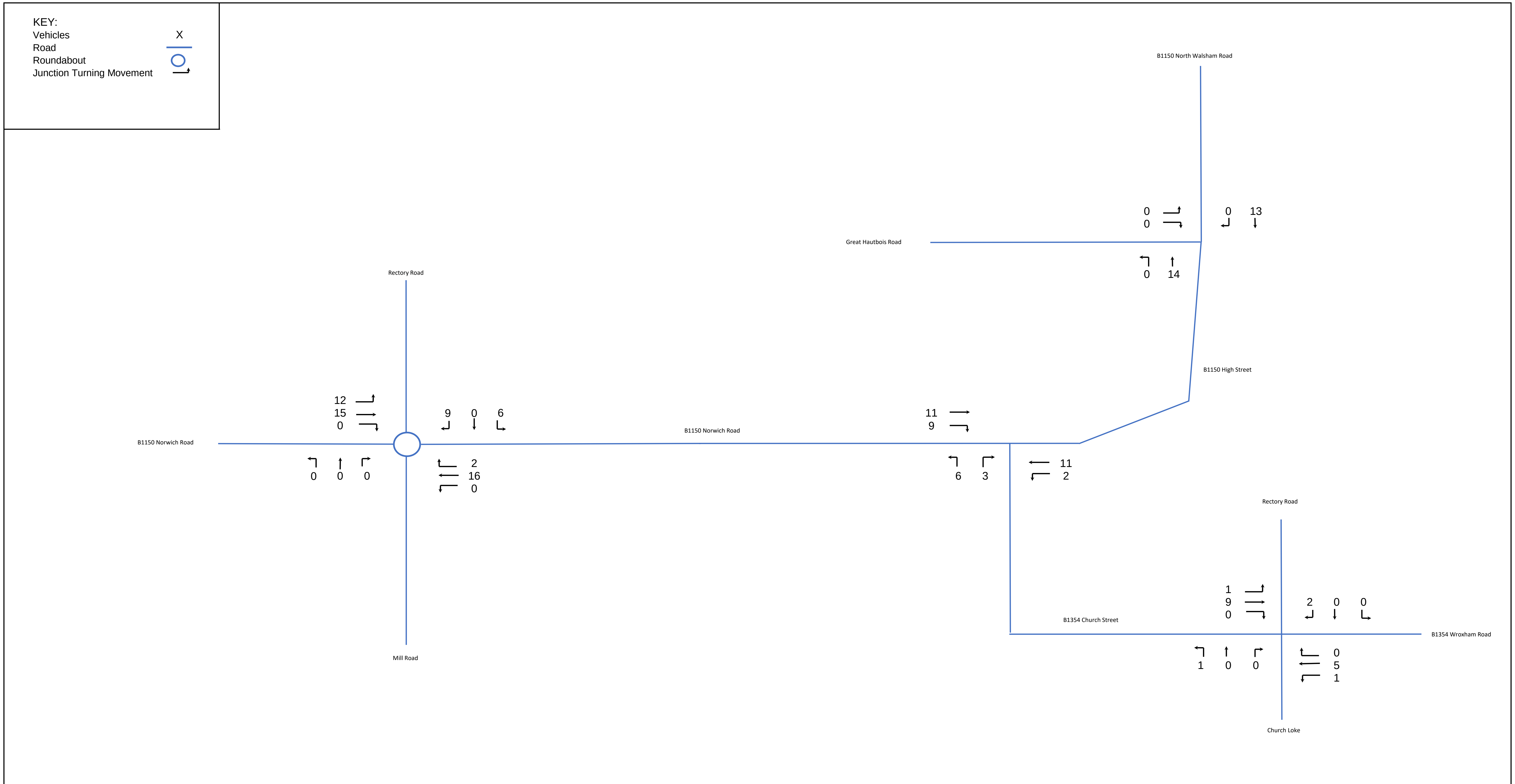
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Minimum PM	WG	TJ	13/10/2023	37



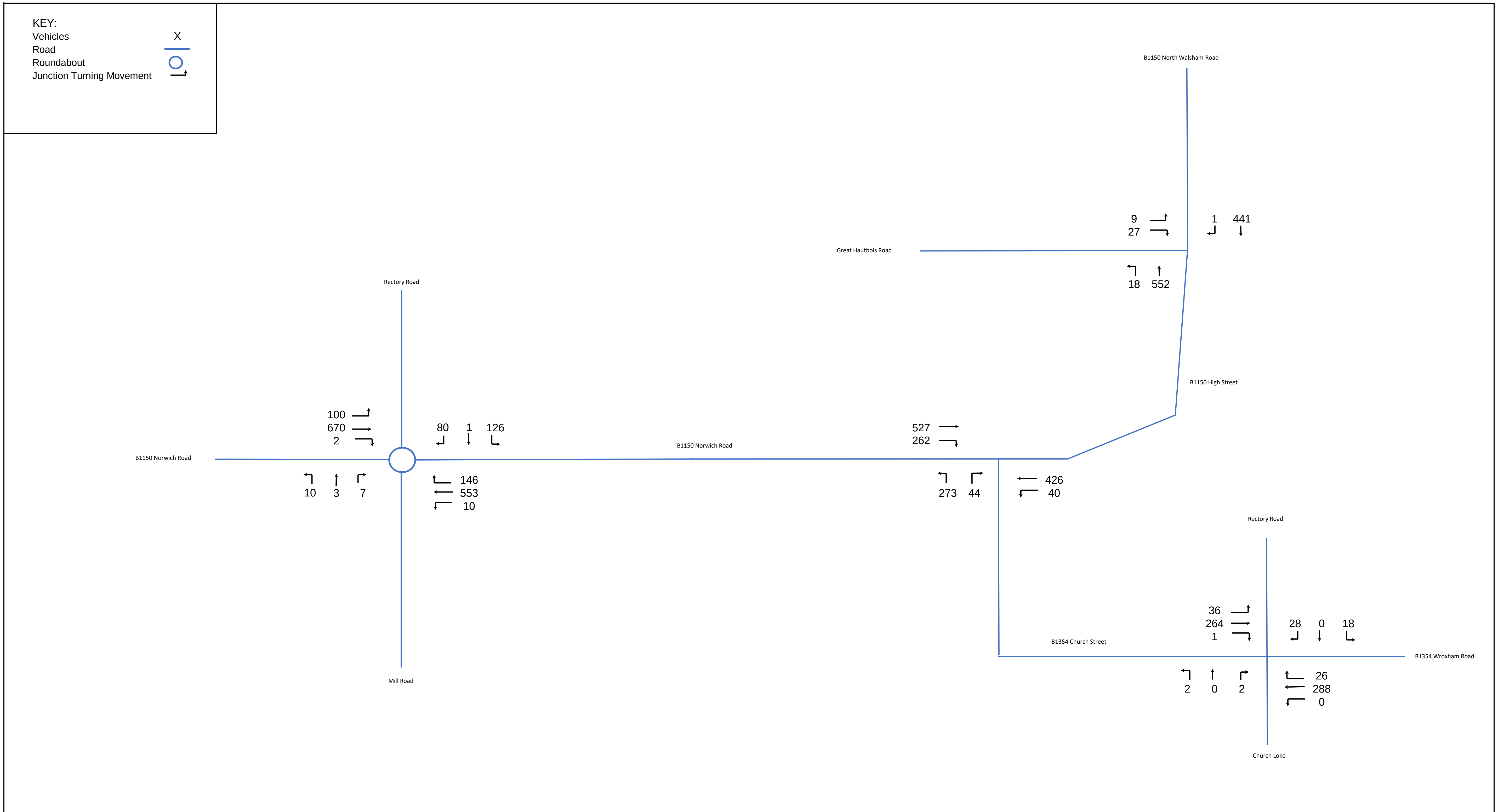
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Minimum PM (HGV Only)	WG	TJ	13/10/2023	38



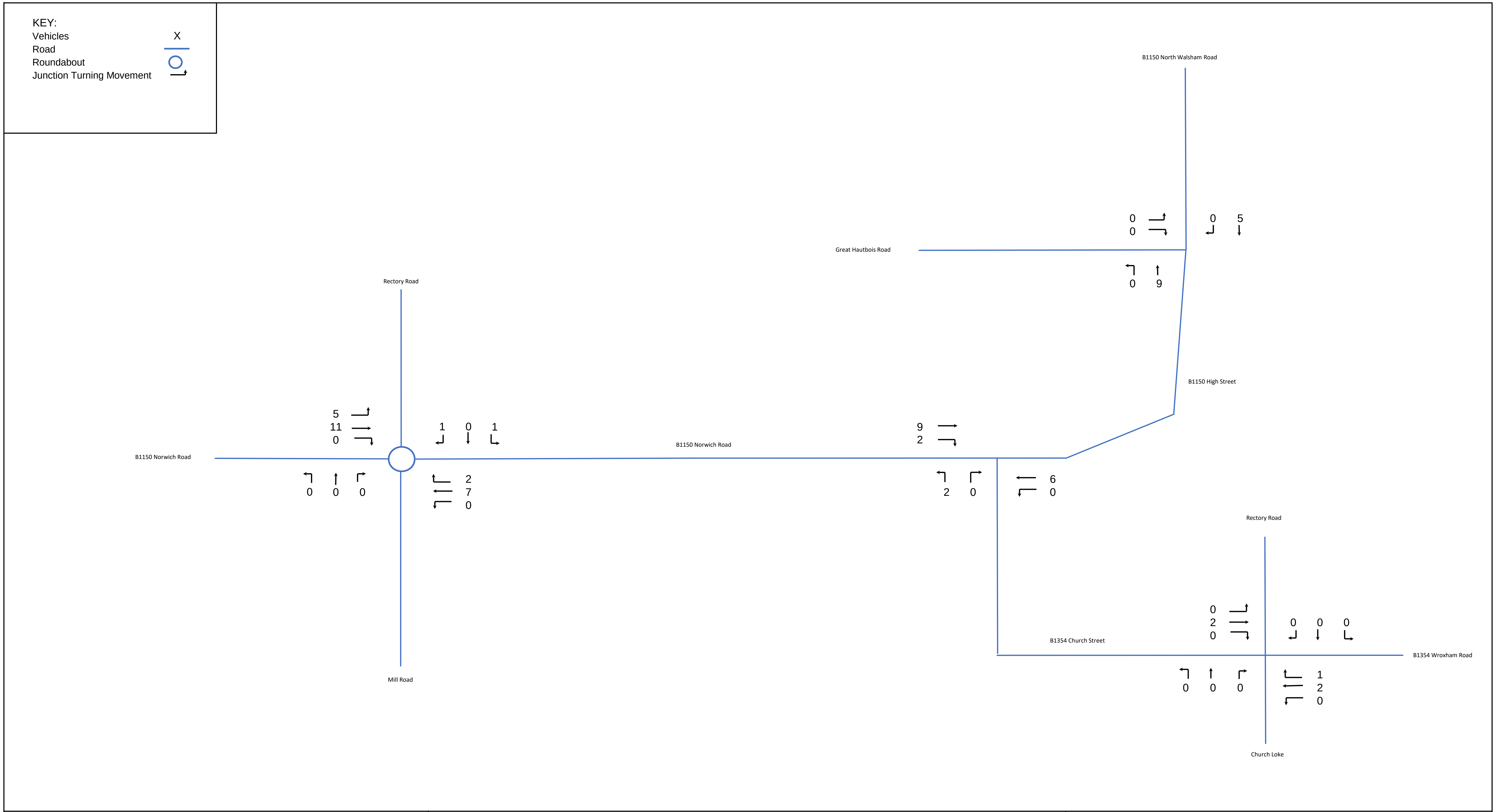
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Something AM	WG	TJ	13/10/2023	39



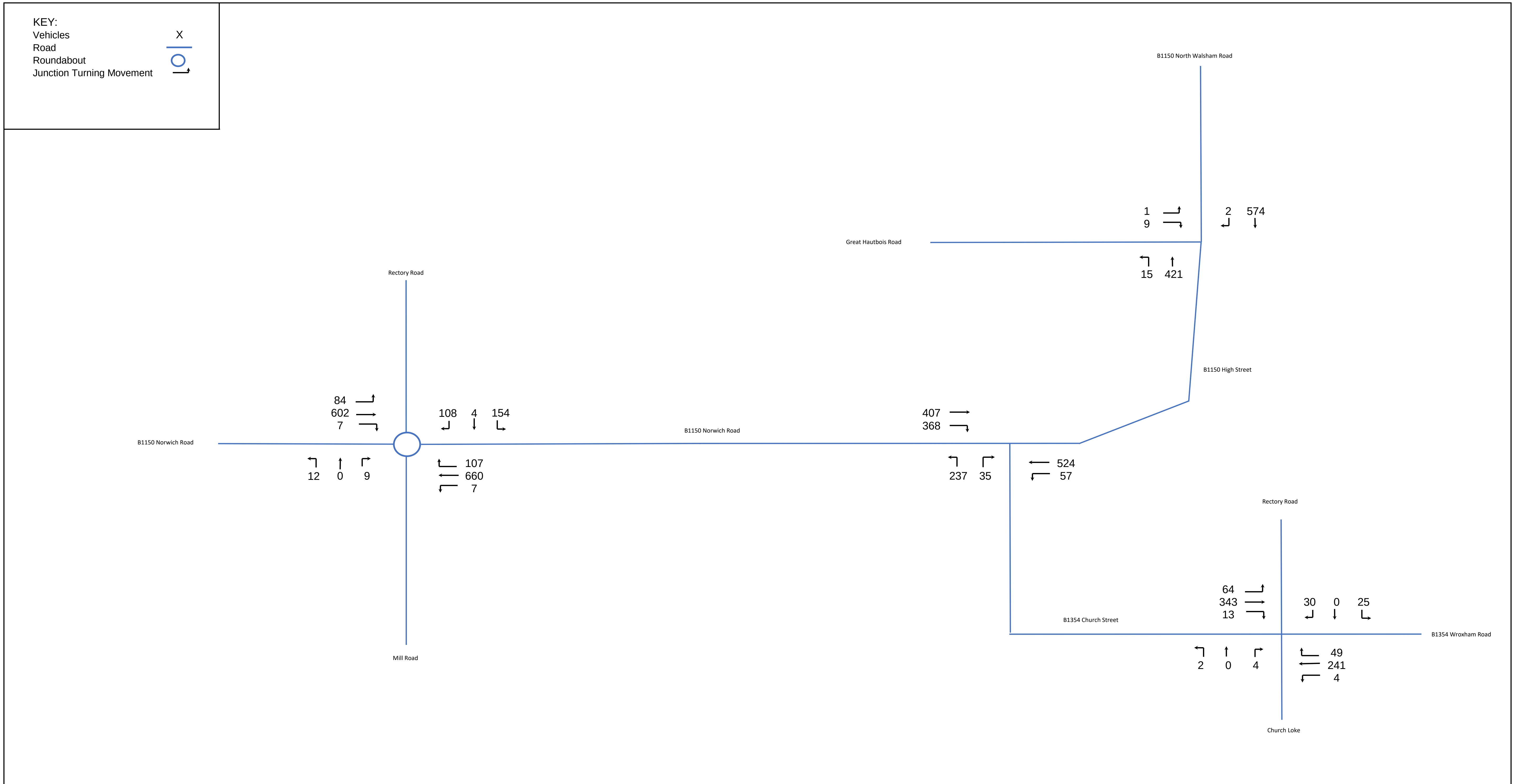
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Something AM (HGV Only)	WG	TJ	13/10/2023	40



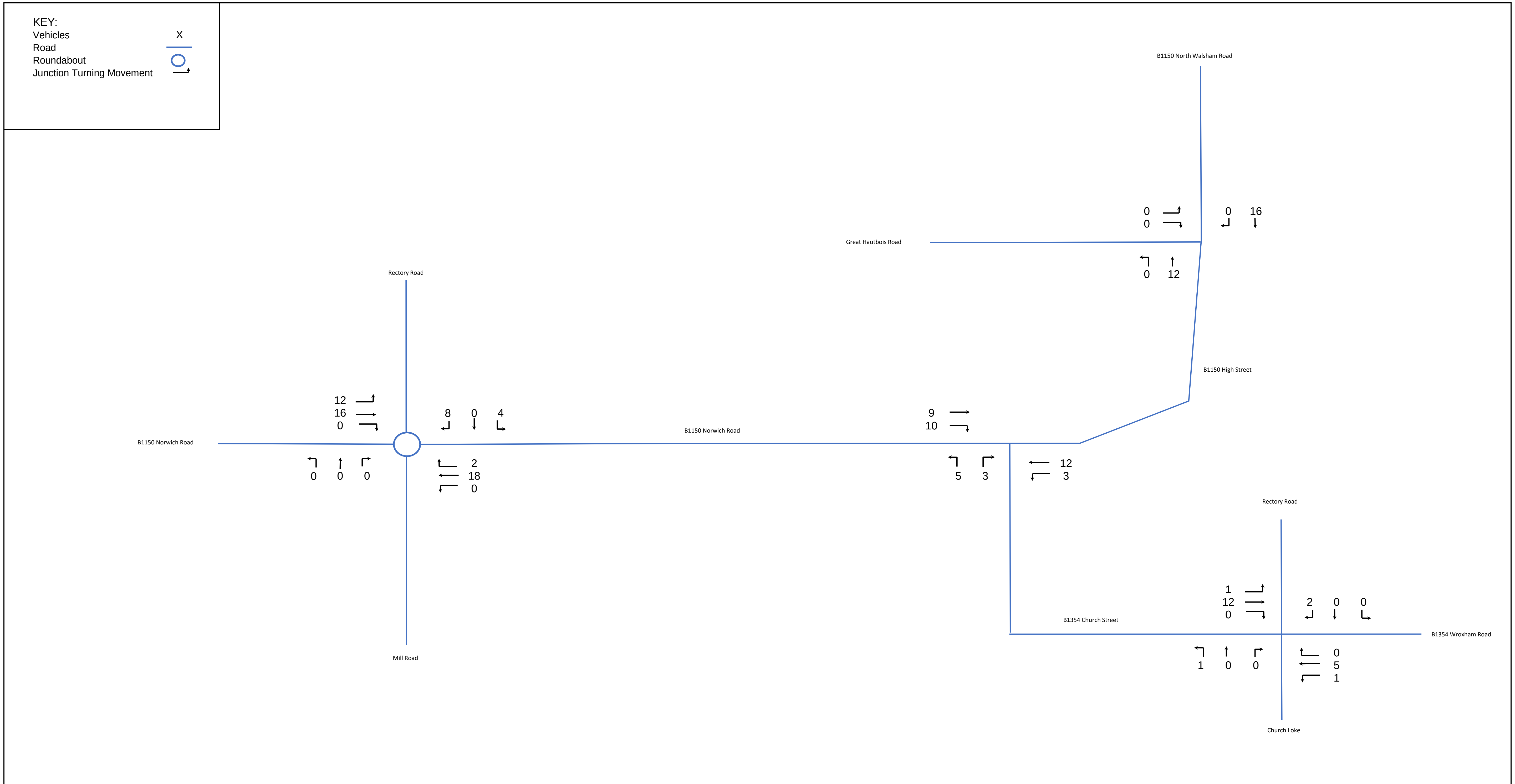
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Something PM	WG	TJ	13/10/2023	41



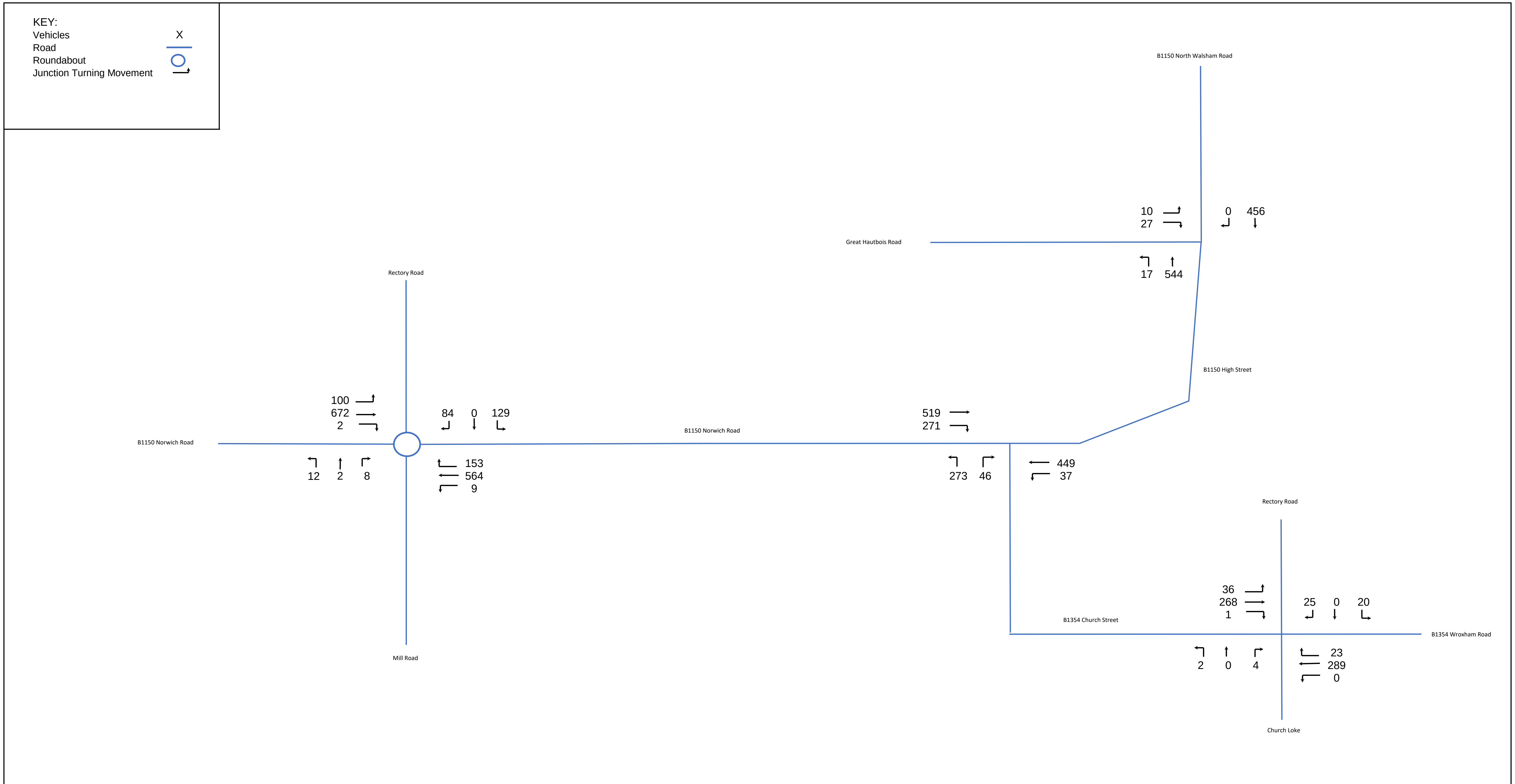
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Something PM (HGV Only)	WG	TJ	13/10/2023	42



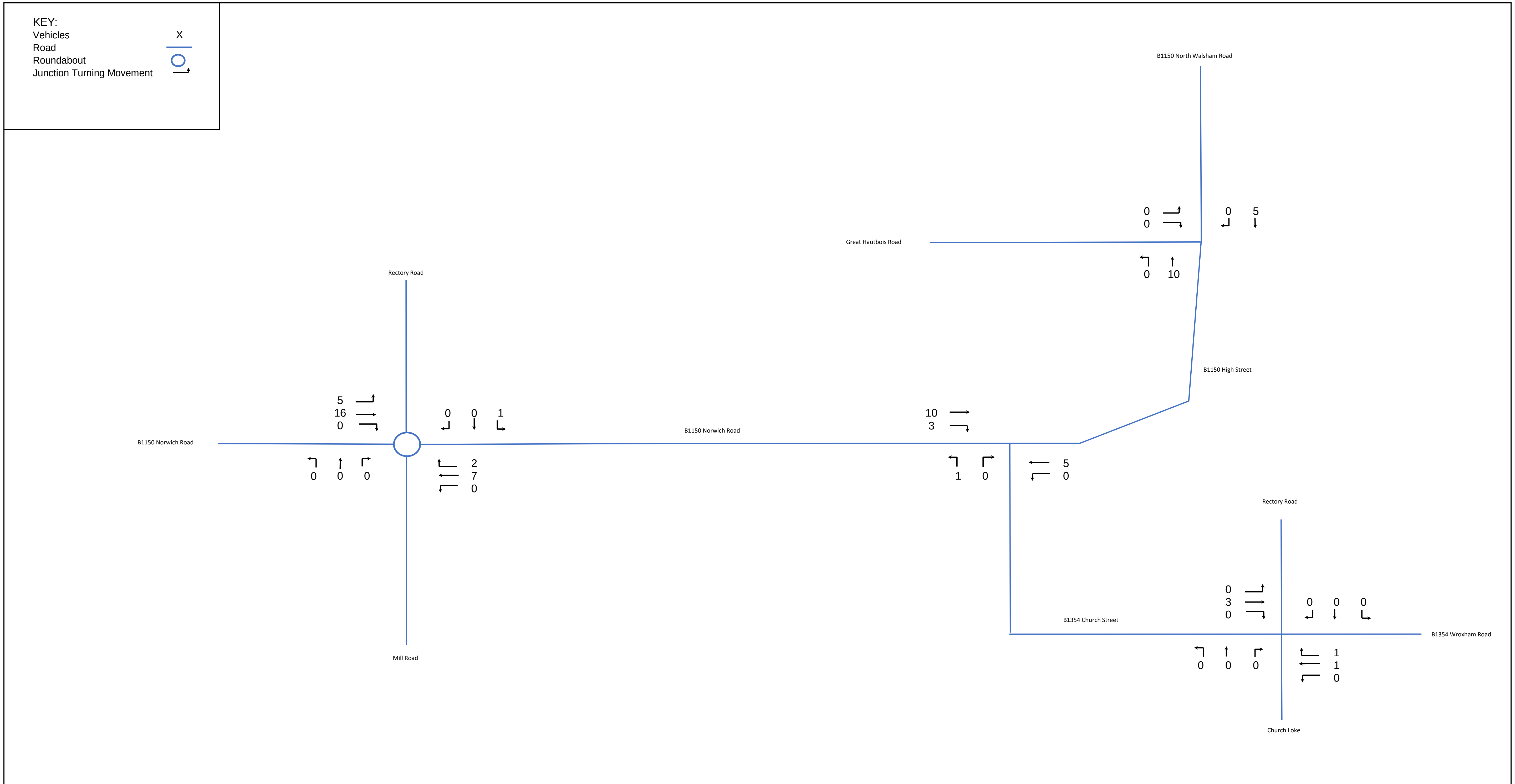
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Minimum AM Demand Flows	WG	TJ	13/10/2023	43



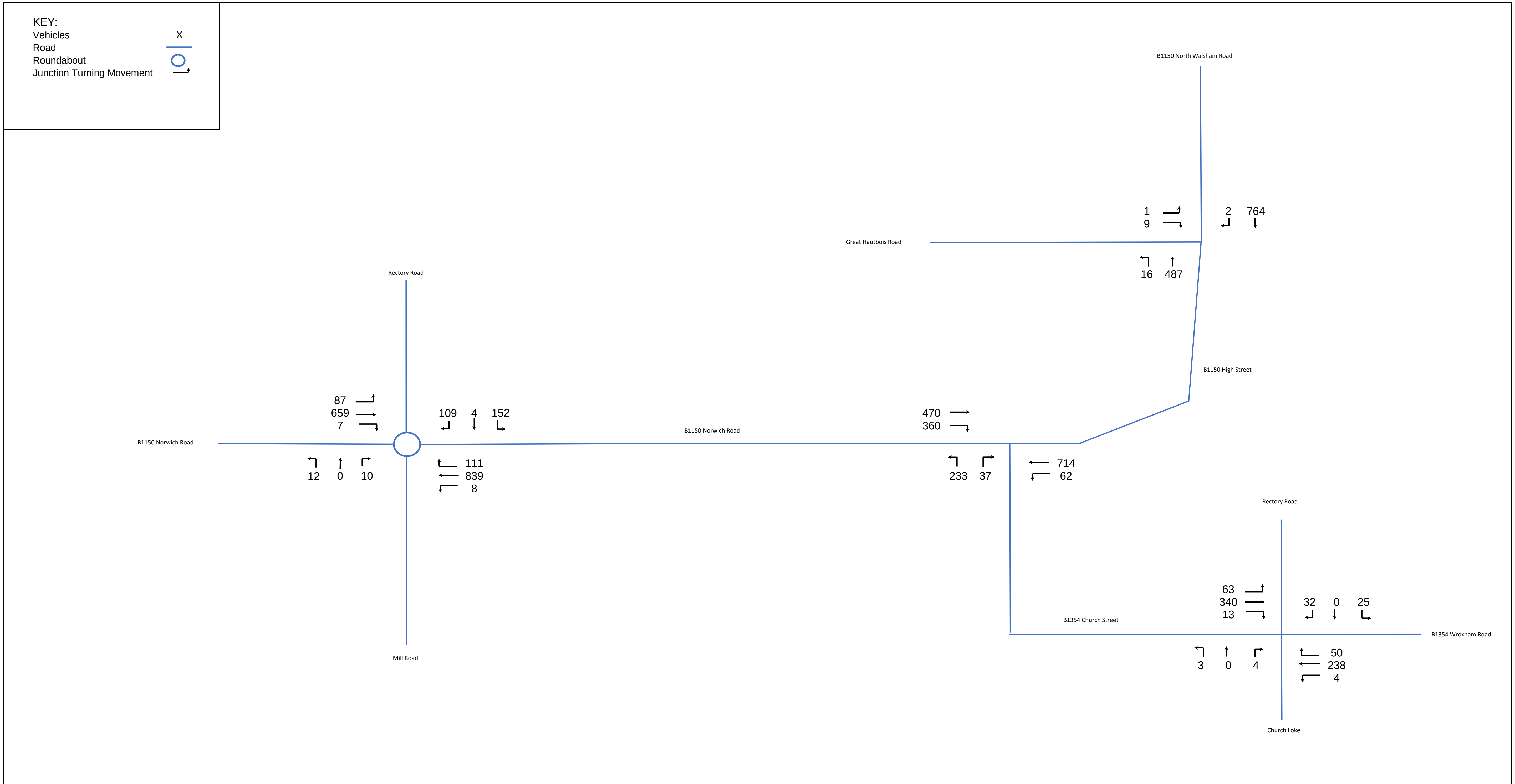
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Minimum AM Demand Flows (HGV Only)	WG	TJ	13/10/2023	44



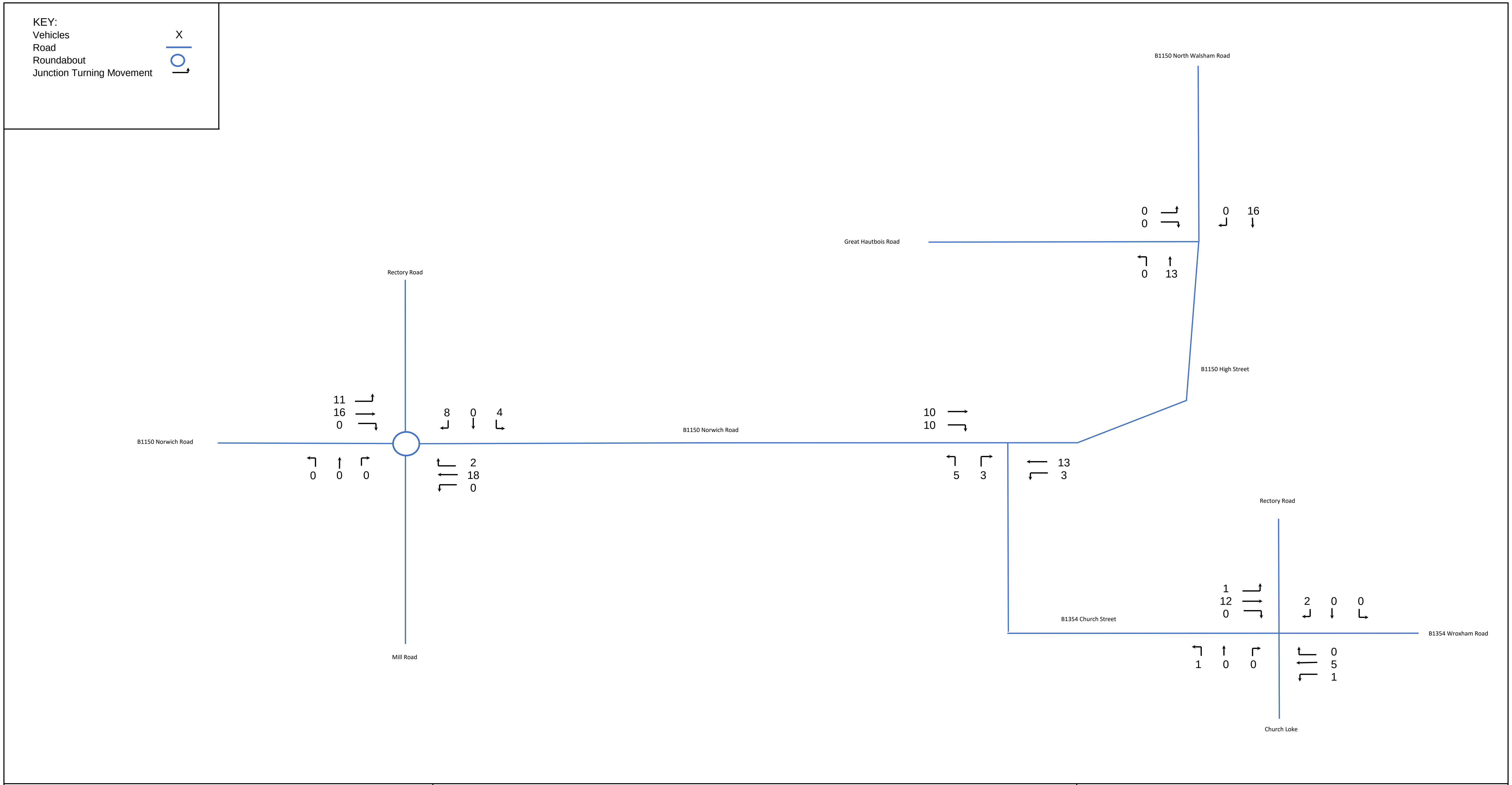
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Minimum PM Demand Flows	WG	TJ	13/10/2023	45



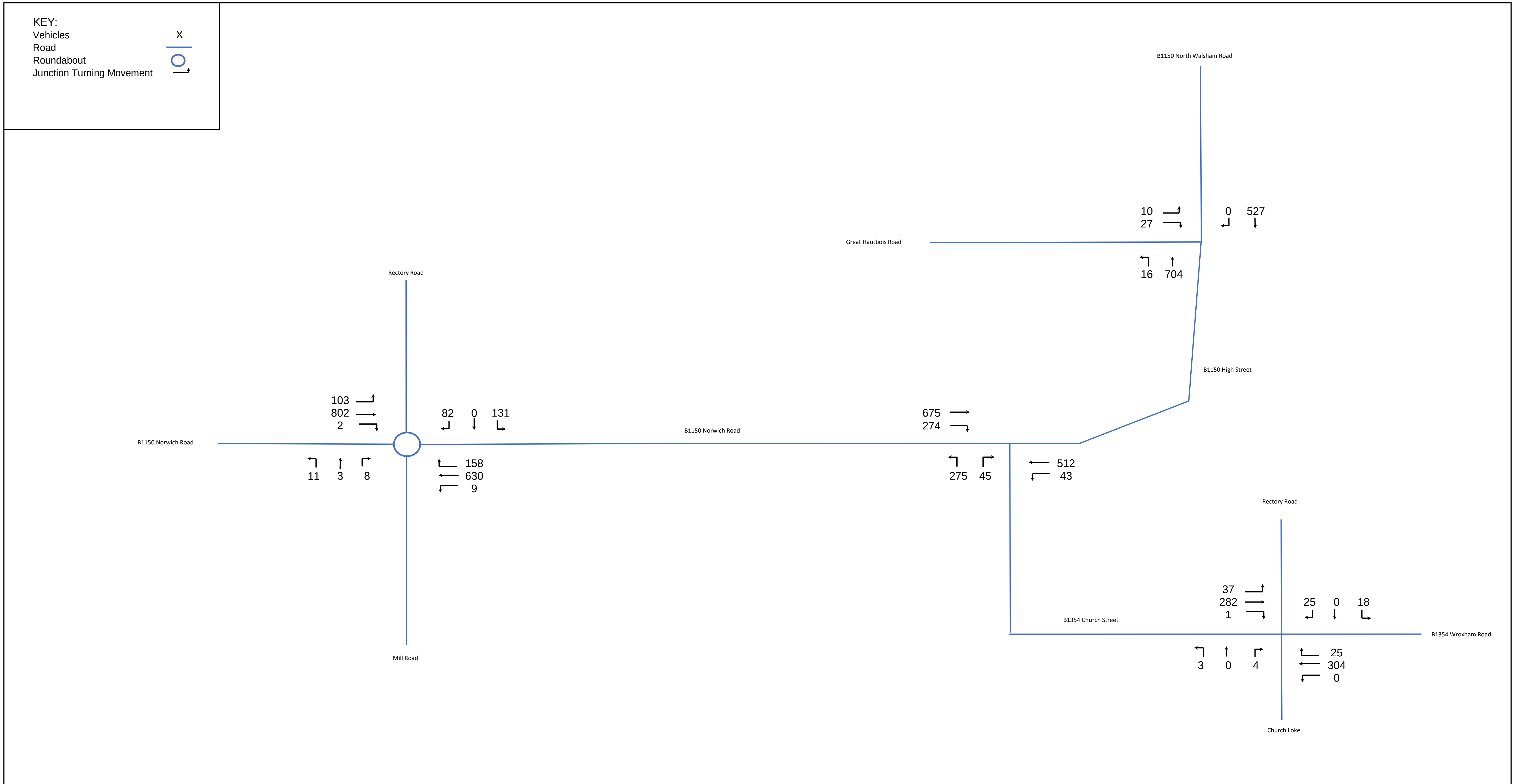
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Minimum PM Demand Flows (HGV Only)	WG	TJ	13/10/2023	46



Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something AM Demand Flows	WG	TJ	13/10/2023	47



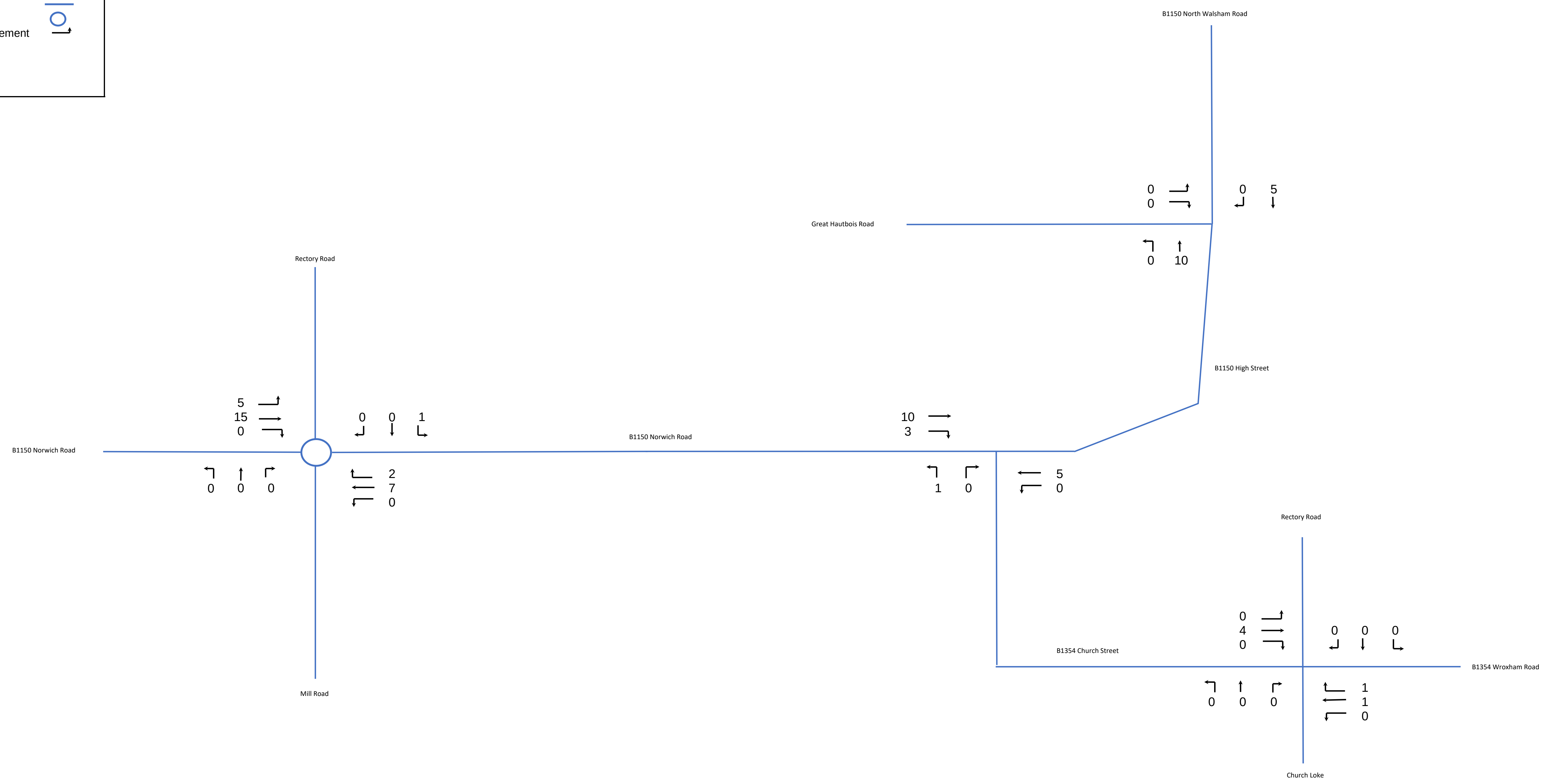
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something AM Demand Flows (HGV Only)	WG	TJ	13/10/2023	48



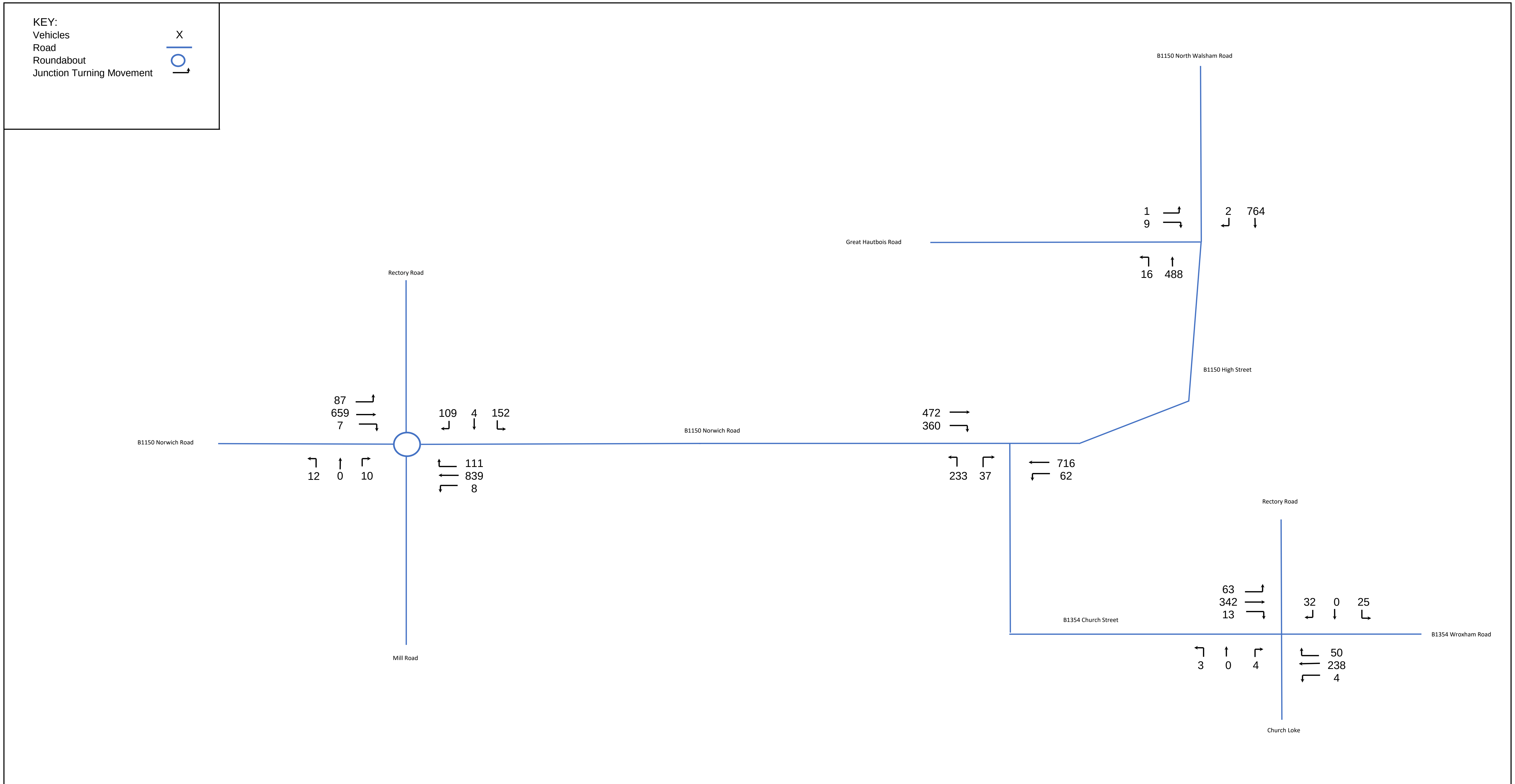
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something PM Demand Flows	WG	TJ	13/10/2023	49

KEY:

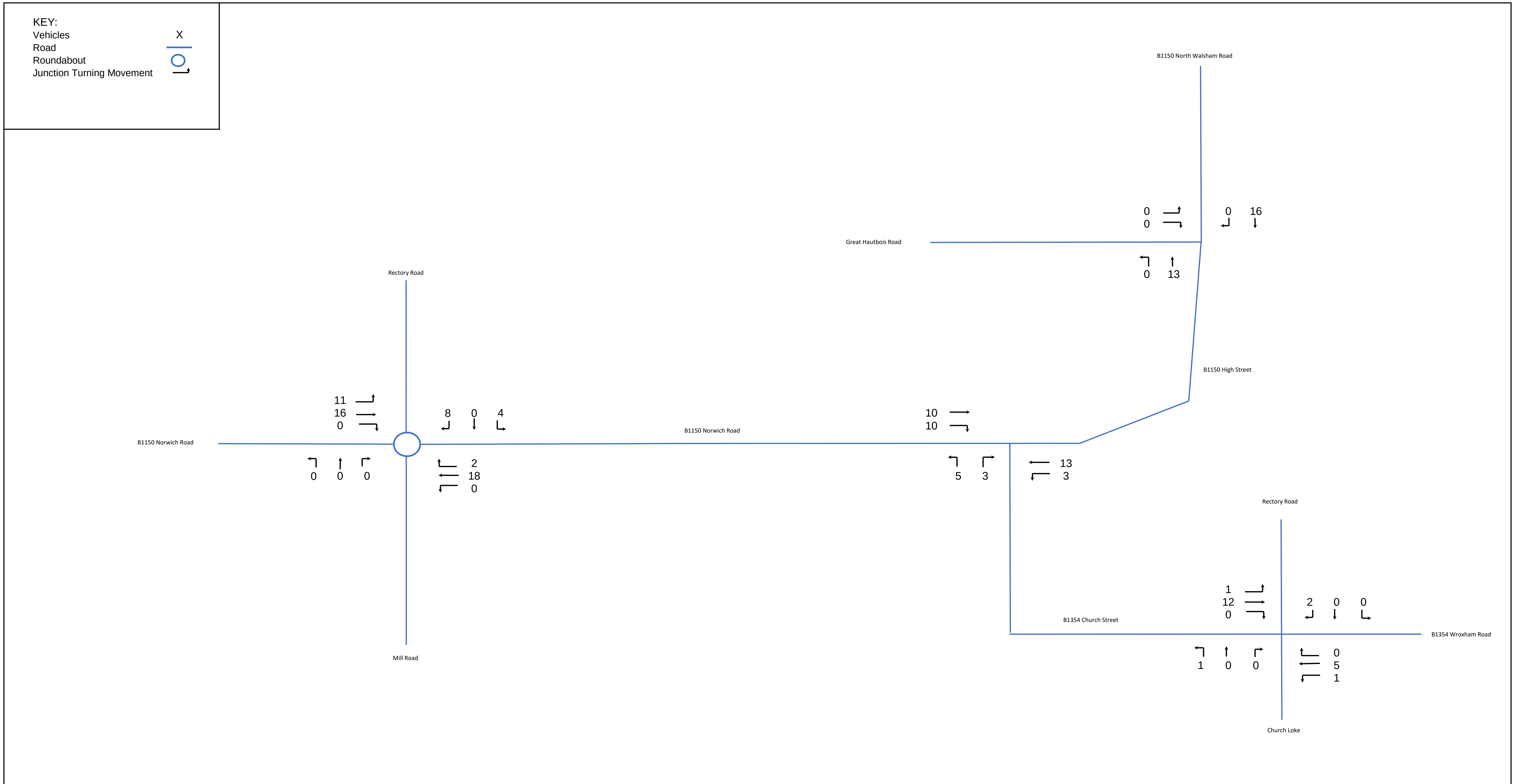
Vehicles	X
Road	
Roundabout	
Junction Turning Movement	



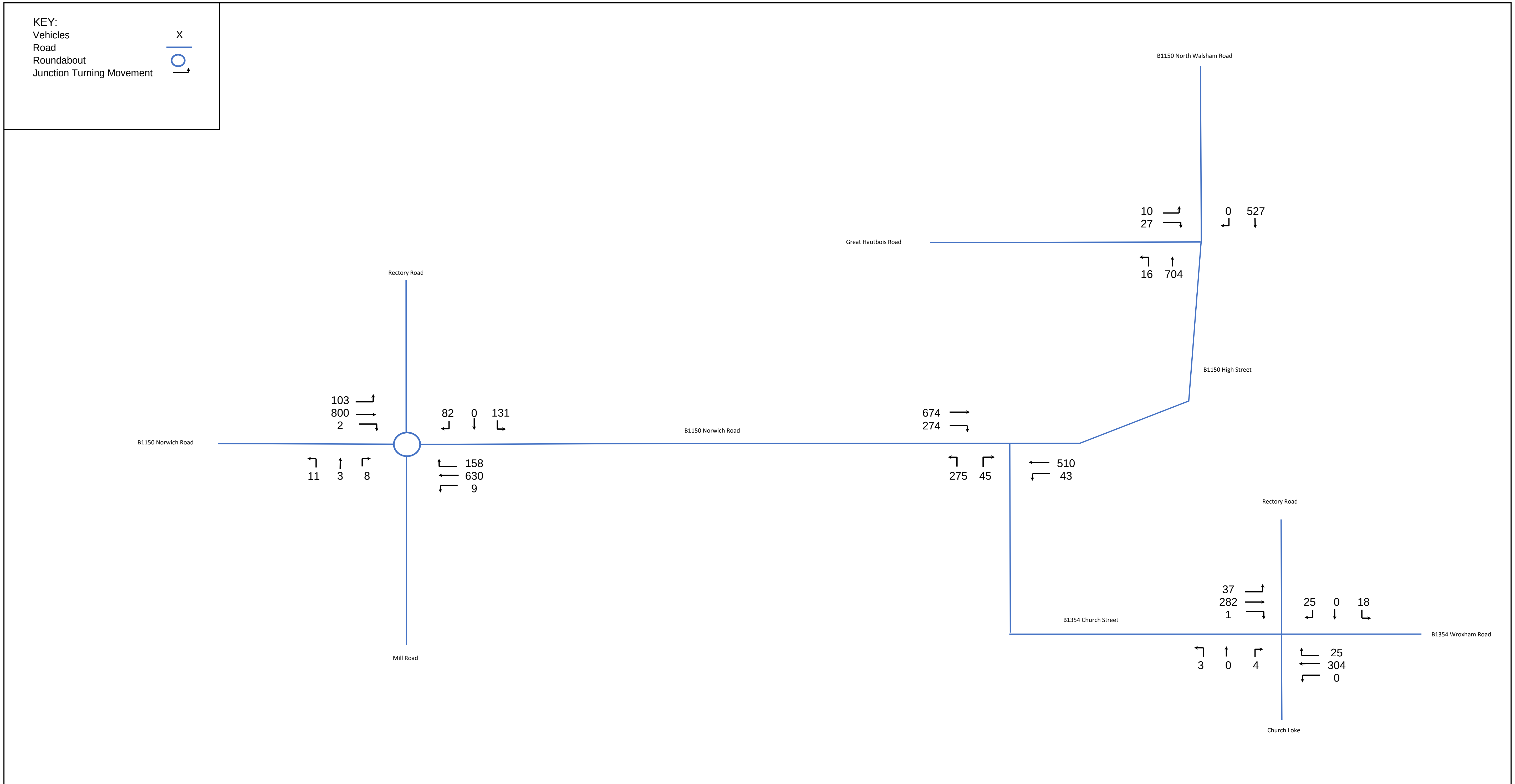
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something PM Demand Flows (HGV Only)	WG	TJ	13/10/2023	50



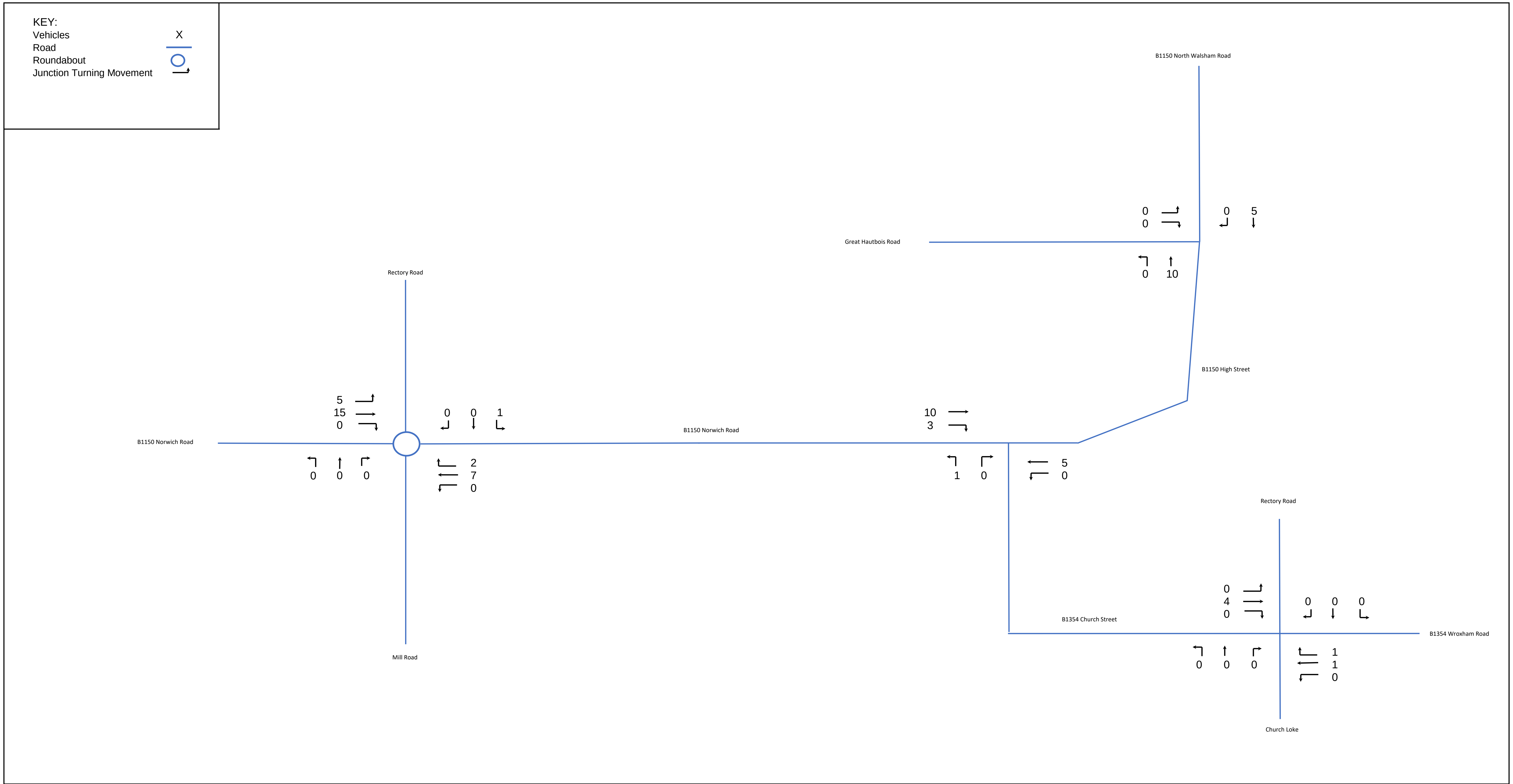
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something AM Demand Flows (Mitigation Scenario)	WG	TJ	13/10/2023	51



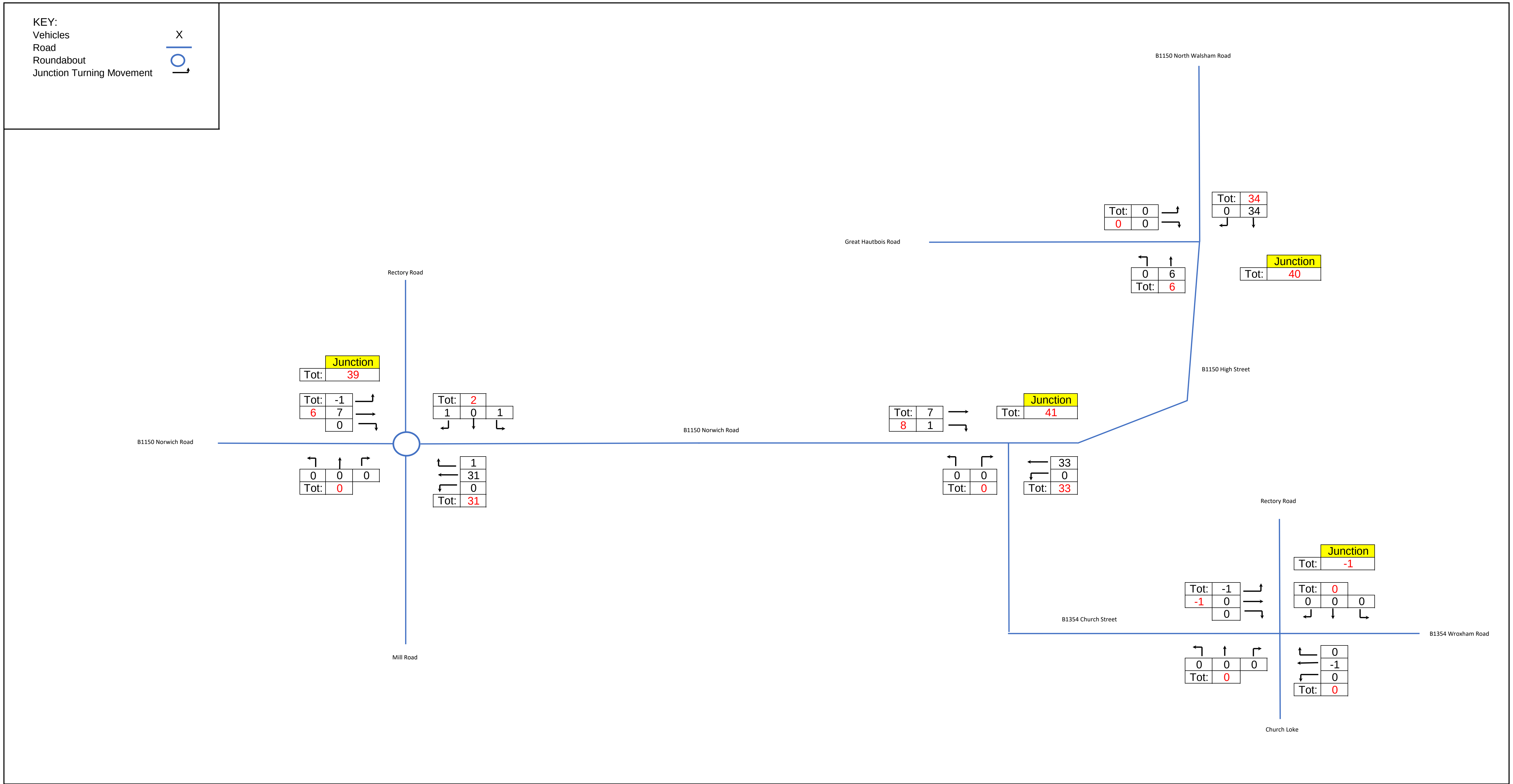
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something AM Demand Flows (Mitigation Scenario, HGV Only)	WG	TJ	13/10/2023	52



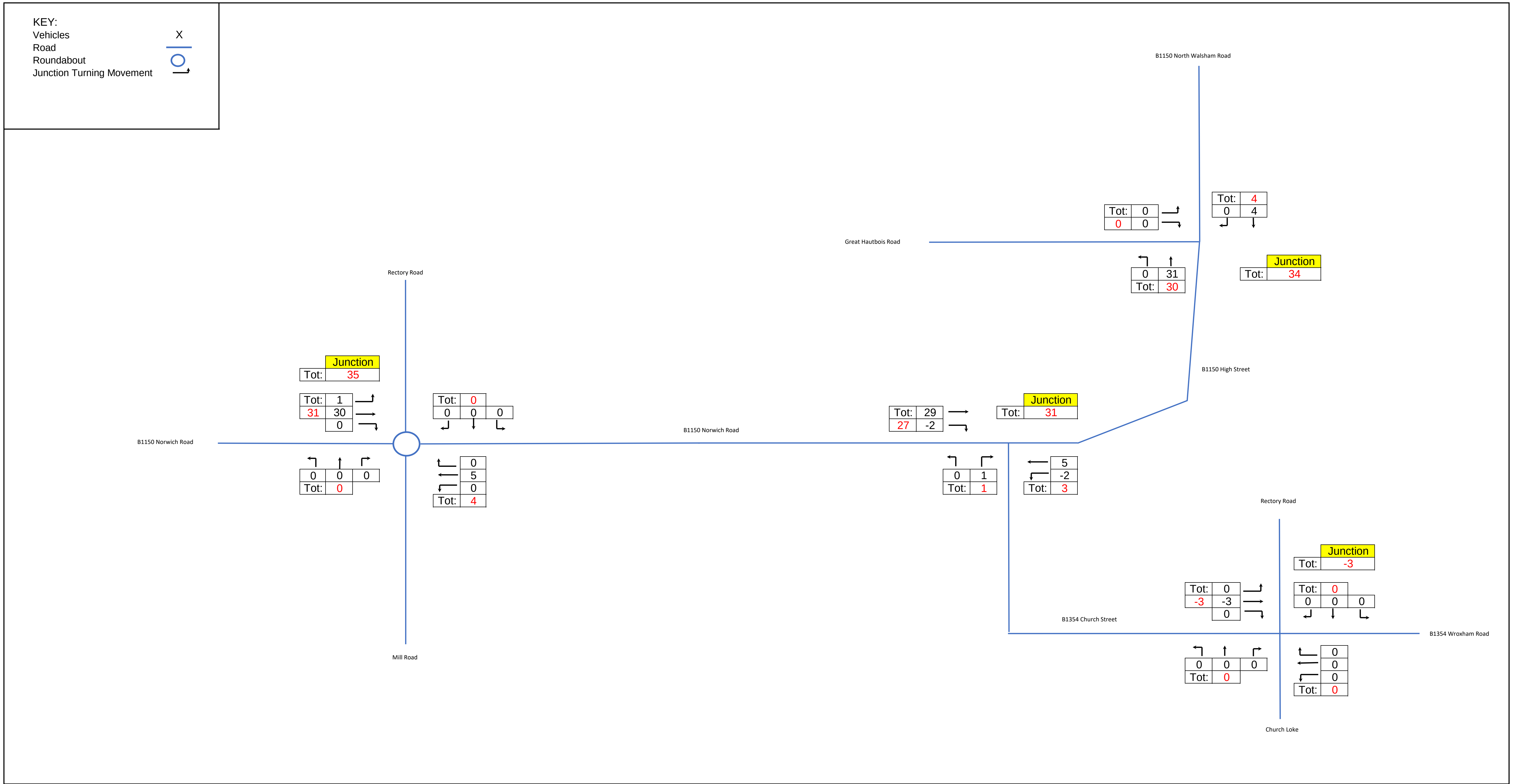
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something PM Demand Flows (Mitigation Scenario)	WG	TJ	13/10/2023	53



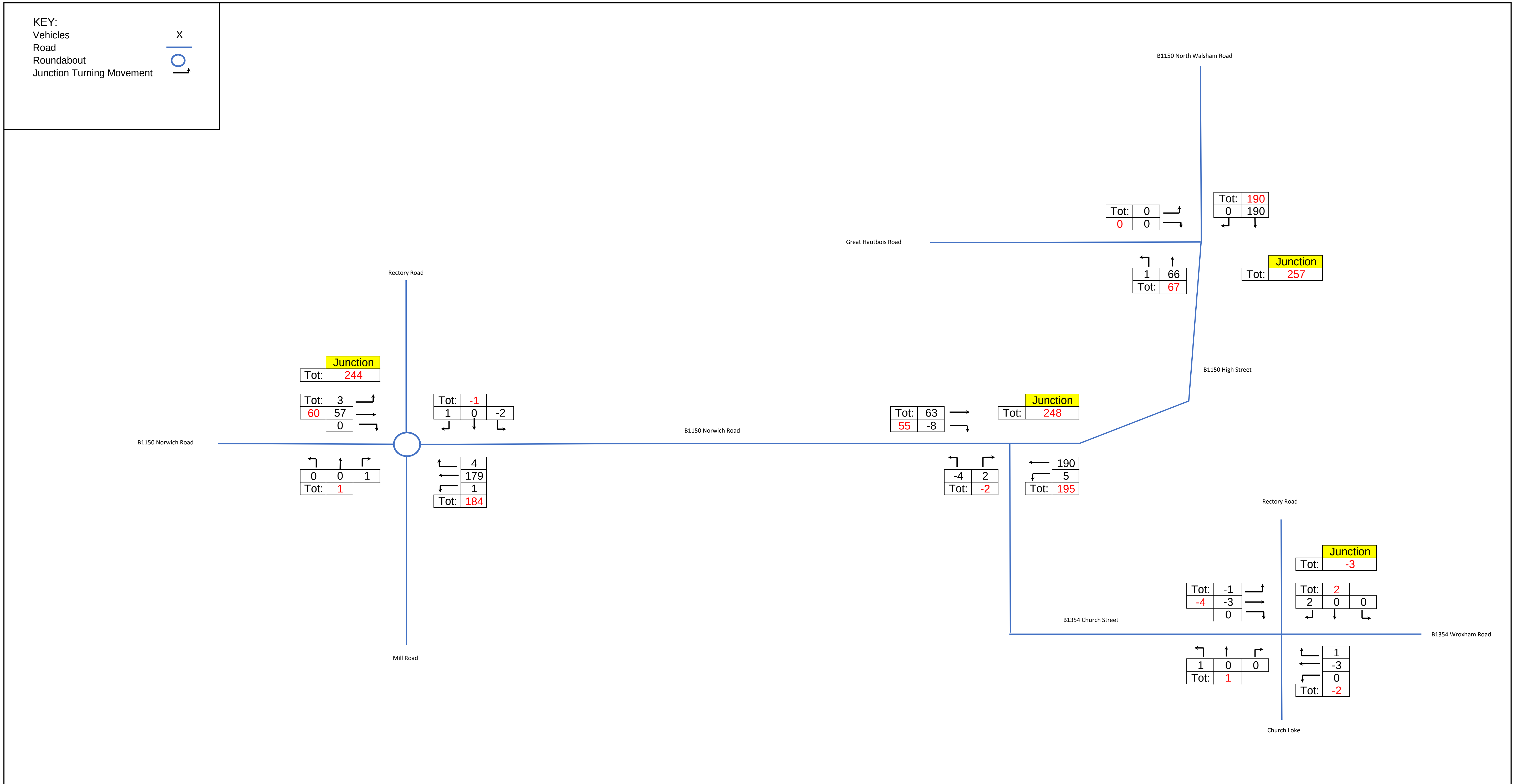
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something PM Demand Flows (Mitigation Scenario, HGV Only)	WG	TJ	13/10/2023	54



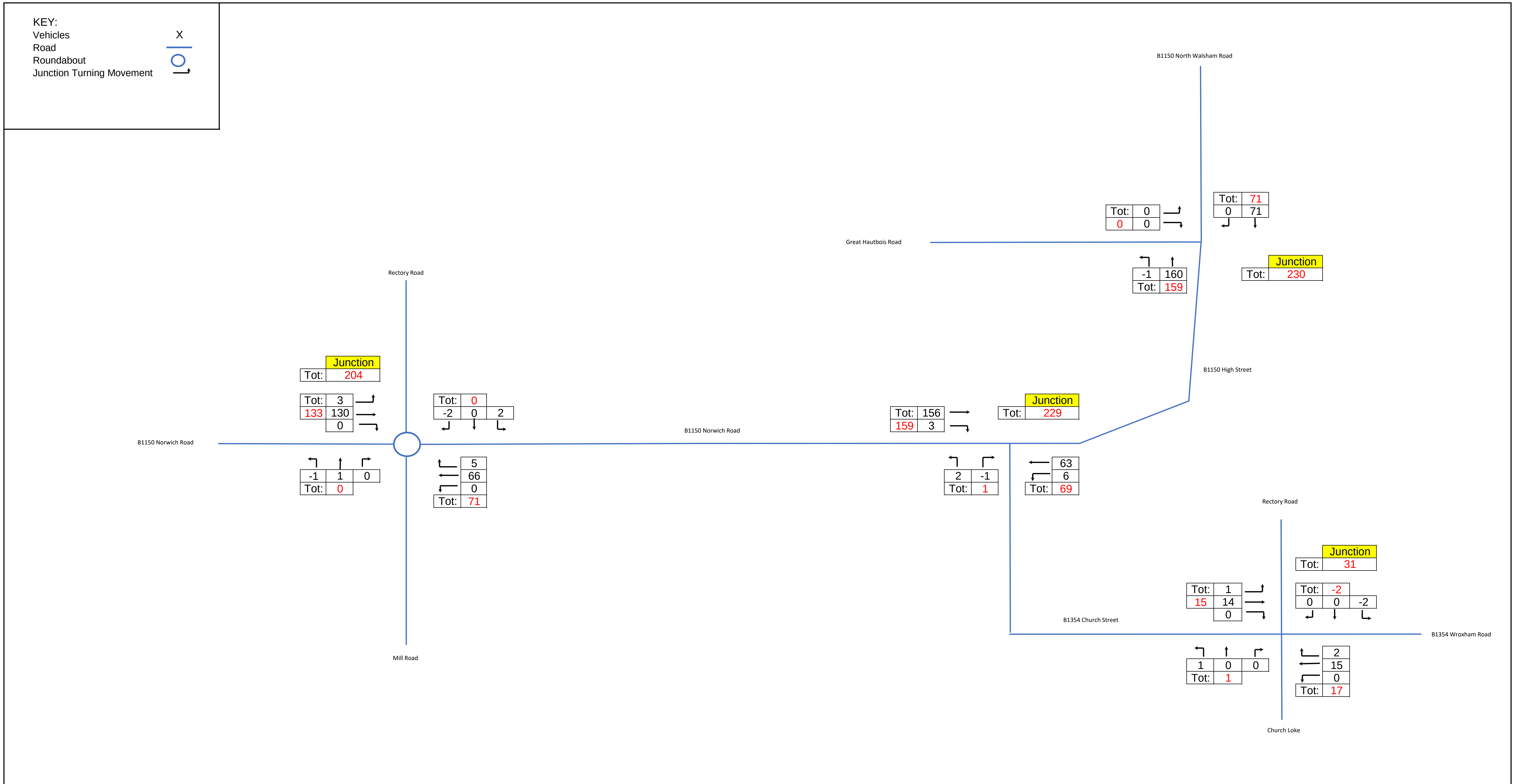
Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Something Minus Do Minimum AM Demand Flows	WG	TJ	13/10/2023	55



Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2029 Do Something Minus Do Minimum PM Demand Flows	WG	TJ	13/10/2023	56

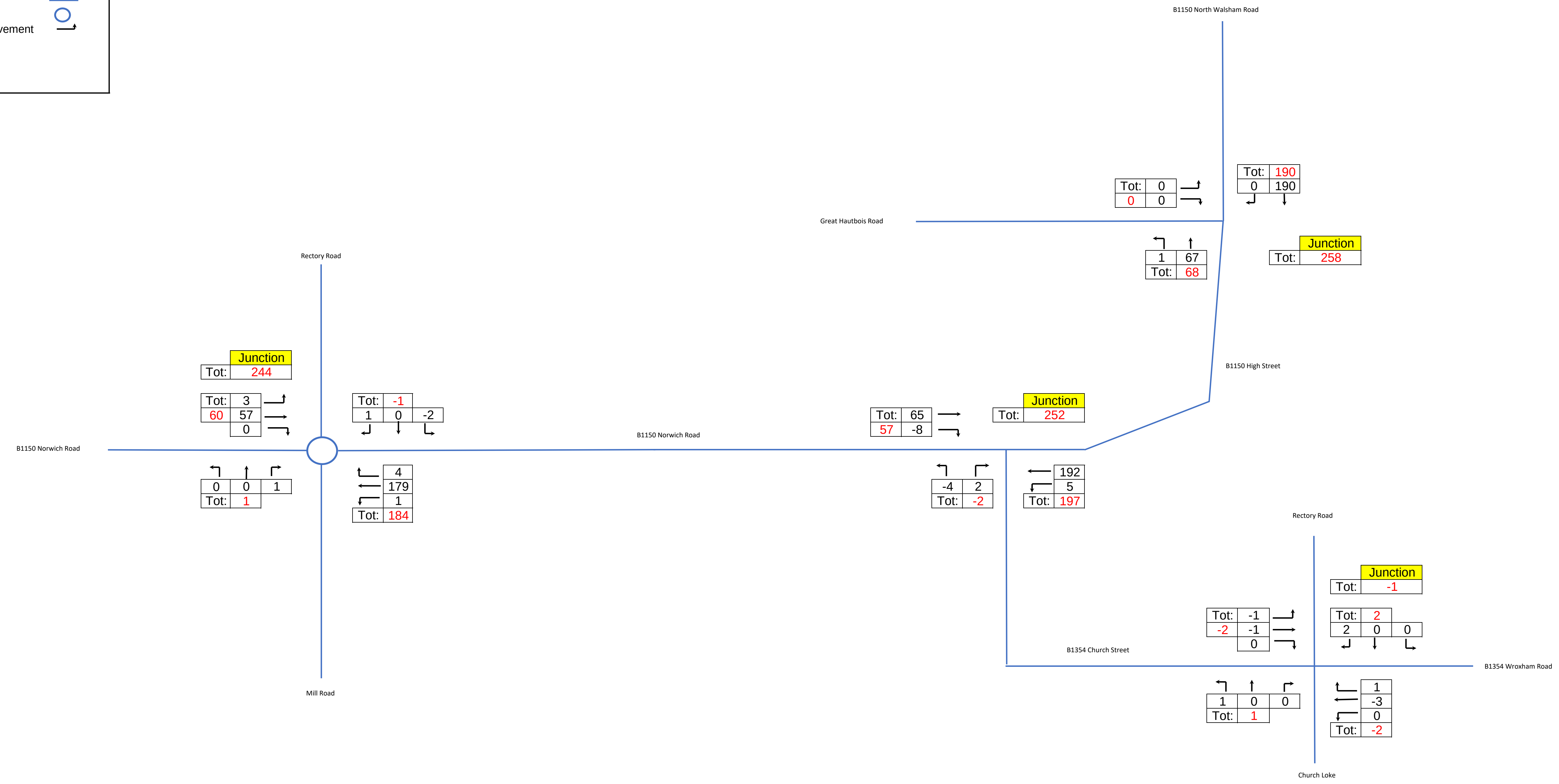


Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something Minus Do Minimum AM Demand Flows	WG	TJ	13/10/2023	57

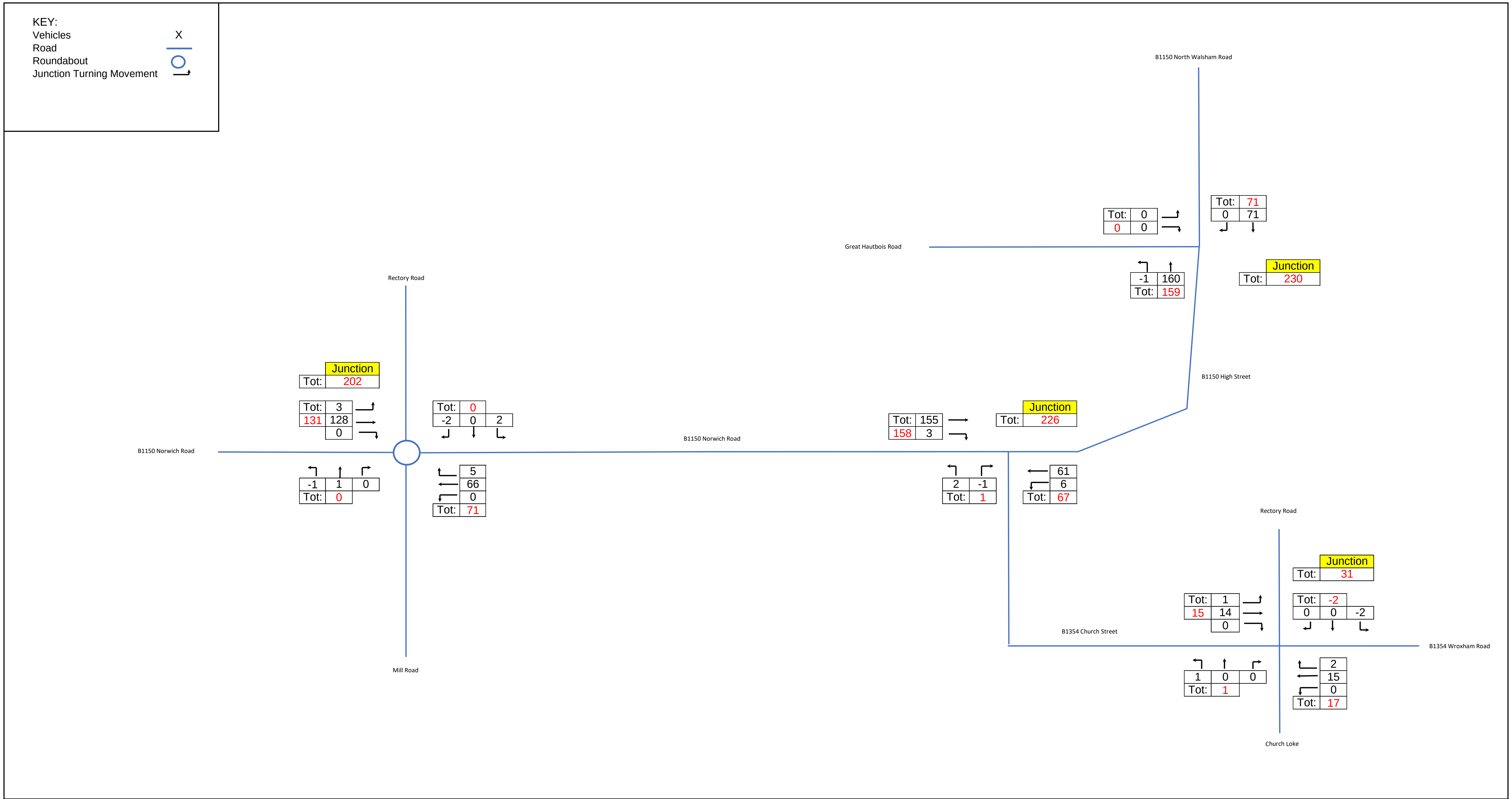


Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something Minus Do Minimum PM Demand Flows	WG	TJ	13/10/2023	58

KEY:
Vehicles X
Road
Roundabout
Junction Turning Movement



Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	**Title**	**Drawn**	**Checked**	**Date**	**Figure**
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something Minus Do Minimum AM Demand Flows (Mitigation Scenario)	WG	TJ	13/10/2023	59



Project		Notes			
60685223 - North Walsham Western Urban Extension	AECOM				
Client	Title	Drawn	Checked	Date	Figure
ESCO Developments, Lovell Partnerships, Flagship Group	Coltishall 2036 Do Something Minus Do Minimum PM Demand Flows (Mitigation Scenario)	WG	TJ	13/10/2023	60

Appendix D – Local Model Validation Reports

AECOM

North Walsham Vissim Model Validation Report

ESCO Developments, Flagship Housing Group and Lovell Partnership

13 April 2023

Delivering a better world

Quality Information

Prepared by	Checked by	Verified by	Approved by
Michael Fowler Graduate Consultant	Javier Navarro Pardo Principal Consultant	Phil Arnold Associate Director	Bevin Carey Regional Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
0.1	17 February 2023	First Draft		Javier Navarro Pardo	Principal Consultant
0.2	13 March 2023	Second Draft		Phil Arnold	Associate Director
1.0	13 April 2023	Draft Issue for Client Comment		Bevin Carey	Regional Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

ESCO Developments, Flagship Housing Group and Lovell Partnership

Prepared by:

Michael Fowler

AECOM Limited
Marlborough Court
10 Bricket Road
St Albans
AL1 3JX
United Kingdom

T: +44(0)1727 535000
aecom.com

Contents

1. Introduction

Background and Report Structure

1.1 ESCO Developments, Flagship Housing Group and Lovell Partnerships have commissioned AECOM to develop a Vissim base model of the town of North Walsham to assess the impacts of increased demand in forecast years and the proposed North Walsham Western Urban Extension (NWWUE). The model has been calibrated and validated to replicate the operation of the town based on data collected in July and November 2022.

1.2 This report documents the data collection and analysis, the development of the network and base year demand, and the calibration/ validation. The report is structured as follows:

- Data collection and analysis;
- Demand development;
- Modelled Network;
- Calibration results;
- Validation results; and
- Conclusions.

Model Scope

1.3 The Vissim model has been developed for the area shown in Figure 1-1. The North Walsham network comprises three signalized junctions and numerous priority-controlled junctions. The Vissim model area includes the A149, which runs through the town with the signalized junctions with the B1150 and B1145.

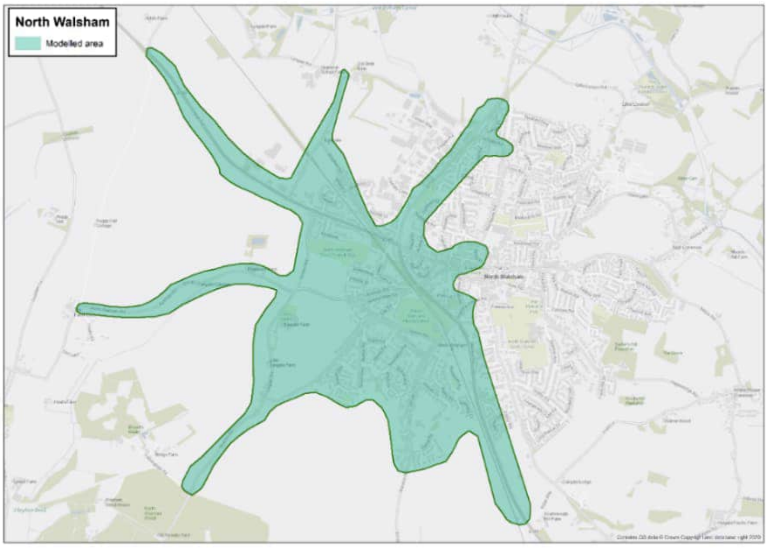


Figure 1-1 – Modelled Area

1.4 Figure 1-2 below shows the key junctions/ links identified from the survey data/ observations in the model area that are significant to local network operation. The key junctions/ links are as follows:

- 1 - Cromer Road and Bradfield Road;
- 2 - Cromer Road and Greens Road;
- 3 - Cromer Road, A149 and B1145;
- 4 - Cromer Road, Aylsham Road, Mundesley Road and Market Street;

- 5 - Aylsham Road underpass;
- 6 - B1150 Norwich Road and A149 North Walsham Bypass; and
- 7- B1150 and Millfield Road.

1.5 These junctions/ links have been considered when developing the model to replicate the existing operation and driving behaviour observed in the video footage available. It should be noted that the operation at some of these locations is dependent on variable factors such as on-street parking, physical constraints, and courtesy/ give way behaviours, which have been modelled and calibrated to observed queuing patterns/levels of delay.

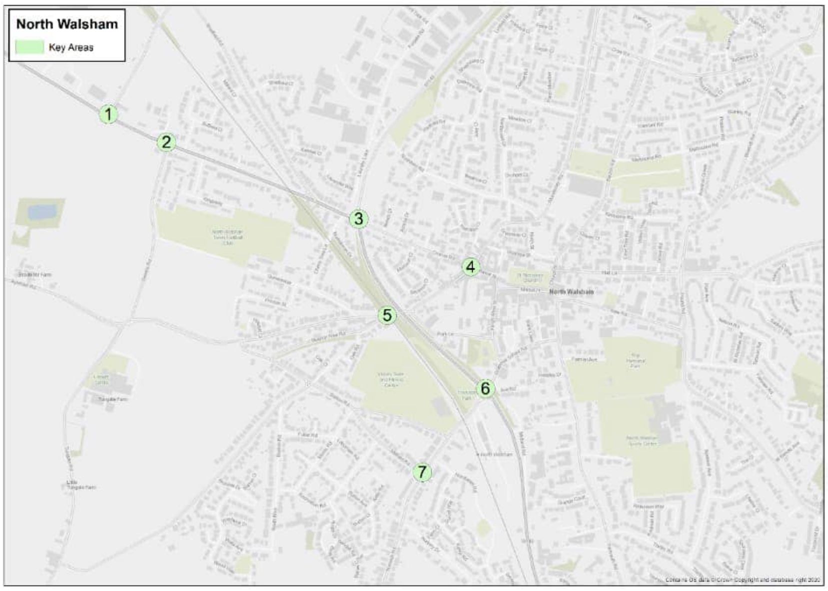


Figure 1-2 – Junctions in North Walsham Model Area

1.6 The Vissim Base models have been developed for the AM and PM peak hours, including 30 minutes warm-up and 15 minutes cool-down periods, to make sure the network is saturated at the beginning of the peak hour and to allow vehicles to complete their journeys after the peak hour.

1.7 The Base models have been developed in line with modelling requirements and the calibration and validation criteria defined in Transport Analysis Guidance (TAG) and the Guidelines for the Use of Microsimulation Software published in May 2022 by National Highways.

2. Data Collection and Analysis

Introduction

2.1 The data collection exercise undertaken by AECOM to inform the Vissim Base model development has been summarised in this section. The data collection comprised the following survey types:

- Automatic Number Plate Recognition (ANPR) data;
- Manual Classified Turning Counts (MCTC) Data; and
- Automatic Traffic Counts (ATC) data.

2.2 The data collection took place between the 12th and 14th July. However, upon review, road works were identified on the 12th of July, which resulted in non-standard delays and routing on this day. The data from the 12th of July was therefore not used.

2.3 Further analysis into the survey data, especially on ANPR sample rates showed that there was a noticeably lower capture rate on the 14th of July compared to the 13th of July across several cameras including key sites such as Site 11 northbound on the B1150.

2.4 An example of the sample rate analysis which was undertaken of the ANPR data can be found in Figure 3.1 for the AM and PM peak hours. The graphs in Figure 3.1 show a large flow difference between the vehicle numbers captured by the ANPR and the total flows along the road on the 14th of July 2022, while the data on the 13th of July show a close match between the two data sets.

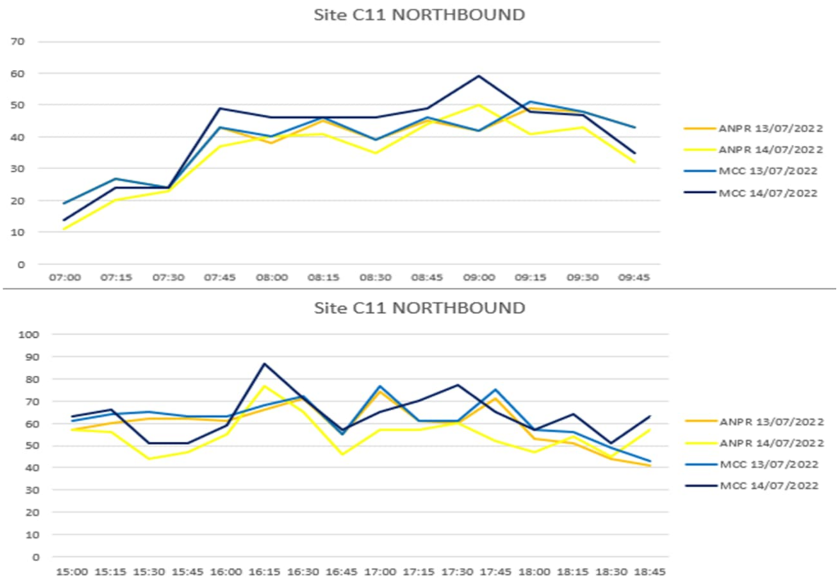


Figure 2-1 – ANPR performance 13th/14th July

2.5 As a result of the initial survey data analysis undertaken it was decided that only the data collected on the 13th of July 2022 will be used to support the VISSIM model development. The ANPR data obtained on the 14th was used to as further verify that origin-destination patterns on the 13th of July were typical.

Automatic Number Plate Recognition (ANPR) data

2.6 The ANPR data collection was categorized into two groups of cameras, Figure 2-2 shows the camera locations.

2.7 The **cordon cameras** were defined to capture the origin/destination demand across the area and total journey time through the model area.

- The **internal cameras** were defined to capture the internal routing within the model area and split the journey times into sections.

2.8 The ANPR data was used to develop the demand matrices and to provide journey times between origins and destinations. The internal cameras were also used to inform the routing through the model area and define the journey time sections used in the model validation.

2.9 As shown in Figure 2-2 some of the ANPR cameras lie outside the modelled area. Whilst these cameras were not used as journey origins or destinations, the routing information obtained from them was also used to inform the routing within the model.

2.10 In addition to the routing and journey time information, the ANPR surveys also included Manual Classified Counts (MCCs) associated with each camera to record the capture rate and classify ANPR data.

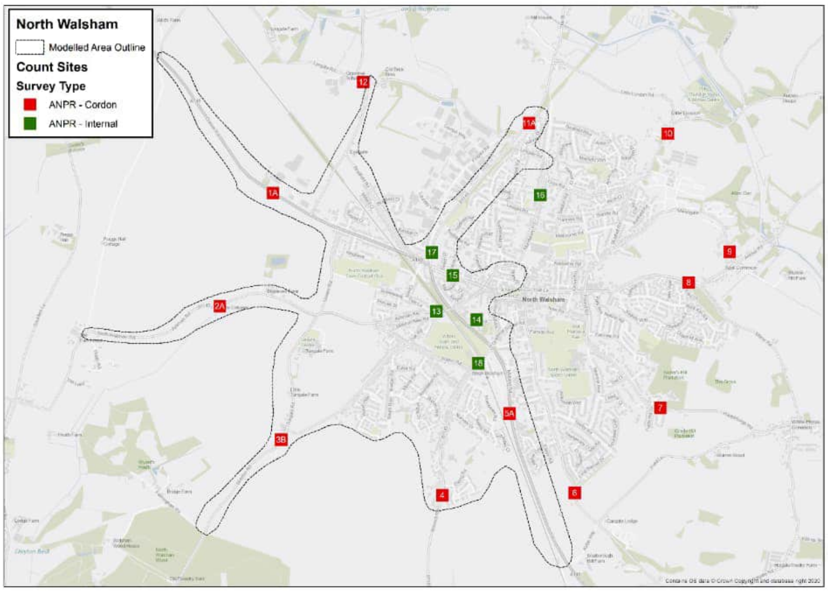


Figure 2-2 – ANPR Cameras

2.11 It should be noted that the ANPR data and routing information is based on the number plates captured successfully during the surveys. Table 2-1 summarizes the captured rate (number of plates that were successfully recognised by the ANPR camera).

2.12 The capture and matched rates in Table 2-1 show that most cameras had a very high sample/ match rate, providing a high degree of confidence that the data reflects the demand and routing patterns within the study area.

Table 2-1 – ANPR Cameras Capture and Match Rate

Site	Sample Rate		
	Overall	Inbound	Outbound
1	99%	100%	99%
2	99%	99%	99%
3	98%	98%	98%
4	98%	99%	97%
5	99%	99%	99%
6	99%	99%	98%
7	94%	94%	94%
8	98%	98%	97%
9	86%	88%	84%
10	99%	99%	99%
11	98%	98%	98%
12	94%	90%	98%

Site	Sample Rate		
	Overall	Inbound	Outbound
13	98%	99%	98%
14	99%	-	99%
15	98%	98%	96%
16	97%	98%	97%
17	98%	99%	97%
18	98%	98%	99%
Total	98%	99%	97%

* For internal cameras inbound refers to Eastbound or Northbound movement and outbound refers to Westbound or Southbound.

Manually Classified Turning Count (MCTC) data

2.13 MCTCs were carried out at the sites indicated in Figure 2-3 on the 12th,13th, and 14th July 2022, between 07:00 and 19:00. The MCTC data was used to refine the base model demand and calibrate the turning flows at each junction shown in Figure 2-3.

2.14 Additional MCTC surveys were undertaken on 10th of November 2022 to compare the traffic flow changes from the July 2022 data.

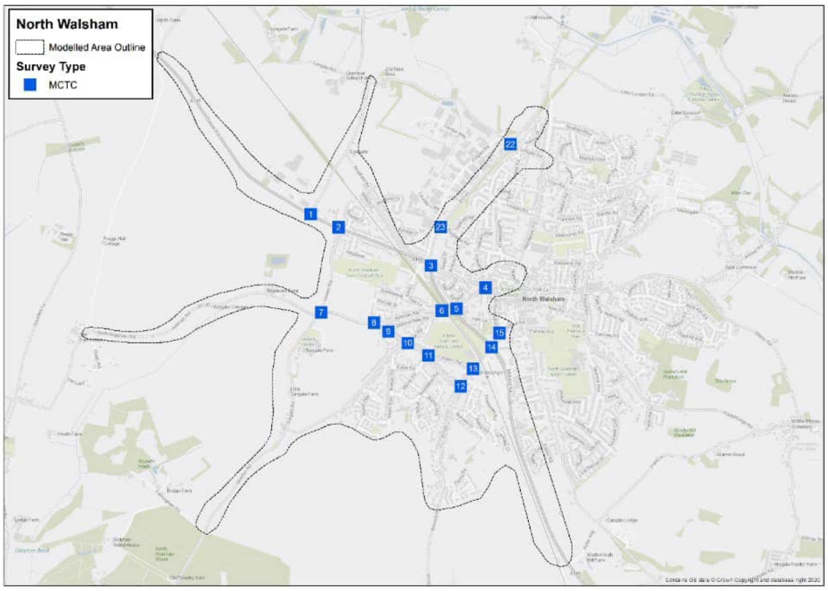


Figure 2-3 – Manual Classified Turning Counts sites

Automatic Traffic Count (ATC) data

2.15 The link counts were collected using ATCs. The ATC data was collected over two weeks period including the 12th, 13th, and 14th July 2022.

2.16 Seventeen ATC sites were surveyed in total that have been used to inform the total trip ends at the entry/ entry points to the model. Their locations are shown in Figure 2-4.

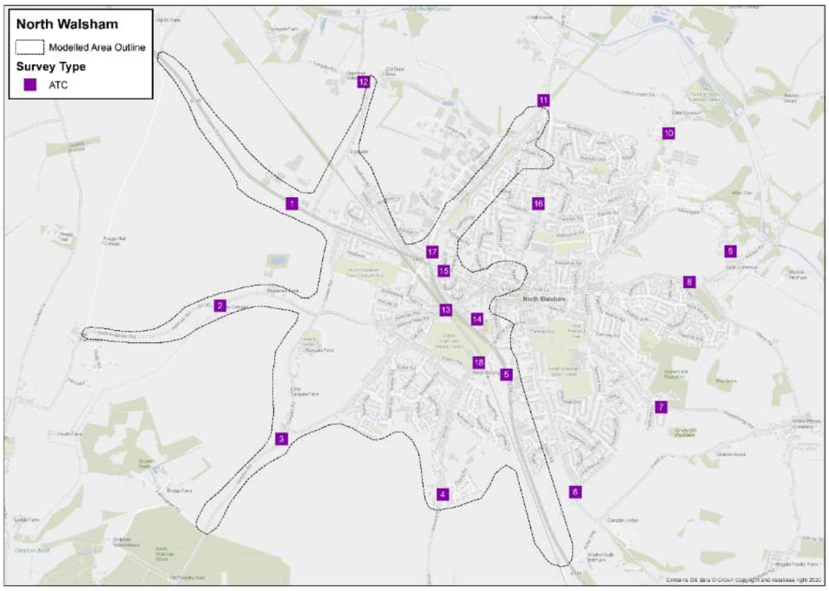


Figure 2-4 – Link counts (Automatic Traffic Counts)

Camera Footage

2.17 Camera footage, which was recorded to produce the MCTC and ANPR data, was obtained to provide the modellers with a more detailed view of the driving behaviour in the area and allow for saturation flow measurements.

3. Data Review and Analysis

Consistency Review

3.1 The locations of MCTCs have been labelled approach arms and model entry points to assist with the analysis of the data consistency review and can be found in Appendix A.

3.2 The consistency between the different data sets was assessed to understand the reliability of the data and identify any discrepancy that could affect the model development. The key comparisons and findings found during the data analysis have been summarised below. The full details of the consistency checks undertaken can be found in Appendix A.

3.3 As a result of consistency checks, it was necessary to include six additional synthetic zones in the model, to balance the flow differences identified between adjacent junctions.

3.4 The synthetic zones identified during the survey data analysis represent minor junctions that were not surveyed during the data collection exercise. These junctions are located between surveyed junctions which were calibrated against observed counts. This is the standard modelling approach to infill volumes between surveyed junctions arising due to minor side roads, parking lots etc.

3.5 Additional MCTC surveys were carried out on 10th of November 2022 to compare the traffic flows against July 2022 data. The analysis showed a close match between the MCTC data of July and November 2022.

Peak Hour Analysis

3.6 The survey data available was processed to identify the morning and evening peak hours by analysing the profile of traffic volumes during the surveyed period. For this calculation, all vehicle movements have been considered as well as calculations of the inbound flows to the model area.

3.7 MCTC and ATC/ MCC data were analysed to determine the peak hour, by totalling all movements and by totalling only entries in the model area. In the AM period, the peak hour was calculated to be 08.00-09.00, both when considering entries into the modelled area and when using all available data. In the PM period calculations similarly returned a consistent peak hour of 16.30-17.30 using both methods. The ATC/MCC data was also analysed and showed the same peak hours as the analysis of the MCTC data.

3.8 Figure 2-4 shows the profile of the rolling hour calculated from the ATC data, which was used for calculating the peak hour.

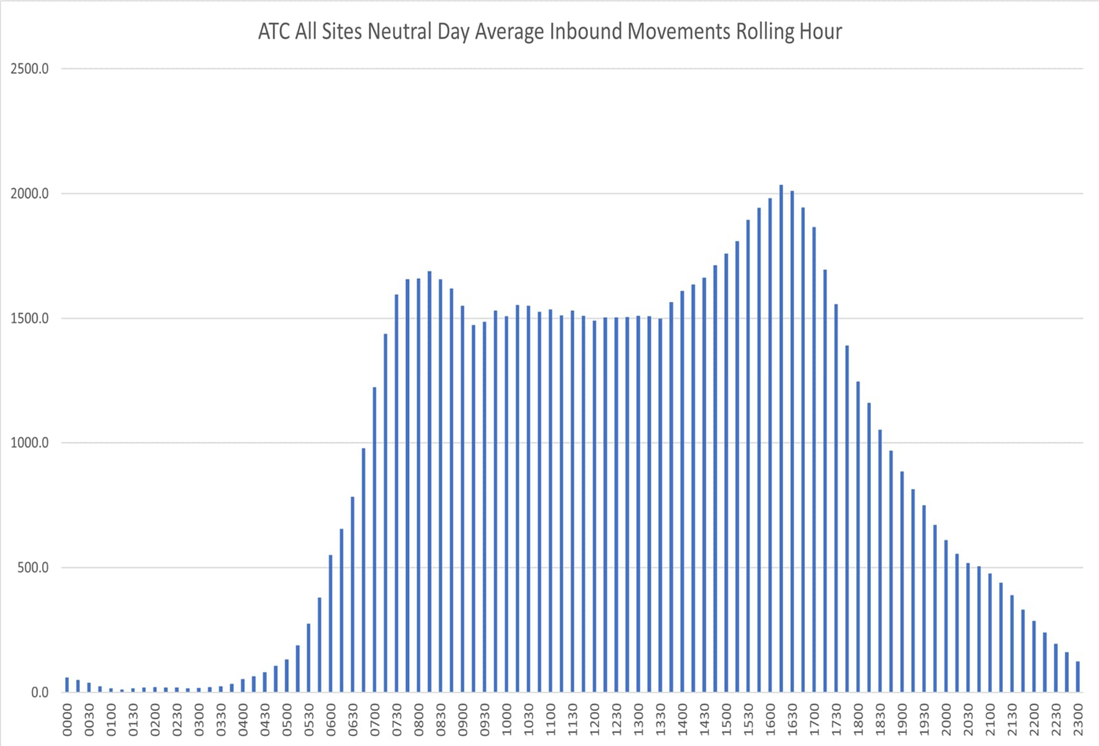


Figure 3-1 – ATC Peak Hour Analysis

3.9 This analysis has identified the following peak hours:

- AM peak hour: 08:00 - 09:00; and
- PM peak hour: 16:30 - 17:30

3.10 The modelled simulation periods include a 30-minute warm-up period to fully saturate the network before the simulated peak hour and a 15-minute cool-down period to allow vehicles to complete their journeys. The modelled periods are, therefore:

- AM modelled period: 07:30 - 09:15; and
- PM modelled period: 16:00 - 17:45.

4. Demand Development

Overview

4.1 This section describes the demand methodology and the routing analysis undertaken to develop and calibrate the traffic demand in the Vissim Base model.

4.2 The model was developed using the dynamic assignment module, as it would allow the model to predict future changes in routing which result from the demand growth, committed schemes or proposed mitigation measures in the area.

4.3 The ANPR data was used to develop the prior demand, which was then adjusted using the MCTC data to calibrate the demand to individual junction turning flows, resulting in the hourly Origin Destination (OD) matrices used in the Vissim model.

4.4 The traffic demand has been calculated for each vehicle type included in the model (Car, Light Goods Vehicle (LGV) and Heavy Goods Vehicle (HGV)) for the modelled peak hours. The available survey data has been used to develop the hourly Origin-destination matrices and the 15-minute profiles for each origin zone.

Demand Development

4.5 ANPR captures number plates at each of the camera locations providing a trip chain report documenting when and where the number plate was captured. This information has been used to develop demand matrices for the Vissim model.

4.6 The ANPR data has been factored up to represent all the vehicles in the network, by expanding the matched vehicles based on the capture rate at each ANPR site. However, the capture rates are not consistent between all the cameras, resulting in small discrepancies between these ANPR demand matrices and the MCTC data.

4.7 To minimise these discrepancies and refine the modelled demand, the ANPR matrix has been manually adjusted to match the MCTC data, allowing for a closer representation of the MCTC counts demand in the area while maintaining a direct correspondence between the VISSIM demand and the original ANPR data, preserving the observed routing data. The process followed is outlined in Figure 4-1.

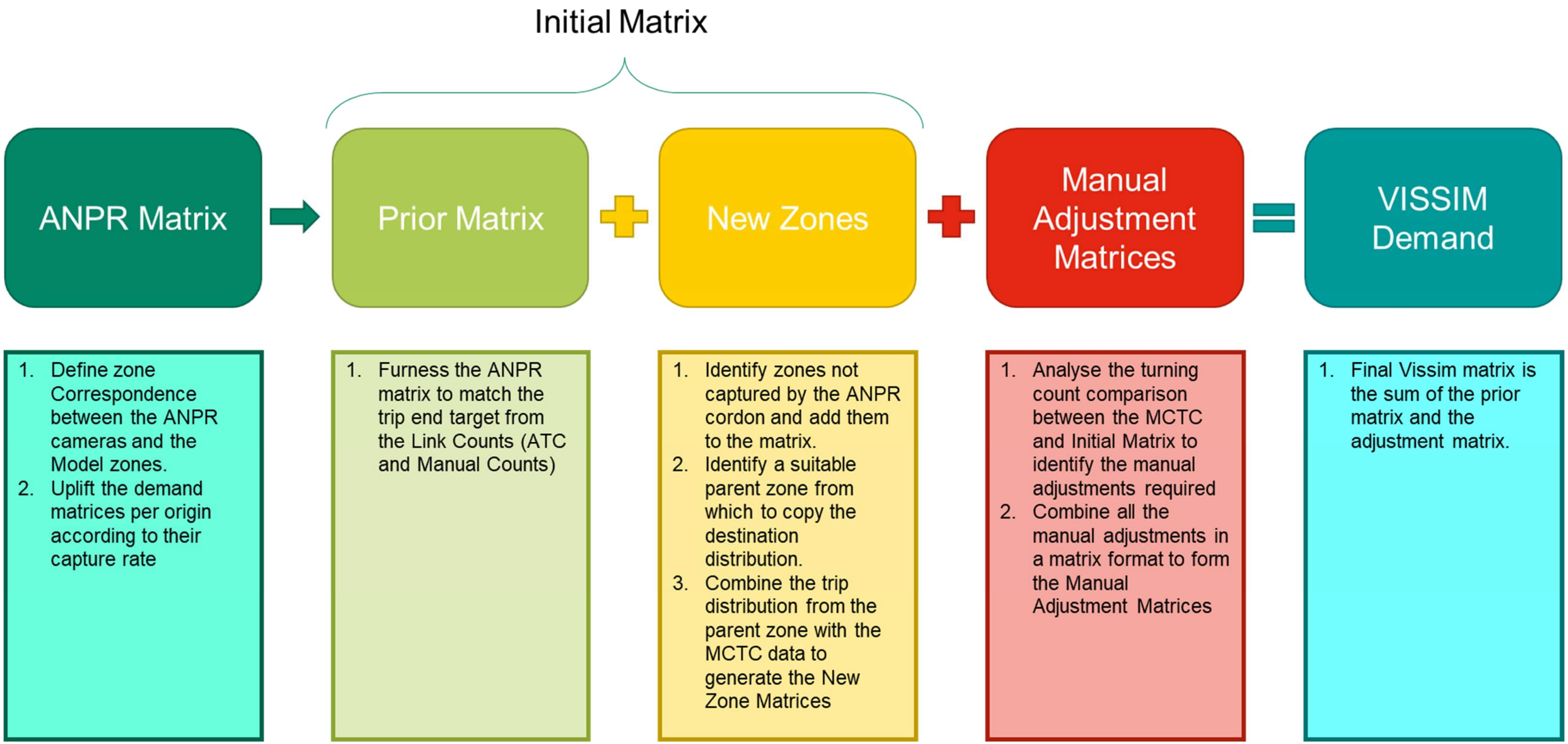


Figure 4-1 – Demand Development Methodology

4.8 To ensure the best possible correlation between the observed data and the Vissim model demand, the vehicle inputs and origin/destination routing have been developed by combining three different components:

- Initial Matrix – reflecting the routing patterns in the ANPR matrix and the link counts at entries and exits of the model;
- New Zones Matrix – additional zones required in Vissim but not directly captured by the ANPR; and
- Manual Adjustment Matrix – adjustments required to address routing and discrepancies between the Initial Matrix and MCTC data.

4.9 The process outline below was followed:

- The ANPR cameras and the Vissim model zones have been consistently referenced to define a correspondence between them e.g., Camera 5 is representative of Zone 5. The OD matrix extracted from the ANPR data has then been uplifted to reflect the number of vehicles at each origin, since the ANPR capture rate is less than 100%.
- The imperfect capture rate, with different number plates missed at each camera, means that the resulting matrix requires uplifting to outbound observed flows. The entry and exit link counts were used to furness the matrix. The last iteration has been set up to match the origin trip ends, to ensure that the demand matrix represents the traffic volumes entering the model area. This process results in an hourly OD matrix for each vehicle type: Cars, HGVs, Taxis, and LGVs.
- Once the matrix derived from ANPR and link counts was in a usable OD matrix format, the entries to the model where ANPR data is unavailable were reviewed. The total origin and destination demand for each additional zone was derived from the differences between adjacent turning counts and the trip distribution was assumed to be the same as another zone with similar characteristics. In this way, a New Zones Matrix was developed, which will infill the Initial Matrix to include zones not covered by ANPR cameras.
- The Initial matrix and the New Zones Matrix were combined and assigned in Vissim – the modelled turning flows and observed turning counts were compared to identify manual adjustments required to meet the flow calibration criteria. This was an iterative process, and several adjustments were needed before adequate match between observed and modelled turning counts was achieved.
- The manual adjustments identified from the comparison between the modelled and observed turning flows are implemented in a separate Manual Adjustments Matrix for each vehicle class; this is then combined with the Initial Matrix and New Zones Matrix developed previously to obtain the final Vissim demand.

Convergence and routing analysis

4.10 The Vissim dynamic assignment module assigns the vehicles on the different paths based on the journey time cost and distance, assigning most of the vehicles to the shorter or faster paths, depending on the convergence parameters.

4.11 The journey time and routing data obtained from the ANPR was used to analyse the routing patterns in the model area and calculate the parameters required to support the convergence process.

4.12 The results of the convergence process and dynamic assignment were then checked against the routing information obtained from the ANPR data to ensure the model provides a suitable representation of the routing patterns in the area for the OD pairs with multiple route choice.

4.13 An example of the routing checks is shown in Figure 4-2 below, for two possible routes between Zone 1 and Zone 4 in both directions. The routing analysis compared the flows along each route against the observed data from ANPR surveys. This analysis provided further reassurance that the observed routing patterns were replicated in the model for the main OD pairs with multiple route options.

4.14 It should be noted that these routing checks were undertaken to identify and address any potential routing issues in the assignment that may affect the operation of the model. However, these checks are not part of the TAG validation criteria required for microsimulation models.

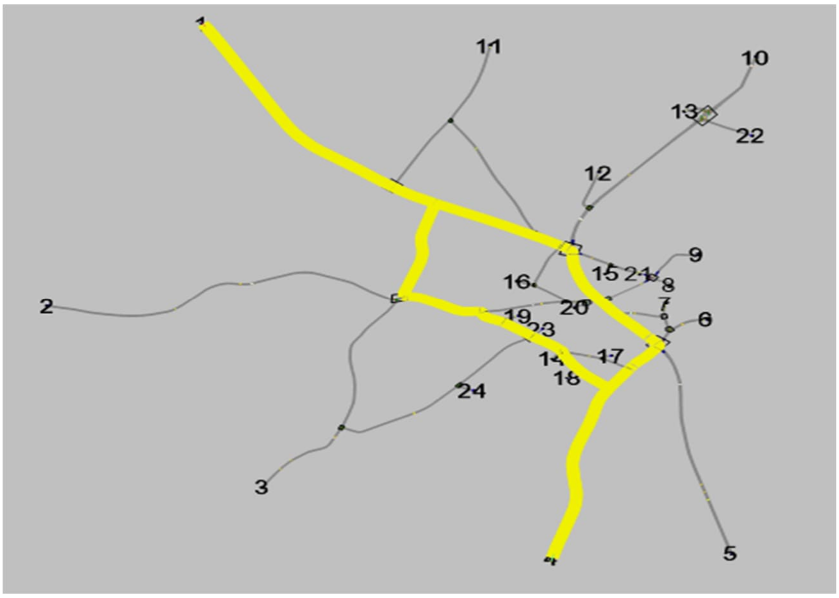


Figure 4-2 - VISSIM Dynamic Assignment with Two Possible Routes

5. Network Development

Network coding

5.1 Scaled Bing maps within Vissim have been used to code the network geometry and structure, such as number of lanes and flare lengths. Reference was also made to Google Maps and Street view to ensure the network reflects conditions on the ground.

5.2 Observation from the video footage available have also been used to inform the network coding and replicate the operation of the existing layout.

Desired Speed Decisions & Reduced Speed Areas

5.3 Desired Speed Decisions, defining the speed distribution that vehicles follow at each point of the network, have been updated to represent the posted speed limits for each link. Reduced Speed Areas have been included to replicate driving behaviours such as bends curves, narrow road sections or pedestrian crossings, but also, to calibrate saturation flows and replicate behaviour at signalised junctions.

5.4 The speed distributions used in the model have been obtained from two different sources. The Guidelines for the Use of Microsimulation Software from National Highways provide distributions for 50 mph and 70 mph, while 30 mph and 60 mph have been obtained from the SPE0111 - Vehicle Speed Compliance by road type and vehicle type in Great Britain from Department for Transport (DfT).

5.5 On some links, the speed limits do not provide a realistic representation of the average speeds. For example, Bradfield Road is a country lane with the national speed limit of 60 mph, However, the average speed for a narrow unlit road is significantly lower according to the ANPR data. The speed limits coded on such links have been derived from observed ANPR data.

5.6 Similar behaviour has been observed in Tungate Road and Skeyton Road, where the journey time data suggests that vehicles travel at lower speeds. A 30 mph speed limit has been coded on Tungate Road since this is a single-track road, and vehicles will slow down at narrow sections or when a vehicle in the opposite direction approaches. Due to the unpredictable/ variable behaviour along these links, and fact that vehicle may need to pass each other/ stop at any point along the link, this can only be replicated by Reduced Speed Areas (RSAs) representing average delay along the link.

5.7 Closer to the town centre on the section of Aylsham Road between Cherry Tree Lane and Station Road the road narrows with residential property walls and fences at either side of the road. A lower speed limit (15mph) was introduced in the model to represent the observed behaviour along this section, where vehicles slow-down below the speed limit (20 mph).

Route Closures

5.8 The routing analysis undertaken during the convergence and assignment was also used to identify certain routes with negligible traffic flows. These routes have been removed from the model to avoid rat-running and improve the model stability.

5.9 The following route closures were implemented in the model to prohibit certain routes which are not practical, due to the conditions of the roads, and this was confirmed by ANPR and MCTC data:

- A route closure has been coded on Skeyton Road, banning the through movement from the south, so the road is only used for access to and from Zone 24 (Brookes Drive). This assumption was supported by the ANPR and MCTC data in the area showing less than 15 vehicles per hour along this route in both directions;
- Secondly, a route closure was applied to avoid vehicles accessing Cromer Road to and from Cherry Tree Lane, as the road is narrow and on-street parking makes this route highly unattractive; and,
- A route closure was also added to Bradfield Road allowing vehicles to only use Cromer Road for Eastbound and Westbound movements.

Priority Rules and Conflict Areas

5.10 Priority Rules and Conflict Areas have been coded and calibrated based on observed network conditions and driving behaviour at roundabouts, priority junctions and other give way situations.

5.11 Priority Rules have also been used to replicate specific behaviours such as the operation of the underpass on Aylsham Road shown in Figure 5-1 where large vehicles use the centre of the road to go through the underpass due to the height of the bridge.

Figure 5-1 – Eastbound Road view on Aylsham Road at A149 underpass

5.12 In addition to the underpass on Aylsham Road there are height restrictions in place for HGVs at the B1150 Norwich Road and A149 Cromer Road. The traffic data collected at the nearby junctions suggests that the constraints created by the height restrictions do not affect all the HGVs as the data and the video footage shows OGV1 and OGV2 going through the underpass.

5.13 The Vissim model has been calibrated to match the number of Cars, LGVs and HGVs observed in the area. However, vehicle classification used to develop the Vissim demand (DfT vehicle classification) which defines the vehicle characteristics, such as vehicle length, acceleration or speed profile does not include any reference to vehicle height as this parameter is not linked to the vehicle type.

Figure 5-2 – Height restriction on N Walsham Rd

Buses

5.14 All bus services in the model were coded based on information available online. For all bus stops in the model a standard dwell time of 20 seconds was assumed.

Signal Information

5.15 The signalised junctions included in the model area have the capability to operate on MOVA (Microprocessor Optimised Vehicle Actuation). However, MOVA logs, and operational files were not collected on the day of the surveys, so it was not possible to model this operation explicitly in the model. This requires use of PCMOVA, an add-on to Vissim, which adds additional time/cost to the model development and increases run-times, so this is typically only used in complex strategic junctions where it is proportionate.

5.16 The signal data provided by Norfolk County Council (NCC), including the specification of the existing controller, and the average green times at the junction were used to develop a variable signal logic file included in the model using VisVAP. The Vehicle Actuated (VA) signal operation allows the model to extend or reduce the green time allocated to each arm of the junction depending on the traffic demand, which is monitored through detectors (representing loops in the road).

5.17 The minimum and maximum green times as well as signal patterns defining the priority of each arm have been calibrated to observed signal operation and signal information, to provide a realistic approximation of the operation of MOVA.

Differences between AM and PM Networks

5.18 Some elements of the models are expected to be different in different time periods. The demand, routing, and signal controllers represent the different flow patterns/ routeing and signal timings in the AM and the PM model. However, there are no differences between AM and PM networks to report.

6. Model Calibration

Introduction

6.1 The purpose of the model calibration process is to ensure that the model represents existing traffic conditions. Calibration is an iterative process in which the model is revised to replicate observed traffic volumes, traffic conditions and vehicle behaviour as closely as possible.

Saturation Flow Calibration

6.2 The saturation flow is the maximum number of vehicles that are able to pass across a lane at a signal stop-line in an hour.

6.3 The modelled saturation flows on each signalized stop line have been compared to estimated saturation flows calculated using the RR67 formula. The measurements required for the RR67 formula (lane-width, radius, etc.) have been measured using Google Maps.

6.4 The modelled saturation flows were extracted from Vissim using a saturation flow script developed by AECOM. Modelled values have been compared to the RR67 values to ensure that they are within an acceptable range. The saturation flow results have been presented, below in Table 6-1.

Table 6-1 - Saturation Flows

Junction	Approach	Modelled	RR67	Difference
Cromer Road / Aylsham Road	Mundesley Road	1761.25	1865	-6%
	Aylsham Road	1761.25	1865	-6%
	Cromer Road	1761.25	1915	-8%
Cromer Road / B1150 / A149	A149 Northbound	1731.16	1808	-4%
	A149 Northbound	1818.8	1915	-5%
	B1150 Southbound	1979.0	1915	3%
	B1150 Southbound	1717.74	1808	-5%
	Cromer Road	1672.69	1785	-6%
	Cromer Road	1717.74	1808	-5%
A149 / Norwich Road / Grammar School Road	A149 Southbound	1781.58	1915	-7%
	A149 Northbound	1780.27	1915	-7%
	A149 Southbound	1723.09	1808	-5%
	Norwich Road	1720.85	1783	-3%
	A149 Northbound	1727.75	1808	-4%
	Norwich Road	1935.75	1859	4%

Flow Calibration Criteria

6.5 This section presents the traffic flow calibration which was undertaken and compares modelled and observed traffic flows using the criteria provided in TAG Unit M3-1.

6.6 The observed and modelled turning flows were compared for each of the junctions for the AM and PM peak hours, using the TAG criteria (Unit M3.1) for flow calibration as shown in Table 6-2.

Table 6-2 – TAG Calibration Criteria

Type	Criteria	Acceptability Guidelines
1 - % Flows	**a.** Individual flows within 15% for flows 700-2700 vph **b.** Individual flows within 100 vph for flows < 700 vph **C.** Individual flows within 400 vph for flows > 2700 vph	> 85% of all cases
2 – GEH Criteria	GEH Statistic - Individual flows: GEH < 5	

6.7 The differences between modelled and observed flows were calculated and the TAG criteria, both for absolute differences and for GEH statistic, were used to determine if these differences were acceptable. The GEH statistic incorporates both relative and the absolute differences and provides a better indication of the significance of differences, compared to using percentage differences which can be misleading.

6.8 The GEH statistic is defined as:

$$GEH=\sqrt{\frac{(M-C)^2}{(M+C)/2}}$$, where M and C are different datasets to be compared.

Flow Calibration Results

6.9 The modelled turning flows were compared against the surveyed turning flows to calibrate the demand inputs and model assignment. The models were run twenty times using different random seeds to produce a set of average turning count results for comparison with the survey data.

6.10 The AM calibration results in Table 5-3 show the calibration results for each vehicle type. The results demonstrate that the AM peak hour flows are also calibrated closely against the observed turning counts when analysed vehicle class, and all exceed the thresholds set out in TAG. The structure of the junctions and turning count references included in the AM calibration results can be found in Appendix B.

Table 6-3 - AM Calibration Results - Peak Hour by Vehicle Class

Vehicle Class	Tag Criteria	Within	Total Counts	Percentage Passing
Car	% Counts within GEH <5	150	151	99%
	% Flows within Individual Flow	151	151	100%
HGV	% Counts within GEH <5	151	151	100%
	% Flows within Individual Flow	151	151	100%
LGV	% Counts within GEH <5	151	151	100%
	% Flows within Individual Flow	151	151	100%
Total	% Counts within GEH <5	145	151	96%
	% Flows within Individual Flow	150	151	99%

6.11 The AM calibration results in Table 5.4 shows the calibration results for total vehicles entering the model. Although not required in TAG, explicitly matching the observed number of vehicles entering the network is a key metric to validate the capacity and delays of the microsimulation models.

6.12 The results demonstrate that modelled flows at all entries to the model are calibrated closely with observed data as all the inputs are below GEH 5 as required in TAG guidance.

Table 6-4 - AM Calibration results - Model Entries

Entry Road	Observed	Modelled	GEH
Bradfield Road Joining Cromer Road	7	2	2.36
Cromer Road Eastbound	346	344	0.11
Mundesley Road Southbound	136	135	0.09
Market Street Westbound	0	0	0.00
Tungate Road Northbound	46	42	0.60
Aylsham Road Eastbound	166	155	0.87
Skeyton Road Eastbound	92	92	0.00
Morris Road Eastbound	73	82	1.02
Norwich Road Northbound	428	419	0.44
North Walsham Bypass Northbound	325	320	0.28
Grammar School Road Westbound	555	551	0.17
Laundry Loke Eastbound	69	71	0.24
Lyngate Road North	225	241	1.05
Lyngate Road West	320	272	2.79
Folgate Road	47	48	0.15
Total	2835	2777	1.09

6.13 The calibration summary in Table 6-5 demonstrates that the PM peak hour model flows are also closely calibrated against the observed turning counts when analysed by vehicle class, exceeding the requirements set out in TAG. The structure of the junctions and turning counts references included in the PM calibration results can be found in Appendix B.

Table 6-5 - PM Calibration Results - Peak Hour by Vehicle Class

Vehicle Class	Tag Criteria	Within	Total Counts	Percentage Passing
Cars	% Counts within GEH <5	151	151	100%
	% Flows within Individual Flow	151	151	100%
HGVs	% Counts within GEH <5	151	151	100%
	% Flows within Individual Flow	151	151	100%
LGVs	% Counts within GEH <5	150	151	99%
	% Flows within Individual Flow	151	151	100%
Total	% Counts within GEH <5	148	151	98%
	% Flows within Individual Flow	151	151	100%

6.14 The PM calibration results in Table 5.6 shows the calibration results for total vehicles entering the model. The results demonstrate that the total entry volumes into the model are calibrated closely with observed data.

Table 6-6 - PM Calibration Results – Model Entries

Junction	Observed	Modelled	GEH
Bradfield Road Joining Cromer Road	5	7	0.82
Cromer Road Eastbound	552	542	0.43
Mundesley Road Southbound	135	143	0.68
Market Street Westbound	0	0	0.00
Tungate Road Northbound	55	46	1.27
Aylsham Road Eastbound	155	147	0.65
Skeyton Road Eastbound	58	54	0.53
Morris Road Eastbound	12	15	0.82
Norwich Road Northbound	537	521	0.70
North Walsham Bypass Northbound	376	373	0.16
Grammar School Road Westbound	530	522	0.35
Laundry Loke Eastbound	167	158	0.71
Lyngate Road Southbound	232	235	0.20
Lyngate Road Westbound	232	235	0.20
Folgate Road	184	188	0.29
Total	3169	3116	0.95

6.15 A flow diagram was constructed to visualise the junctions/ network and show turning flows within the model. The flow diagrams, showing calibration of flows for all turning movements in the AM and PM, can be found in Appendix C.

Calibration Parameters

6.16 Table 6-7 summarises the main calibration and specific driving behaviour parameters recommended by TAG and DfT for microsimulation models. These parameters have been included in the North Walsham VISSIM model in line with the recommended guidance.

Table 6-7 - Microsimulation Model Parameters – TAG/DfT

Parameter	Value	Following Guidance
Headway	1s time	Yes
Gap	1 to 4 seconds, depends on location	Yes
Vehicle Dynamics	Following graphs	Yes
Reaction Time	-	-
Desired Speed Distributions	Following graphs	Yes
Driver Awareness	Following graphs	Yes
Influence of signing on the approach to a diverge of the motorway lane selection	5	Yes
Cooperative Merging	Yes, used on merging and weaving links Maximum speed difference - 6.71mph Maximum collision time – 10s	Yes
Implied Capacity at roundabouts and signal stop lines	-	-
Min Distance between vehicles at a standstill	1.5m	Yes

7. Model Validation

Introduction

7.1 Following the model calibration process, the VISSIM models were validated using journey time data. The vehicle travel time results from the models were compared against the surveyed journey time data to validate the queuing and delay in the model. The models were run twenty times using different random seeds to produce a set of average journey time results for comparison with the survey data.

7.2 The TAG M3-1 criteria for journey time validation are shown in Table 7-1 below.

Table 7-1 – TAG Validation Criteria

Criteria	Acceptability Guidelines
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	> 85% of routes

Journey Time Validation Results

7.3 Figure 7-1 shows the nine journey time routes which have been defined within the model area. The average observed journey times were compared to the average modelled journey times in accordance with the criteria set out in TAG M3-1. The journey times routes were defined using the camera position of the ANPR surveys used to capture the observed journey time data.

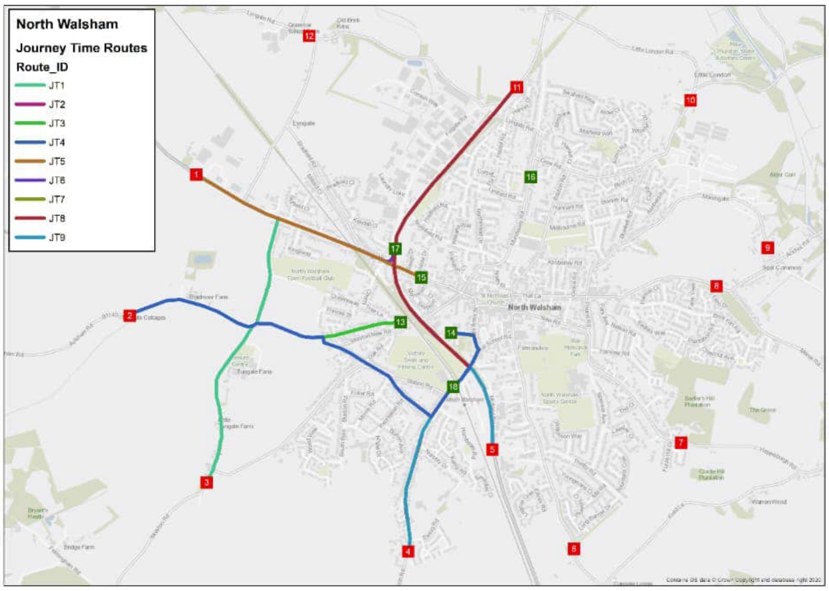


Figure 7-1 – Journey Time Routes

7.4 The definition of these journey times routes has been carried out using the position of the ANPR cameras used to capture the observed journey time data. The inner cameras have also been used split the longer routes into sections, so the profile of delays along the routes can be replicated to make sure the main capacity constraints in the area are validated.

7.5 Tables 6-2 and 6-3 show the individual performance of each of the defined journey time routes for all vehicles, all of which pass the TAG criteria. For ease, the routes are identified as JT 1 to 9 in the following paragraphs.

Table 7-2 – AM Journey Time Validation

ID	Route Name	Observed	Modelled	% Difference	Validation
1	JT1_EB	183	173	-6%	Yes
2	JT1_WB	167	174	4%	Yes
3	JT2_NB	178	186	5%	Yes
4	JT2_SB	173	168	-3%	Yes
5	JT3_EB	105	109	4%	Yes
6	JT3_WB	129	135	4%	Yes
7	JT4_EB	340	309	-9%	Yes
8	JT4_WB	258	251	-3%	Yes
9	JT5_EB	142	134	-6%	Yes
10	JT5_WB	146	142	-3%	Yes
11	JT6_NB	158	171	8%	Yes
12	JT6_SB	176	175	0%	Yes
13	JT7_NB	222	214	-4%	Yes
14	JT7_SB	94	89	-5%	Yes
15	JT8_NB	291	303	4%	Yes
16	JT8_SB	264	255	-3%	Yes
17	JT9_EB	211	194	-8%	Yes
18	JT9_WB	160	156	-2%	Yes

Table 7-3 – PM Journey Time Validation

ID	Route Name	Observed	Modelled	% Difference	Validation
1	JT1_EB	204	176	-14%	Yes
2	JT1_WB	180	180	0%	Yes
3	JT2_NB	192	198	3%	Yes
4	JT2_SB	207	206	0%	Yes
5	JT3_EB	104	104	0%	Yes
6	JT3_WB	134	130	-3%	Yes
7	JT4_EB	364	342	-6%	Yes
8	JT4_WB	267	256	-4%	Yes
9	JT5_EB	155	151	-3%	Yes
10	JT5_WB	150	149	0%	Yes
11	JT6_NB	189	186	-1%	Yes
12	JT6_SB	192	184	-4%	Yes
13	JT7_NB	274	244	-11%	Yes
14	JT7_SB	96	94	-2%	Yes
15	JT8_NB	362	349	-4%	Yes
16	JT8_SB	294	295	0%	Yes
17	JT9_EB	265	226	-14.5%	Yes
18	JT9_WB	173	160	-8%	Yes

7.6 The detailed journey time comparisons through the key parts of the model have been extracted and compared against the observed data in the sections below Figure 7-2 to Figure 7-10, showing that the model provides an accurate representation of the journey time and delays along the routes. The comparison of all the journey time routes included in the model routes can be found in Appendix D.

JT1

7.7 JT1 runs from Zone 1 – Cromer Road South to Zone 3 – Skeyton Road, as shown in Figure 7-2. This route is considered important as this is the region of the proposed development. This route shows that the lower speeds included in the models is aligned with the average speed obtained from the observed journey time data.

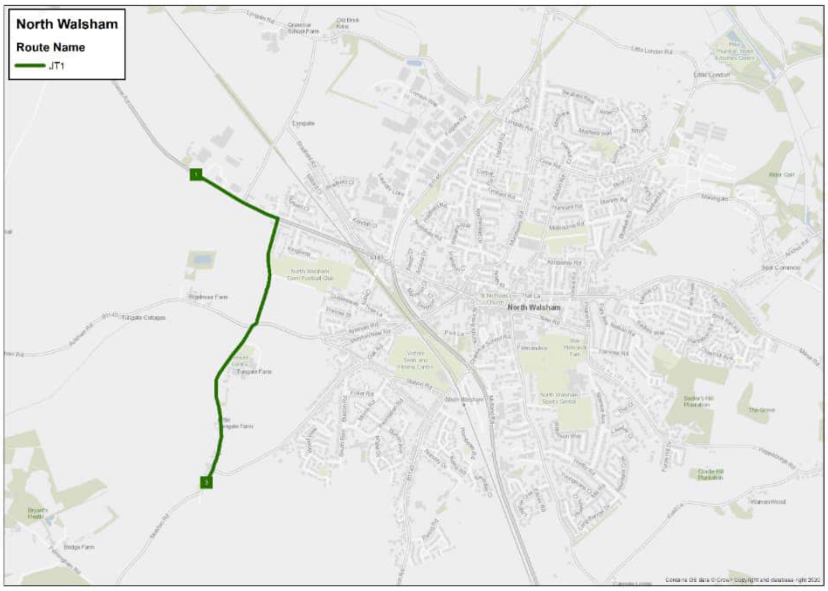


Figure 7-2 – JT1 Route Diagram

7.8 Figure 7-3 show the eastbound validation profile of this route with the observed data for both peaks.

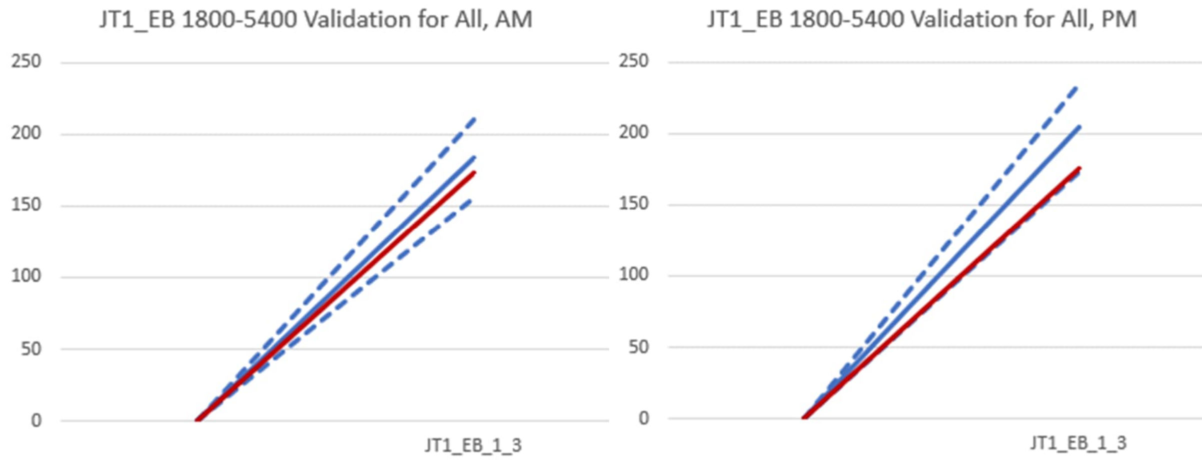


Figure 7-3 – JT1 Eastbound Journey Time Validation profile

7.9 Figure 7-4 show the westbound validation profile of this route with the observed data for both peaks.

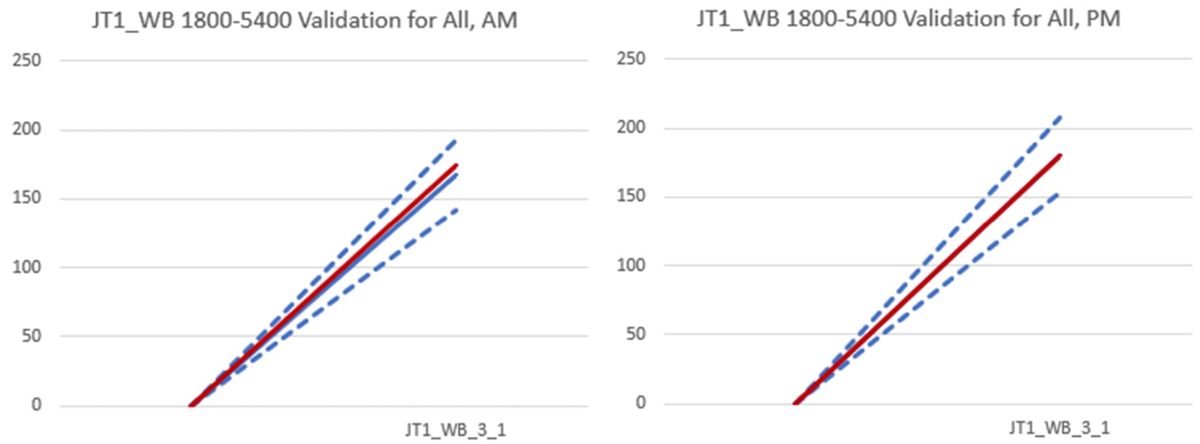


Figure 7-4 – JT1 Westbound Journey Time Validation profile

JT2

7.10 JT2 run from Zone 5 – North Walsham Bypass North to Zone 10 – North Walsham Bypass, as shown in Figure 5-5.

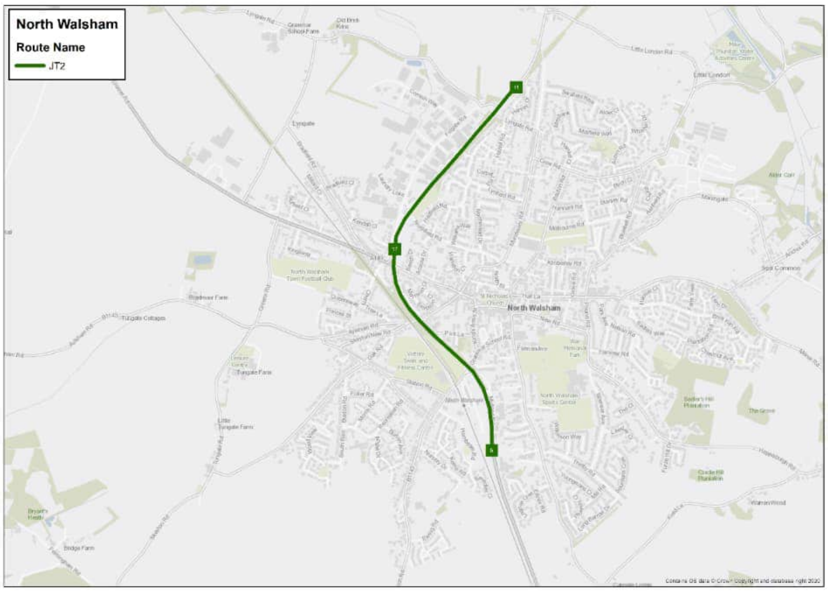


Figure 7-5 – JT 2 Route Diagram

7.11 Figure 7-6 show the northbound validation profile of this route with the observed data for both peaks.

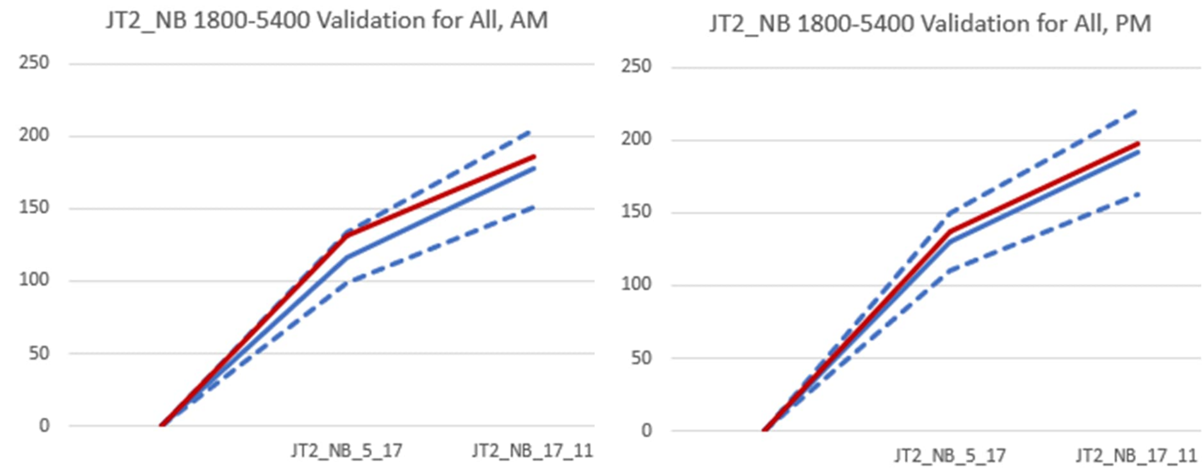


Figure 7-6 – JT2 Northbound Validation Profile

7.12 Figure 7-7 show the southbound validation profile of this route with the observed data for both peaks.

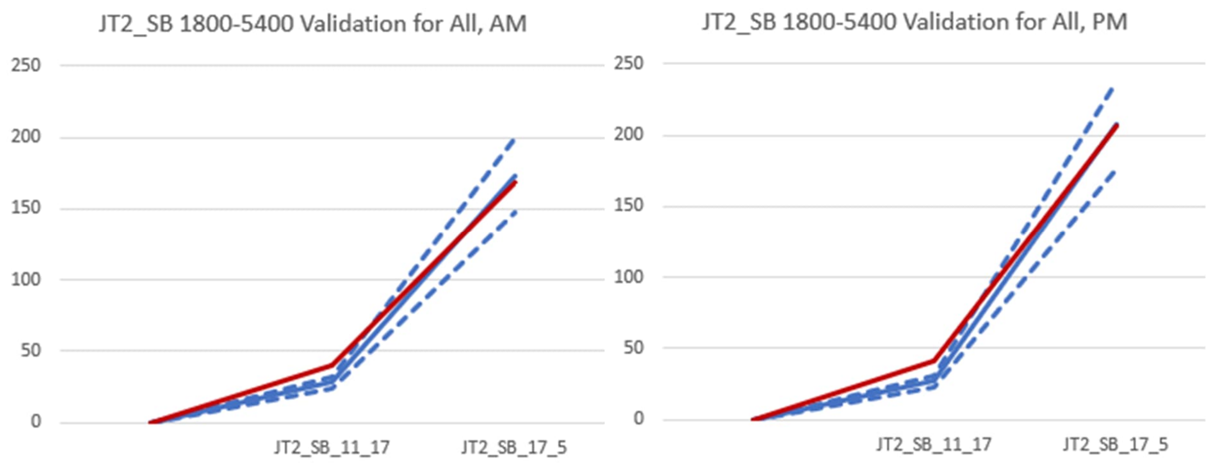


Figure 7-7 – JT2 Southbound Validation Profile

JT4

7.13 JT4 runs from Zone 2 Aylsham Road to Camera 14 Park Lane in the eastbound direction and from Zone 5 to Zone 2 in the westbound direction. This route has a different start/end point in the east as Park Lane is a one-way street.

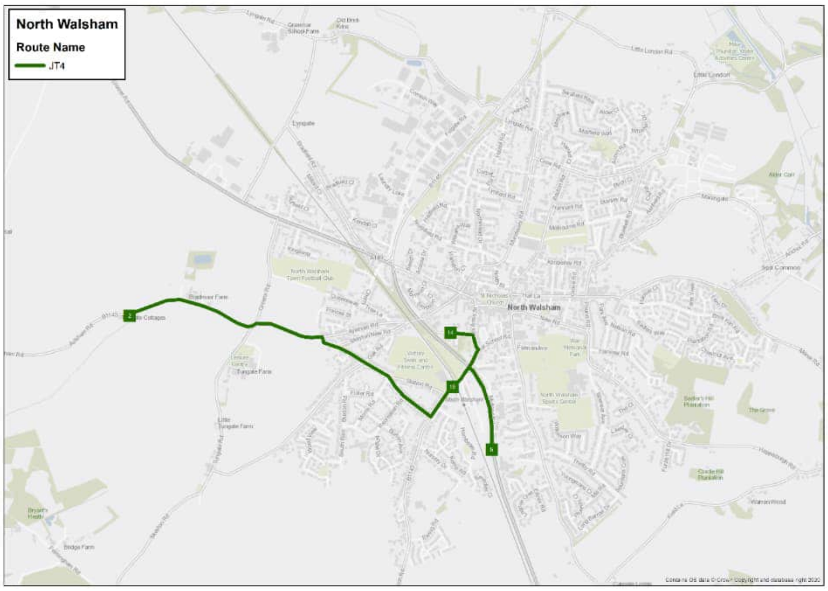


Figure 7-8 – JT4 Route Diagram

7.14 Figure 7-9 show the eastbound validation profile of this route with the observed data for both peaks.

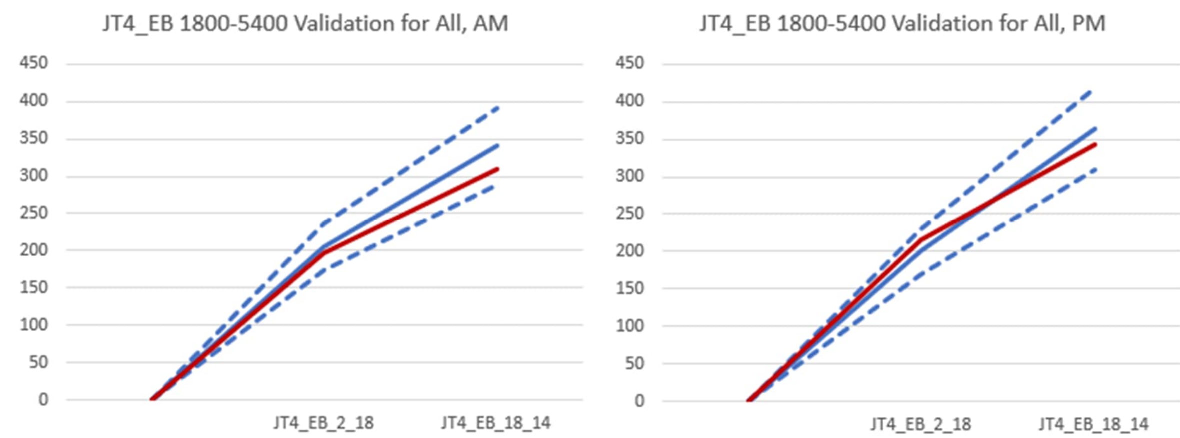
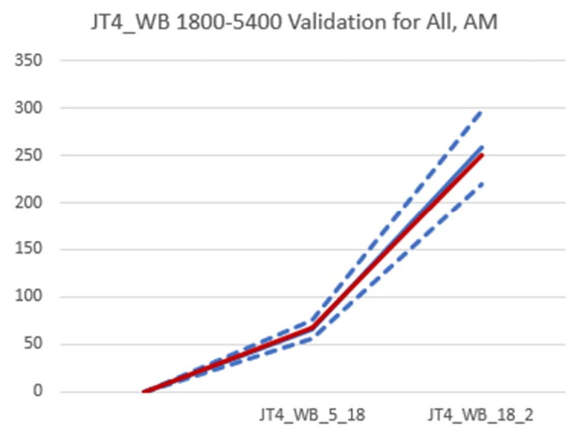


Figure 7-9 – JT4 Eastbound Validation Profile

7.15 Figure 7-10 show the westbound validation profile of this route with the observed data for both peaks.



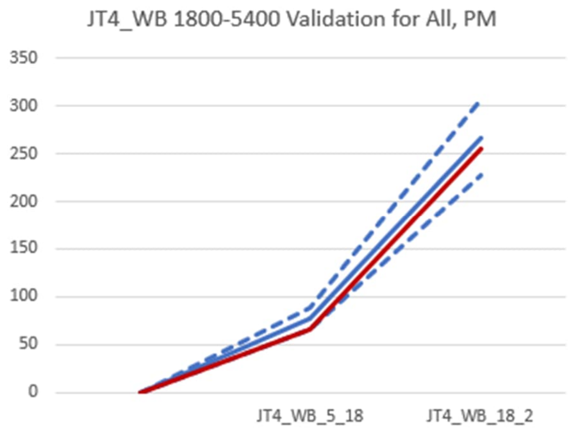


Figure 7-10 – JT4 Westbound Validation profile

Queue Comparison

7.16 In addition to the journey time validation of the model, TAG also recommends a review of the queues in the model and how these relate to existing queues. Although journey times provide a more accurate representation of the existing delays, the visual comparison of the queue patterns in the area provides further reassurance to support the model operation and results.

7.17 Two main sources have been used to understand the main queues in the model area: survey videos and live traffic information from Google Maps on the day the surveys took place.

7.18 The main queues in the AM peak hour are:

- Queues approaching the signalised crossroads of the B1150 and A149; and
- Queues approaching the signalised crossroad of Cromer Road and The North Walsham Bypass.

7.19 Figure 7-11 shows the typical traffic conditions from Google Maps, on a neutral weekday at 08:30.

7.20 Figure 7-12 below, shows a peak hour average speed plot extracted from the model at the same time. The comparison shows that the model provides a reasonable representation of the queuing patterns in the area.

7.21 It should be noted that the lower speeds along Millfield Road, Aylsham Road or Tungate Road shown on the average speed plots, result from lower speeds coded in the model to represent the impact of on-street parking or narrow roads.

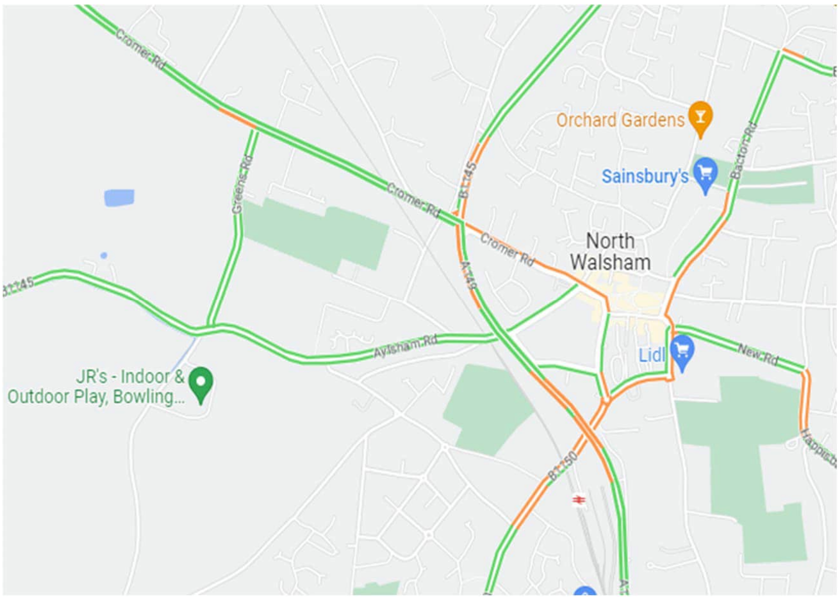


Figure 7-11 - Typical queues from Google Traffic on a Wednesday, 08:30

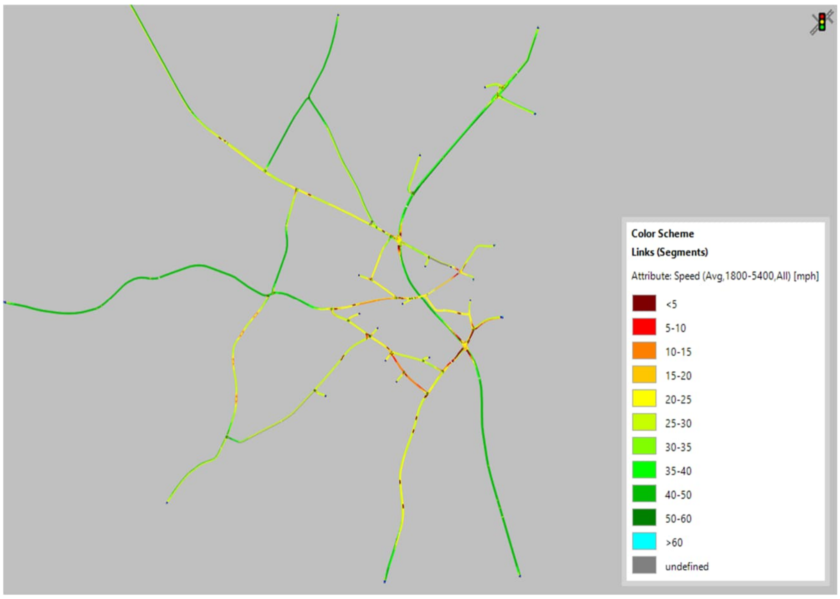


Figure 7-12 - AM Peak Hour Speed Plot

7.22 The main queues in PM peak are largely similar to those in the AM peak hour. These are:

- Queues approaching the crossroads of the A149 and the B1150; and
- Queues/ reduced speeds on Aylsham Road.

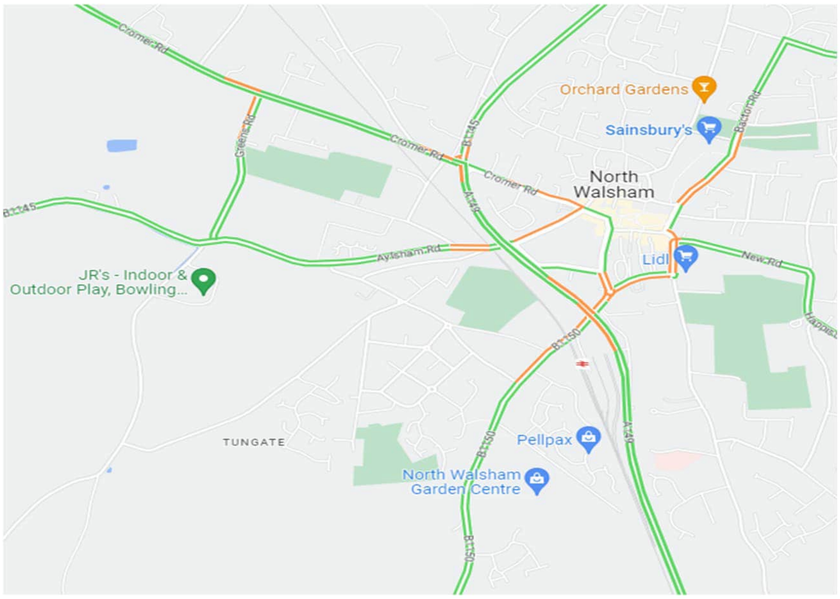


Figure 7-13 - Typical queues from Google Traffic on a Wednesday, 17:00

7.23 Figure 7-13 shows the typical traffic conditions from Google Maps, on a Wednesday at 17:00, and Figure 7-14 below, show the modelled queues during the PM peak. It can be observed that similar queueing patterns are replicated in the model.

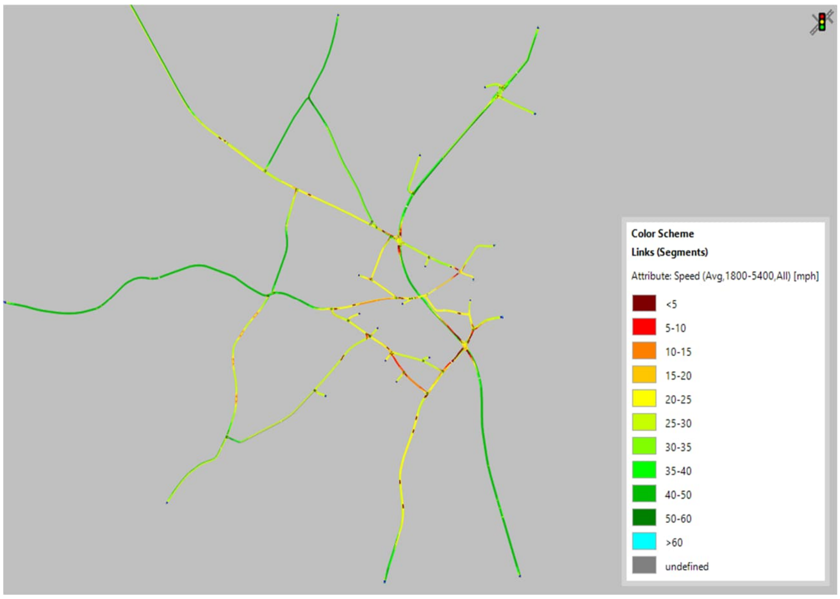


Figure 7-14 – PM Peak Hour Speed Plot

Model Variability

7.24 Microsimulation models are run several times with different random seeds to obtain a statistically representative result. This approach replicates daily variability, since each run has different arrival profiles which results in a different chain of events. A representative average of the results is the obtained/ presented.

7.25 The observed data indicates there is limited variability in the network operation except for the signalised A149/B1150 junction. The queue along Norwich Road approaching this junction is generally long but varied in length, and often disperses every cycle, resulting in highly variable journey times along this section, depending on when the vehicles arrive at the junction.

7.26 This operation and the associated variability have been represented in the model. Figure 7-15 and 7-16 show the operation of the signalised junction on the A149 and Norwich Road in the VISSIM model.

7.27 The figures show how the queues along Norwich Road northbound build up to a significant length but are discharged fully every cycle. This operation is consistent with the observations from the video footage.

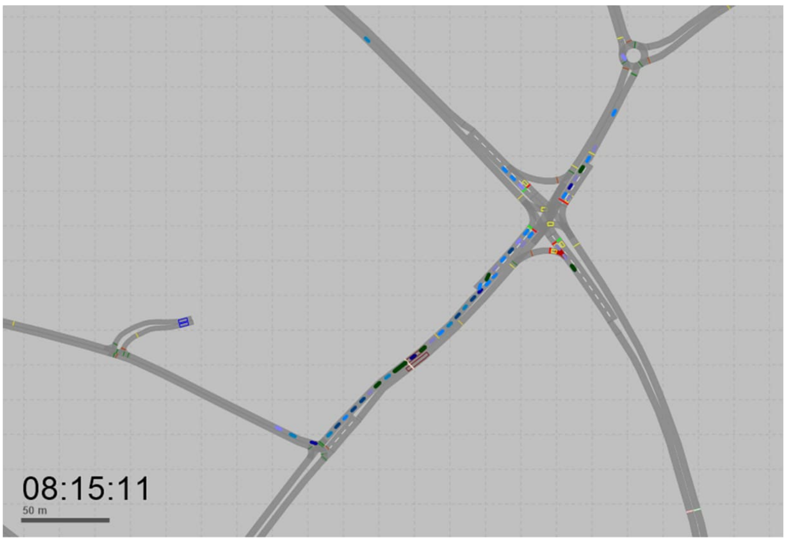


Figure 7-15 - A149/B1150 Junction – Norwich Road northbound green signal starts (AM)

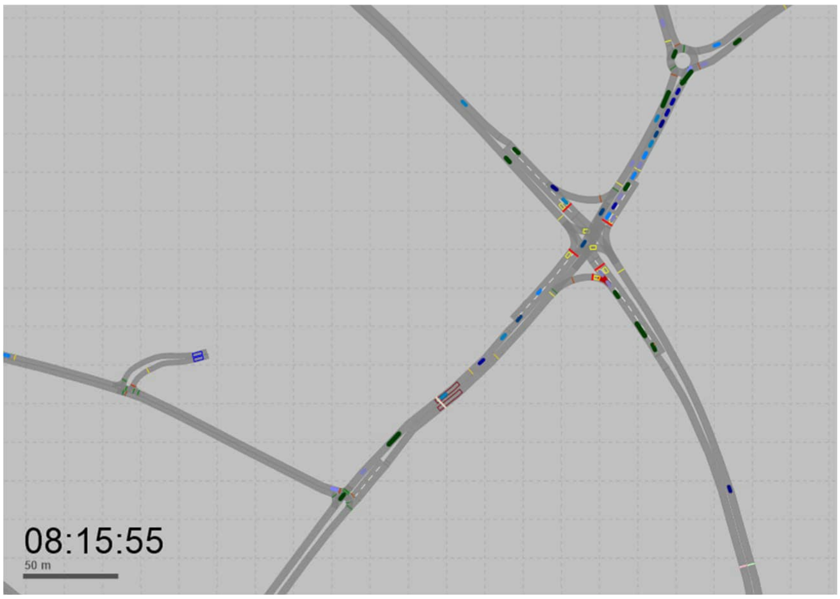


Figure 7-16 - A149/B1150 Junction – Norwich Road northbound green signal ends (AM)

7.28 Figure 7-17 shows the crossroads of the A149 and the B1150 in the VISSIM model at the moment that the green period begins for traffic from the B1150 at 16:42. While Figure 7-18 shows the same junction at the end of the green period. The two figures demonstrate how the queues in this direction build up significantly, but then disperse which is in accordance with observations from video footage.

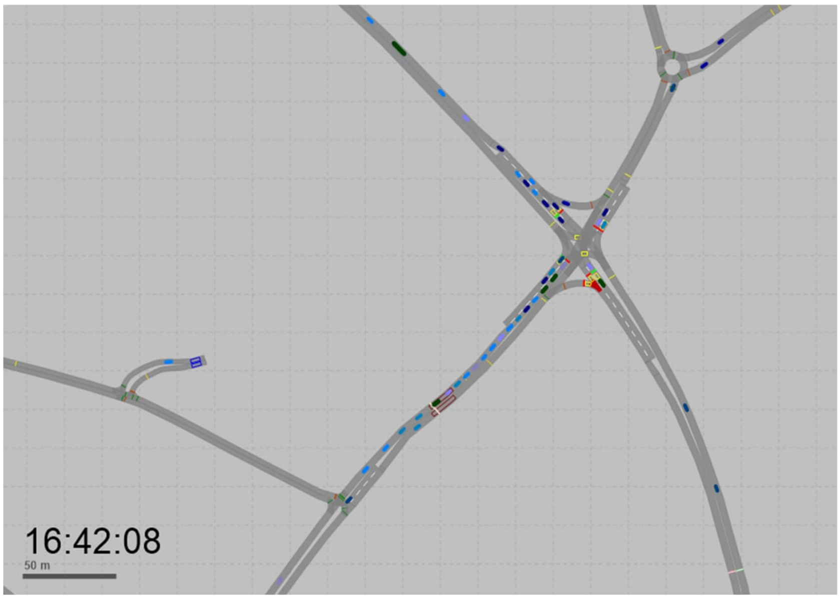


Figure 7-17 - A149/B1150 Junction – Norwich Road northbound green signal starts (PM)

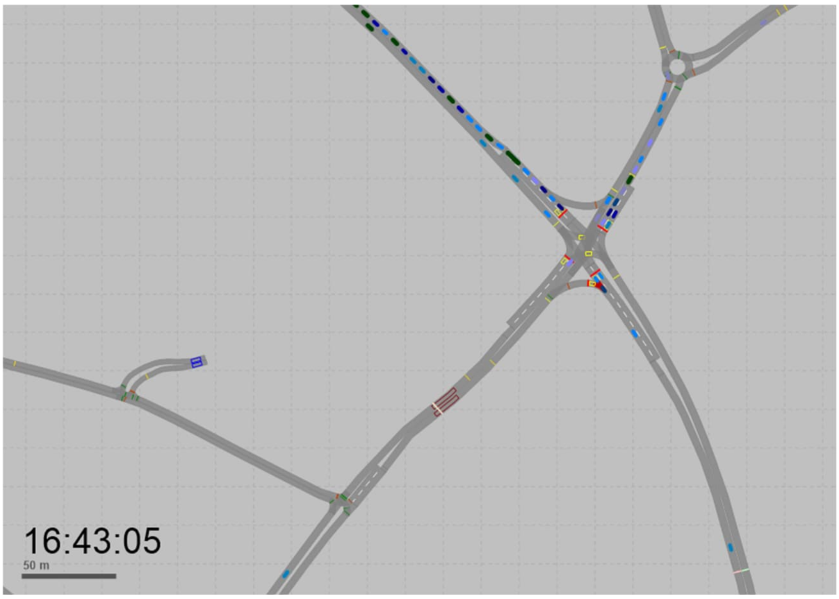


Figure 7-18 - A149/B1150 Junction – Norwich Road northbound green signal ends (PM)

8. Conclusion

8.1 North Walsham is located on the east of England, north of Norwich. The town experiences some congestion around the signalised junctions and the town centre roads with queues often building up in these areas at AM and PM peak times. However, these queues are not too extensive with vehicles usually progressing through signals in a single cycle, with minimum impacts on nearby junctions.

8.2 The base models have been calibrated and validated against the observed traffic flow and journey time data in line with the required criteria set out in TAG and best practice. The calibration/ validation results exceed the requirements for turning counts and journey times and the models are therefore closely aligned with observed data. The models also replicate observed queueing patterns and specific behaviours observed from video footage. The models are therefore validated to industry standard guidelines.

8.3 It is considered the base models provide a close representation of the queues and delays in the network, as well as the observed driving behaviour in the area, and are fit for the purpose of testing future traffic levels/ patterns or potential changes to the road network.

Appendix A – Consistency Checks

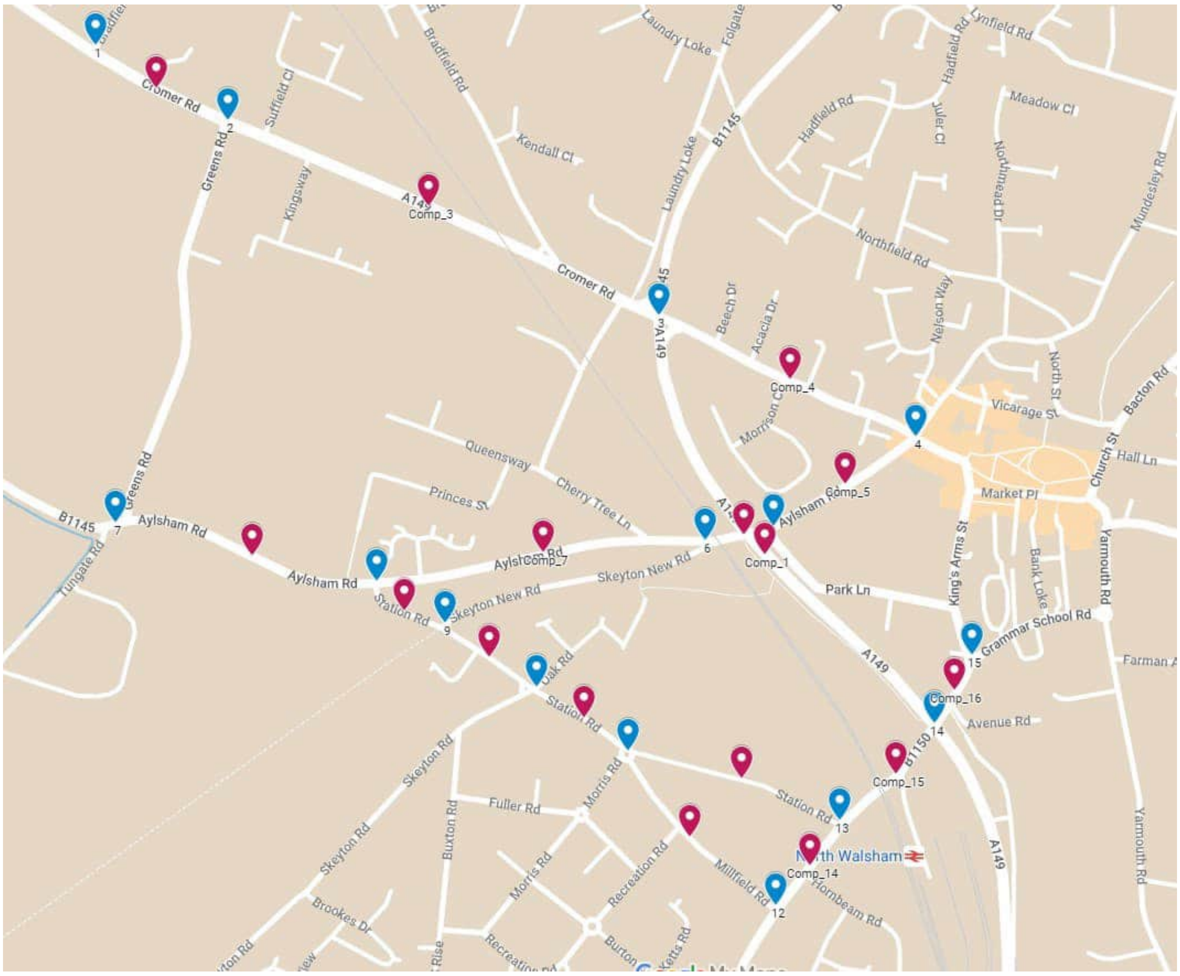


Figure 7. MCTC Count Sites and Comparisons

					Difference			GEH								Difference			GEH			
ID	Site	Exit	Site	Entry	13/07/2022	14/07/2022	AM Avg	########	########	########	AM Avg	Site	Exit	Site	Entry	13/07/2022	14/07/2022	PM Avg	########	########	########	AM Avg
Comp_1	14	B	3	C	4	12	**8**	17	0	1	**0**	14	B	3	C	16	-2	**7**	18	1	0	**0**
	3	C	14	B	0	5	**3**	18	0	0	**0**	3	C	14	B	23	23	**23**	16	1	1	**1**
Comp_2	1	C	2	A	11	4	**8**	0	1	0	**0**	1	C	2	A	3	1	**2**	0	0	0	**0**
	2	A	1	C	0	0	**0**	0	0	0	**0**	2	A	1	C	1	2	**2**	0	0	0	**0**
Comp_3	2	C	3	B	56	34	**45**	5	3	2	**2**	2	C	3	B	30	57	**44**	4	1	3	**2**
	3	B	2	C	3	-19	**-8**	2	0	1	**0**	3	B	2	C	-40	-21	**-31**	4	2	1	**2**
Comp_4	3	D	4	B	-10	-12	**-11**	2	1	1	**1**	3	D	4	B	-11	-13	**-12**	1	1	1	**1**
	4	B	3	D	11	15	**13**	6	5	5	**5**	4	B	3	D	5	17	**11**	6	3	6	**5**
Comp_5	4	C	5	A	0	0	**0**	#DIV/0!	#DIV/0!	#DIV/0!	**#DIV/0!**	4	C	5	A	0	0	**0**	#DIV/0!	#DIV/0!	#DIV/0!	**#DIV/0!**
	5	A	4	C	-3	0	**-2**	0	0	0	**0**	5	A	4	C	-5	2	**-2**	0	0	0	**0**
Comp_6	5	B	6	A	2	0	**1**	0	0	0	**0**	5	B	6	A	2	0	**1**	0	0	0	**0**
	6	A	5	B	0	0	**0**	0	0	0	**0**	6	A	5	B	0	-1	**-1**	0	0	0	**0**
Comp_7	6	B	8	A	5	9	**7**	0	0	1	**1**	6	B	8	A	-27	-38	**-33**	3	2	3	**3**
	8	A	6	B	6	5	**6**	0	0	0	**0**	8	A	6	B	-2	-14	**-8**	1	0	1	**1**
Comp_8	7	D	8	B	-1	1	**0**	0	0	0	**0**	7	D	8	B	-2	0	**-1**	0	0	0	**0**
	8	B	7	D	0	0	**0**	0	0	0	**0**	8	B	7	D	1	-1	**0**	0	0	0	**0**
Comp_9	8	C	9	B	1	0	**1**	0	0	0	**0**	8	C	9	B	3	2	**3**	0	0	0	**0**
	9	B	8	C	-2	2	**0**	0	0	0	**0**	9	B	8	C	0	-4	**-2**	0	0	0	**0**
Comp_10	9	C	10	B	-3	1	**-1**	0	0	0	**0**	9	C	10	B	-2	-2	**-2**	0	0	0	**0**
	10	B	9	C	5	4	**5**	0	0	0	**0**	10	B	9	C	-1	4	**2**	0	0	0	**0**
Comp_11	10	D	11	A	-2	-7	**-5**	0	0	1	**0**	10	D	11	A	-5	-1	**-3**	0	0	0	**0**
	11	A	10	D	-8	2	**-3**	1	1	0	**0**	11	A	10	D	-11	6	**-3**	1	1	0	**0**
Comp_12	11	D	13	B	-8	1	**-4**	9	1	0	**1**	11	D	13	B	-19	9	**-5**	9	4	1	**1**
	13	B	11	D	-19	-13	**-16**	6	3	2	**3**	13	B	11	D	-6	-17	**-12**	9	1	3	**2**
Comp_13	11	C	12	B	23	40	**32**	1	2	3	**2**	11	C	12	B	10	19	**15**	2	1	2	**1**
	12	B	11	C	-29	-30	**-30**	2	2	2	**2**	12	B	11	C	-32	-50	**-41**	2	2	4	**3**
Comp_14	12	A	13	C	31	22	**27**	30	1	1	**1**	12	A	13	C	10	12	**11**	32	0	1	**0**
	13	C	12	A	-9	4	**-3**	31	0	0	**0**	13	C	12	A	-23	-10	**-17**	29	1	0	**1**
Comp_15	13	A	14	C	2	3	**3**	31	0	0	**0**	13	A	14	C	48	14	**31**	33	2	1	**1**
	14	C	13	A	5	-16	**-6**	32	0	1	**0**	14	C	13	A	2	-6	**-2**	30	0	0	**0**
Comp_16	14	A	15	B	-5	10	**3**	0	0	0	**0**	14	A	15	B	4	-7	**-2**	1	0	0	**0**
	15	B	14	A	-7	11	**2**	0	0	1	**0**	15	B	14	A	4	-1	**2**	1	0	0	**0**

Figure 8. MCTC Consistency Check

Appendix B - Calibration Results

									Cars			HGV			LGV		
						ALL VEH			CAR			HGV			LGV		
	Junction	From	To	Turn ID	Node	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
1AC	1	A	C	J1_A_C	101	4	0	2.828	2	0	2.000	0	0	0.000	2	0	2.000
1AB	1	A	B	J1_A_B	101	3	2	0.632	2	1	0.816	0	0	0.000	1	1	0.000
1BA	1	B	A	J1_B_A	101	3	2	0.632	2	2	0.000	0	0	0.000	1	0	1.414
1BC	1	B	C	J1_B_C	101	346	342	0.197	254	253	0.085	33	34	0.164	56	56	0.033
1CB	1	C	B	J1_C_B	101	537	470	3.004	406	357	2.511	33	30	0.498	88	82	0.601
1CA	1	C	A	J1_C_A	101	8	4	1.509	4	4	0.129	0	0	0.000	4	0	2.828
2AC	2	A	C	J2_A_C	102	287	266	1.248	209	196	0.881	29	24	0.981	46	46	0.022
2AB	2	A	B	J2_A_B	102	74	76	0.265	52	56	0.564	6	10	1.399	16	10	1.602
2BA	2	B	A	J2_B_A	102	159	130	2.430	139	107	2.900	4	5	0.471	14	18	0.988
2BC	2	B	C	J2_B_C	102	70	27	6.113	55	25	4.828	7	3	1.897	7	0	3.742
2CB	2	C	B	J2_C_B	102	78	64	1.699	64	57	0.841	6	0	3.464	8	6	0.656
2CA	2	C	A	J2_C_A	102	386	345	2.120	273	256	1.073	26	25	0.148	79	65	1.693
3AD	3	A	D	J3_A_D	103	29	25	0.710	16	18	0.461	0	3	2.510	12	4	2.719
3AC	3	A	C	J3_A_C	103	265	245	1.275	206	197	0.641	15	15	0.051	32	33	0.097
3AB	3	A	B	J3_A_B	103	174	159	1.182	135	123	1.097	15	17	0.500	21	19	0.401
3BA	3	B	A	J3_B_A	103	124	89	3.418	99	62	4.130	9	17	2.160	15	10	1.399
3BD	3	B	D	J3_B_D	103	92	52	4.727	72	38	4.631	2	2	0.000	10	12	0.660
3BC	3	B	C	J3_B_C	103	197	167	2.193	145	135	0.841	22	10	3.045	29	23	1.281
3CB	3	C	B	J3_C_B	103	282	232	3.125	192	177	1.089	18	9	2.370	68	45	2.994
3CA	3	C	A	J3_C_A	103	211	240	1.951	149	184	2.731	16	14	0.463	40	42	0.289
3CD	3	C	D	J3_C_D	103	14	0	5.292	12	0	4.899	0	0	0.000	2	0	2.000
3DC	3	D	C	J3_D_C	103	3	2	0.632	3	2	0.632	0	0	0.000	0	0	0.000
3DB	3	D	B	J3_D_B	103	5	6	0.282	4	4	0.258	0	0	0.000	1	2	0.916
3DA	3	D	A	J3_D_A	103	3	3	0.057	3	3	0.057	0	0	0.000	0	0	0.000
4AD	4	A	D	J4_A_D	104	137	135	0.141	119	118	0.064	0	0	0.000	17	17	0.012
4BA	4	B	A	J4_B_A	104	70	38	4.378	55	26	4.483	0	3	2.530	12	8	1.179
4BD	4	B	D	J4_B_D	104	55	30	3.826	38	22	2.983	3	4	0.485	8	4	1.423
4CA	4	C	A	J4_C_A	104	224	243	1.240	193	211	1.249	2	3	0.772	26	29	0.563
4CD	4	C	D	J4_C_D	104	120	120	0.046	93	102	0.936	3	0	2.449	13	17	1.093
5BA	5	B	A	J5_B_A	105	195	135	4.641	156	122	2.875	3	0	2.449	22	13	2.084
5CB	5	C	B	J5_C_B	105	208	158	3.716	168	143	2.013	3	1	1.596	28	14	3.042
5CA	5	C	A	J5_C_A	105	152	228	5.497	131	192	4.768	1	3	1.543	19	33	2.737
6AC	6	A	C	J6_A_C	106	46	42	0.680	37	41	0.562	1	0	1.414	4	1	1.897
6AB	6	A	B	J6_A_B	106	164	115	4.135	131	102	2.682	2	0	2.000	24	13	2.531
6BA	6	B	A	J6_B_A	106	179	126	4.252	146	113	2.881	2	0	2.000	22	13	2.084
6BC	6	B	C	J6_B_C	106	6	2	1.907	4	0	2.828	0	0	0.000	2	2	0.104
6CB	6	C	B	J6_C_B	106	7	3	1.789	4	2	1.155	0	1	1.414	0	0	0.000
6CA	6	C	A	J6_C_A	106	16	0	5.657	10	0	4.472	1	0	1.414	0	0	0.000
7AD	7	A	D	J7_A_D	107	76	70	0.660	58	50	1.053	5	10	1.811	13	10	0.838
7AC	7	A	C	J7_A_C	107	21	25	0.844	17	25	1.756	2	0	2.000	2	0	2.000
7AB	7	A	B	J7_A_B	107	56	45	1.526	42	39	0.511	5	0	3.162	9	6	0.937
7BA	7	B	A	J7_B_A	107	62	30	4.796	48	27	3.485	6	3	1.497	8	0	4.000
7BD	7	B	D	J7_B_D	107	109	126	1.551	90	107	1.684	2	6	1.924	12	13	0.366
7BC	7	B	C	J7_B_C	107	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
7CB	7	C	B	J7_C_B	107	4	4	0.076	4	4	0.076	0	0	0.000	0	0	0.000
7CA	7	C	A	J7_C_A	107	22	5	4.663	16	5	3.434	3	0	2.449	2	0	2.000
7CD	7	C	D	J7_C_D	107	22	34	2.183	17	27	2.141	1	4	2.090	3	2	0.632
7DC	7	D	C	J7_D_C	107	18	13	1.229	12	12	0.043	2	0	2.000	2	1	0.816
7DB	7	D	B	J7_D_B	107	128	129	0.119	96	105	0.854	2	3	0.487	26	22	0.806
7DA	7	D	A	J7_D_A	107	146	124	1.893	128	101	2.503	2	5	1.561	13	18	1.247
8AC	8	A	C	J8_A_C	108	35	13	4.416	27	11	3.629	3	2	0.530	4	0	2.828
8AB	8	A	B	J8_A_B	108	141	91	4.627	114	78	3.641	0	0	0.000	21	13	1.981
8BA	8	B	A	J8_B_A	108	101	77	2.572	79	63	1.868	2	5	1.645	16	8	2.176
8BC	8	B	C	J8_B_C	108	105	153	4.194	85	120	3.466	6	15	2.826	12	17	1.385
8CB	8	C	B	J8_C_B	108	151	176	1.989	123	141	1.541	5	8	1.089	20	28	1.633
8CA	8	C	A	J8_C_A	108	78	38	5.191	69	32	5.148	2	0	2.000	5	6	0.447
9AC	9	A	C	J9_A_C	109	51	45	0.873	46	41	0.766	1	1	0.000	4	3	0.535
9AB	9	A	B	J9_A_B	109	2	2	0.000	1	0	1.414	0	0	0.000	1	2	0.816
9BA	9	B	A	J9_B_A	109	2	5	1.645	0	4	2.775	1	1	0.236	0	0	0.000
9BC	9	B	C	J9_B_C	109	139	161	1.784	112	127	1.412	8	16	2.357	16	17	0.295
9CB	9	C	B	J9_C_B	109	229	213	1.049	193	174	1.425	7	8	0.276	24	32	1.503
9CA	9	C	A	J9_C_A	109	16	10	1.711	14	10	1.202	0	0	0.000	0	0	0.000
10AD	10	A	D	J10_A_D	110	4	1	1.897	1	0	1.414	0	0	0.000	3	1	1.414
10AC	10	A	C	J10_A_C	110	1	0	1.414	0	0	0.000	0	0	0.000	0	0	0.000
10AB	10	A	B	J10_A_B	110	4	2	1.155	3	0	2.449	0	0	0.000	0	2	2.000
10BA	10	B	A	J10_B_A	110	2	0	2.000	1	0	1.414	0	0	0.000	1	0	1.414
10BD	10	B	D	J10_B_D	110	133	165	2.618	109	131	2.047	9	17	2.266	15	16	0.329
10BC	10	B	C	J10_B_C	110	52	41	1.660	44	37	1.116	0	0	0.000	5	4	0.572
10CB	10	C	B	J10_C_B	110	55	64	1.142	48	53	0.690	0	0	0.000	6	11	1.686
10CA	10	C	A	J10_C_A	110	3	0	2.449	0	0	0.000	0	0	0.000	0	0	0.000
10CD	10	C	D	J10_C_D	110	41	28	2.251	33	28	0.943	0	0	0.000	5	0	3.162
10DC	10	D	C	J10_D_C	110	33	38	0.839	31	37	0.980	0	0	0.000	1	1	0.280
10DB	10	D	B	J10_D_B	110	181	158	1.790	151	131	1.684	7	8	0.258	18	19	0.232
10DA	10	D	A	J10_D_A	110	5	15	3.198	2	14	4.198	0	0	0.000	2	1	0.502
11AD	11	A	D	J11_A_D	111	34	25	1.627	30	25	0.924	0	0	0.000	2	0	2.000
11AC	11	A	C	J11_A_C	111	129	142	1.117	102	110	0.777	9	14	1.592	18	18	0.107
11AB	11	A	B	J11_A_B	111	12	14	0.461	11	14	0.755	0	0	0.000	1	0	1.414
11AA	11	A	A	J11_A_A	111	1	13	4.470	1	10	3.812	0	3	2.366	0	0	0.000
11BA	11	B	A	J11_B_A	111	42	62	2.736	39	60	2.953	0	0	0.000	2	2	0.036
11BD	11	B	D	J11_B_D	111	13	0	5.099	11	0	4.690	0	0	0.000	0	0	0.000
11BC	11	B	C	J11_B_C	111	21	20	0.243	18	18	0.024	0	0	0.000	3	2	0.632
11BB	11	B	B	J11_B_B	111	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
11CB	11	C	B	J11_C_B	111	13	10	0.948	13	10	0.948	0	0	0.000	0	0	0.000
11CA	11	C	A	J11_C_A	111	162	133	2.401	133	108	2.244	7	5	0.861	17	20	0.608
11CD	11	C	D	J11_C_D	111	3	0	2.449	3	0	2.449	0	0	0.000	0	0	0.000
11CC	11	C	C	J11_C_C	111	0	11	4.712	0	4	2.846	0	0	0.000	0	7	3.755
11DC	11	D	C	J11_D_C	111	2	0	2.000	1	0	1.414	0	0	0.000	1	0	1.414
11DB	11	D	B	J11_D_B	111	3	0	2.449	3	0	2.449	0	0	0.000	0	0	0.000
11DA	11	D	A	J11_D_A	111	22	4	4.895	19	4	4.321	0	0	0.000	2	0	2.000
11DD	11	D	D	J11_D_D	111	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
12AC	12	A	C	J12_A_C	112	385	327	3.055	308	263	2.691	14	11	0.985	55	54	0.101
12AB	12	A	B	J12_A_B	112	122	78	4.422	105	74	3.237	2	0	2.000	13	3	3.330
12BA	12	B	A	J12_B_A	112	86	84	0.272	74	73	0.093	0	1	1.414	12	9	0.827
12BC	12	B	C	J12_B_C	112	89	120	3.064	68	86	2.078	7	15	2.350	12	19	1.856
12CB	12	C	B	J12_C_B	112	85	99	1.495	66	68	0.202	5	5	0.045	12	27	3.360
12CA	12	C	A	J12_C_A	112	350	320	1.667	262	256	0.370	14	14	0.121	69	50	2.477
13AC	13	A	C	J13_A_C	113	511	406	4.891	417	338	4.066	15	10	1.276	69	58	1.407
13AB	13	A	B	J13_A_B	113	35	26	1.610	33	26	1.269	0	0	0.000	1	0	1.414
13BA	13	B	A	J13_B_A	113	40	64	3.340	35	62	3.889	0	0	0.000	3	2	0.632
13BC	13	B	C	J13_B_C	113	1	0	1.414	1	0	1.414	0	0	0.000	0	0	0.000
13CB	13	C	B	J13_C_B	113	10	2	3.293	8	2	2.712	0	0	0.000	2	0	2.000
13CA	13	C	A	J13_C_A	113	455	399	2.715	354	325	1.555	15	15	0.130	81	59	2.623
14AD	14	A	D	J14_A_D	114	47	71	3.177	34	37	0.520	1	13	4.448	11	22	2.657
14AC	14	A	C	J14_A_C	114	277	247	1.825	236	205	2.067	5	5	0.067	33	37	0.676
14AB	14	A	B	J14_A_B	114	130	161	2.535	94	139	4.182	6	4	0.749	28	17	2.295
14BA	14	B	A	J14_B_A	114	89	117	2.764	70	97	2.965	9	4	1.938	6	16	2.992
14BD	14	B	D	J14_B_D	114	160	141	1.578	110	104	0.614	21	16	1.113	27	21	1.268
14BC	14	B	C	J14_B_C	114	216	155	4.479	172	131	3.374	7	5	0.707	29	19	1.985
14CB	14	C	B	J14_C_B	114	179	146	2.630	123	114	0.789	11	3	2.903	44	28	2.694
14CA	14	C	A	J14_C_A	114	279	264	0.898	234	225	0.621	7	12	1.523	31	28	0.562
14CD	14	C	D	J14_C_D	114	47	51	0.557	35	46	1.662	0	0	0.000	12	5	2.258
14DC	14	D	C	J14_D_C	114	55	30	3.791	42	29	2.145	3	0	2.449	9	1	3.546
14DB	14	D	B	J14_D_B	114	194	168	1.906	133	110	2.120	15	16	0.316	39	42	0.541
14DA	14	D	A	J14_D_A	114	84	121	3.668	73	105	3.421	1	2	0.816	10	14	1.115
15AC	15	A	C	J15_A_C	115	30	21	1.815	21	21	0.033	1	0	1.414	3	0	2.449
15AB	15	A	B	J15_A_B	115	60	59	0.071	46	49	0.435	1	5	2.478	11	5	2.121
15AA	15	A	A	J15_A_A	115	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
15BA	15	B	A	J15_B_A	115	139	190	3.998	119	170	4.269	2	3	0.744	16	17	0.185
15BC	15	B	C	J15_B_C	115	307	298	0.535	252	248	0.237	15	13	0.674	33	37	0.668
15BB	15	B	B	J15_B_B	115	1	14	4.716	1	8	3.271	0	2	2.000	0	4	2.811
15CB	15	C	B	J15_C_B	115	400	409	0.433	322	328	0.308	11	14	0.862	62	67	0.635
15CA	15	C	A	J15_C_A	115	165	142	1.852	137	127	0.884	1	0	1.414	22	15	1.577
15CC	15	C	C	J15_C_C	115	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
22AC	22	A	C	J22_A_C	122	190	195	0.339	139	135	0.333	16	22	1.324	35	38	0.472
22AB	22	A	B	J22_A_B	122	141	138	0.284	112	114	0.212	9	9	0.116	20	14	1.442
22BC	22	B	C	J22_B_C	122	6	0	3.464	3	0	2.449	0	0	0.000	3	0	2.449
22BA	22	B	A	J22_B_A	122	63	72	1.125	30	41	1.854	11	11	0.015	22	20	0.403
22CA	22	C	A	J22_C_A	122	389	357	1.683	327	297	1.704	19	24	1.109	43	35	1.205
22CB	22	C	B	J22_C_B	122	12	12	0.014	8	8	0.000	0	0	0.000	4	4	0.025
23AB	23	A	B	J23_A_B	123	47	47	0.000	41	41	0.016	0	0	0.000	6	6	0.041
23AC	23	A	C	J23_A_C	123	160	178	1.385	132	159	2.227	7	4	1.303	21	15	1.363
23AD	23	A	D	J23_A_D	123	18	16	0.485	11	10	0.324	1	0	1.414	6	6	0.020
23BA	23	B	A	J23_B_A	123	45	47	0.229	36	36	0.025	3	4	0.704	6	6	0.020
23BC	23	B	C	J23_B_C	123	224	174	3.575	198	145	4.072	5	8	1.177	21	21	0.022
23BD	23	B	D	J23_B_D	123	51	51	0.000	37	38	0.139	1	0	1.414	13	13	0.041
23CA	23	C	A	J23_C_A	123	123	117	0.525	81	75	0.633	8	9	0.259	34	33	0.155
23CB	23	C	B	J23_C_B	123	67	55	1.557	47	47	0.029	8	4	1.681	12	4	2.940
23CD	23	C	D	J23_C_D	123	22	23	0.179	13	13	0.084	6	9	1.145	3	1	1.414
23DA	23	D	A	J23_D_A	123	11	12	0.295	4	4	0.025	4	5	0.494	3	3	0.000
23DB	23	D	B	J23_D_B	123	18	19	0.244	7	7	0.019	2	3	0.661	9	9	0.017
23DC	23	D	C	J23_D_C	123	18	17	0.203	6	2	2.000	8	12	1.293	4	3	0.506

Figure 8-1. AM Cal Turns

					ALL VEH			CAR			HGV			LGV		
Junction	From	To	Turn ID	Node	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH	Observed	Modelled	GEH
1	A	C	J1_A_C	101	6	3	1.332	2	3	0.717	0	0	0.000	0	0	0.000
1	A	B	J1_A_B	101	3	4	0.584	2	3	0.661	0	0	0.000	1	1	0.049
1	B	A	J1_B_A	101	6	4	0.944	4	4	0.050	0	0	0.000	1	0	1.414
1	B	C	J1_B_C	101	563	536	1.143	452	456	0.197	17	16	0.159	78	64	1.705
1	C	B	J1_C_B	101	467	439	1.323	388	374	0.709	13	19	1.397	54	46	1.109
1	C	A	J1_C_A	101	2	0	2.000	1	0	1.414	1	0	1.414	0	0	0.000
2	A	C	J2_A_C	102	482	438	2.073	387	378	0.481	15	13	0.411	65	47	2.478
2	A	B	J2_A_B	102	88	104	1.604	70	83	1.486	2	3	0.632	12	18	1.479
2	B	A	J2_B_A	102	115	116	0.102	95	95	0.041	3	3	0.000	13	19	1.386
2	B	C	J2_B_C	102	53	48	0.696	41	44	0.438	1	0	1.033	9	4	1.961
2	C	B	J2_C_B	102	79	76	0.352	70	72	0.190	1	0	1.414	6	4	0.749
2	C	A	J2_C_A	102	353	323	1.632	296	280	0.958	12	16	0.944	37	28	1.626
3	A	D	J3_A_D	103	60	52	1.104	47	46	0.191	0	0	0.000	12	6	1.981
3	A	C	J3_A_C	103	287	282	0.293	232	219	0.842	7	8	0.276	45	55	1.407
3	A	B	J3_A_B	103	194	184	0.727	164	161	0.220	9	8	0.290	14	15	0.172
3	B	A	J3_B_A	103	148	134	1.153	113	111	0.198	9	4	1.891	23	19	0.816
3	B	D	J3_B_D	103	135	135	0.009	119	116	0.300	2	3	0.772	11	16	1.385
3	B	C	J3_B_C	103	290	226	3.955	233	201	2.176	9	7	0.632	45	18	4.746
3	C	B	J3_C_B	103	269	211	3.727	228	191	2.545	6	3	1.252	32	17	3.077
3	C	A	J3_C_A	103	275	258	1.038	215	216	0.058	11	16	1.336	40	26	2.379
3	C	D	J3_C_D	103	28	23	0.907	26	23	0.523	0	0	0.000	1	0	1.414
3	D	C	J3_D_C	103	6	9	1.112	6	9	1.112	0	0	0.000	0	0	0.000
3	D	B	J3_D_B	103	6	9	1.079	6	9	1.079	0	0	0.000	0	0	0.000
3	D	A	J3_D_A	103	1	0	1.414	1	0	1.414	0	0	0.000	0	0	0.000
4	A	D	J4_A_D	104	139	142	0.261	127	131	0.326	0	0	0.000	8	11	1.092
4	B	A	J4_B_A	104	107	68	4.128	88	52	4.296	2	0	2.000	16	16	0.075
4	B	D	J4_B_D	104	91	95	0.379	72	79	0.749	0	3	2.550	13	13	0.028
4	C	A	J4_C_A	104	304	260	2.617	252	247	0.294	1	0	1.414	41	13	5.462
4	C	D	J4_C_D	104	121	131	0.930	102	97	0.486	2	3	0.632	12	31	4.148
4	D	C (Banned Movement)	Banned M	104	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
4	D	B (Banned Movement)	Banned M	104	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
4	D	A (Banned Movement)	Banned M	104	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
5	A	C (Banned Movement)	Banned M	105	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
5	A	B (Banned Movement)	Banned M	105	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
5	B	A	J5_B_A	105	180	110	5.818	142	98	4.002	1	0	1.414	24	12	2.884
5	B	C (Banned Movement)	Banned M	105	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
5	C	B	J5_C_B	105	194	139	4.304	171	122	4.084	4	0	2.828	12	17	1.289
5	C	A	J5_C_A	105	248	282	2.074	213	247	2.220	2	3	0.632	29	32	0.561
6	A	C	J6_A_C	106	50	38	1.737	42	38	0.560	0	0	0.000	0	0	0.000
6	A	B	J6_A_B	106	148	100	4.320	129	83	4.463	4	0	2.828	12	17	1.277
6	B	A	J6_B_A	106	159	94	5.769	128	82	4.457	1	0	1.414	24	12	2.884
6	B	C	J6_B_C	106	9	7	0.670	6	7	0.430	0	0	0.000	0	0	0.000
6	C	B	J6_C_B	106	5	5	0.000	4	4	0.000	0	0	0.000	1	1	0.000
6	C	A	J6_C_A	106	21	16	1.162	14	16	0.516	0	0	0.000	0	0	0.000
7	A	D	J7_A_D	107	81	101	2.052	68	80	1.356	1	3	1.414	10	18	2.115
7	A	C	J7_A_C	107	27	21	1.203	17	21	0.939	1	0	1.414	4	0	2.828
7	A	B	J7_A_B	107	64	59	0.625	53	55	0.232	1	0	1.414	7	4	1.089
7	B	A	J7_B_A	107	40	35	0.741	30	31	0.226	0	0	0.548	9	4	1.938
7	B	D	J7_B_D	107	116	104	1.174	91	91	0.021	2	3	0.744	18	10	2.230
7	B	C	J7_B_C	107	5	5	0.000	5	5	0.000	0	0	0.000	0	0	0.000
7	C	B	J7_C_B	107	5	4	0.496	4	4	0.025	0	0	0.000	1	0	1.414
7	C	A	J7_C_A	107	29	22	1.439	24	19	1.136	2	3	0.632	2	0	2.000
7	C	D	J7_C_D	107	22	16	1.266	17	16	0.134	0	0	0.000	5	0	3.162
7	D	C	J7_D_C	107	24	17	1.594	21	17	0.966	0	0	0.000	2	0	2.000
7	D	B	J7_D_B	107	79	78	0.164	66	64	0.236	2	0	2.000	10	13	1.008
7	D	A	J7_D_A	107	101	108	0.685	82	89	0.773	2	0	2.000	15	19	0.936
8	A	C	J8_A_C	108	20	18	0.530	15	16	0.179	1	0	1.414	3	2	0.632
8	A	B	J8_A_B	108	97	67	3.331	79	59	2.453	4	0	2.828	13	8	1.474
8	B	A	J8_B_A	108	99	68	3.339	71	62	1.142	1	0	1.414	22	7	4.022
8	B	C	J8_B_C	108	116	153	3.194	100	126	2.424	2	6	2.093	11	21	2.511
8	C	B	J8_C_B	108	106	136	2.740	89	112	2.290	0	0	0.000	14	24	2.334
8	C	A	J8_C_A	108	77	56	2.549	59	48	1.475	1	0	1.414	14	8	1.809
9	A	C	J9_A_C	109	43	42	0.130	42	42	0.023	0	0	0.000	0	0	0.000
9	A	B	J9_A_B	109	4	1	1.897	3	1	1.414	0	0	0.000	0	0	0.000
9	B	A	J9_B_A	109	4	2	1.292	1	2	0.676	0	0	0.000	2	0	2.000
9	B	C	J9_B_C	109	134	169	2.828	113	139	2.350	3	6	1.511	15	23	1.866
9	C	B	J9_C_B	109	178	192	1.008	145	160	1.175	0	0	0.000	28	32	0.766
9	C	A	J9_C_A	109	24	14	2.333	20	12	1.972	0	0	0.000	1	2	0.640
10	A	D	J10_A_D	110	6	0	3.464	2	0	2.000	0	0	0.000	0	0	0.000
10	A	C	J10_A_C	110	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
10	A	B	J10_A_B	110	6	8	0.756	6	8	0.756	0	0	0.000	0	0	0.000
10	B	A	J10_B_A	110	0	2	1.924	0	2	1.924	0	0	0.000	0	0	0.000
10	B	D	J10_B_D	110	127	168	3.395	108	139	2.768	2	6	2.093	14	23	2.143
10	B	C	J10_B_C	110	47	41	0.905	44	41	0.460	1	0	1.414	1	0	1.414
10	C	B	J10_C_B	110	34	30	0.671	29	30	0.221	0	0	0.000	2	0	2.000
10	C	A	J10_C_A	110	2	0	2.000	0	0	0.000	0	0	0.000	0	0	0.000
10	C	D	J10_C_D	110	28	20	1.644	21	20	0.232	0	0	0.000	6	0	3.464
10	D	C	J10_D_C	110	27	45	2.978	19	35	3.038	0	0	0.000	8	10	0.698
10	D	B	J10_D_B	110	162	167	0.394	130	133	0.257	0	0	0.000	27	34	1.285
10	D	A	J10_D_A	110	5	4	0.397	5	4	0.397	0	0	0.000	0	0	0.000
11	A	D	J11_A_D	111	33	18	2.993	28	16	2.583	0	0	0.000	2	2	0.000
11	A	C	J11_A_C	111	111	150	3.418	91	122	3.044	2	6	2.129	18	21	0.734
11	A	B	J11_A_B	111	9	12	0.854	8	12	1.193	0	0	0.000	1	0	1.414
11	A	A	J11_A_A	111	8	9	0.293	6	9	1.046	0	0	0.000	2	0	2.000
11	B	A	J11_B_A	111	8	10	0.667	6	6	0.000	0	0	0.000	2	4	1.155
11	B	D	J11_B_D	111	3	2	0.632	2	2	0.000	0	0	0.000	0	0	0.000
11	B	C	J11_B_C	111	2	2	0.000	2	2	0.000	0	0	0.000	0	0	0.000
11	B	B	J11_B_B	111	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
11	C	B	J11_C_B	111	10	4	2.314	6	4	0.944	0	0	0.000	3	0	2.449
11	C	A	J11_C_A	111	163	154	0.703	126	124	0.183	0	0	0.000	33	30	0.498
11	C	D	J11_C_D	111	4	0	2.828	3	0	2.449	0	0	0.000	1	0	1.414
11	C	C	J11_C_C	111	1	2	0.782	1	2	0.782	0	0	0.000	0	0	0.000
11	D	C	J11_D_C	111	2	0	2.000	2	0	2.000	0	0	0.000	0	0	0.000
11	D	B	J11_D_B	111	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
11	D	A	J11_D_A	111	27	43	2.667	22	33	2.080	1	0	1.414	2	10	3.225
11	D	D	J11_D_D	111	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
12	A	C	J12_A_C	112	388	390	0.104	303	315	0.691	10	14	1.141	68	61	0.878
12	A	B	J12_A_B	112	101	56	5.137	80	46	4.334	0	0	0.000	20	10	2.612
12	B	A	J12_B_A	112	51	44	0.956	44	42	0.243	0	0	0.000	6	2	2.000
12	B	C	J12_B_C	112	68	85	1.987	55	63	0.991	3	7	1.643	10	16	1.713
12	C	B	J12_C_B	112	109	125	1.510	85	109	2.446	0	0	0.000	19	16	0.655
12	C	A	J12_C_A	112	442	395	2.292	358	319	2.097	9	12	1.053	66	63	0.342
13	A	C	J13_A_C	113	501	441	2.746	394	357	1.917	11	14	0.822	88	71	1.948
13	A	B	J13_A_B	113	35	40	0.777	30	40	1.651	0	0	0.000	4	0	2.828
13	B	A	J13_B_A	113	25	42	2.967	43	41	0.379	0	0	0.000	2	2	0.259
13	B	C	J13_B_C	113	9	4	2.079	8	4	1.753	0	0	0.000	0	0	0.000
13	C	B	J13_C_B	113	8	10	0.667	11	10	0.309	0	0	0.000	3	0	2.449
13	C	A	J13_C_A	113	492	428	2.998	399	350	2.537	10	13	0.745	74	65	1.042
14	A	D	J14_A_D	114	60	61	0.173	53	49	0.517	1	0	1.414	6	12	2.014
14	A	C	J14_A_C	114	237	227	0.650	194	189	0.332	5	7	0.760	34	31	0.553
14	A	B	J14_A_B	114	132	122	0.892	105	111	0.582	3	3	0.000	22	8	3.647
14	B	A	J14_B_A	114	96	58	4.369	80	58	2.688	4	0	2.828	12	0	4.899
14	B	D	J14_B_D	114	263	261	0.142	211	212	0.079	10	11	0.443	38	37	0.147
14	B	C	J14_B_C	114	239	199	2.703	189	157	2.405	3	4	0.485	44	38	0.978
14	C	B	J14_C_B	114	194	150	3.331	160	129	2.605	4	3	0.450	25	18	1.405
14	C	A	J14_C_A	114	289	261	1.679	238	208	2.009	5	8	1.246	44	45	0.142
14	C	D	J14_C_D	114	58	55	0.446	51	50	0.212	1	1	0.236	6	4	0.944
14	D	C	J14_D_C	114	64	57	0.920	52	52	0.021	2	3	0.689	10	2	3.321
14	D	B	J14_D_B	114	237	222	1.024	195	192	0.237	10	13	0.787	26	17	1.905
14	D	A	J14_D_A	114	85	93	0.858	65	70	0.632	2	3	0.689	14	20	1.411
15	A	C	J15_A_C	115	20	21	0.254	16	17	0.270	1	1	0.000	2	3	0.661
15	A	B	J15_A_B	115	60	51	1.215	50	51	0.134	0	0	0.000	9	0	4.243
15	A	A	J15_A_A	115	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
15	B	A	J15_B_A	115	190	172	1.304	151	138	1.047	4	0	2.828	31	34	0.535
15	B	C	J15_B_C	115	280	235	2.827	230	193	2.562	7	11	1.436	40	31	1.591
15	B	B	J15_B_B	115	1	4	1.875	1	4	1.875	0	0	0.000	0	0	0.000
15	C	B	J15_C_B	115	361	358	0.137	294	298	0.209	8	10	0.651	52	51	0.160
15	C	A	J15_C_A	115	180	164	1.251	160	148	0.996	2	3	0.632	14	13	0.286
15	C	C	J15_C_C	115	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
22	A	C	J22_A_C	122	338	304	1.921	282	259	1.411	10	10	0.048	46	35	1.737
22	A	B	J22_A_B	122	74	89	1.709	47	69	2.859	10	10	0.047	17	11	1.738
22	B	C	J22_B_C	122	8	8	0.018	8	8	0.018	0	0	0.000	0	0	0.000
22	B	A	J22_B_A	122	163	155	0.655	127	125	0.218	6	2	2.000	30	28	0.334
22	C	A	J22_C_A	122	367	363	0.194	316	303	0.750	10	14	1.115	41	47	0.853
22	C	B	J22_C_B	122	5	6	0.447	3	2	0.632	2	2	0.000	0	2	2.025
23	A	B	J23_A_B	123	38	38	0.049	27	27	0.029	5	5	0.044	6	6	0.020
23	A	C	J23_A_C	123	120	115	0.438	105	96	0.893	2	4	1.131	13	15	0.599
23	A	D	J23_A_D	123	9	4	1.915	8	4	1.609	0	0	0.000	1	0	1.311
23	B	A	J23_B_A	123	68	69	0.121	58	59	0.085	0	0	0.000	10	10	0.110
23	B	C	J23_B_C	123	152	151	0.114	130	125	0.483	5	8	1.194	17	18	0.239
23	B	D	J23_B_D	123	12	15	0.816	11	13	0.577	0	0	0.000	1	2	0.816
23	C	A	J23_C_A	123	160	151	0.722	124	117	0.601	6	6	0.121	30	27	0.504
23	C	B	J23_C_B	123	142	145	0.284	132	138	0.474	0	0	0.000	10	8	0.702
23	C	D	J23_C_D	123	14	16	0.491	8	12	1.336	4	4	0.179	2	0	2.000
23	D	A	J23_D_A	123	19	19	0.011	16	15	0.254	0	0	0.000	3	4	0.510
23	D	B	J23_D_B	123	72	64	0.958	61	53	1.046	0	0	0.000	11	11	0.000
23	D	C	J23_D_C	123	93	104	1.089	80	85	0.534	4	4	0.000	9	15	1.719

Figure 8-2. PM Cal Turns

Appendix C – Flow Diagram

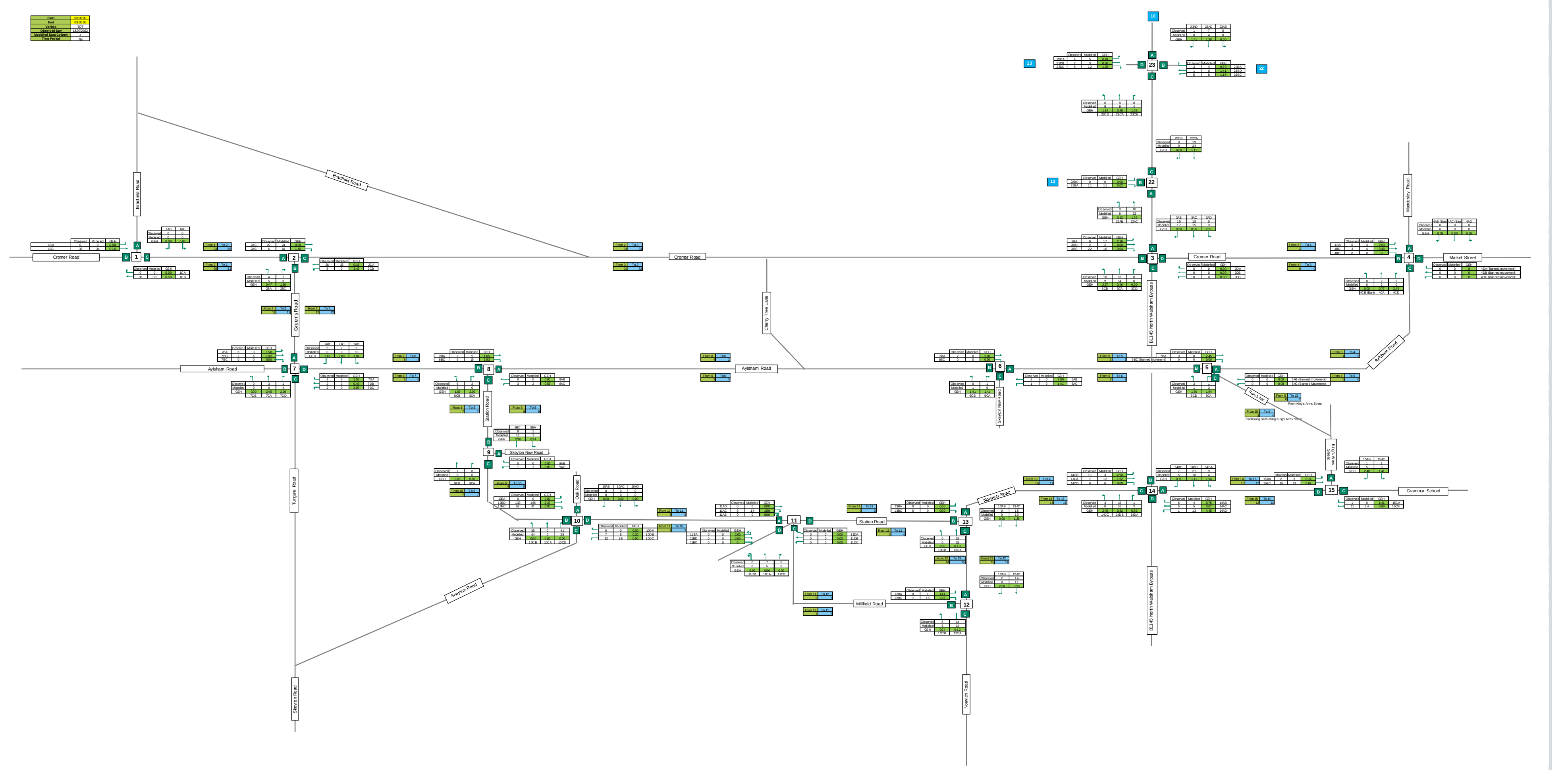


Figure 8-3. AM Calibration Flow Diagram

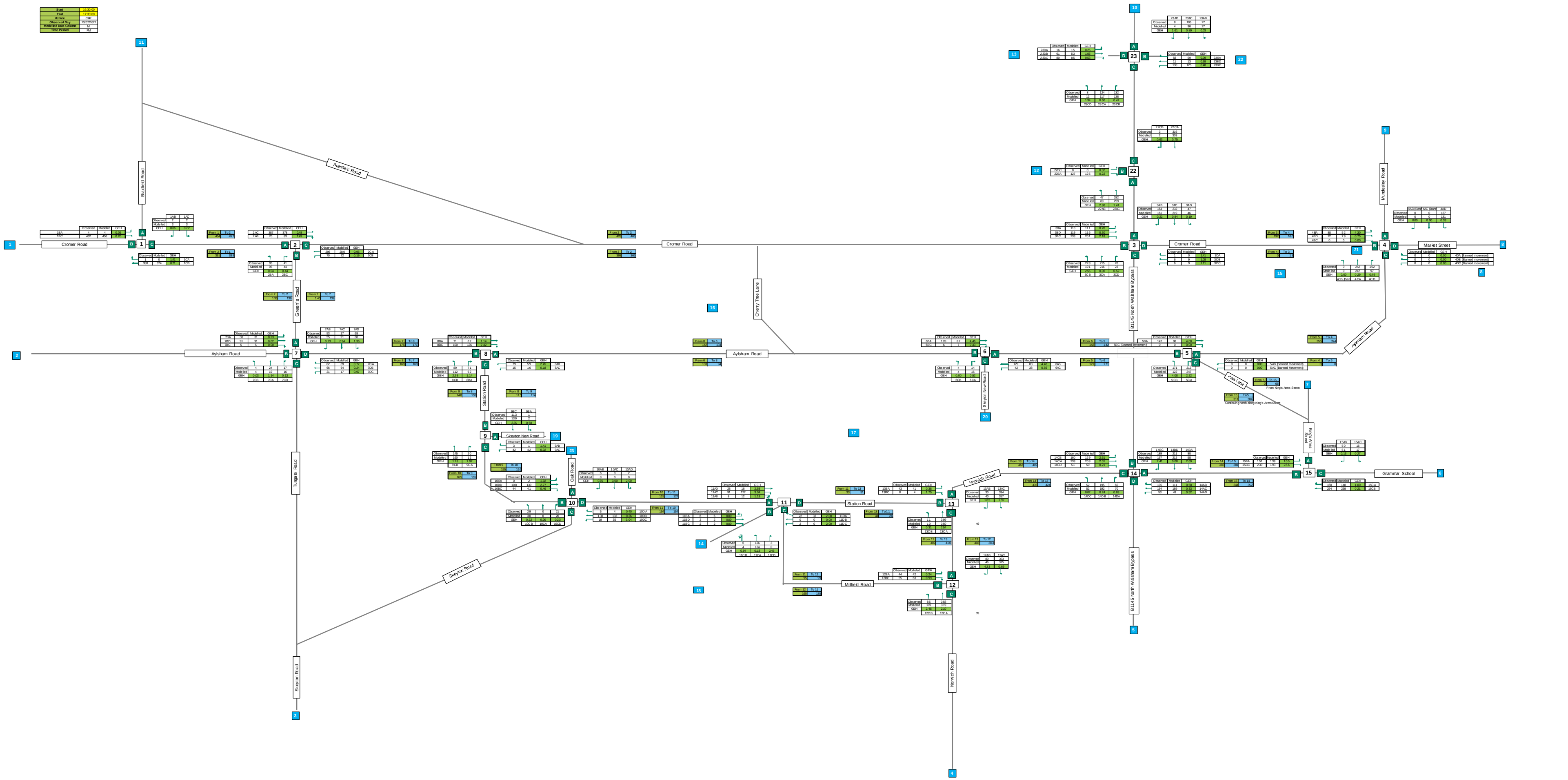


Figure 8-4. PM Calibration Flow Chart

Appendix D – Journey Time Validation Results

Journey Time Route 1

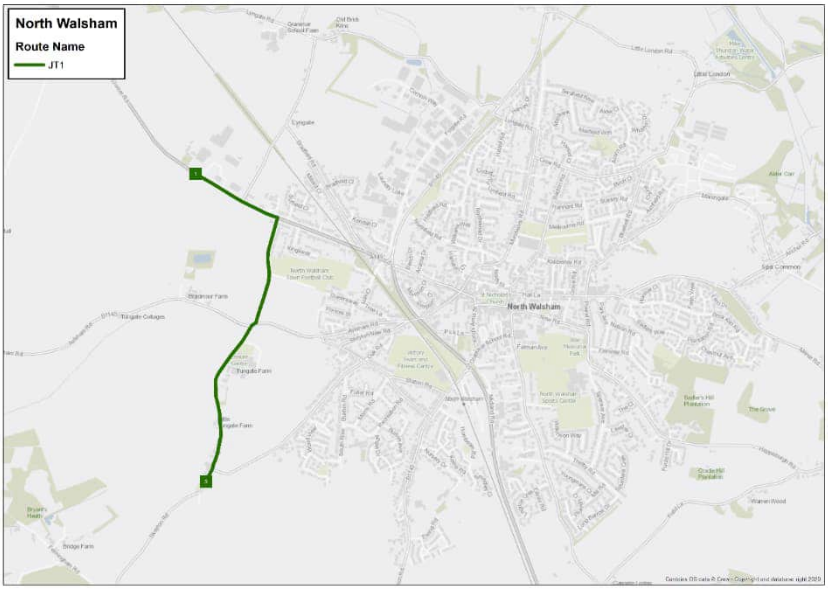


Figure 8-5. JT1 Route Diagram

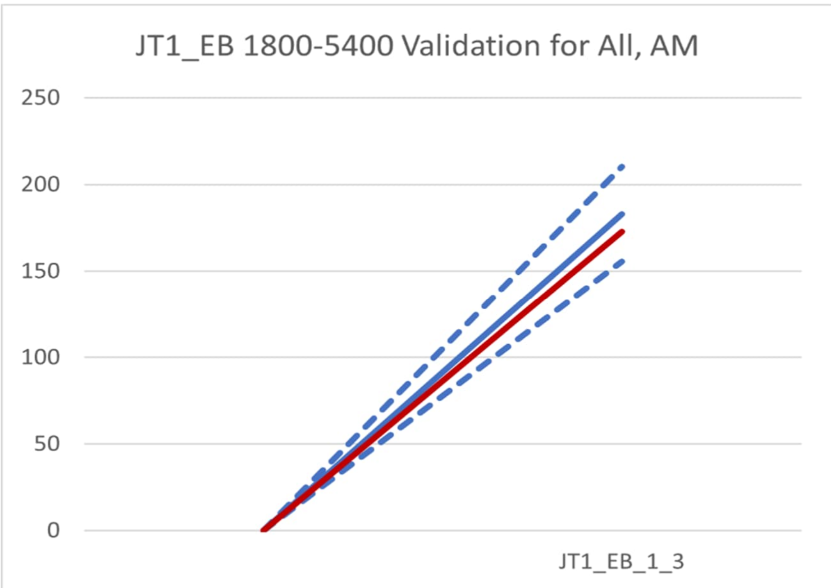


Figure 8-6. Journey Time 1 Eastbound AM Validation

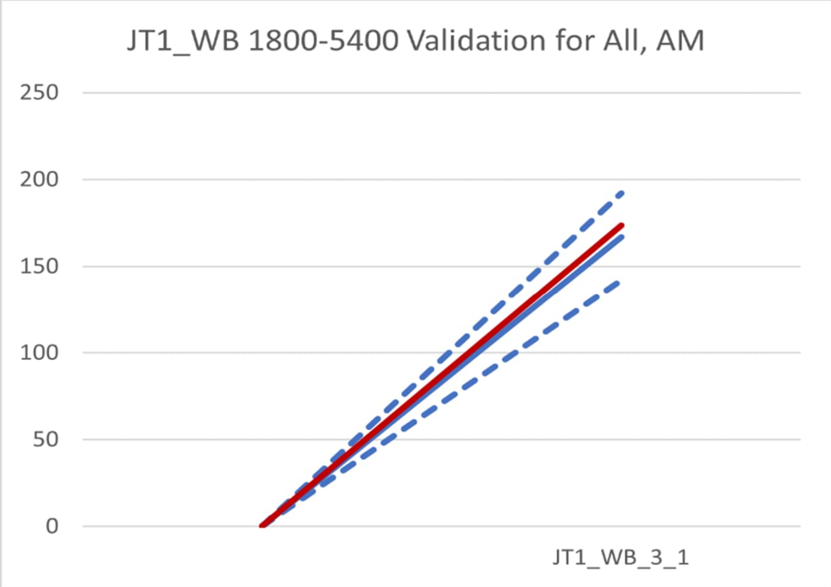


Figure 8-7. Journey Time 1 Westbound AM Validation

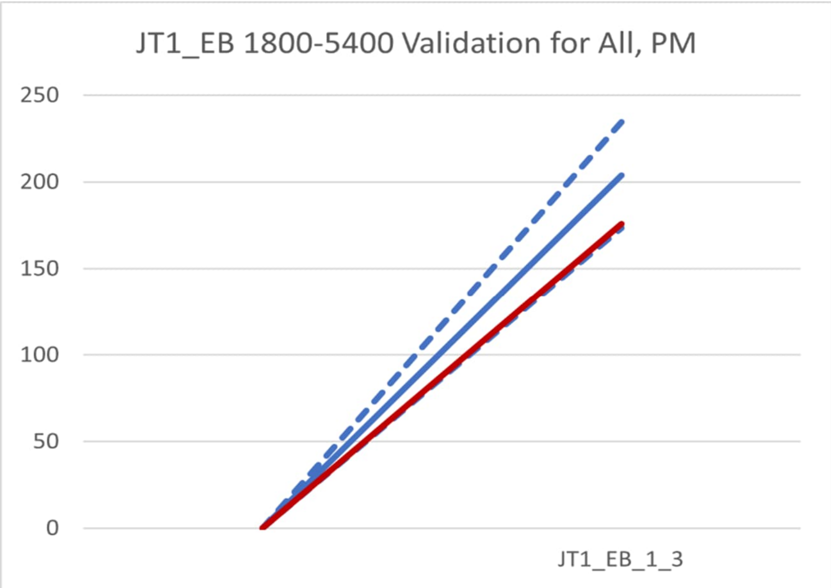


Figure 8-8. Journey Time 1 PM Eastbound Validation

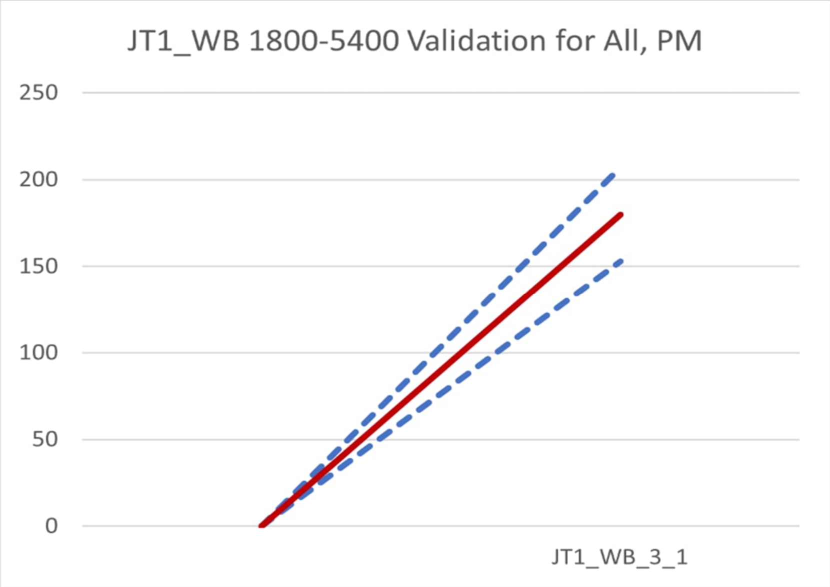


Figure 8-9. Journey Time 1 PM Westbound Validation

Journey Time Route 2

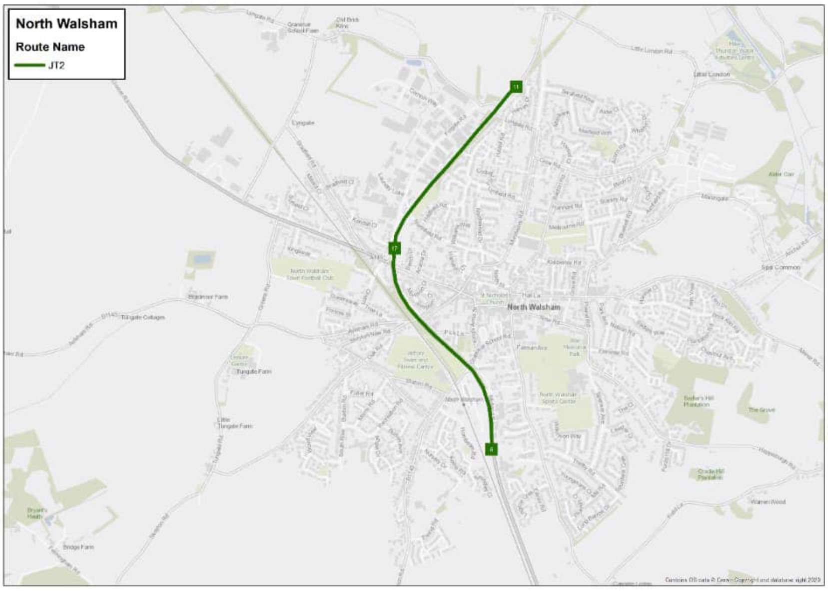


Figure 8-10. JT2 Route Diagram

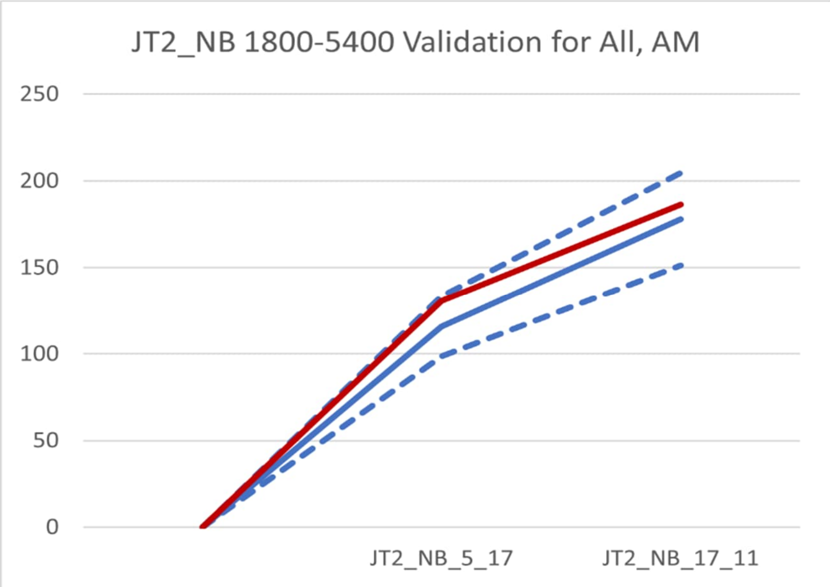


Figure 8-11. Journey Time 2 AM Northbound Validation

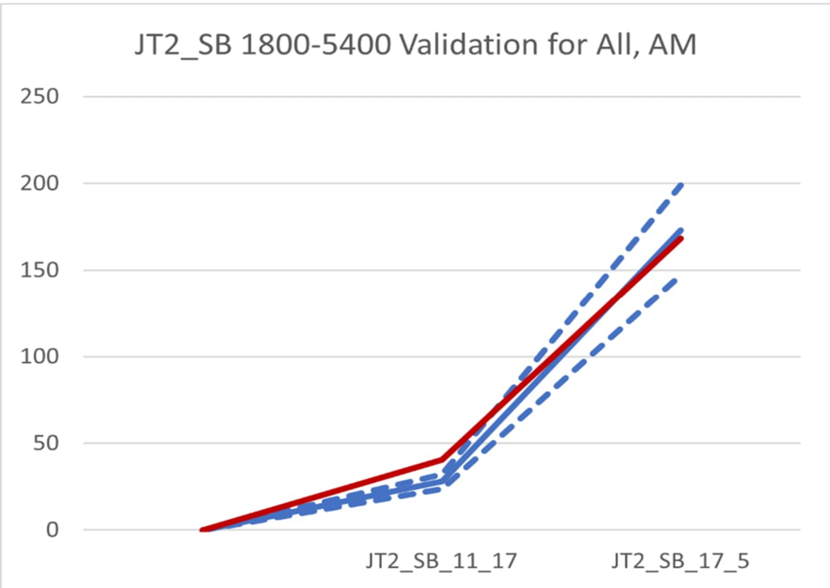


Figure 8-12. Journey Time 2 AM Southbound Validation

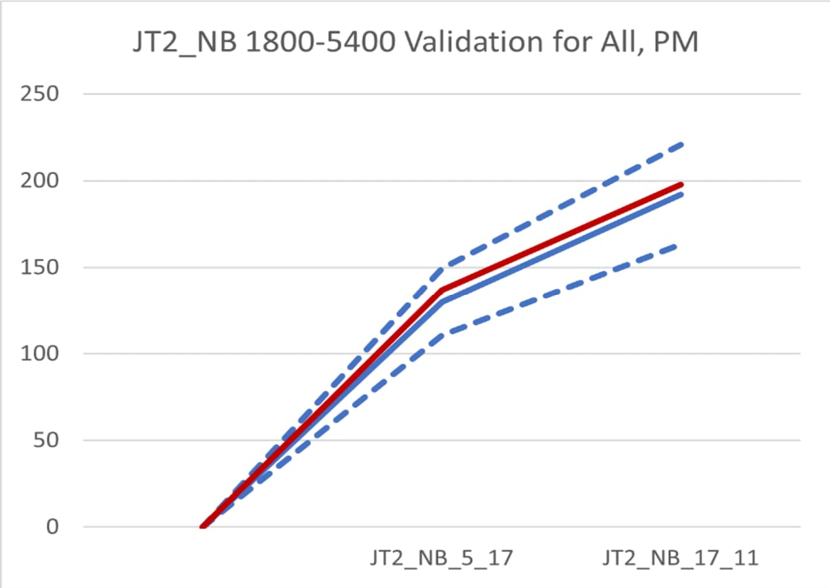


Figure 8-13. Journey Time 2 PM Northbound Validation

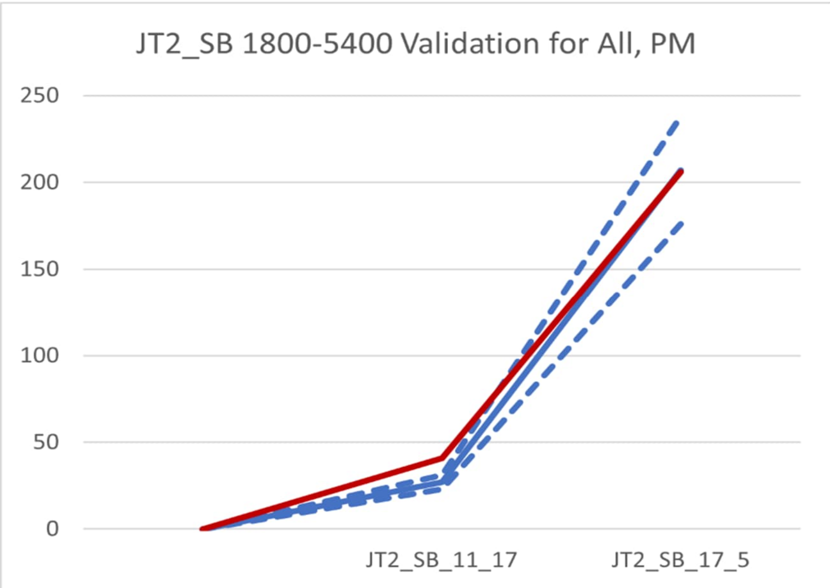


Figure 8-14. Journey Time 2 PM Southbound Validation

Journey Time Route 3

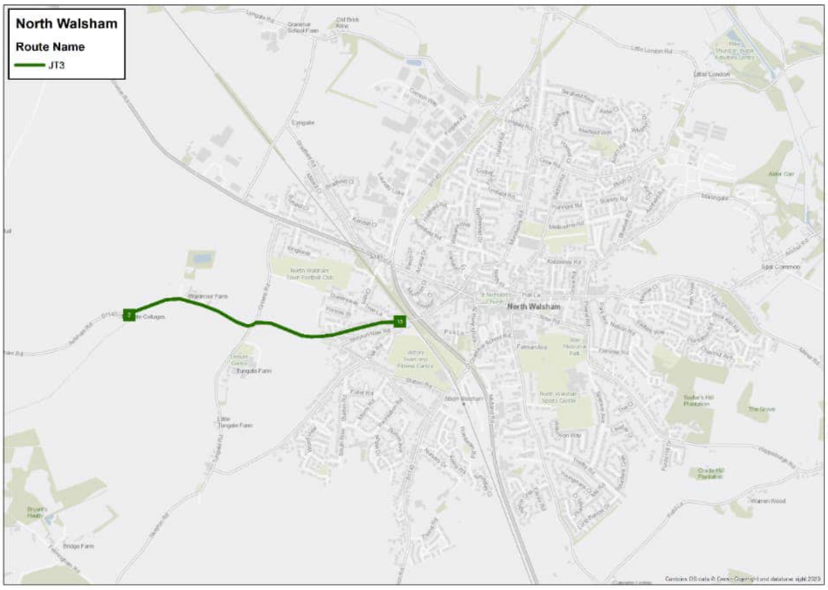


Figure 8-15. JT3 Route Diagram

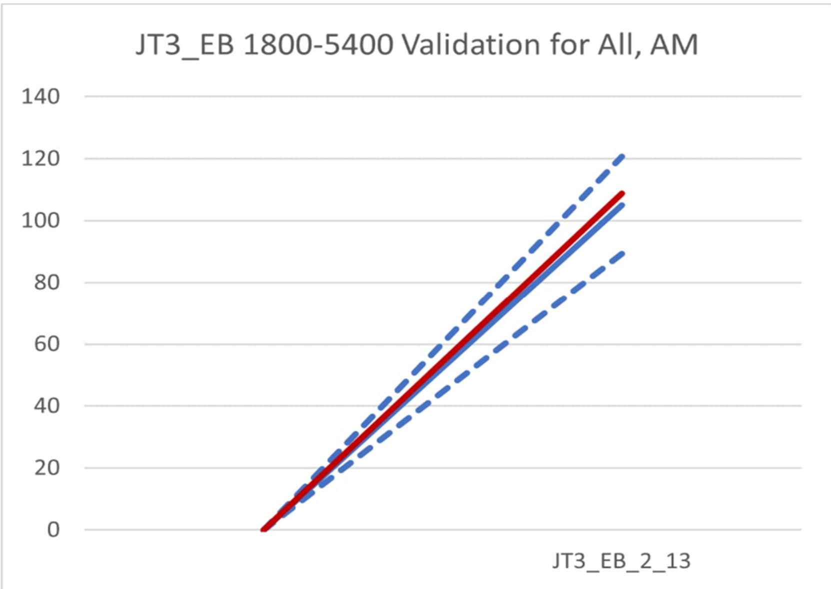


Figure 8-16. Journey Time 3 AM Eastbound Validation

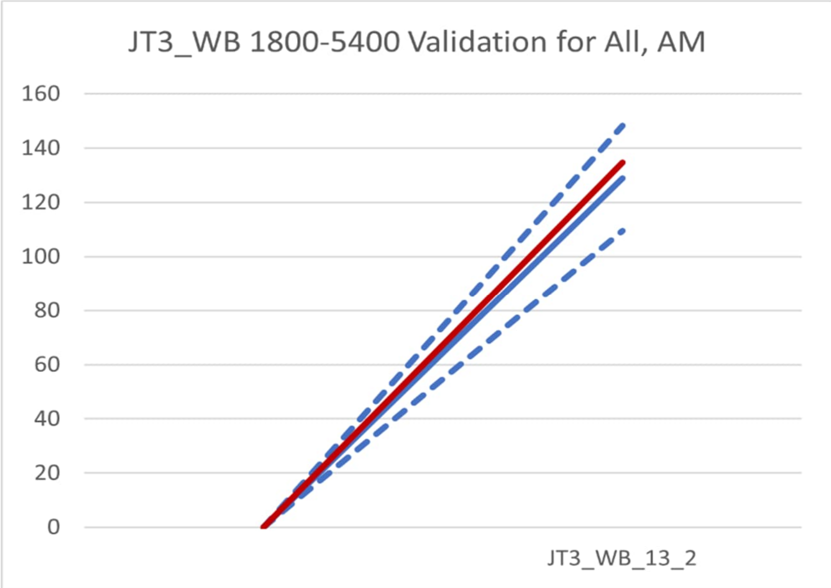


Figure 8-17. Journey Time 3 AM Westbound Validation

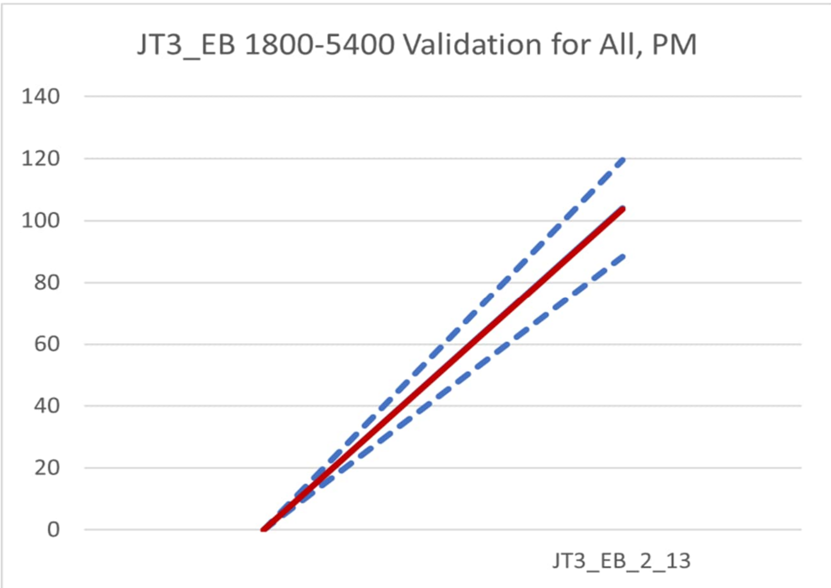


Figure 8-18. Journey Time 3 PM Eastbound Validation

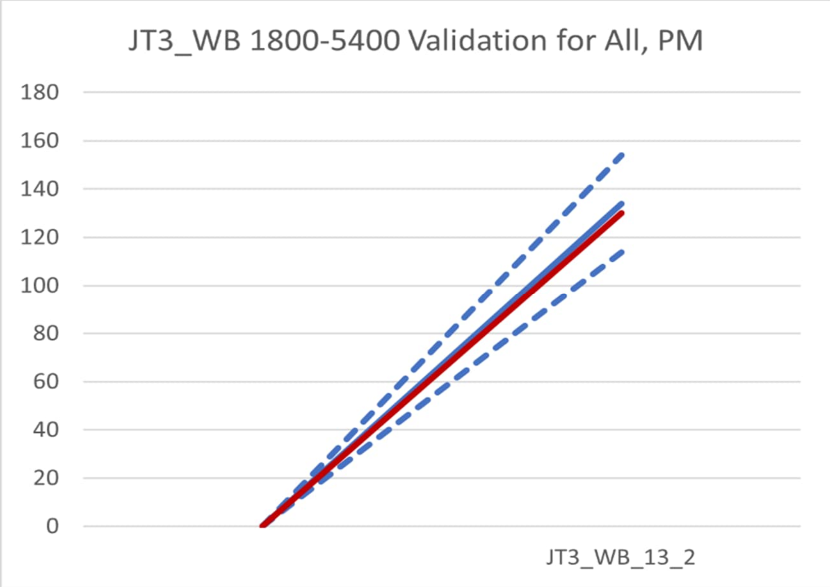


Figure 8-19. Journey Time 3 PM Westbound Validation

Journey Time Route 4

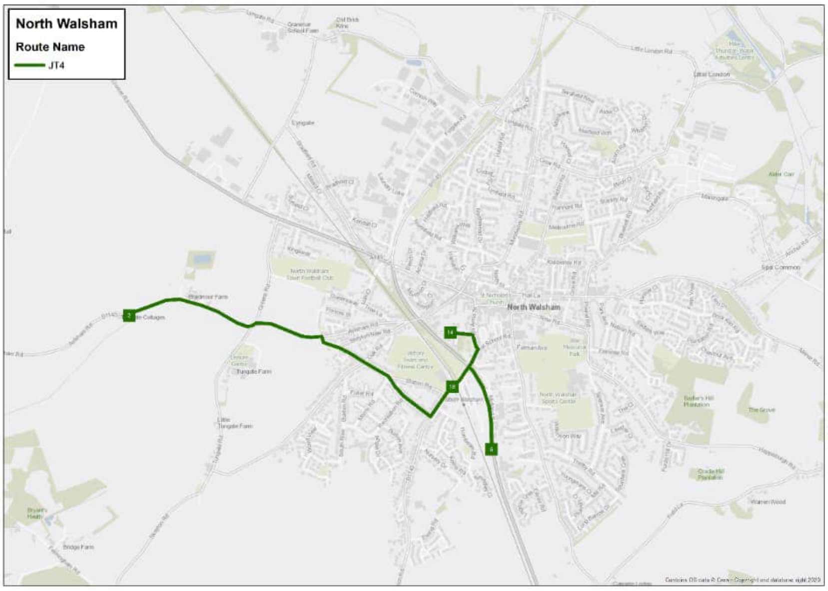


Figure 8-20. JT4 Route Diagram

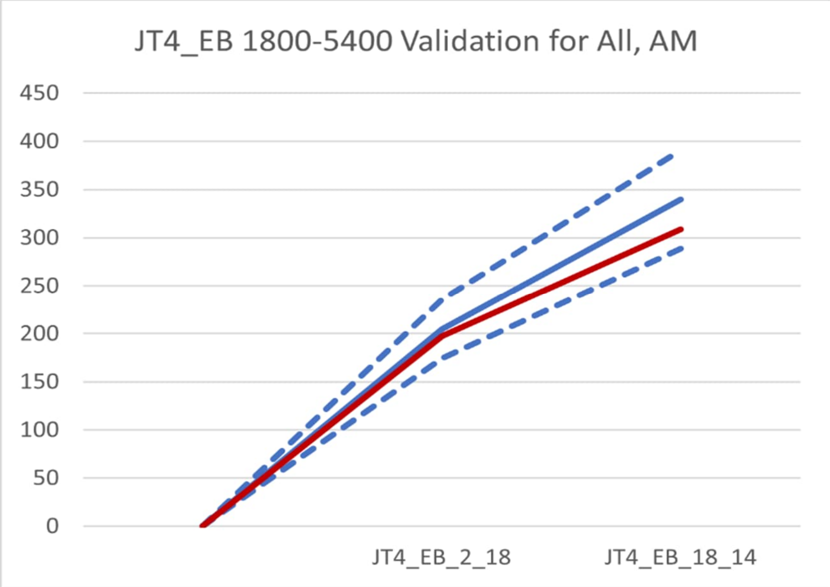


Figure 8-21. Journey Time 4 AM Eastbound Validation

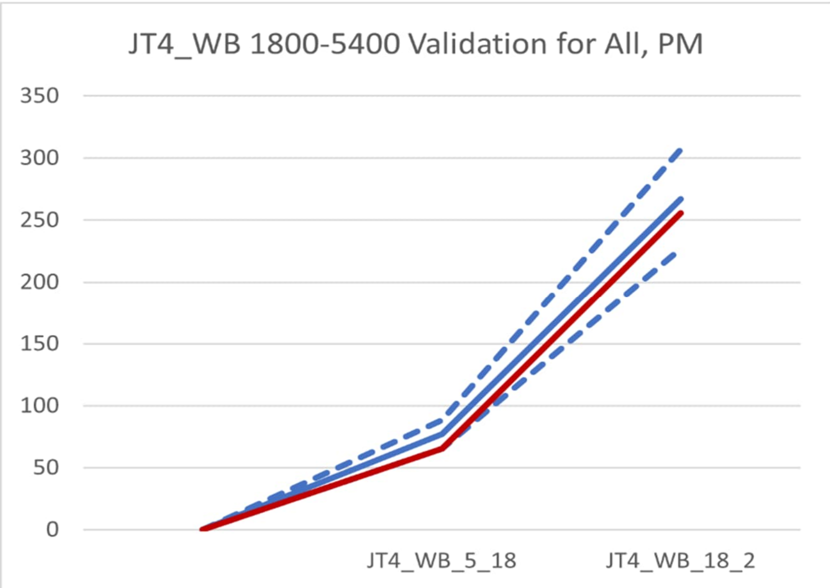


Figure 8-22. Journey Time 4 AM Westbound Validation

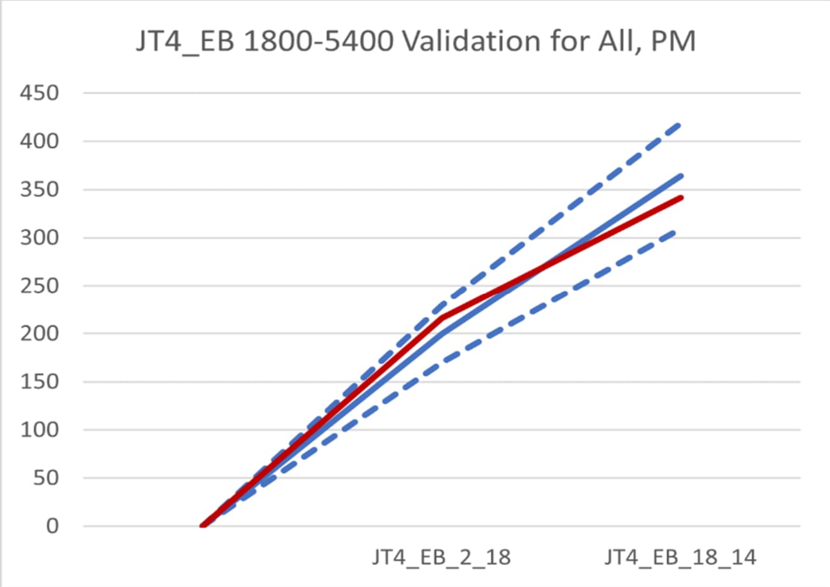


Figure 8-23. Journey Time 4 PM Eastbound Validation

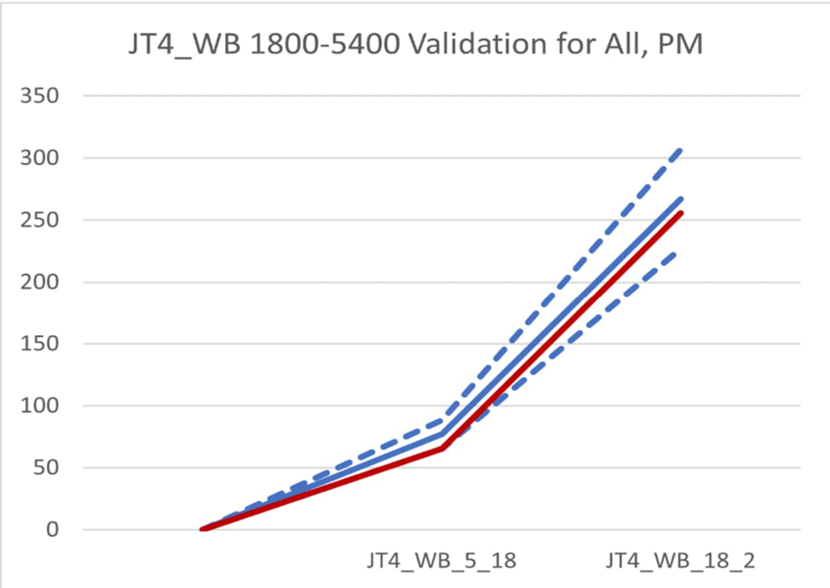


Figure 8-24. Journey Time 4 PM Westbound Validation

Journey Time Route 5

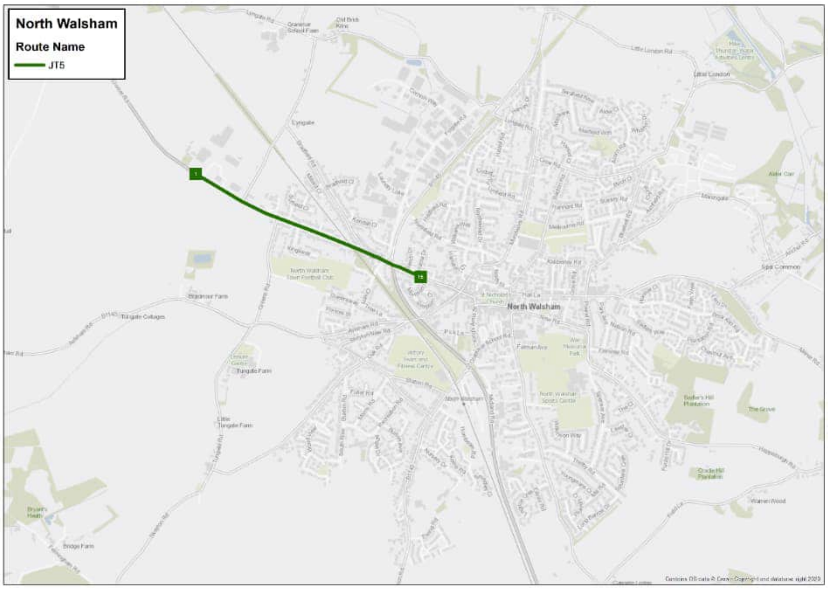


Figure 8-25. JT5 Route Diagram

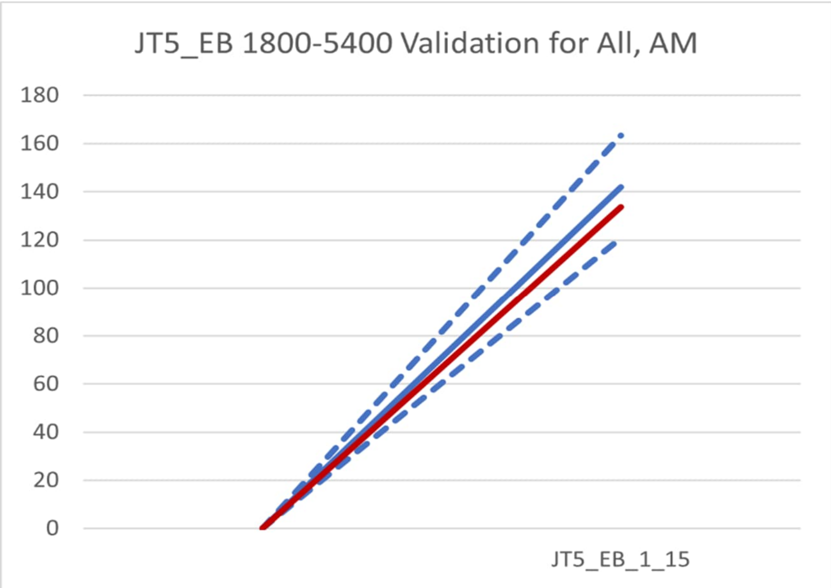


Figure 8-26. Journey Time 5 AM Eastbound Validation

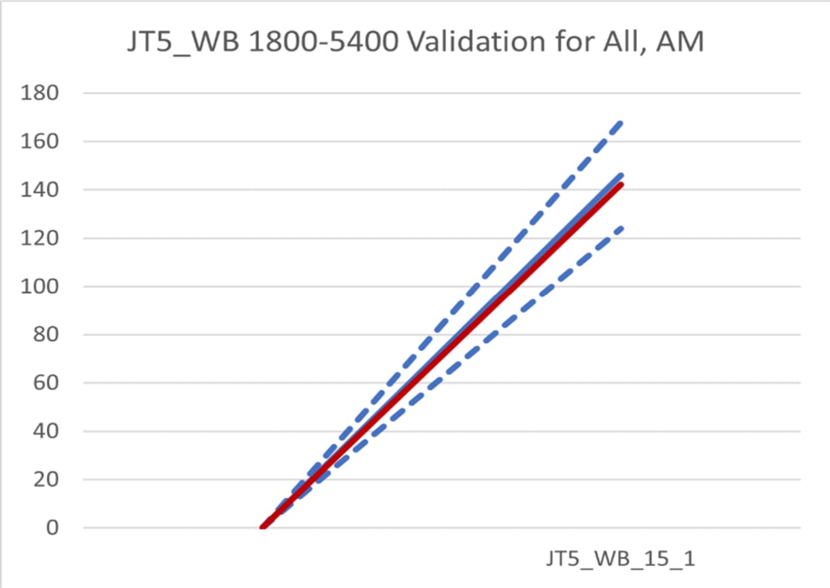


Figure 8-27. Journey Time 5 AM Westbound Validation

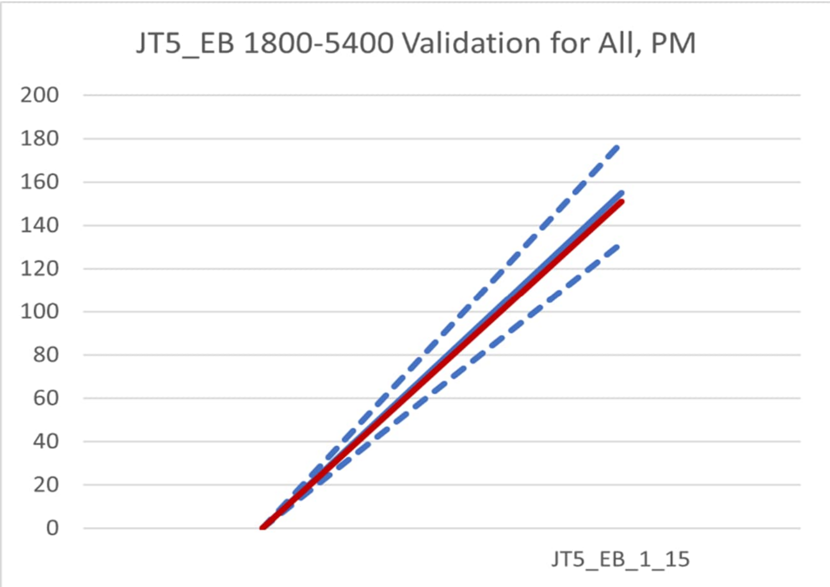


Figure 8-28. Journey Time 5 PM Eastbound Validation

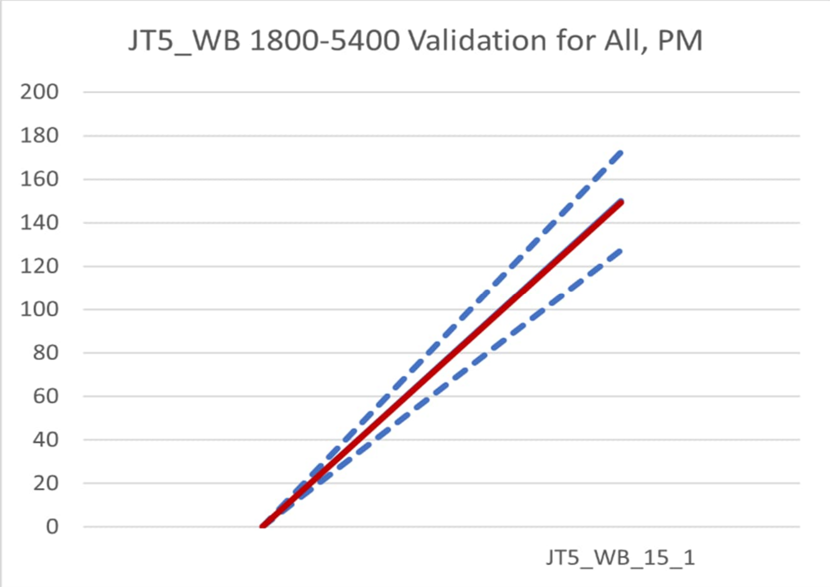


Figure 8-29. Journey Time 5 PM Westbound Validation

Journey Time Route 6

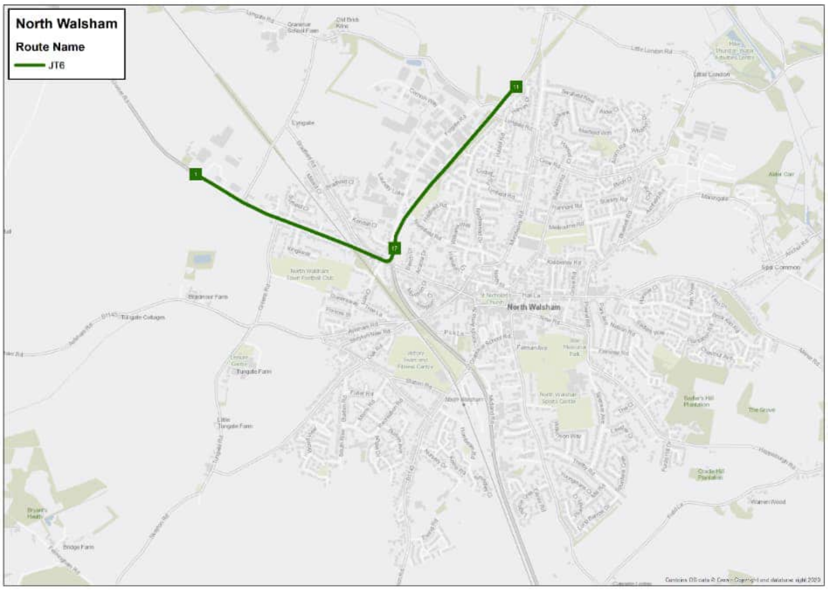


Figure 8-30. JT6 Route Diagram

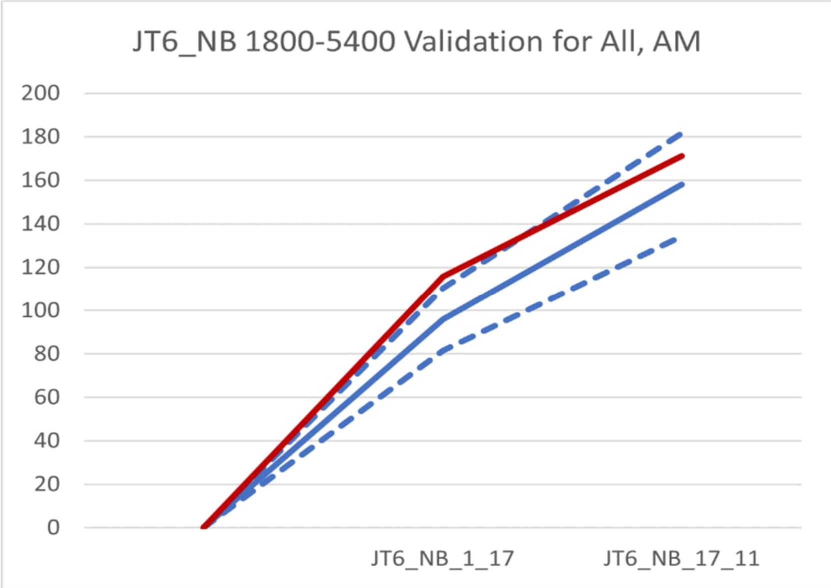


Figure 8-31. Journey Time 6 AM Northbound Validation

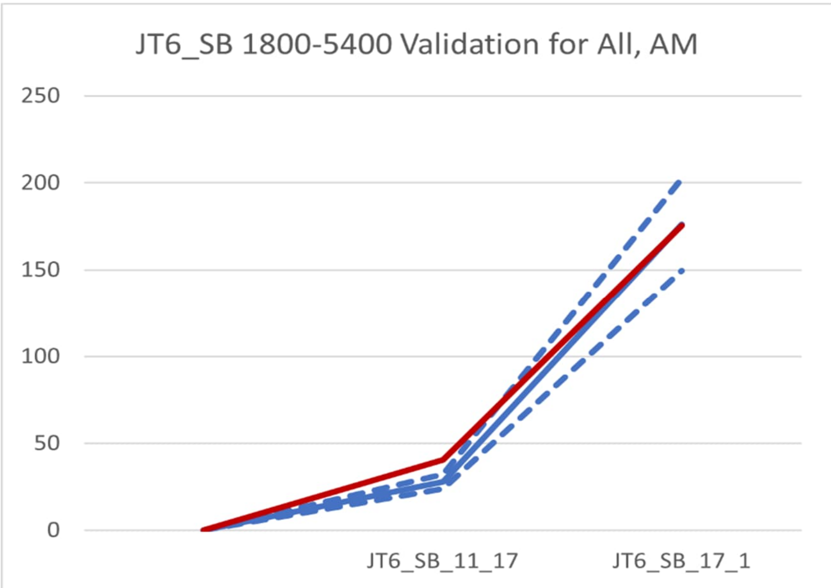


Figure 8-32. Journey Time 6 AM Southbound Validation

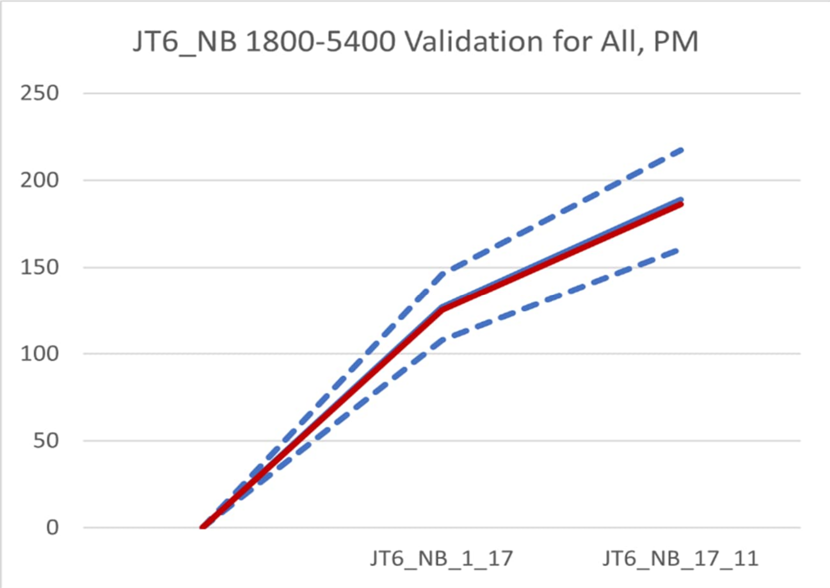


Figure 8-33. Journey Time 6 PM Northbound Validation

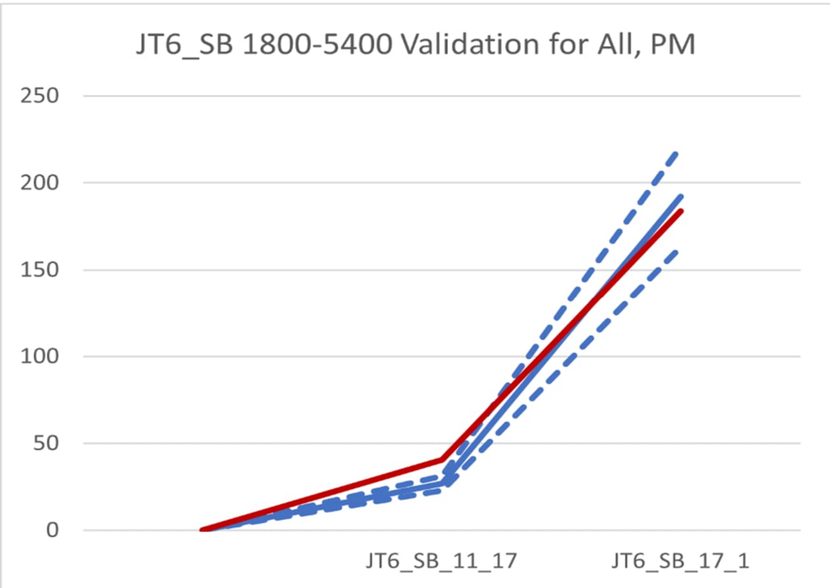


Figure 8-34. Journey Time 6 PM Southbound Validation

Journey Time Route 7

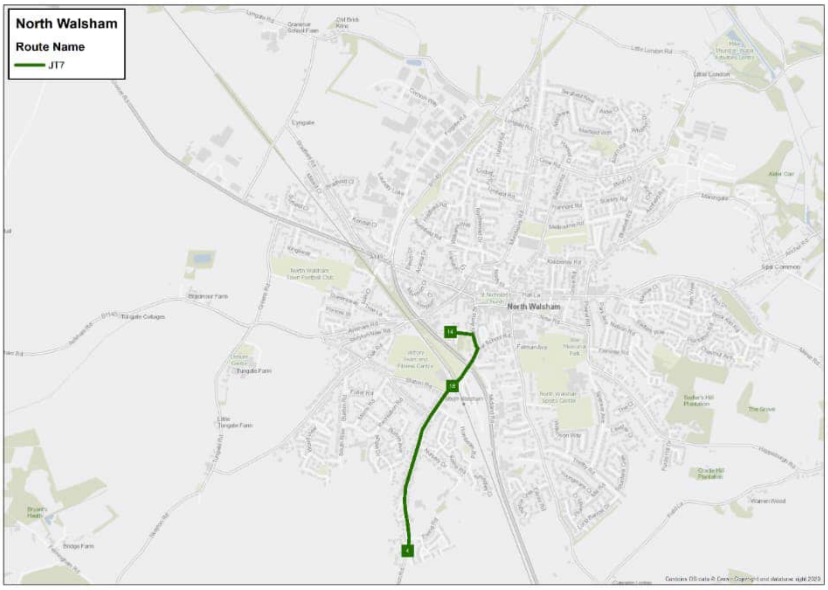


Figure 8-35. JT7 Route Diagram

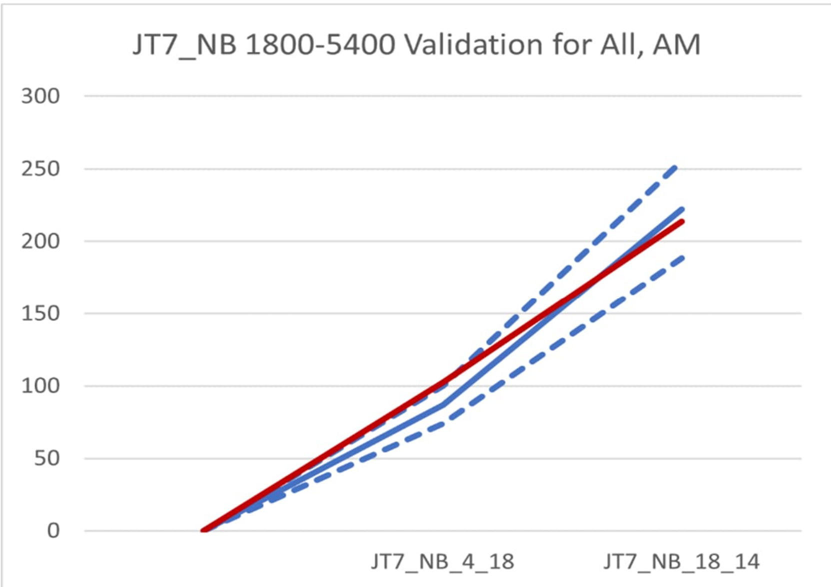


Figure 8-36. Journey Time 7 AM Northbound Validation

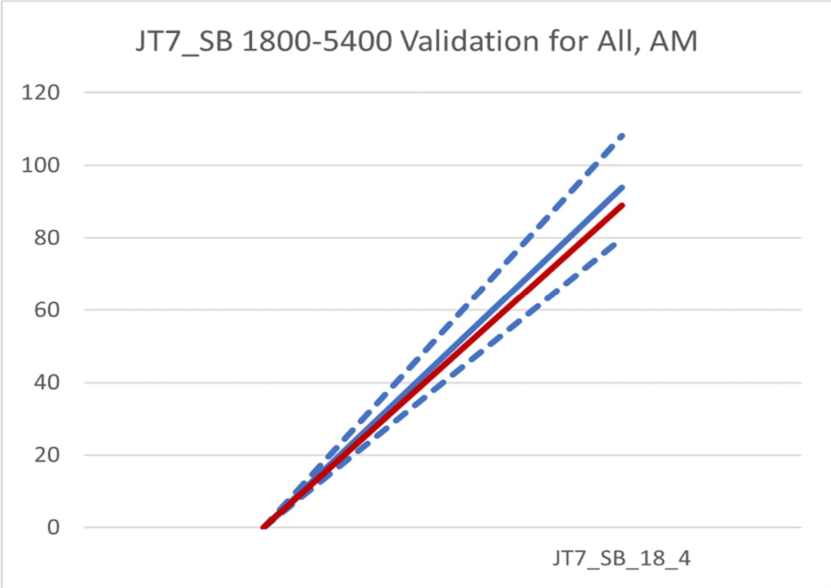


Figure 8-37. Journey Time 7 AM Southbound Validation

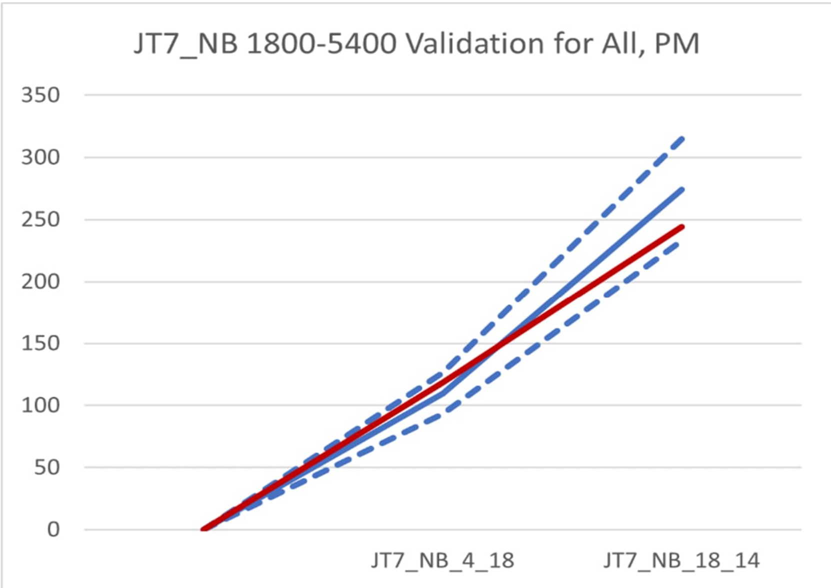


Figure 8-38. Journey Time 7 PM Northbound Validation

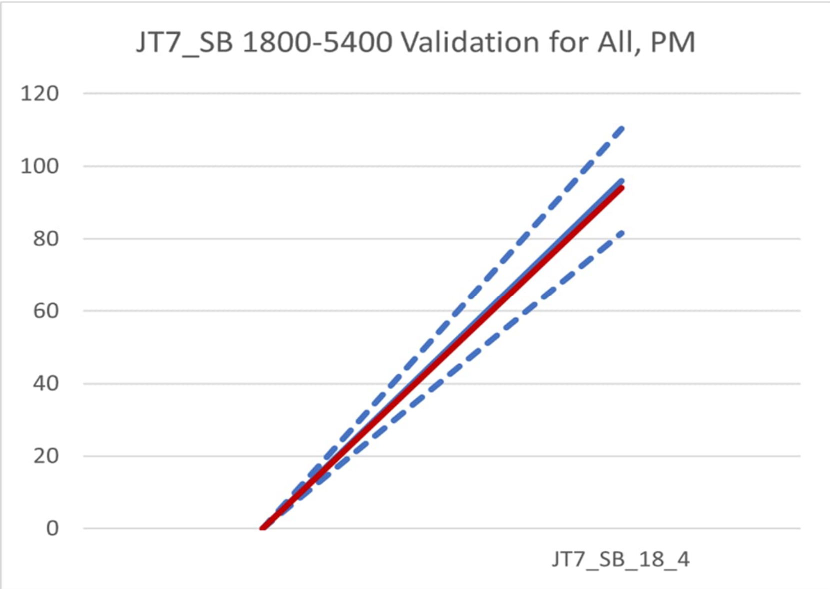


Figure 8-39. Journey Time 7 PM Southbound Validation

Journey Time Route 8

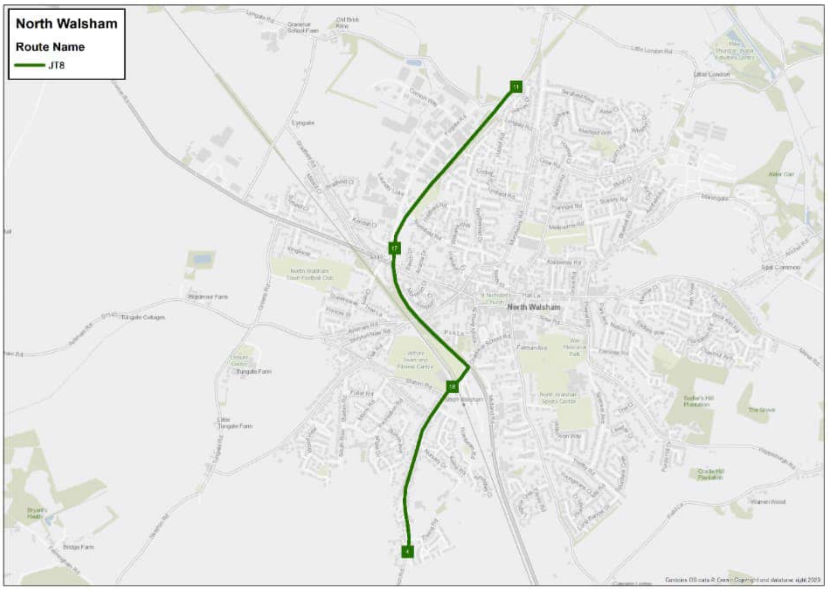


Figure 8-40. JT8 Route Diagram

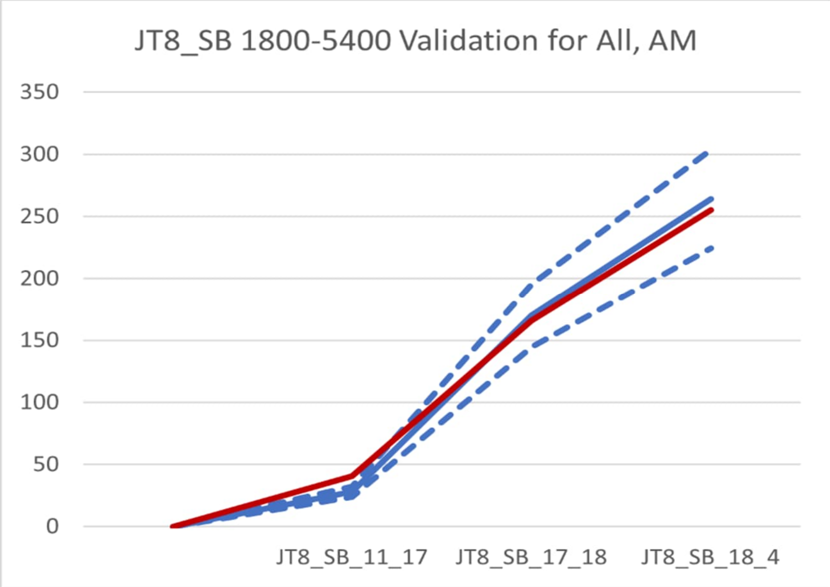


Figure 8-41. Journey Time 8 AM Northbound Validation

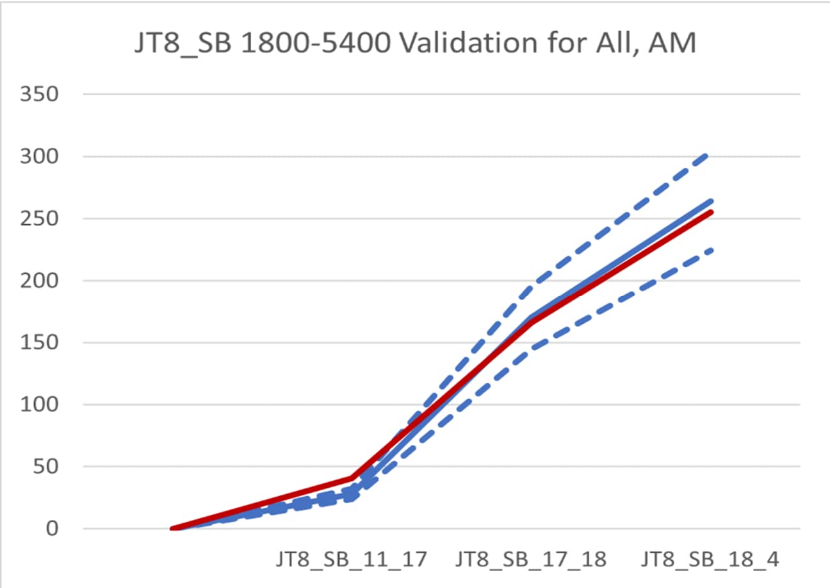


Figure 8-42. Journey Time 8 AM Southbound Validation

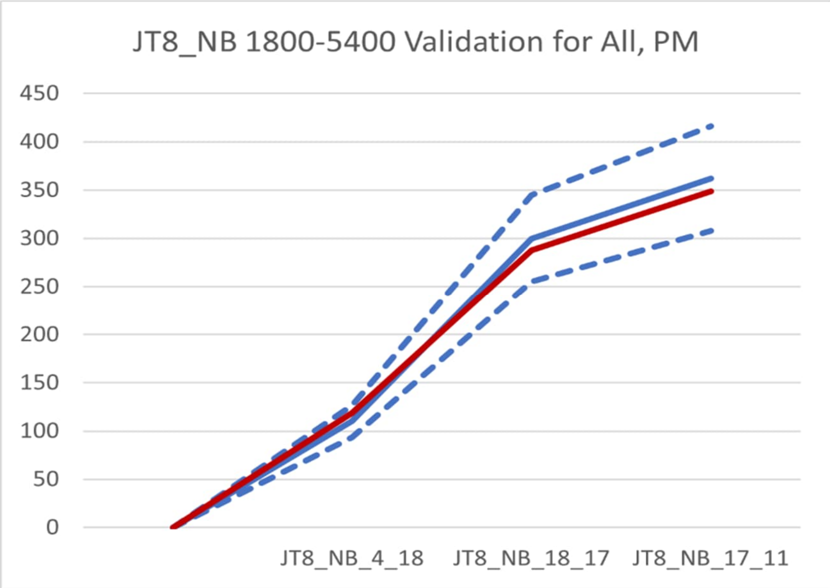


Figure 8-43. Journey Time 8 PM Northbound Validation

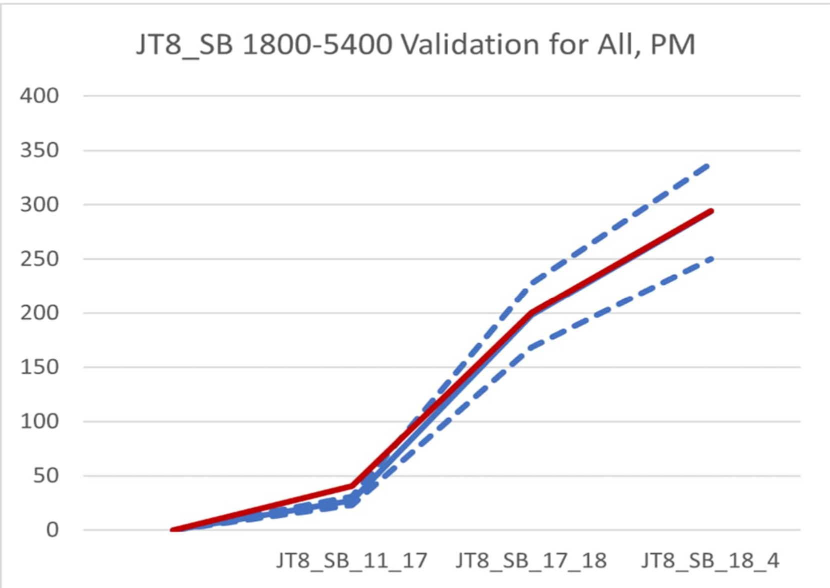


Figure 8-44. Journey Time 8 PM Southbound Validation

Journey Time Route 9

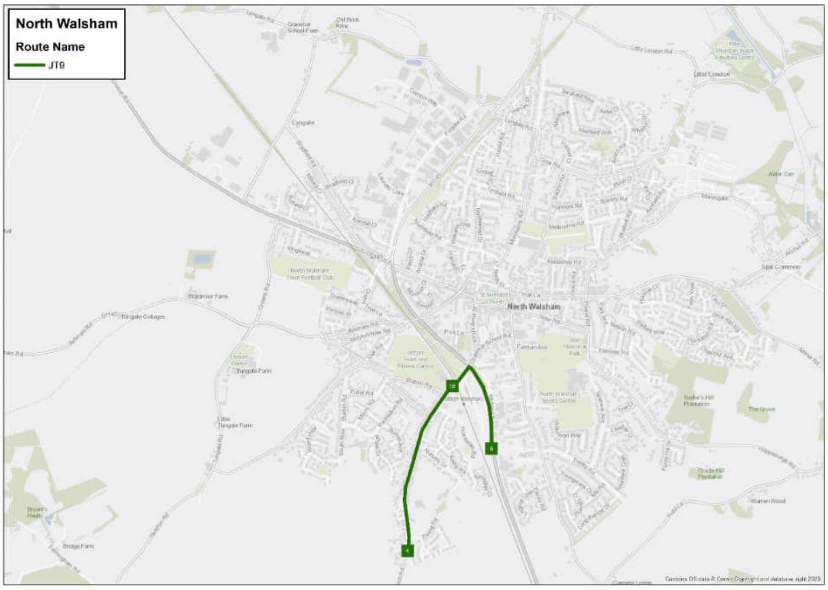


Figure 8-45. JT9 Route Diagram

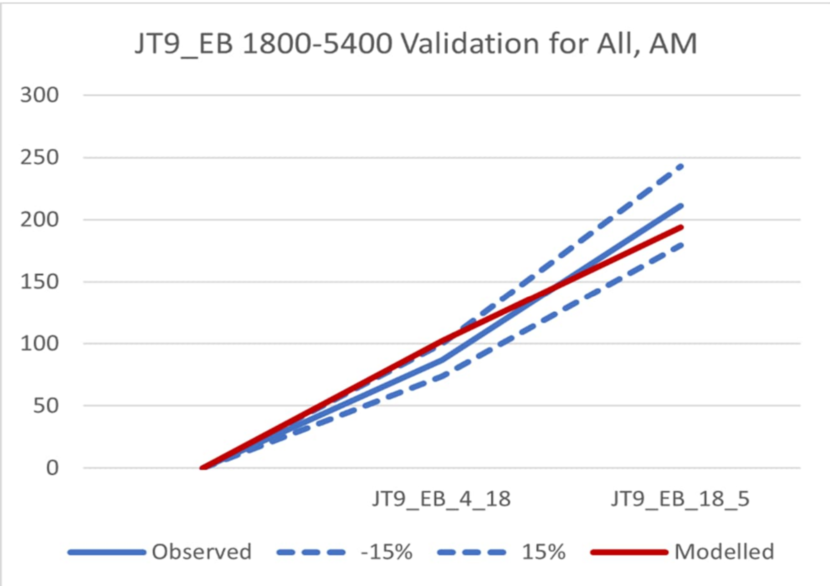


Figure 8-46. Journey Time 9 AM Eastbound Validation

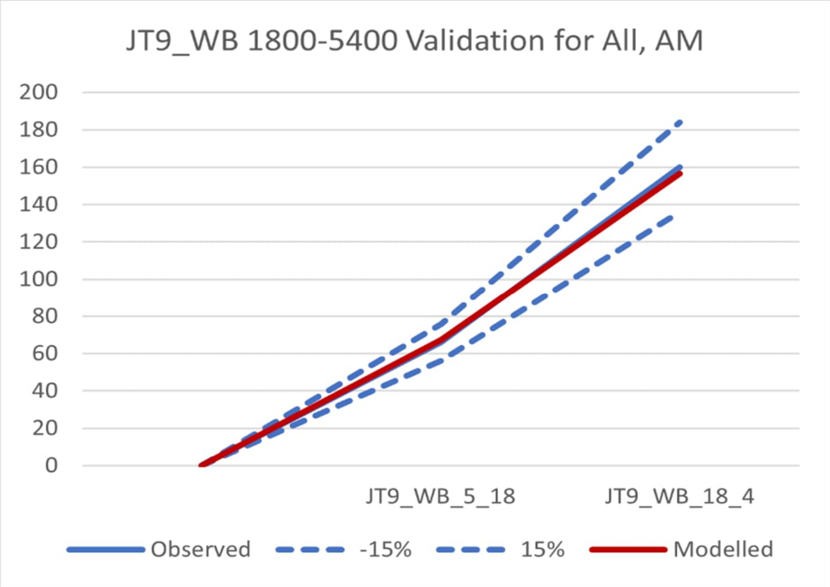


Figure 8-47. Journey Time 9 AM Westbound Validation

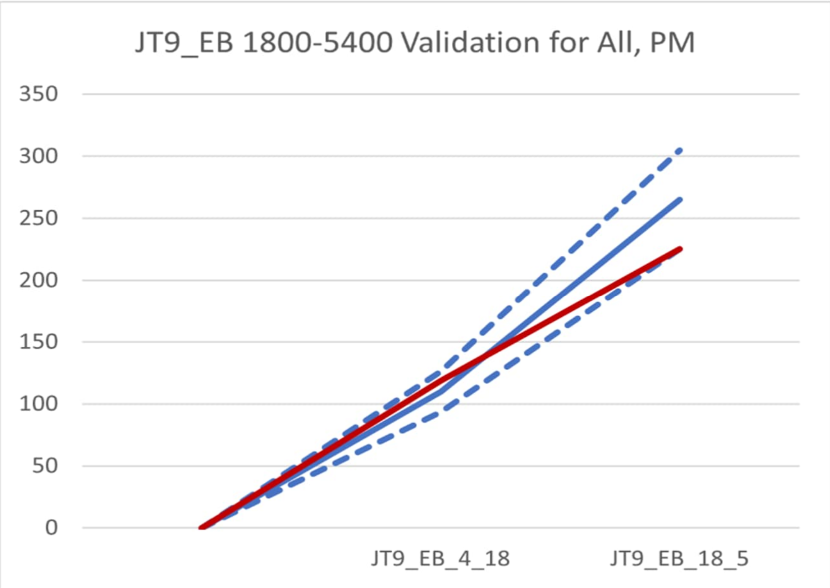


Figure 8-48. Journey Time 9 PM Eastbound Validation

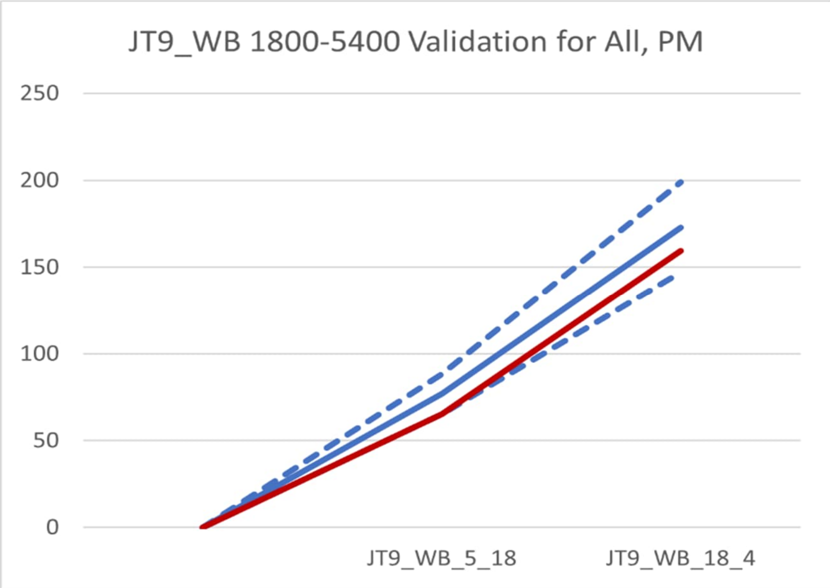


Figure 8-49. Journey Time 9 PM Westbound Validation

Appendix E – Journey Time Variability

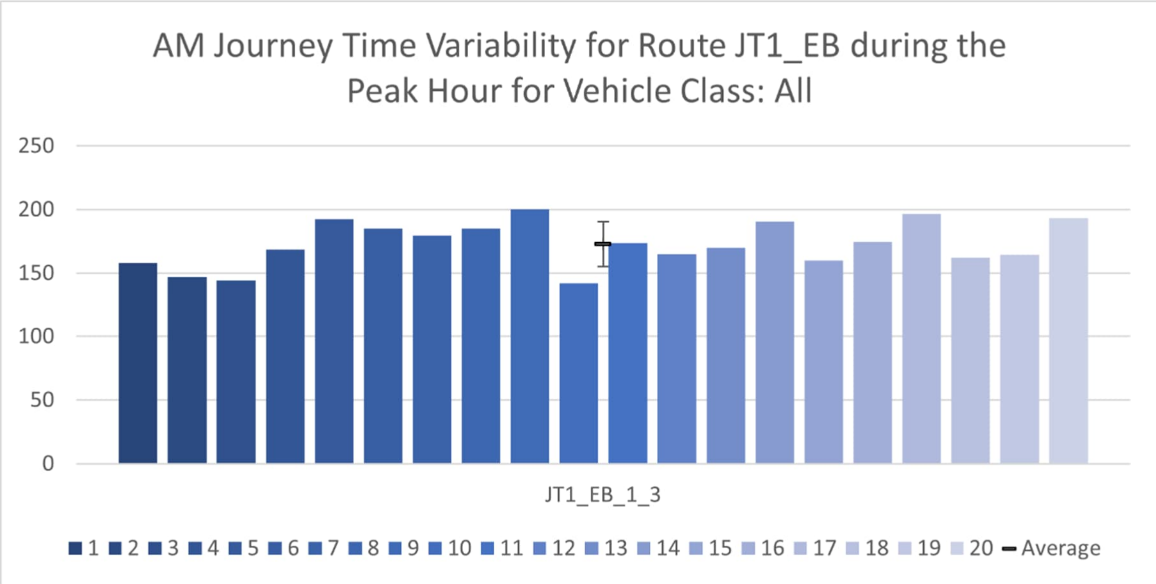


Figure 8-50. Journey Time 1 AM Eastbound Variability

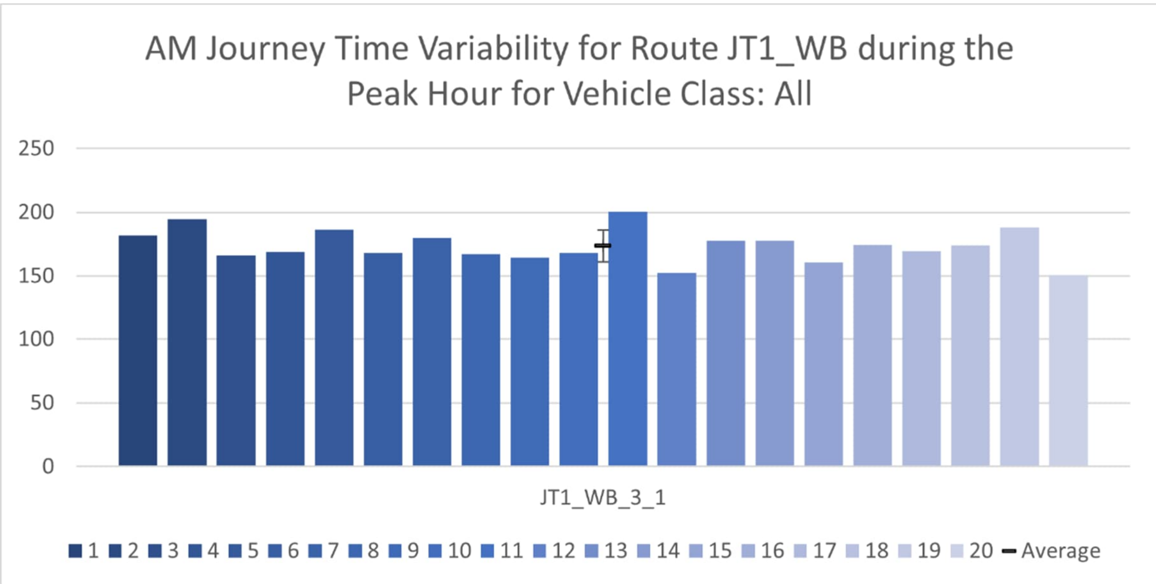


Figure 8-51. Journey Time 1 AM Westbound Variability

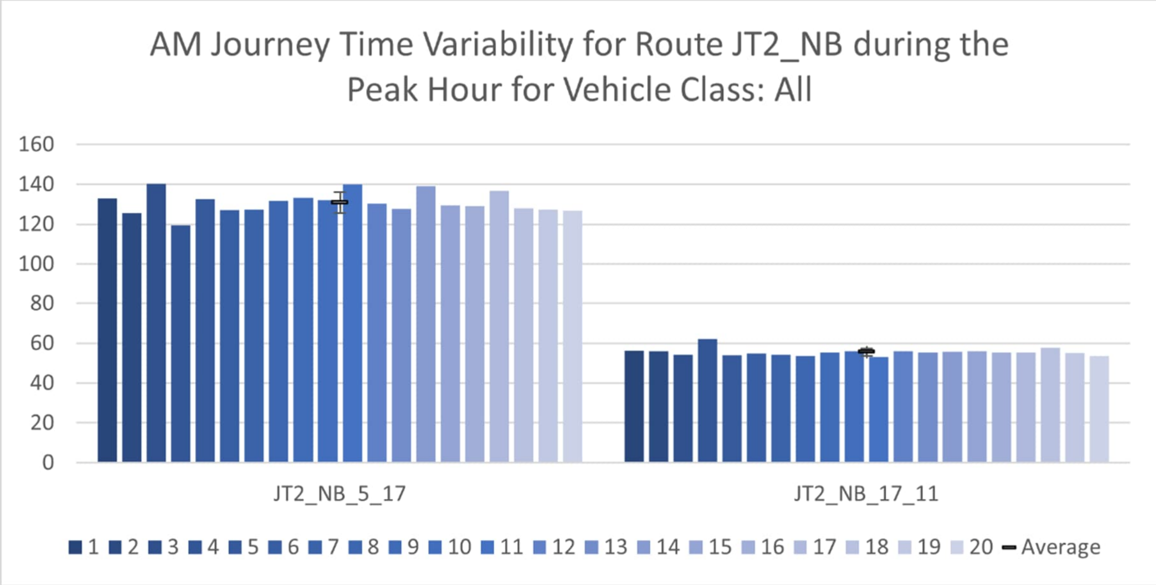


Figure 8-52. Journey Time 2 AM Northbound Variability

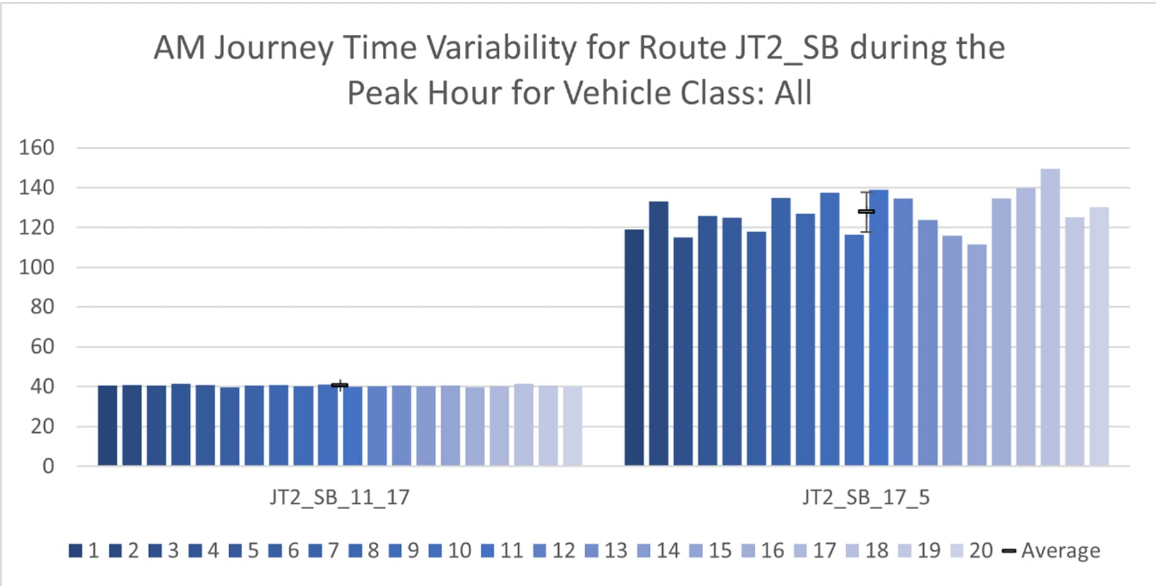


Figure 8-53. Journey Time 2 AM Southbound Variability

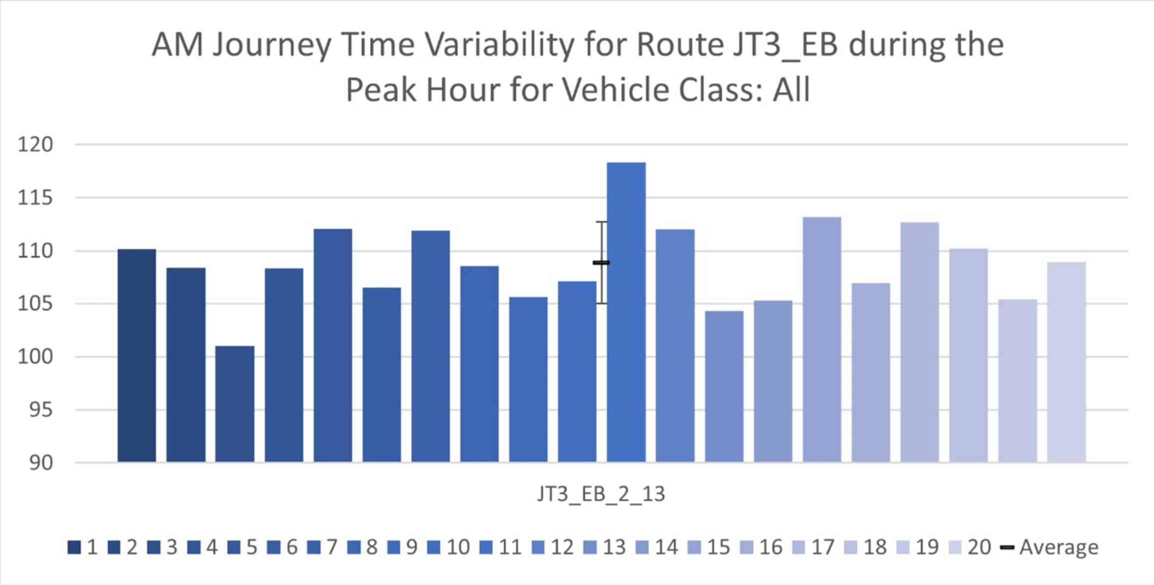


Figure 8-54. Journey Time 3 AM Eastbound Variability

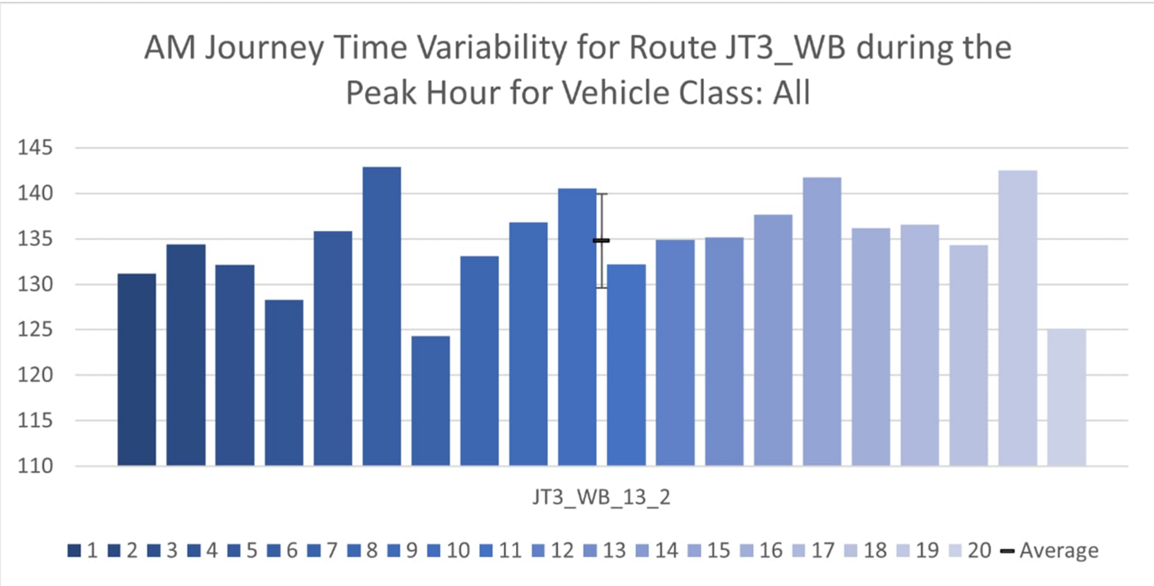


Figure 8-55. Journey Time 3 AM Westbound Variability

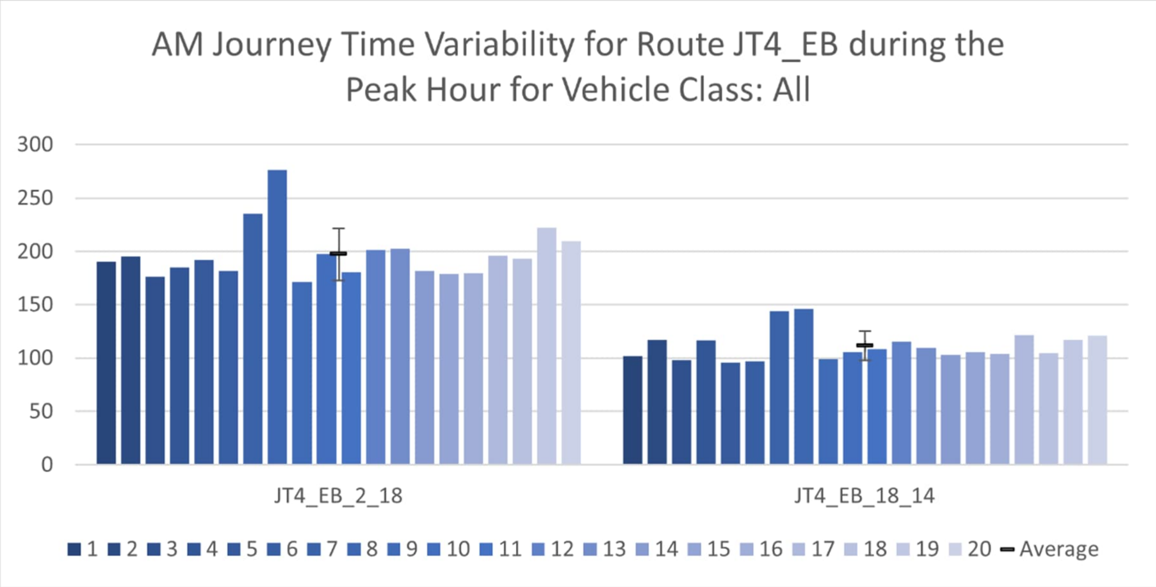


Figure 8-56. Journey Time 4 AM Eastbound Variability

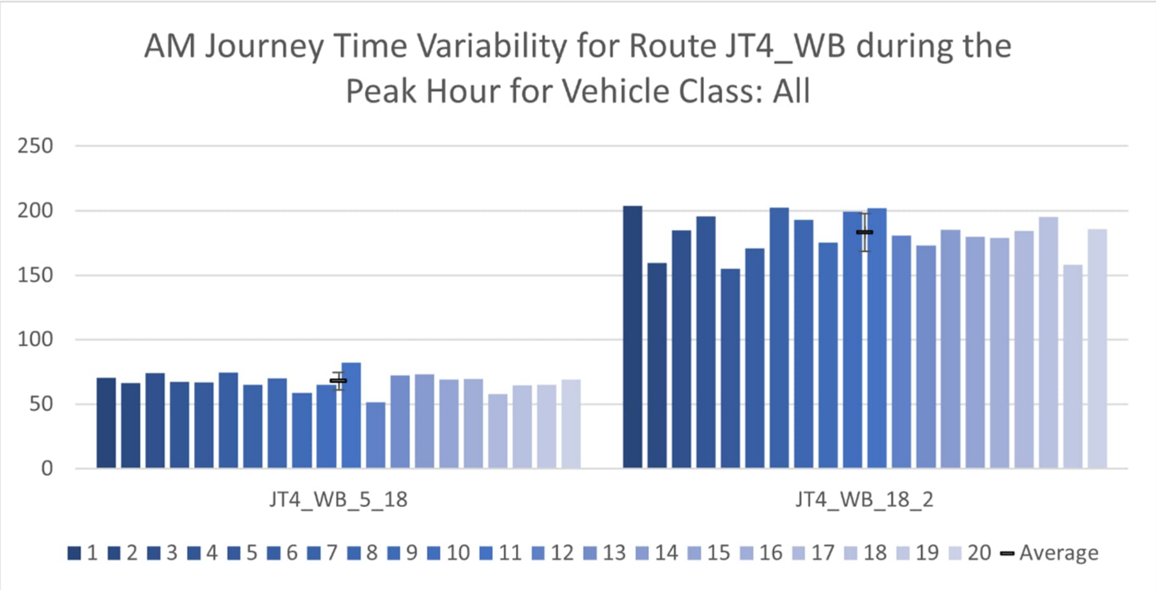


Figure 8-57. Journey Time 4 AM Westbound Variability

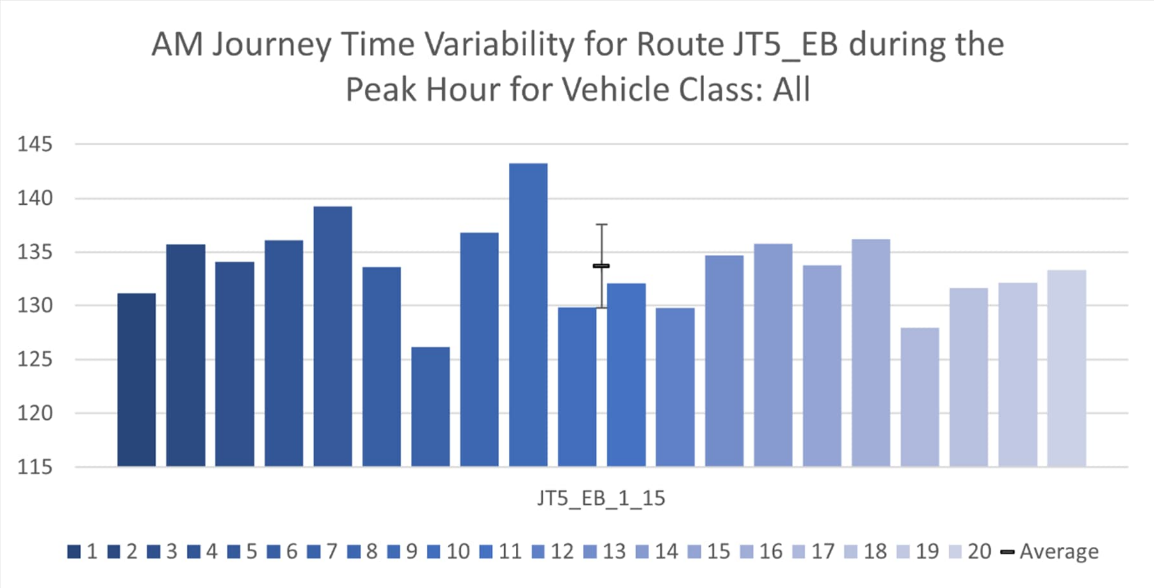


Figure 8-58. Journey Time 5 AM Eastbound Variability

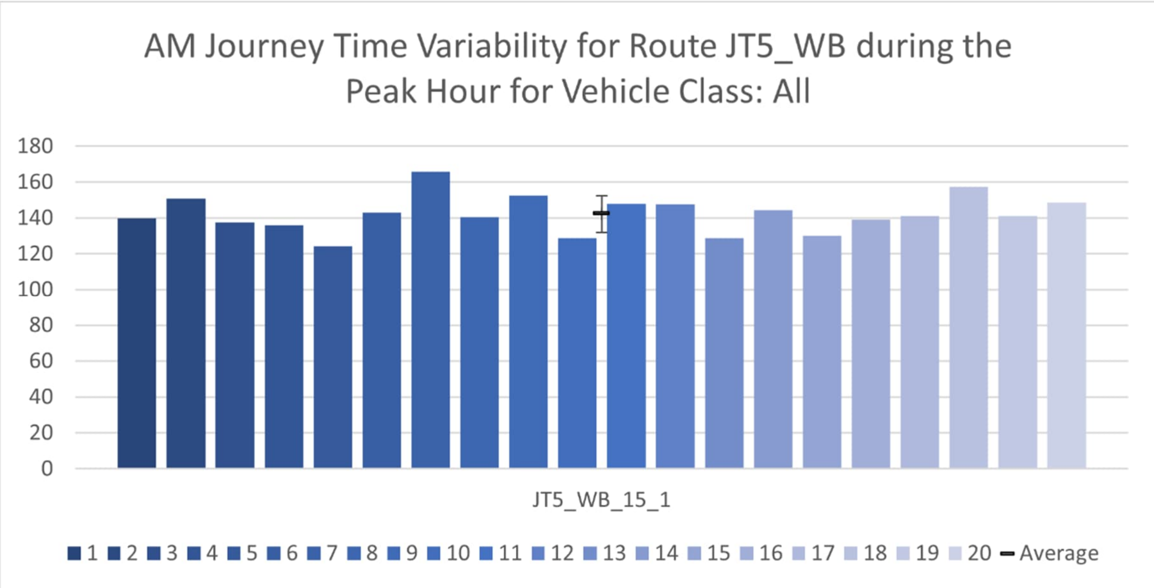


Figure 8-59. Journey Time 5 AM Westbound Variability

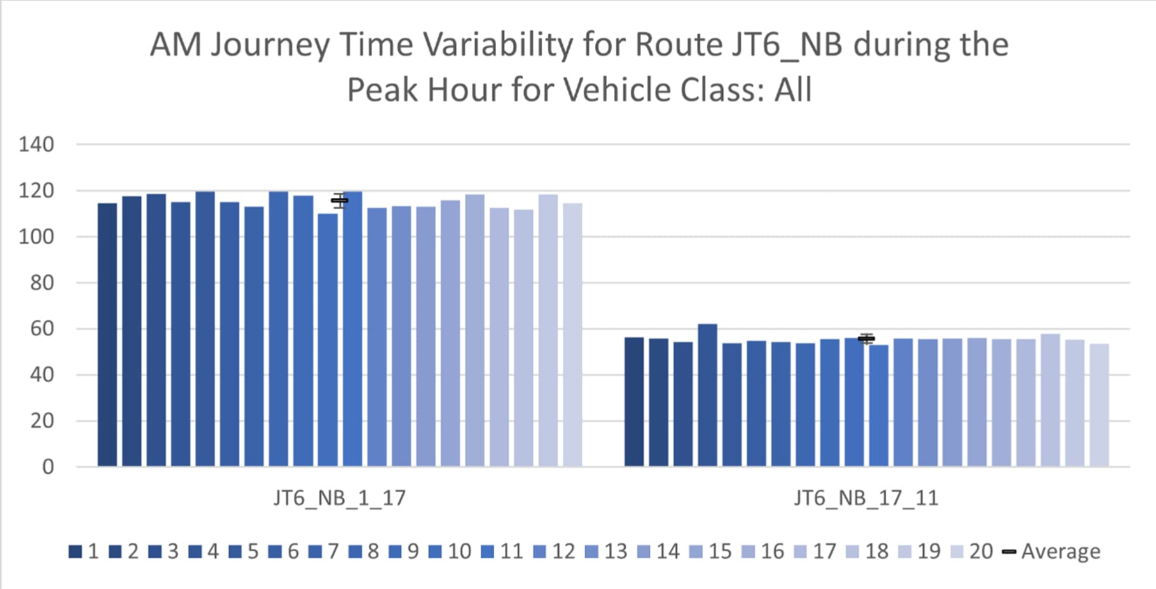


Figure 8-60. Journey Time 6 AM Northbound Variability

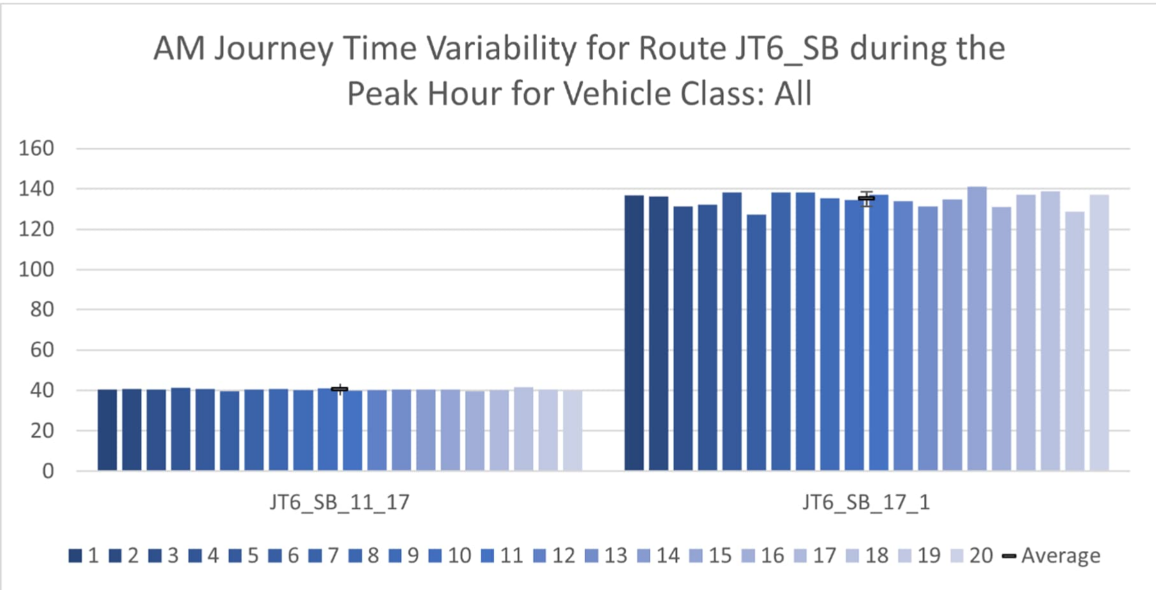


Figure 8-61. Journey Time 6 AM Southbound Variability

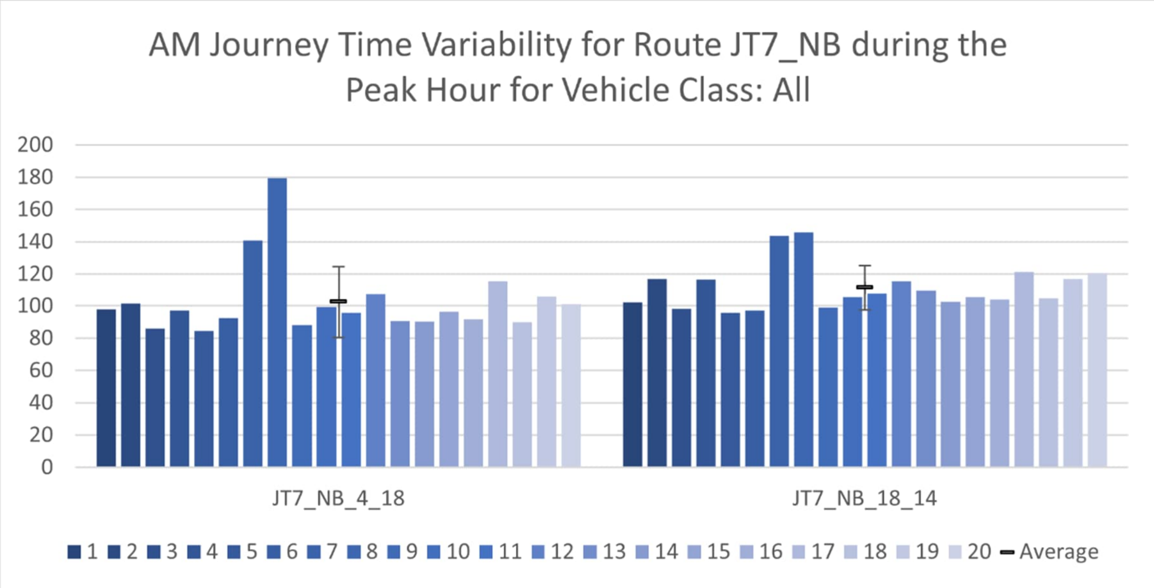


Figure 8-62. Journey Time 7 AM Northbound Variability

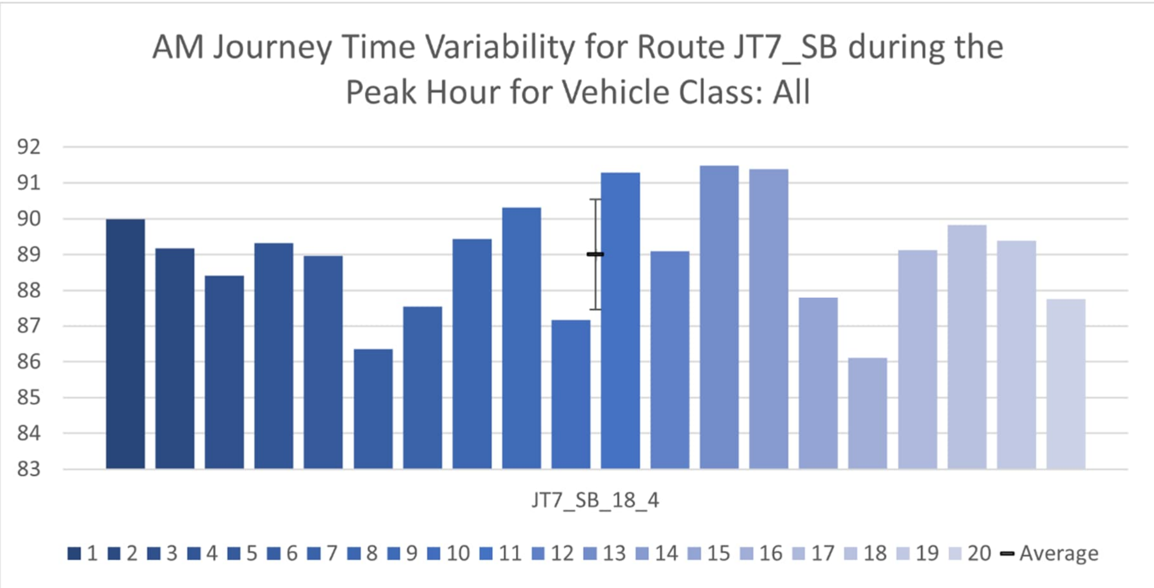


Figure 8-63. Journey Time 7 AM Southbound Variability

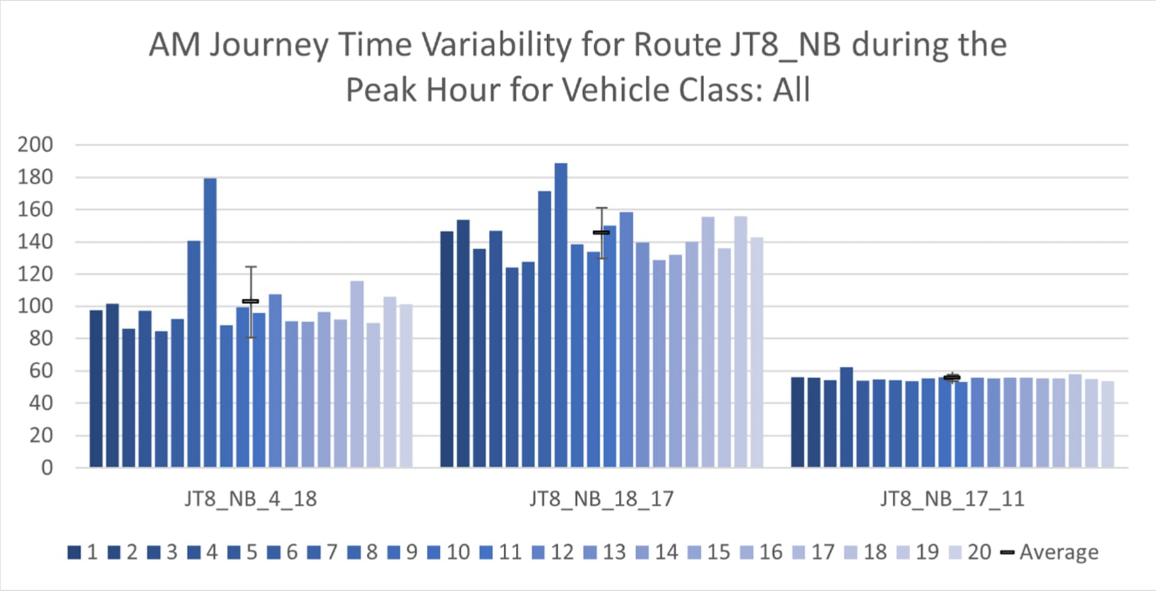


Figure 8-64. Journey Time 8 AM Northbound Variability

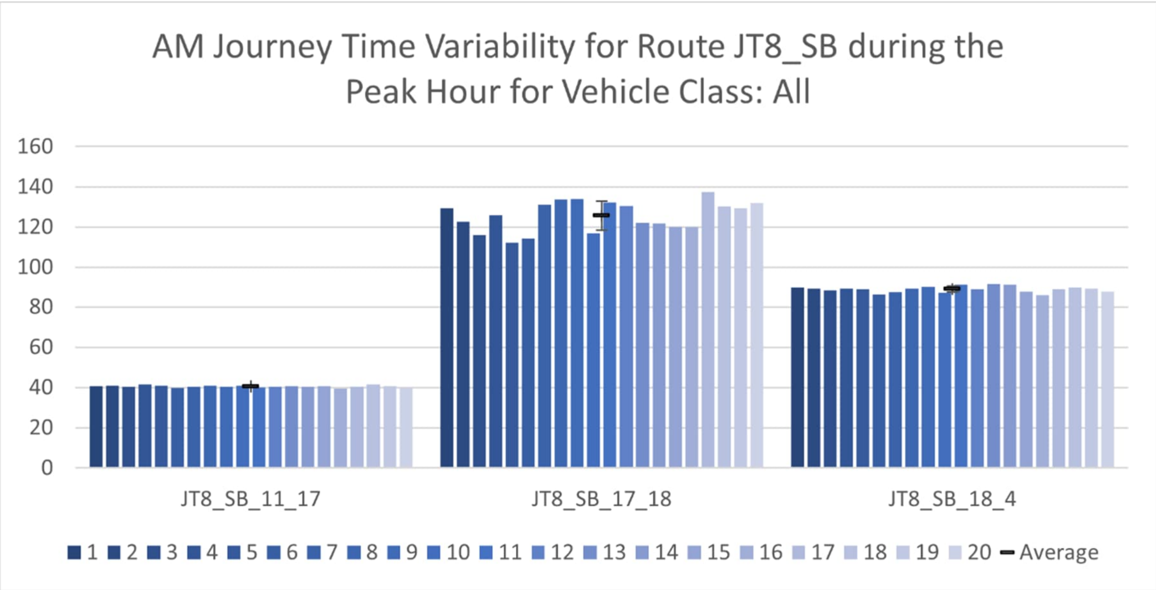


Figure 8-65. Journey Time 8 AM Southbound Variability

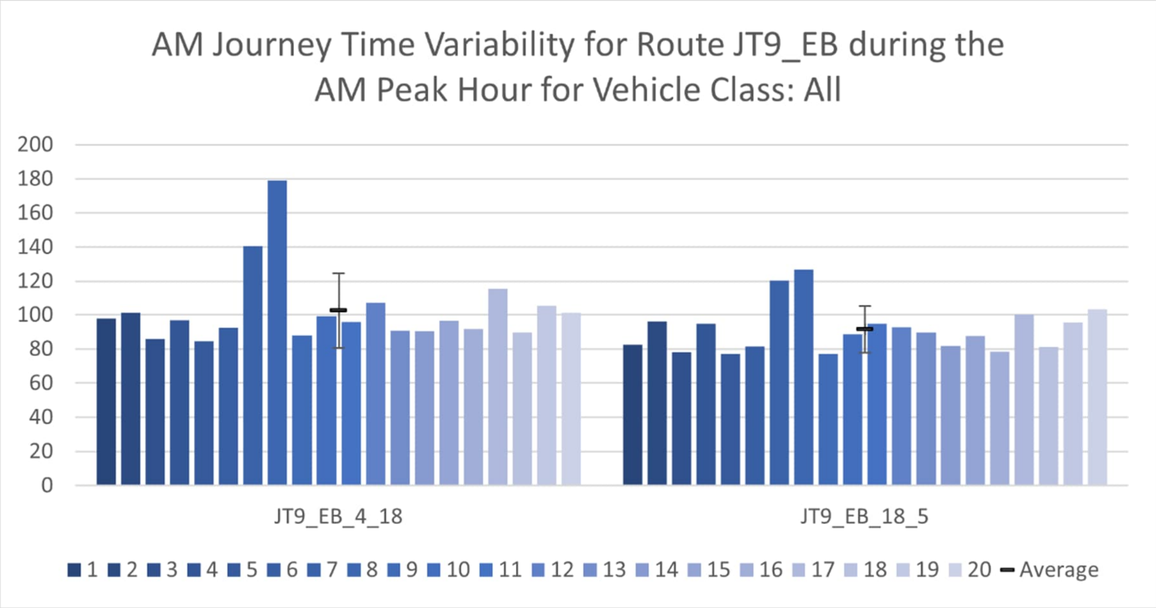


Figure 8-66. Journey Time 9 AM Eastbound Variability

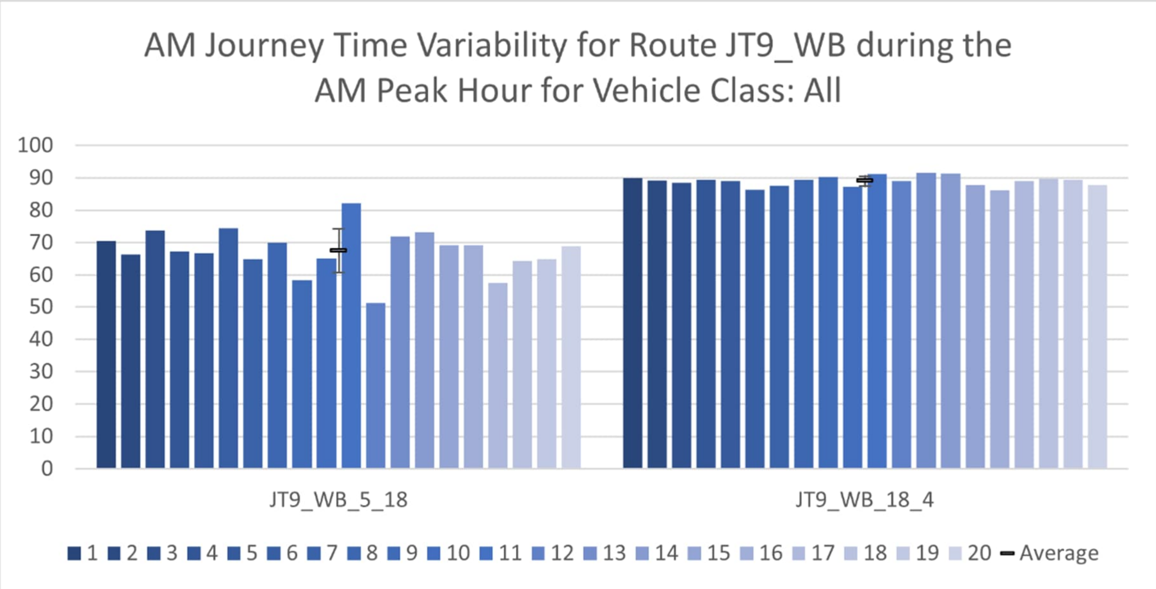


Figure 8-67. Journey Time 9 AM Westbound Variability

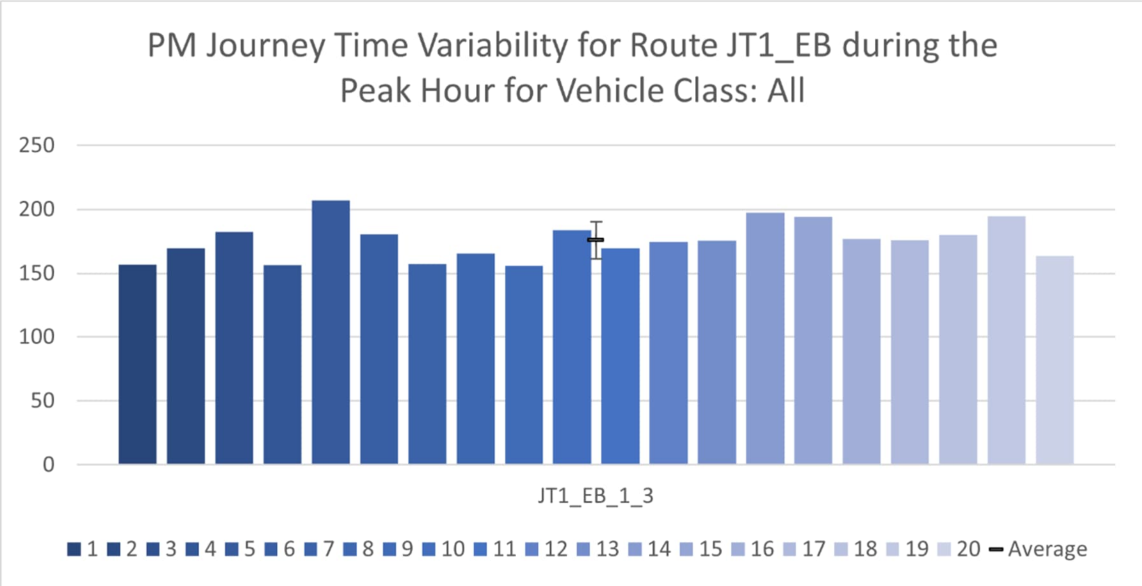


Figure 8-68. Journey Time 1 PM Eastbound Variability

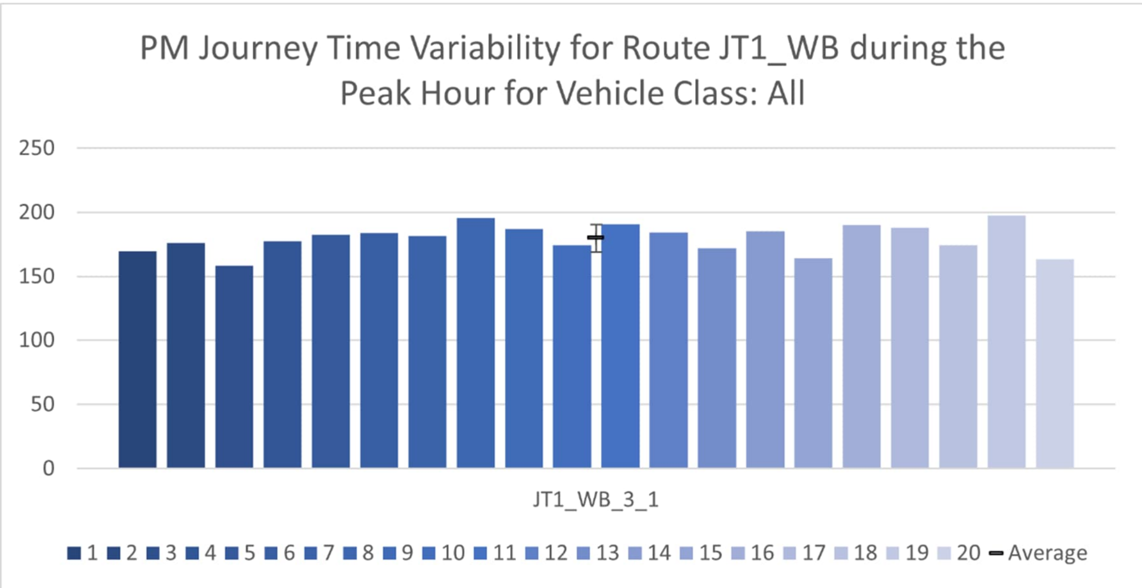


Figure 8-69. Journey Time 1 PM Westbound Variability

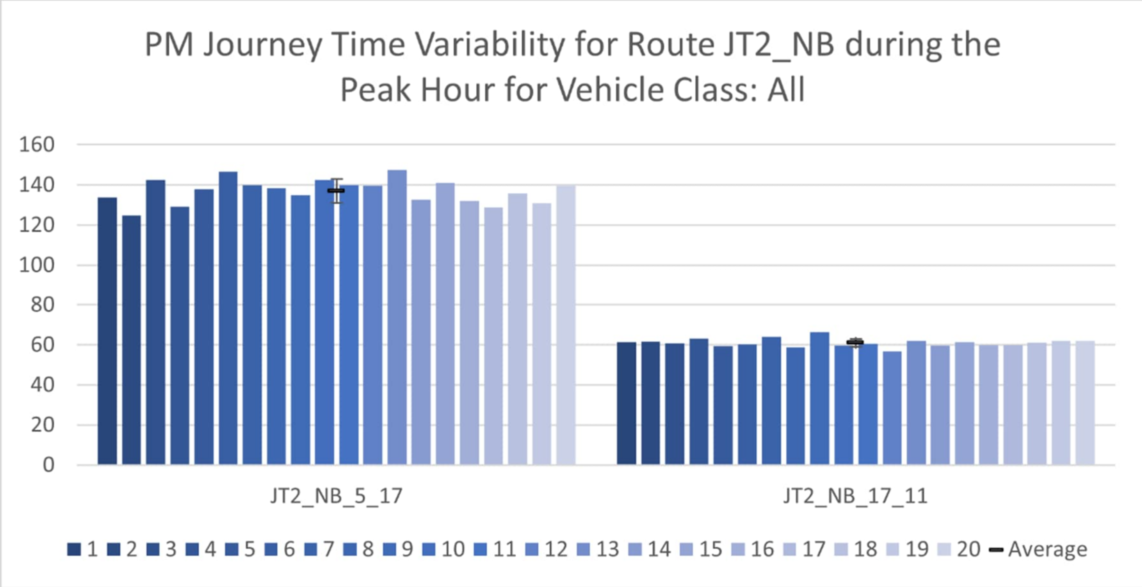


Figure 8-70. Journey Time 2 PM Northbound Variability

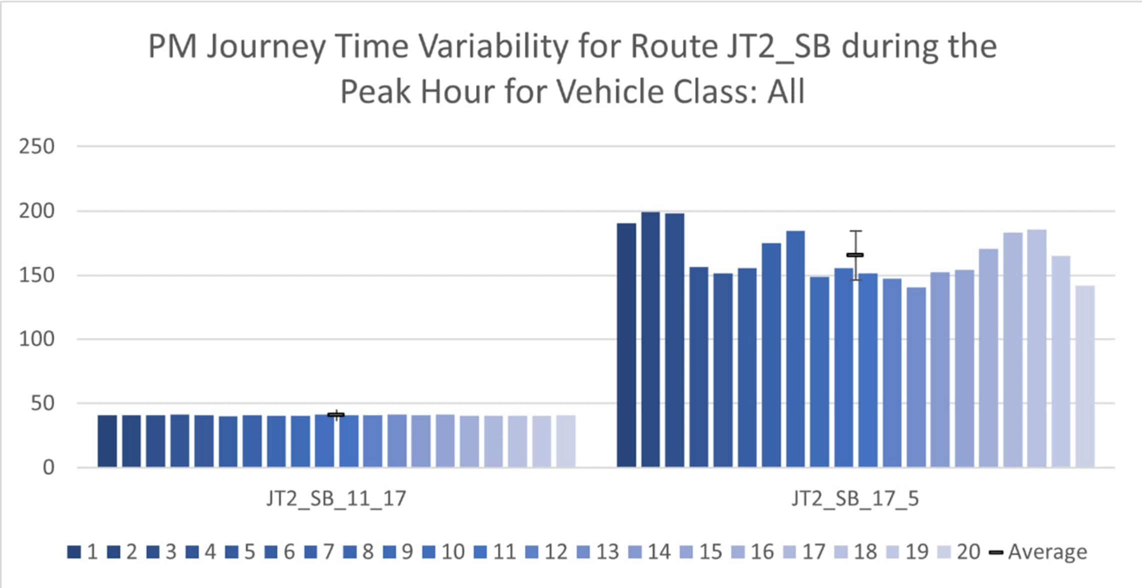


Figure 8-71. Journey Time 2 PM Northbound Variability

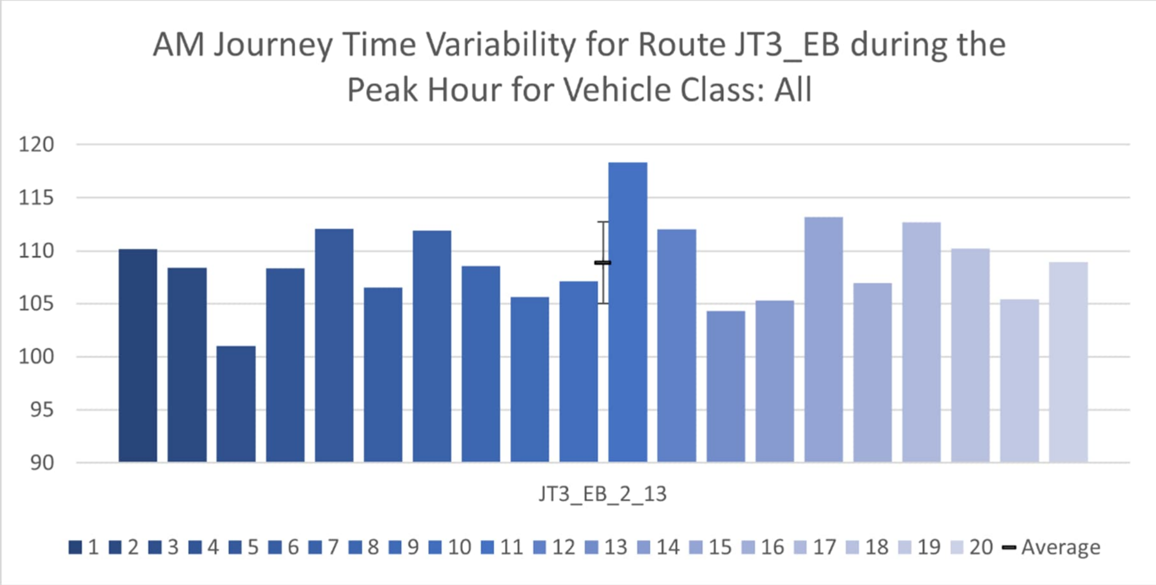


Figure 8-72. Journey Time 3 PM Eastbound Variability

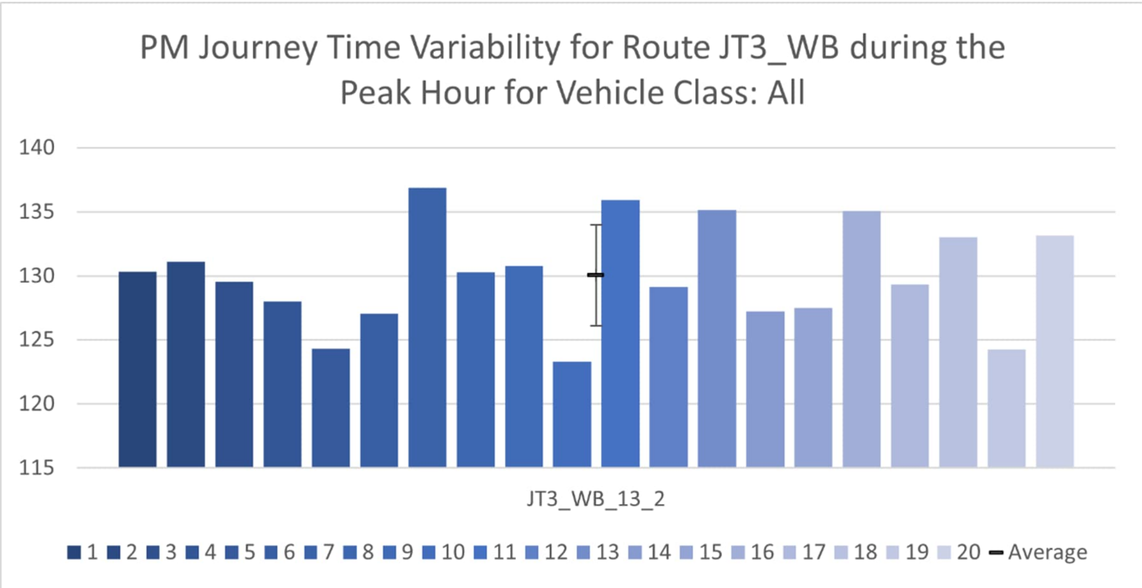


Figure 8-73. Journey Time 3 PM Westbound Variability

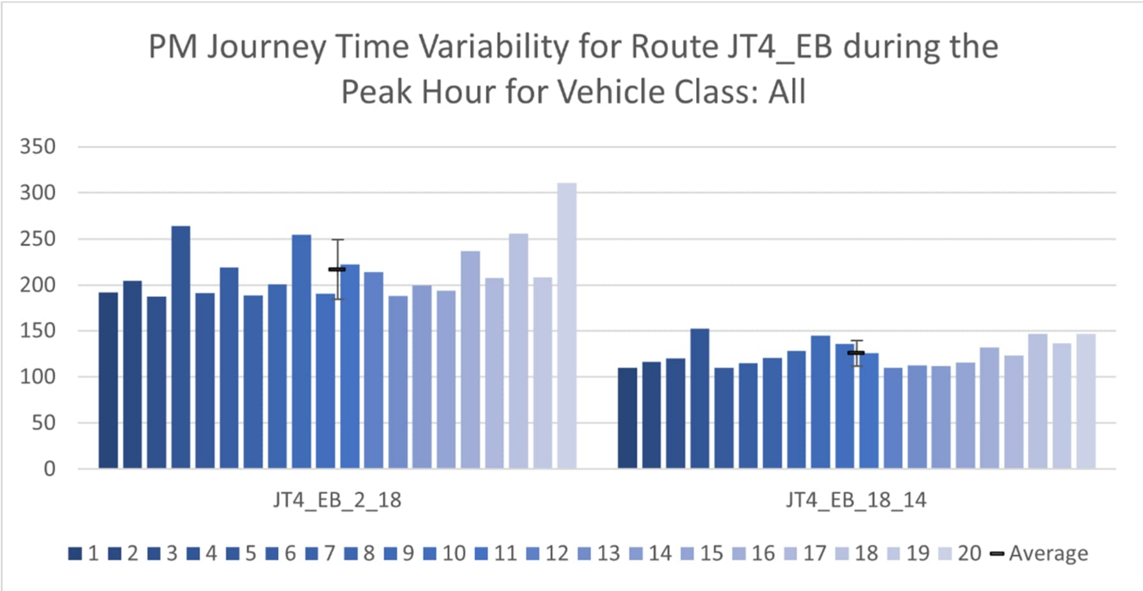


Figure 8-74. Journey Time 4 PM Eastbound Variability

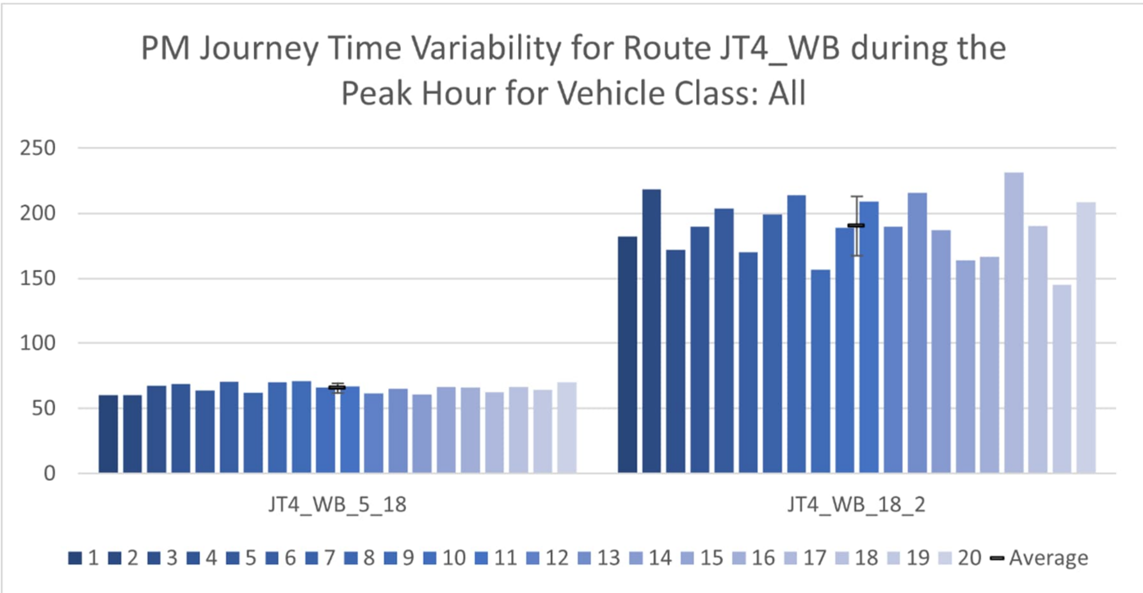


Figure 8-75. Journey Time 4 PM Westbound Variability

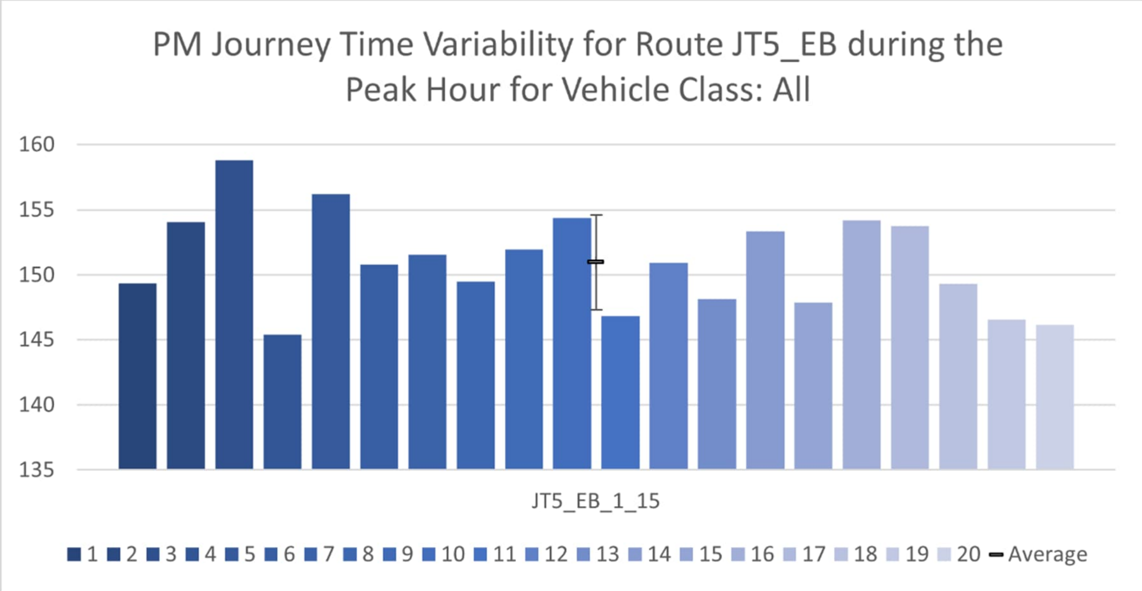


Figure 8-76. Journey Time 5 PM Eastbound Variability

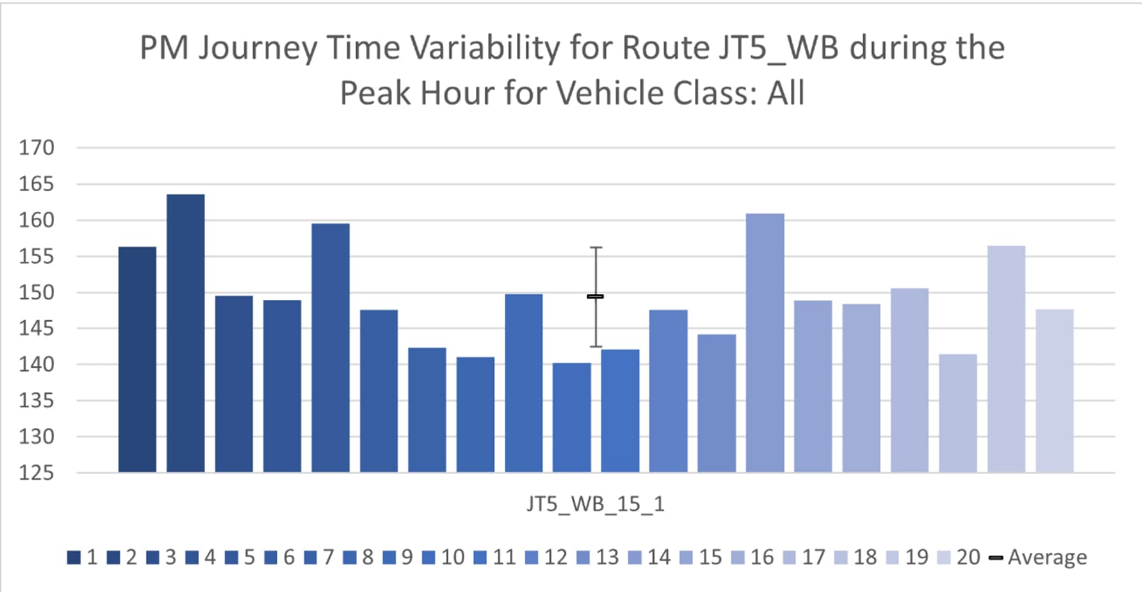


Figure 8-77. Journey Time 5 PM Westbound Variability

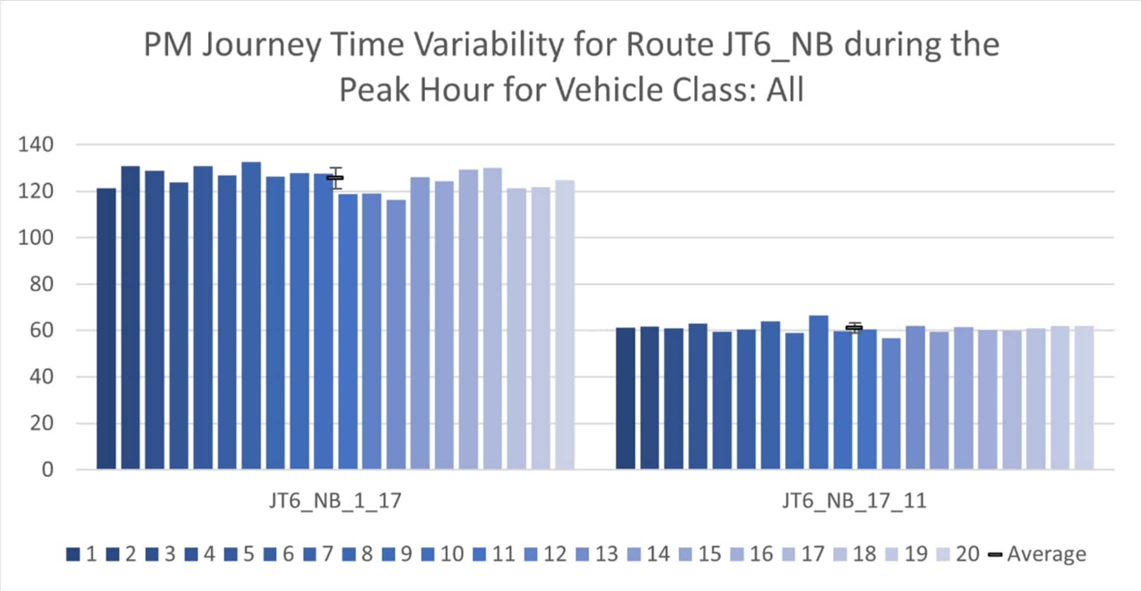


Figure 8-78. Journey Time 6 PM Northbound Variability

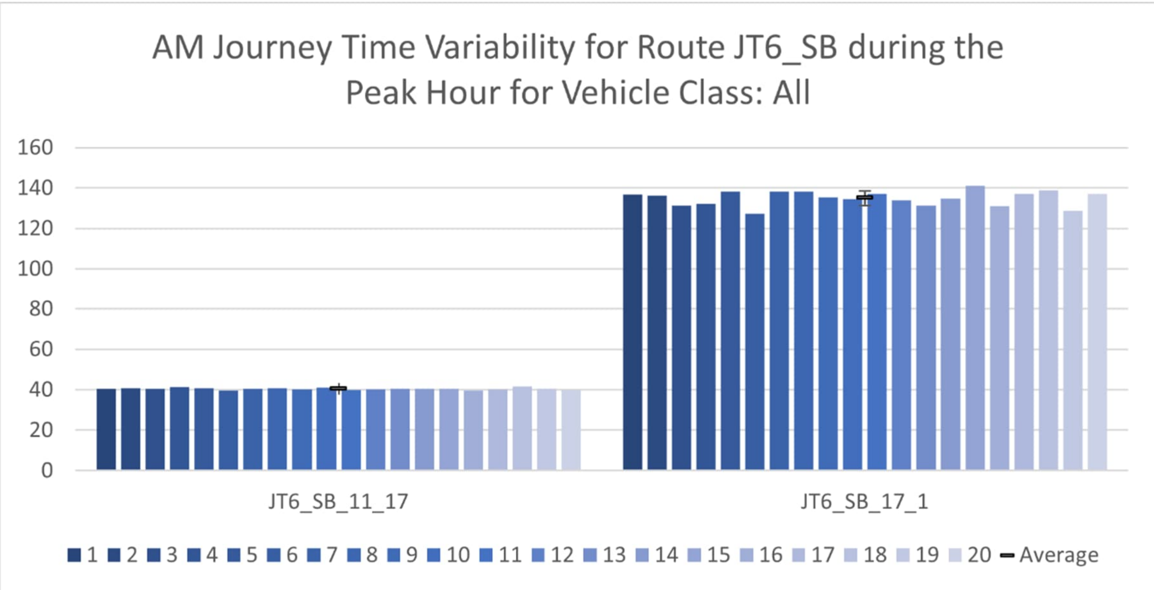


Figure 8-79. Journey Time 6 PM Southbound Variability

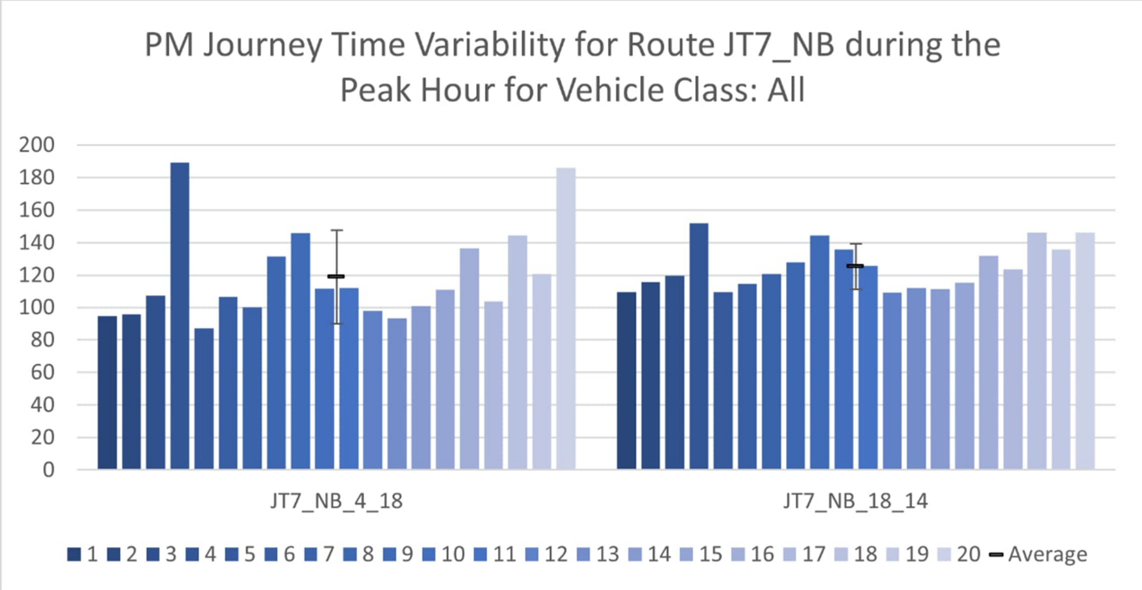


Figure 8-80. Journey Time 7 PM Northbound Variability

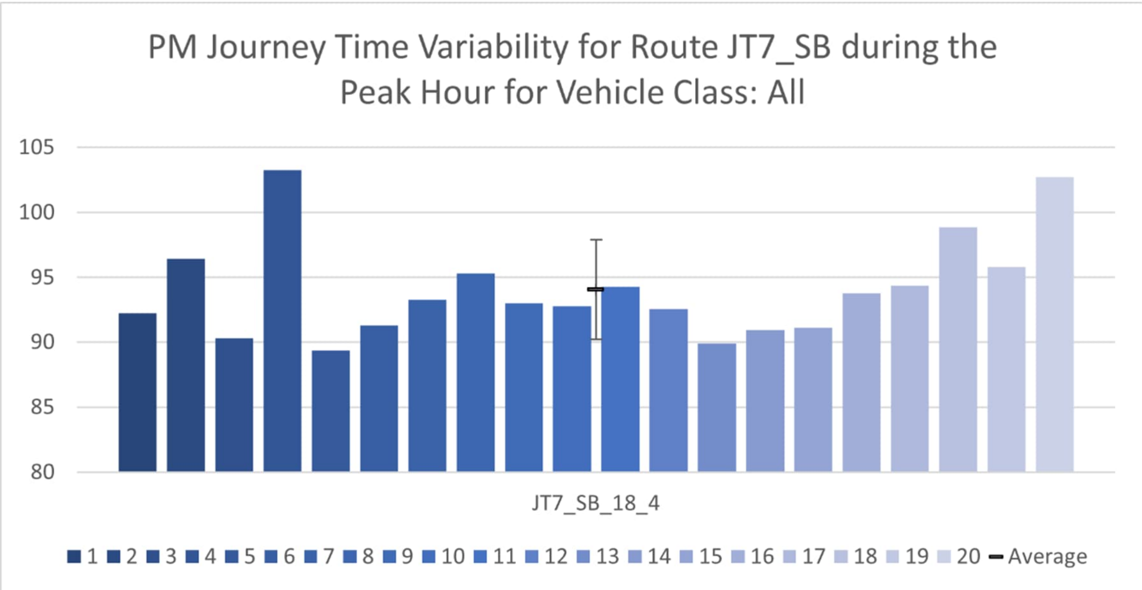


Figure 8-81. Journey Time 7 PM Southbound Variability

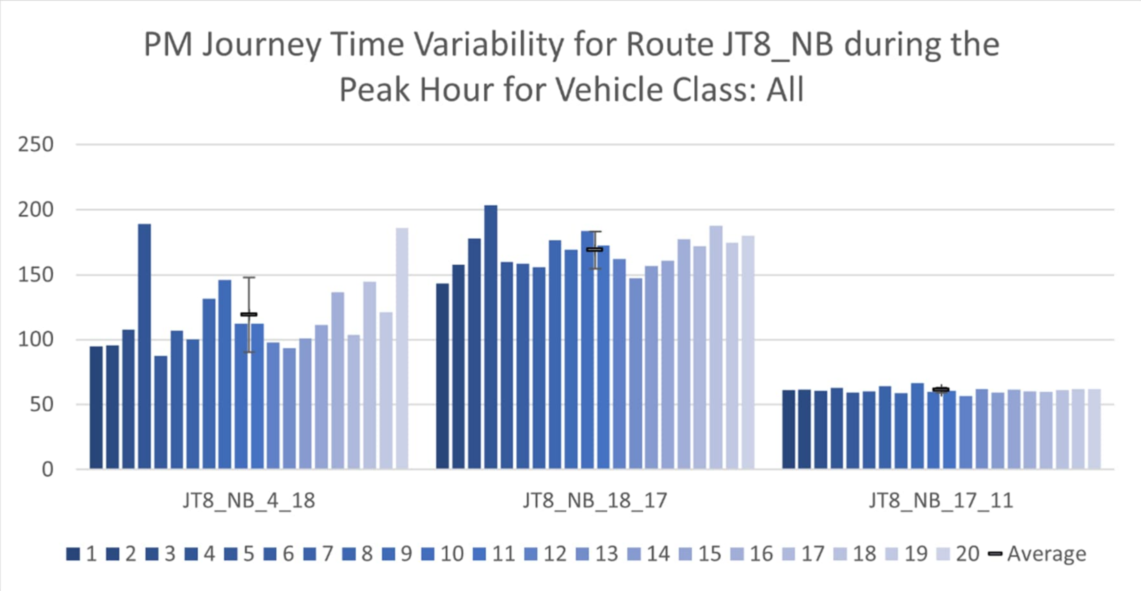


Figure 8-82. Journey Time 8 PM Northbound Variability

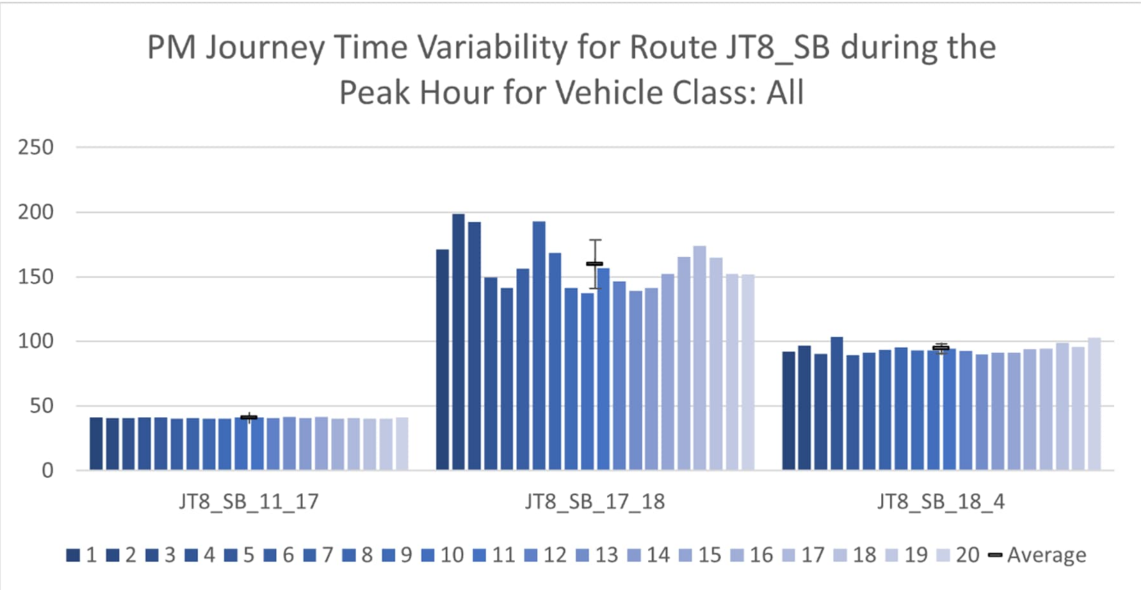


Figure 8-83. Journey Time 8 PM Southbound Variability

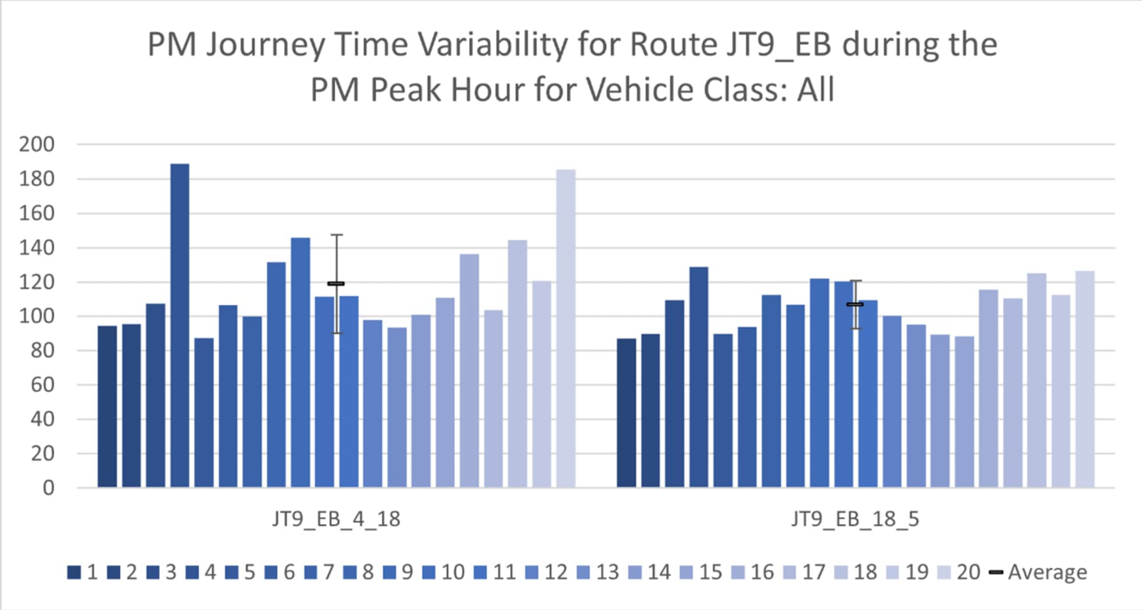


Figure 8-84. Journey Time 9 PM Eastbound Variability

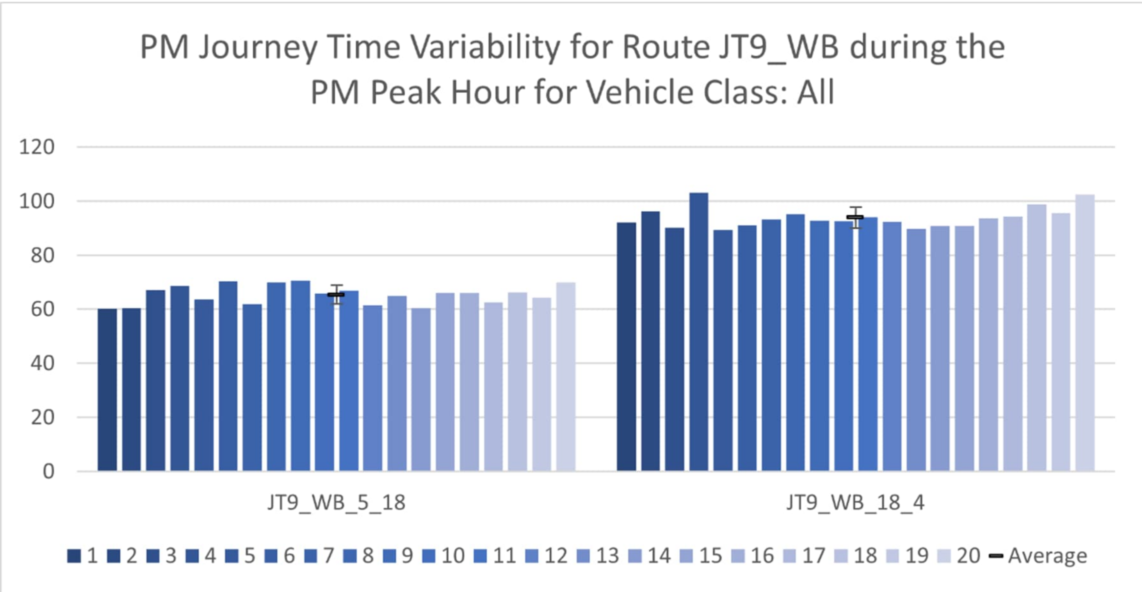


Figure 8-85. Journey Time 9 PM Westbound Variability

aecom.com

AECOM

Coltishall Vissim Model Validation Report

ESCO Developments, Flagship Housing Group and Lovell Partnerships

21 April 2023

Delivering a better world

Quality information

Prepared by	Checked by	Verified by	Approved by
WG	JNP	PA	
Will Glover Graduate Consultant	Javier Navarro Pardo Principal Consultant	Phil Arnold Associate Director	Bevin Carey Regional Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1.0	21/04/2023	Revision for Client Review	BC	B Carey	Regional Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

The Client Group

Prepared by:

Will Glover

AECOM Limited
Marlborough Court
10 Bricket Road
St Albans
AL1 3JX
United Kingdom

T: +44(0)1727 535000
aecom.com

Table of Contents

1. Introduction

Background and Report Structure

1.1 ESCO Developments, Flagship Housing Group and Lovell Partnerships ('The Client Group') have commissioned AECOM to develop a VISSIM base model of the village of Coltishall to set up a reliable basis to assess the future operation of the network and the potential impact of the North Walsham Western Urban Extension (NWWUE). The model has been calibrated and validated to replicate the operation of the town based on data collected in November 2022.

1.2 This report documents the data collection and analysis, the development of the network and base year demand, and the calibration/ validation. The report is structured as follows:

- Data collection and analysis;
- Demand development;
- Network Development;
- Model Calibration results;
- Model Validation results; and
- Conclusion.

Model Scope

1.3 The Vissim model has been developed for the area shown in Figure 1-1. The Coltishall network has no signalised junctions with all the junctions operating as priority controlled. The model area includes a mini roundabout to the west of the village, a small gyratory road around a petrol station in the centre of the village and the narrow bridge over the river in the middle of the village. The Vissim model area shown in Figure 1-1 includes the B1150, which is the main corridor between Norwich and North Walsham, and the critical junctions/ links constraining the capacity of the corridor, such as the bridge and the village centre.

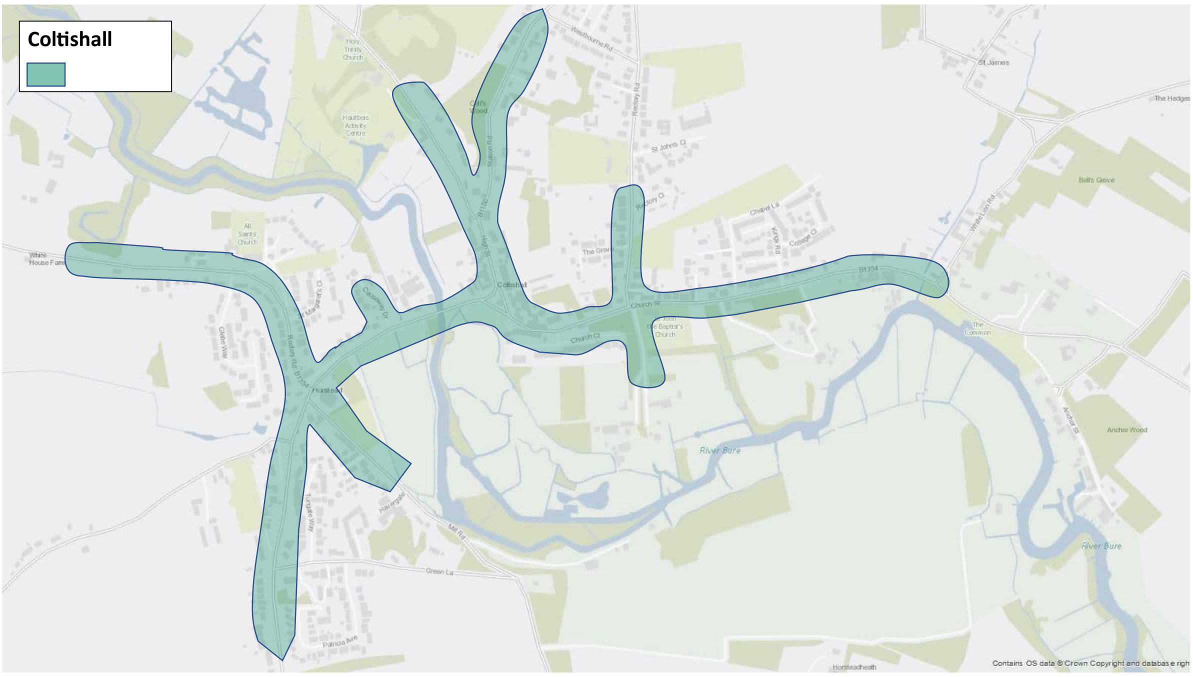


Figure 1-1 – Coltishall Modelled Area

1.4 Figure 1-2 below shows the key junctions/ locations identified from the survey data/ observations in the model area that have a critical impact on network operation.

Figure 1-2 – Key areas in Coltishall

1.5 The key areas are defined as follows:

1. Roundabout linking Rectory Road to the B1150;
2. Bridge over the River Bure on the B1150;
3. Gyratory road around the Esso Petrol Filling Station (PFS); and
4. High Street in Coltishall.

1.6 These areas have been considered when developing the model to replicate the existing operation and driving behaviour observed in the video footage available. It should be noted that the operation of some of these critical areas is entirely dependent on variable factors such as on-street parking and courtesy/ give way behaviours, which have been modelled and calibrated to observed queuing patterns/ levels of delay.

1.7 The Vissim Base models have been developed for the AM and PM peak hours, including 15-minute warm-up and 15-minute cool-down periods.

1.8 The Base models have been developed in line with modelling requirements and the calibration and validation criteria defined in Transport Analysis Guidance (TAG) and the Guidelines for the Use of Microsimulation Software published in May 2022 by National Highways.

2. Data Collection and Analysis

Introduction

2.1 The data collection exercise undertaken by AECOM to inform the Vissim Base model development has been summarised in this section.

Manual Classified Turning Count (MCTC) Data

2.2 Manual Classified Turning Counts (MCTCs) were carried out at the sites indicated in Figure 2-1 on Thursday 10th November 2022 between 07:00 and 19:00. The MCTC data was used to develop the base model demand and calibrate the turning flows at each junction shown in Figure 2-1.

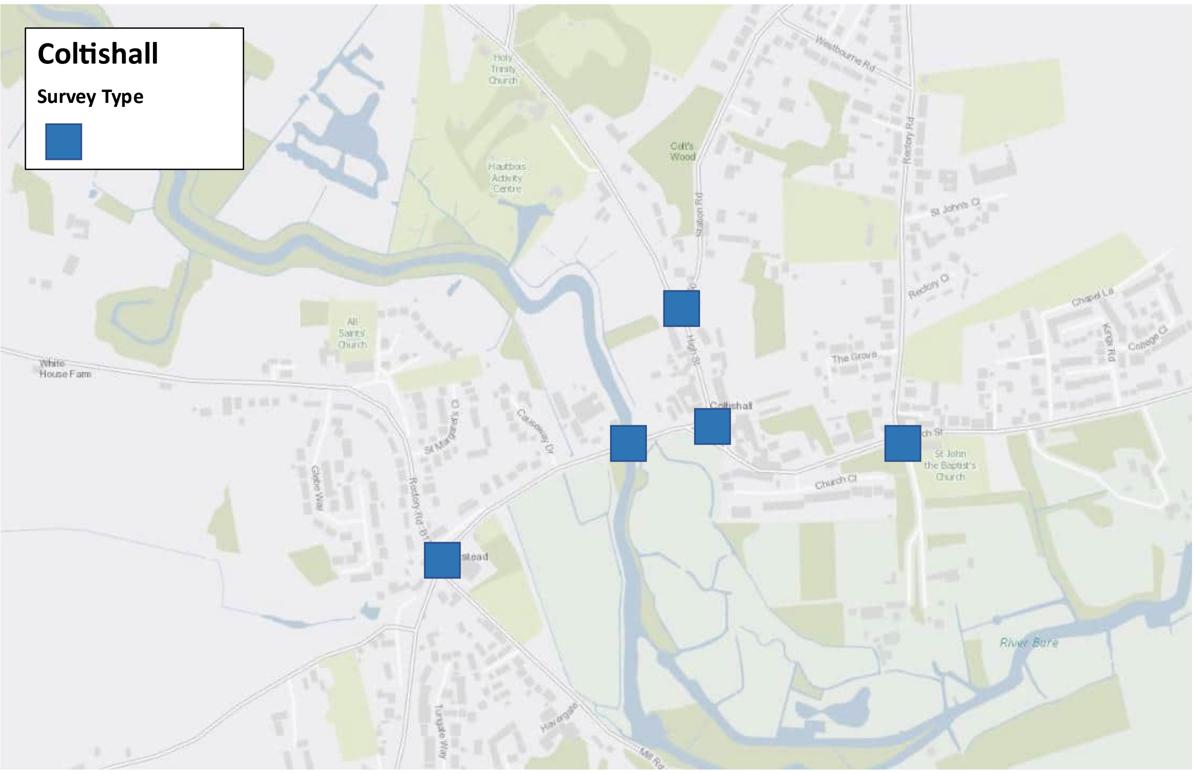


Figure 2-1 – Manual Classified Turning Counts sites

Automatic Traffic Count (ATC) data

2.3 The link counts were collected using Automatic Traffic Count (ATC) loops. The ATC data was collected over two weeks between Thursday 10th of November and Wednesday 23rd of November 2022.

2.4 Five ATC sites were surveyed in total that have been used to inform the total trip ends at the entry/ entry points to the model. Their locations are shown below in Figure 2-2.

Figure 2-2 – Link counts (Automatic Traffic Counts)

Journey Time Data

2.5 The surveys also captured floating car data for two routes through the modelled area on 30th November 2022. The surveyed journey time routes are shown in Figure 2-3.

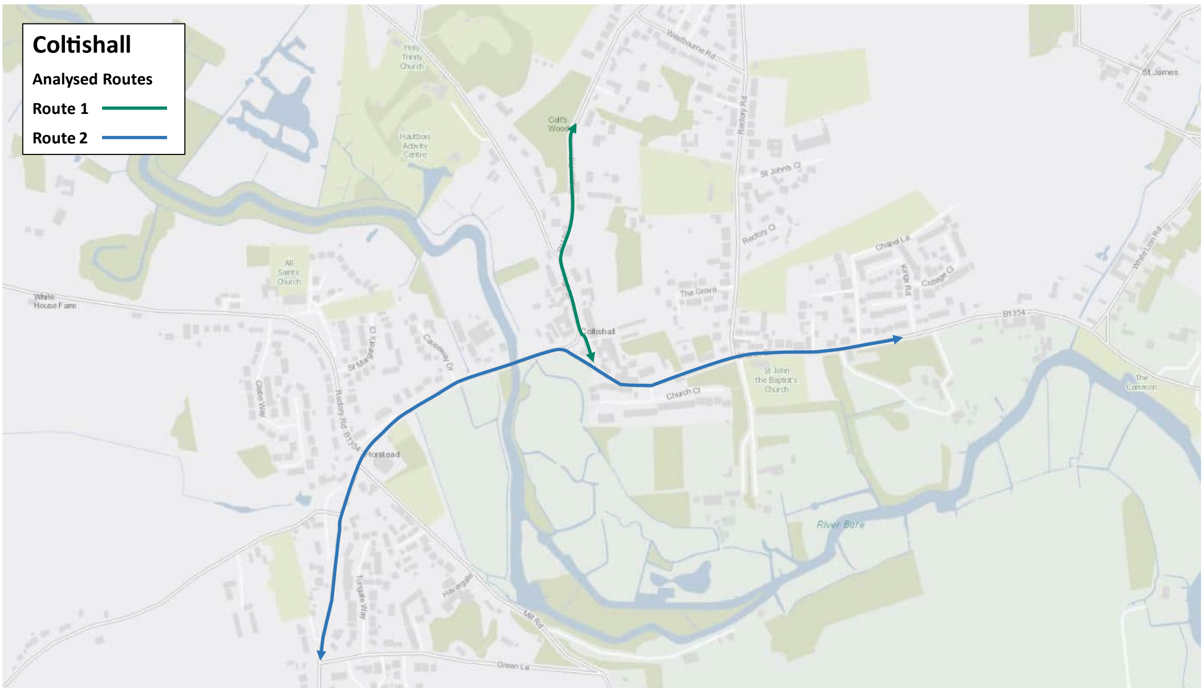


Figure 2-3 Journey Time Routes

Camera Footage

2.6 Camera footage, which was recorded to produce the MCTC and floating car journey time data, was obtained to provide the modellers with a more detailed view of the driving behaviour in the area.

Data Review and Analysis

Consistency Review

2.7 The locations of MCTC counts with labelled approach arms and model entry points to assist with the analysis of the data consistency review can be found in Appendix A.

2.8 The consistency between the different data sets was assessed to understand the reliability of the data and identify any discrepancies which could affect the model development. The full details of the consistency checks undertaken can be found in Appendix B.

2.9 The flow analysis and consistency checks highlighted a small flow difference between some junctions, these differences were below GEH 3 and will not affect the model calibration.

2.10 However, the flow difference between the PFS and the Rectory Road/ Norwich Road mini roundabout (Causeway Drive) could be affected by a potential increase in queue length from the bridge. To address this flow difference and ensure the model will capture any detrimental effects on Causeway Drive in the forecast scenarios, an additional model zone was added to represent Causeway Drive, to balance the flows between the junctions.

Peak Hour Analysis

2.11 The survey data available was processed to identify the morning and evening peak hours by analysing the profile of traffic volumes during the surveyed period. For this calculation, all vehicle movements have been considered as well as calculations of the inbound flows to the model area.

2.12 MCTC data was analysed using two methods to determine the peak hour, by totalling all movements and by totalling only entries in the model area. In the AM period, the peak hour was calculated to be 07.45-08.45, both when considering entries into the modelled area and when using all available data. In the PM period calculations similarly returned a consistent peak hour of 16.30-17.30 using both methods. The ATC data was also analysed and showed the same peak hours as analysis of the MCTC data.

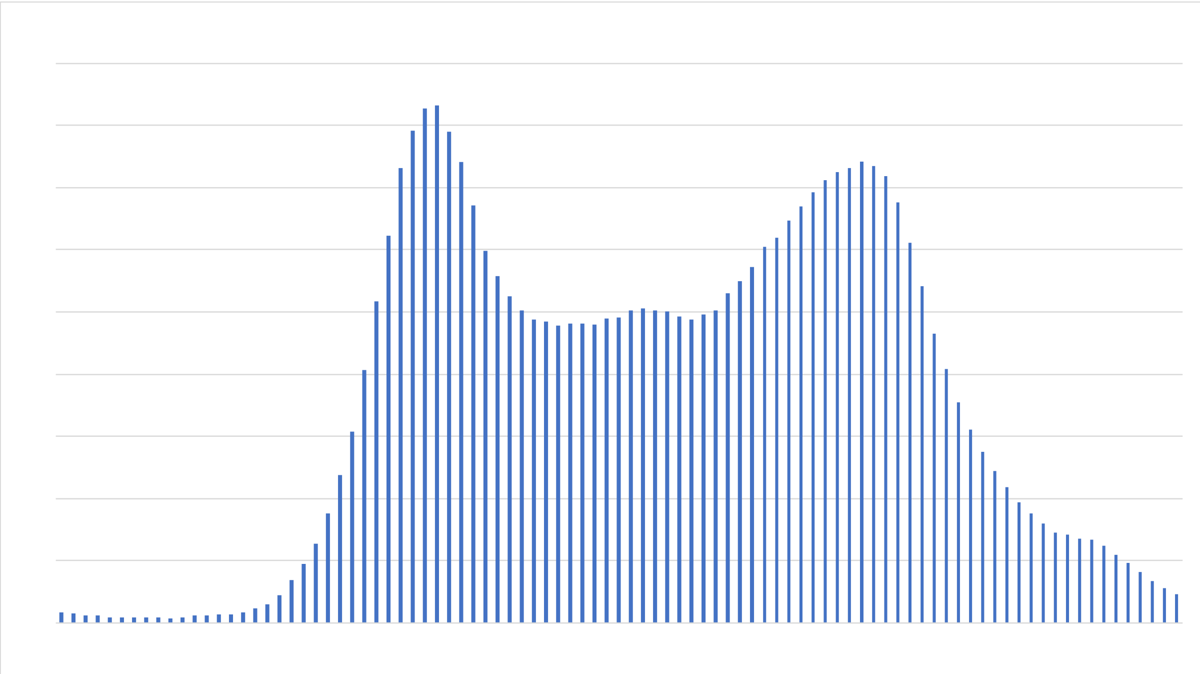


Figure 2-4 ATC Neutral Day Average All Movements Rolling Hour

2.13 Based on the assessment of the cumulative hourly flows shown above in Figure 2-4, the following morning and evening peak periods for the general traffic were assumed as follows:

- Morning Peak (AM): 07:45 to 08:45; and
- Evening Peak (PM): 16:30 to 17:30.

2.14 The modelled simulation periods include a 15-minute warm-up period to fully saturate the network before the simulated peak hour and a 15-minute cool-down period to allow vehicles to complete their journeys. The modelled periods are therefore:

- AM modelled period: 07:30 - 09:00; and
- PM modelled period: 16:15 - 17:45.

3. Demand Development

Overview

3.1 This section describes the demand methodology and the routing analysis undertaken to develop and calibrate the traffic demand and routing in the Vissim Base model.

3.2 The model was developed using the dynamic assignment module, as it would allow the model to predict future changes in routing as a consequence of the demand growth, committed schemes or proposed mitigation measures in the area.

3.3 The traffic demand has been calculated for each vehicle type included in the model (Car, Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV)) for the modelled peak hours. The available survey data has been used to develop the hourly Origin-destination matrices and the 15-minute profiles for each origin zone.

Methodology

3.4 To ensure the best possible correlation between the observed data and the Vissim model demand, the vehicle inputs and origin/destination routing have been developed by combining two different components:

- Prior Matrix – This was developed using MCTC turning count proportions to define origin to destination routes.
- New Zones Matrix – a synthetic zone was added on Causeway Drive, labelled as Zone 2. The demand at this zone has been estimated based on the flow differences identified between the adjacent MCTC data.

3.5 Figure 3-1 shows the location of the defined zones in Vissim. The MCTC sites are labelled with numbers 101-105, whilst the origin zones are labelled with numbers 1-9.

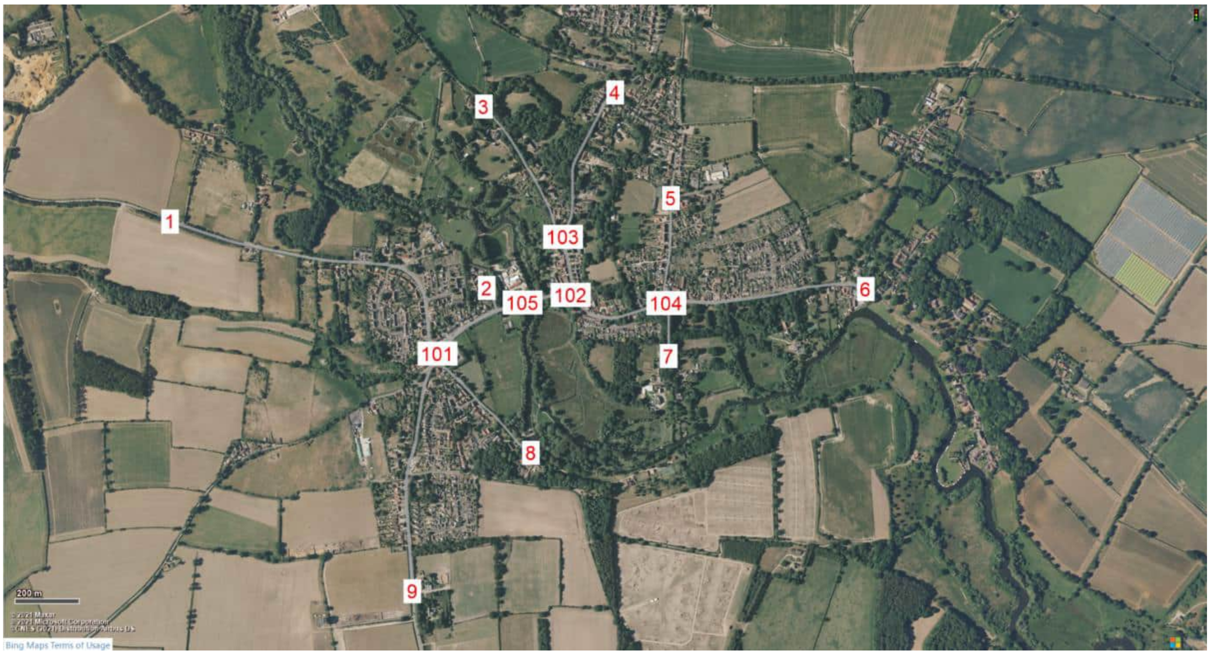


Figure 3-1 Vissim Zone Map

3.6 The movements to and from Zone 2, which was added as a synthetic zone, were estimated from flow difference between MCTC-1 and MCTC-5. All other zone movements were estimated through turn proportion data gathered from MCTC surveys.

3.7 The final matrix was sense-checked against key movements in the modelled area to ensure accuracy, most notably the movement between Zones 4 to 9, since this is the central corridor which passes through Coltishall, linking North Walsham to Norwich in the south.

Convergence

3.8 The models have been converged using standard convergence criteria from Vissim, although there is no route choice available in the Coltishall model network.

Routing Analysis & Closures

3.9 The routing proportions obtained from the convergence process were analysed and reviewed to ensure that there are not unrealistic route patterns included in the model.

3.10 Several paths were highlighted as unrealistic and have been closed to prevent abnormal or unrealistic driving behaviour. Some examples of these routes are shown in Figure 3-2 and Figure 3-3.

3.11 As shown in Figure 3-2, a route for vehicles travelling northbound on the B1150 which involves looping around the roundabout on Rectory Road to turn onto Mill Road has been closed, since drivers can make a direct right-turn onto Mill Road before the roundabout.

Figure 3-2 Closed route at Rectory Road roundabout

3.12 As shown in Figure 3-3, a route for vehicles travelling from the B1150 onto the High Street which involves a circulating around the petrol station has been closed, since drivers can make continue straight onto the high street instead.

Figure 3-3 Closed route at petrol station gyratory

4. Network Development

Network coding

4.1 Scaled Bing maps within Vissim have been used to code the network geometry and structure, such as number of lanes and flare lengths and reference was also made to Google Maps and Streetview to ensure the network reflects conditions on the ground.

4.2 Observation from the video footage available have also been used to inform the network coding and replicate the operation of the existing layout.

Desired Speed Decisions

4.3 Desired Speed Decisions, defining the speed distribution that vehicles follow at each point of the network, have been updated to represent the posted speed limits for each link.

4.4 The speed distributions used in the model, and the variability that a group of vehicles show at the same speed limit, have been obtained from two different sources. The Guidelines for the Use of Microsimulation Software from National Highways provide distributions for 50 mph and 70 mph, while 30 mph and 60 mph have been obtained from the SPE0111 - Vehicle Speed Compliance by road type and vehicle type in Great Britain from the Department for Transport (DfT).

4.5 40mph distributions have been obtained by interpolation between the 30 mph and the 50 mph distributions. The 30 mph, 40 mph and 50 mph distributions are shown in Appendix C.

4.6 It should be noted that the speed distribution for 20mph included in the models has been calculated using the journey time data on the section operating in free flow conditions.

Reduced Speed Areas

4.7 Reduced Speed Areas (RSAs) have been included to replicate driving behaviour, for example on curved roads and turns onto roads.

4.8 RSA have also been used to represent specific behaviours observed in the model area. It should be noted that additional RSAs have been coded in the PM model to represent the queuing patterns observed on the High Street. These queues are caused by parked cars which were only observed in the PM peak and these RSAs have not been included in the AM peak hour model, as the parked vehicles were not present.

Priority Rules and Conflict areas

4.9 Priority Rules and Conflict Areas have been coded following the industry standard approach and were calibrated to replicate the observed network conditions and driver behaviour.

4.10 Priority rules have also been used to represent the give way operation observed on the Norwich Road bridge, where large vehicles give way to each other as they cannot pass over the bridge at the same time.

4.11 It should be noted that additional priority rules were coded in the PM model to reflect the observed queuing and give way behaviour on the High Street. The floating car journey time video footage was used to observe give way behaviour, which was replicated in the model, so the queues caused by the parked cars in the PM peak are replicated.

Public Transport

4.12 Bus routes and departure times included in the modelled area were sourced from the website https://bustimes.org/. An average dwell time of ten seconds was assumed for all bus stops in the model.

Differences between AM and PM model networks

4.13 Some limited differences between the AM and PM peak hour models were coded to replicate the operation of the High Street, where the queues, delays and give way behaviour caused by the parked cars along this route were only present in the PM peak hour.

5. Model Calibration

Introduction

5.1 The purpose of the model calibration process is to ensure that the model represents existing traffic conditions. Calibration is an iterative process in which the model is revised to replicate observed traffic volumes, traffic conditions and vehicle behaviour as closely as possible.

Flow Calibration Criteria

5.2 This section presents the traffic flow calibration and the comparison between the modelled and observed traffic flows using the criteria provided in TAG Unit M3-1.

5.3 The observed and modelled turning flows were compared for each of the junctions for the AM and PM peak hours, using the TAG criteria (Unit M3.1) for flow calibration as shown in Table 1.

Table 1 – TAG Calibration Criteria

Criteria	Acceptability Guidelines
Criteria 1 - % Flows a. Individual flows within 15% for flows 700-2700 vph b. Individual flows within 100 vph for flows < 700 vph c. Individual flows within 400 vph for flows > 2700 vph	> 85% of all cases
Criteria 2 – GEH Criteria a. GEH Statistic -Individual flows: GEH < 5	

5.4 The differences between modelled and observed flows were calculated and the TAG criteria, both for absolute differences and for GEH statistic, were used to determine if these differences were acceptable. The GEH statistic incorporates both relative and the absolute differences and provides a better indication of the significance of differences, compared to using percentage differences which can be misleading.

5.5 The GEH statistic is defined as:

$$GEH=\sqrt{\frac{(M-C)^2}{(M+C)/2}}$$, where M and C are different datasets to be compared.

Flow Calibration Results

5.6 The modelled turning flows were compared against the surveyed turning flows to calibrate the demand inputs and model assignment. The models were run twenty times using different random seeds to produce a set of average turning count results for comparison with the survey data.

5.7 The structure of the junctions and turning counts references within the model area can be seen in Appendix A, whilst tables indicating the GEH scores can be found in Appendix D.

5.8 The AM calibration results in Table 2 show the calibration results for each vehicle type. The results demonstrate that the AM peak hour flows are calibrated closely against the observed turning counts when analysed vehicle class, and all exceed the thresholds set out in TAG.

Table 2 – AM Calibration Results - Peak Hour by Vehicle Class

Vehicle Class	Tag Criteria	Within	Total Counts	Percentage Passing
Cars	**% Counts within GEH <5**	50	50	100%
	% Flows within Individual Flow	50	50	100%
LGVS	**% Counts within GEH <5**	50	50	100%
	% Flows within Individual Flow	50	50	100%

Vehicle Class	Tag Criteria	Within	Total Counts	Percentage Passing
HGVs	% Counts within GEH <5	50	50	100%
	% Flows within Individual Flow	50	50	100%
Total	% Counts within GEH <5	50	50	100%
	% Flows within Individual Flow	50	50	100%

5.9 The AM calibration results in Table 3 show the calibration results for total vehicles entering the model. Although not required in TAG, explicitly matching the observed number of vehicles entering the network is a key metric to validate the capacity and delays of the microsimulation models.

5.10 The results demonstrate that all entry junctions into the model are calibrated closely with observed data. It has therefore been checked that the correct number of vehicles are entering the model.

Table 4 – AM Peak Hour Calibration results - Model Entries

From	Observed	Modelled	% Diff.
Mill Road	20	20	0.0%
B1150 / Norwich Road (EB)	637	634	-0.5%
B1354 / Buxton Road	255	249	-2.4%
Station Road	527	523	-0.8%
Great Hautbois Road	10	10	0.0%
Rectory Road	58	56	-3.4%
B1354 / Wroxham Road (WB)	285	280	-1.8%
Church Loke	8	8	0.0%

5.11 The calibration summary in Table 5 demonstrates that the PM peak hour model flows are also closely calibrated against the observed turning counts when analysed by vehicle class, exceeding the requirements set out in TAG.

Table 5 – PM Calibration Results - Peak Hour by Vehicle Class

Vehicle Class	Tag Criteria	Within	Total Counts	Percentage Passing
Car	% Counts within GEH <5	50	50	100%
	% Flows within Individual Flow	50	50	100%
LGV	% Counts within GEH <5	50	50	100%
	% Flows within Individual Flow	50	50	100%
HGV	% Counts within GEH <5	50	50	100%
	% Flows within Individual Flow	50	50	100%
Total	% Counts within GEH <5	50	50	100%
	% Flows within Individual Flow	50	50	100%

5.12 The PM calibration results in Table 6 shows the calibration results for total vehicles entering the model. The results demonstrate that all entry junctions into the model are calibrated closely with observed data. It has therefore been checked that the correct number of vehicles are entering the model.

Table 6 – PM Peak Hour Calibration Results – Model Entries

From	Observed	Modelled	% Diff.
Mill Road	21	20	-4.8%
B1150 / Norwich Road (EB)	730	715	-2.1%
B1354 / Buxton Road	200	197	-1.5%
Station Road	427	418	-2.1%

From	Observed	Modelled	% Diff.
Great Hautbois Road	36	34	-5.6%
Rectory Road	44	43	-2.3%
B1354 / Wroxham Road (WB)	305	302	-1.0%
Church Loke	4	4	0.0%

Calibration Parameters

5.13 Table 7 summarises the main calibration and specific driving behaviour parameters recommended by TAG and DfT for microsimulation models. These parameters have been included in the Coltishall Vissim model in line with the recommended guidance.

Table 7 – Microsimulation Model Parameters – TAG/DfT

Parameter	Value	Following guidance
Headway	1s time	Yes
Gap	1 to 4 seconds, depends on location.	Yes
Vehicle Dynamics	Following graphs	Yes
Reaction Time	-	-
Desired Speed Distributions	Following graphs	Yes
Driver Awareness	Following graphs	Yes
Influence of signing on the approach to a diverge of the motorway lane selection	5	Yes
Cooperative Merging	Yes, used on merging and weaving links. Maximum speed difference - 6.71mph Maximum collision time – 10s	Yes
Implied Capacity at roundabouts and signal stop lines	-	-
Min Distance between vehicles at a standstill	1.5m	Yes

6. Model Validation

Introduction

6.1 Following the model calibration process, the VISSIM models were validated using journey time data. The vehicle travel time results from the models were compared against the surveyed journey time data to validate the queuing and delay in the model. The models were run twenty times using different random seeds to produce a set of average journey time results for comparison with the survey data.

6.2 The TAG M3-1 criteria for journey time validation are shown in Table 8 below.

Table 8 – TAG Validation Criteria

Criteria	Acceptability Guidelines
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	> 85% of routes

Journey Time Validation Results

6.3 Figure 6-1 shows the two journey time routes which have been defined within the model area. The average observed journey times were compared to the average modelled journey times in accordance with the criteria set out in TAG M3-1. The journey times routes were defined using the GPS position of the floating car video footage used to capture the observed journey time data.

Figure 6-1 Coltishall Routes

6.4 Table 9 and Table 10 show the individual performance of each of the defined journey time routes for all vehicles, all of which pass the TAG criteria.

Table 9 – AM Journey Time Validation

ID	Route Name	Observed	Modelled	% Difference	Validation
1	JT1_SB			%	Y
2	JT1_NB			- %	Y
3	JT2_EB			%	Y
4	JT2_WB			%	Y

Table 10 – PM Journey Time Validation

ID	Route Name	Observed	Modelled	% Difference	Validation
1	JT1_SB			%	Y
2	JT1_NB			- %	Y
3	JT2_EB			- %	Y
4	JT2_WB			%	Y

6.5 Figure 6-2 to Figure 6-7 show the cumulative journey time profiles of these routes with the maps and observed data for both peaks. It can be seen that the models closely replicate the profile of delay along the modelled routes.

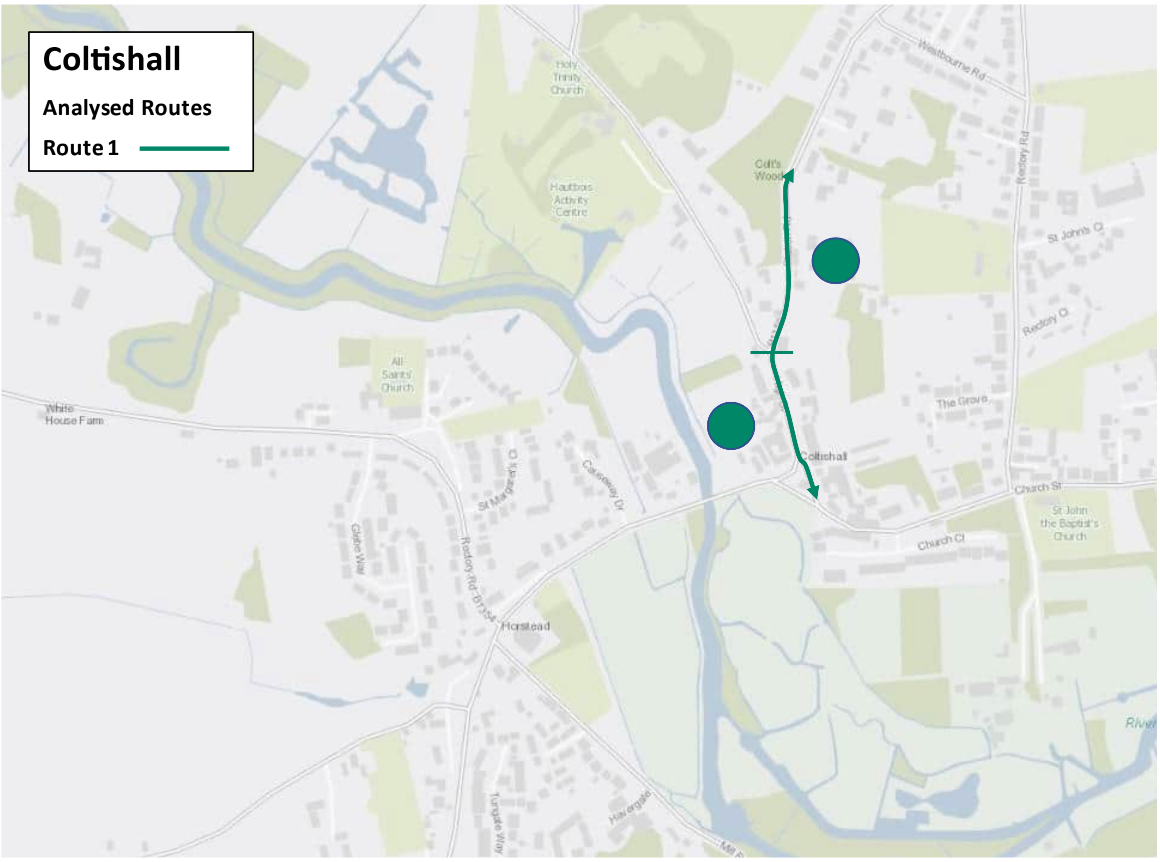
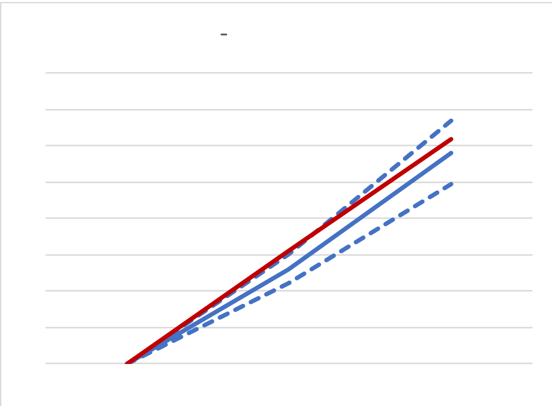


Figure 6-2 – Route 1 SB Map



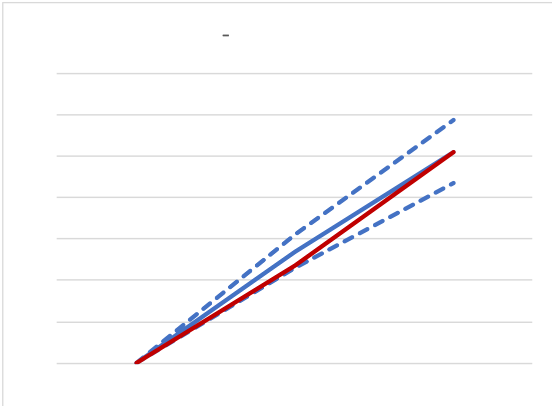
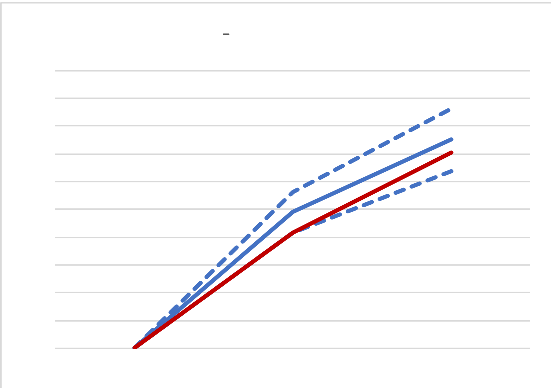


Figure 6-3 – Route 1 SB journey time validation profiles



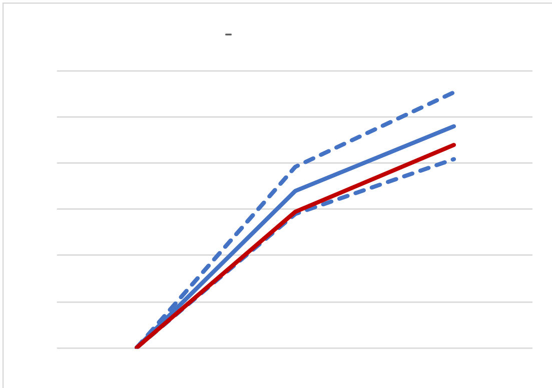


Figure 6-4 – Route 1 NB journey time validation profiles

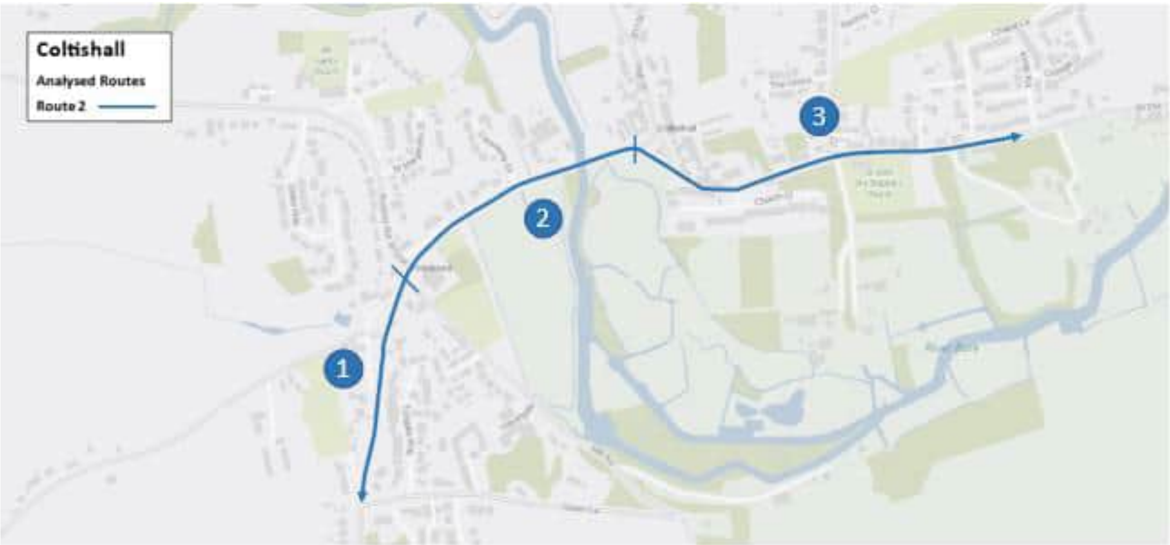


Figure 6-5 – Route 2 EB Map

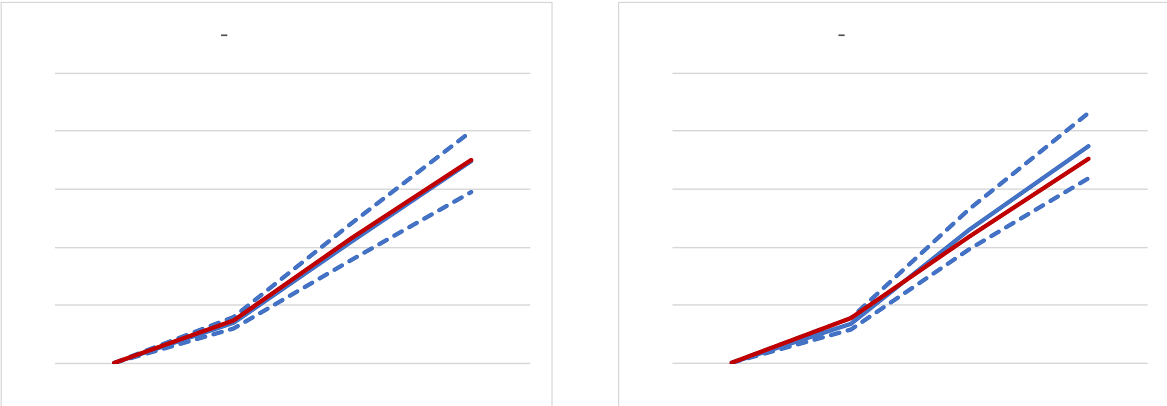


Figure 6-6 – Route 2 EB journey time validation profiles

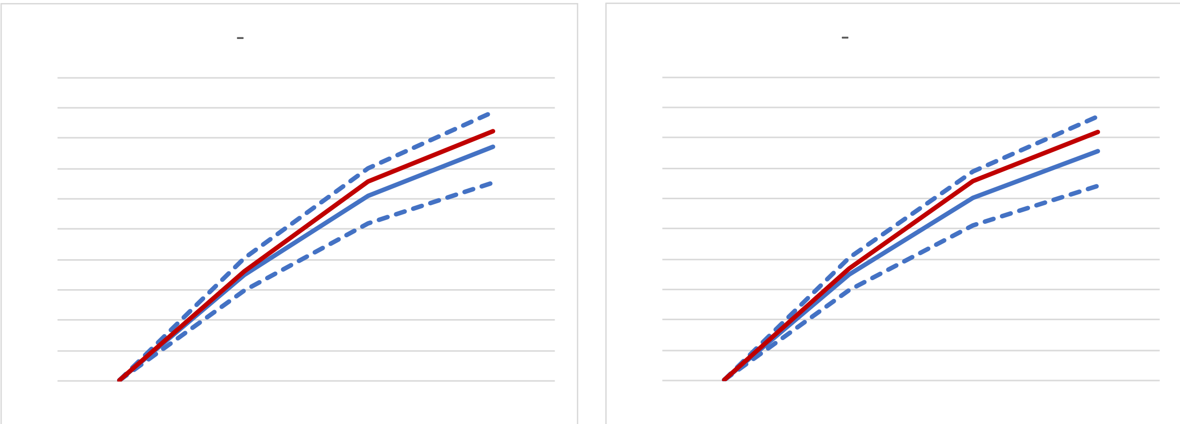


Figure 6-7 – Route 2 WB journey time validation profiles

Queue Calibration

6.6 In addition to the journey time validation of the model, TAG recommends a review of the representation of existing queues in the model. Although journey times provide a more accurate representation of the existing delays, the visual comparison of the queue patterns in the area provides further reassurance that the model represents the operation of the network.

6.7 Two main sources have been used to define the main queues of the model: the floating car footage of driving behaviour in Coltishall and the typical travel speed information taken from Google Maps.

AM Peak Hour

6.8 The main queue in the AM period occurs on the B1150 as traffic approaches the petrol station from the southwest. This queueing behaviour can be seen in Figure 6-8, which was captured from floating car footage of Route 2, this was a moving queue caused by right turning vehicles waiting to turn into the B1150 northwards.

Figure 6-8 – Floating car footage of AM queuing on B1150

6.9 Figure 6-9 shows the typical traffic conditions according to Google Maps on a Tuesday at 08:30. Figure 6-10 shows the peak hour average speed plot from the AM model, where it can be observed that a similar queue is present.

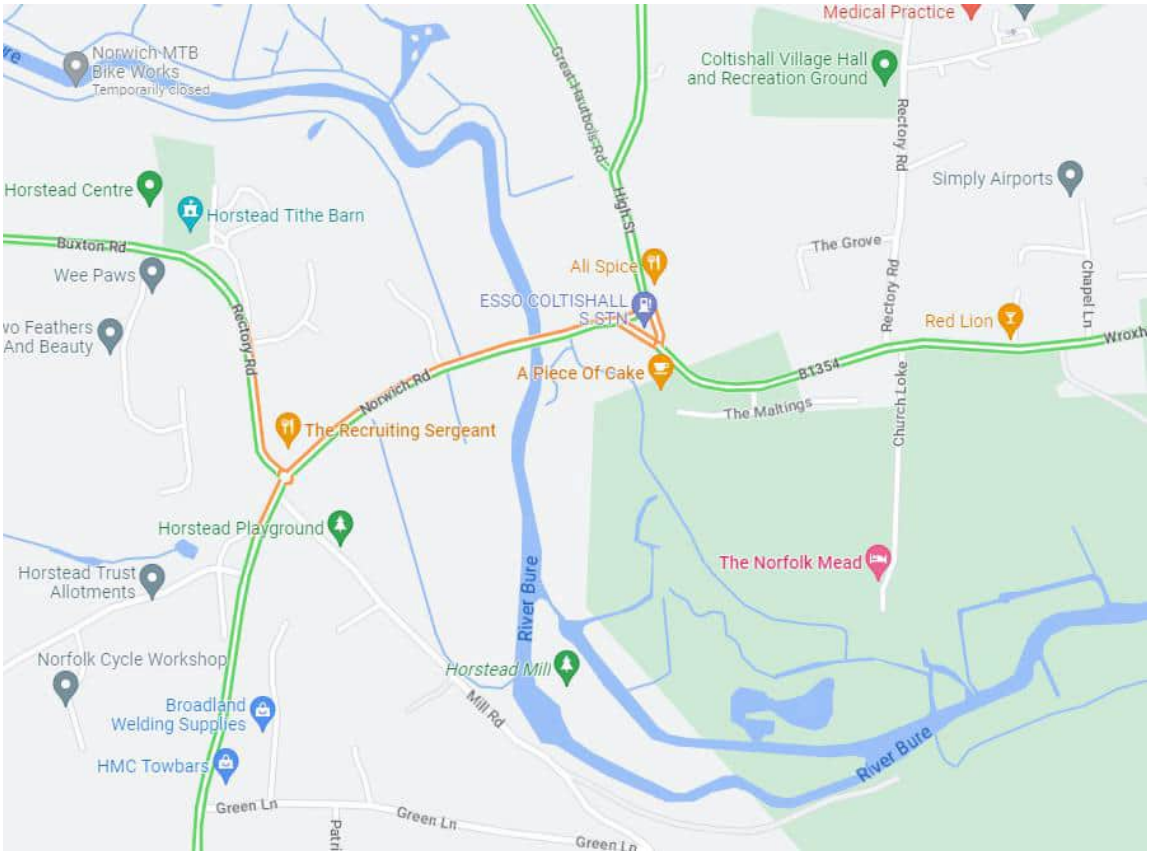


Figure 9 - Typical queues from Google traffic on a Wednesday, 08:30

Figure 10 – AM Peak Hour Speed Plot

PM Peak Hour

6.10 The main queue in PM period occurs on the High Street, where parked cars prevent the free flow of traffic in both directions simultaneously. The presence of parked cars can be seen in Figure 6-11, taken from a Google StreetView. This image shows that cars are parked on both sides of the street, which limits the road space available for vehicles to pass. Figure 6-12 is a still taken from the floating car footage of the Route 1 southbound journey in the PM period which shows how parked cars impede the free flow of traffic in both directions.

Figure 6-11-1 Parked cars on High Street

Figure 6-12 PM queuing on High Street, from floating car footage

6.11 Figure 6-13 shows the typical traffic conditions according to Google Maps on a Tuesday at 16:40, whilst Figure 6-14 shows the modelled queues during the PM peak, where this queuing is replicated.

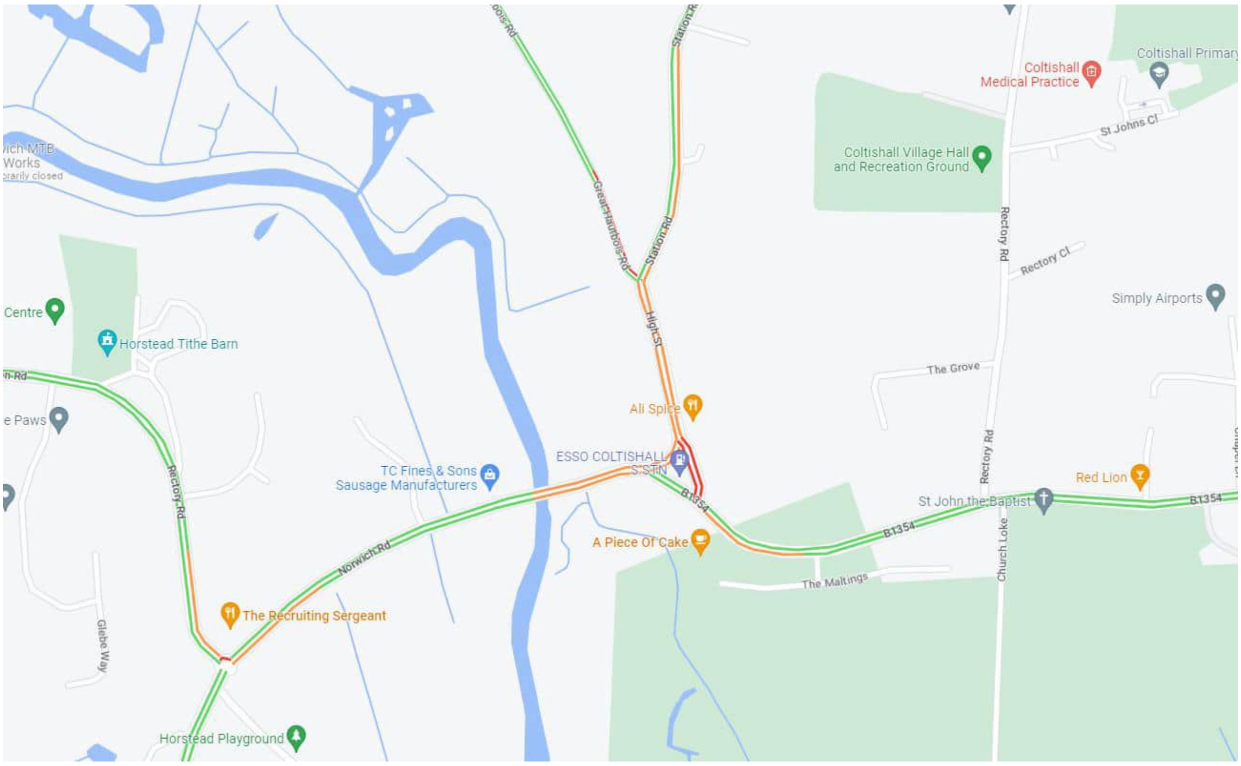


Figure 6-13 –Google traffic view captured on a Monday at 16:40

Figure 6-14 – PM peak hour Speed Plot

Model Variability

6.12 Microsimulation models are run several times with different random seeds to obtain a statistically representative result. This approach replicates daily variability, since each run has different arrival profiles which results in a different chain of events. A representative average of the results is the obtained/ presented.

6.13 The survey videos show that the queues on the High Street in the PM period can be highly variable since they can appear and disappear in short periods of time.

6.14 A variability analysis of the modelling journey times results has been undertaken in this section. Figure 6-15 shows the modelled journey times for Route 1 SB in the PM period for all of the model runs, whilst Figure 6-16 shows the modelled journey times for Route 1 NB in the PM period for all the model runs.

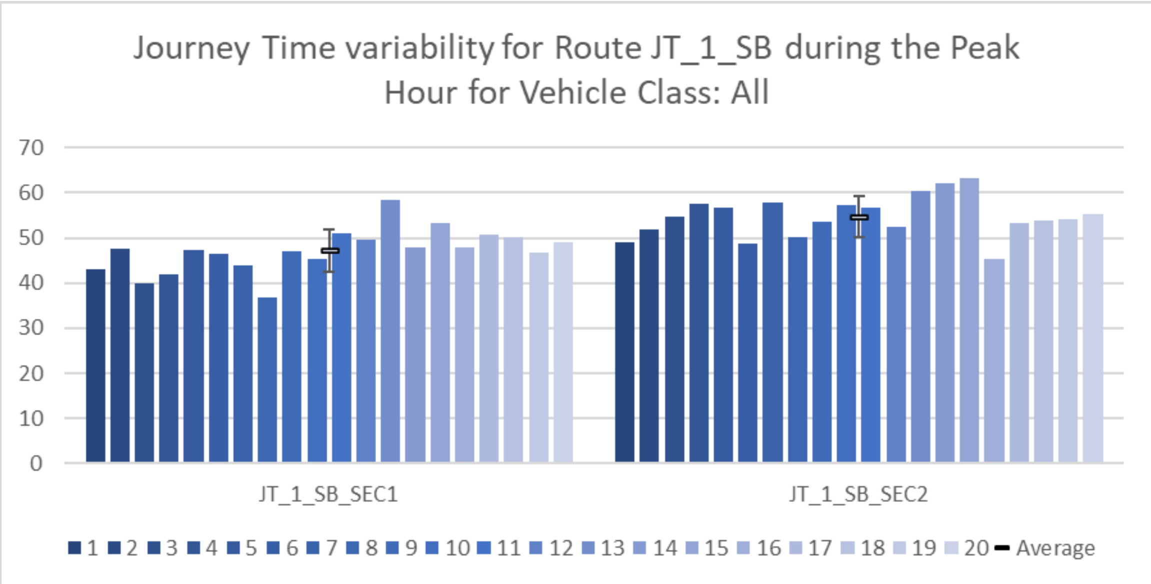


Figure Error! No text of specified style in document.**-2 – Route 1 SB modelled journey times**

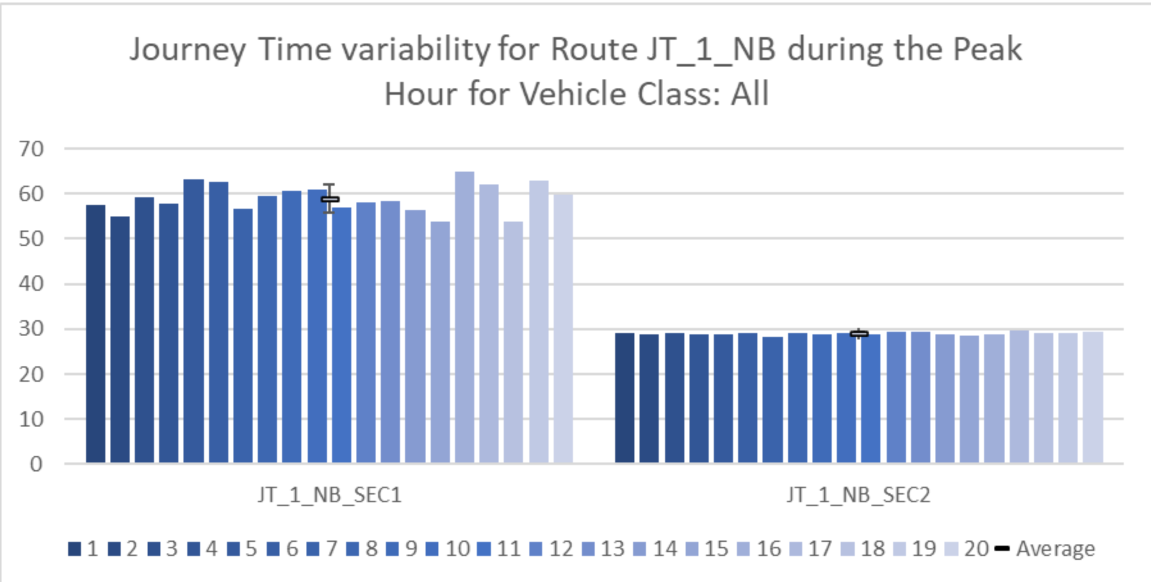


Figure 6-16 – Route 1 NB modelled journey times

6.15 As can be seen in these graphs, the modelled journey times in the PM peak are variable, particularly in the southbound direction. This variability is caused by parked cars on the High Street and the subsequent give way behaviour and queuing. This phenomenon has been replicated in the model, replicating the variability seen in the surveys.

7. Conclusion

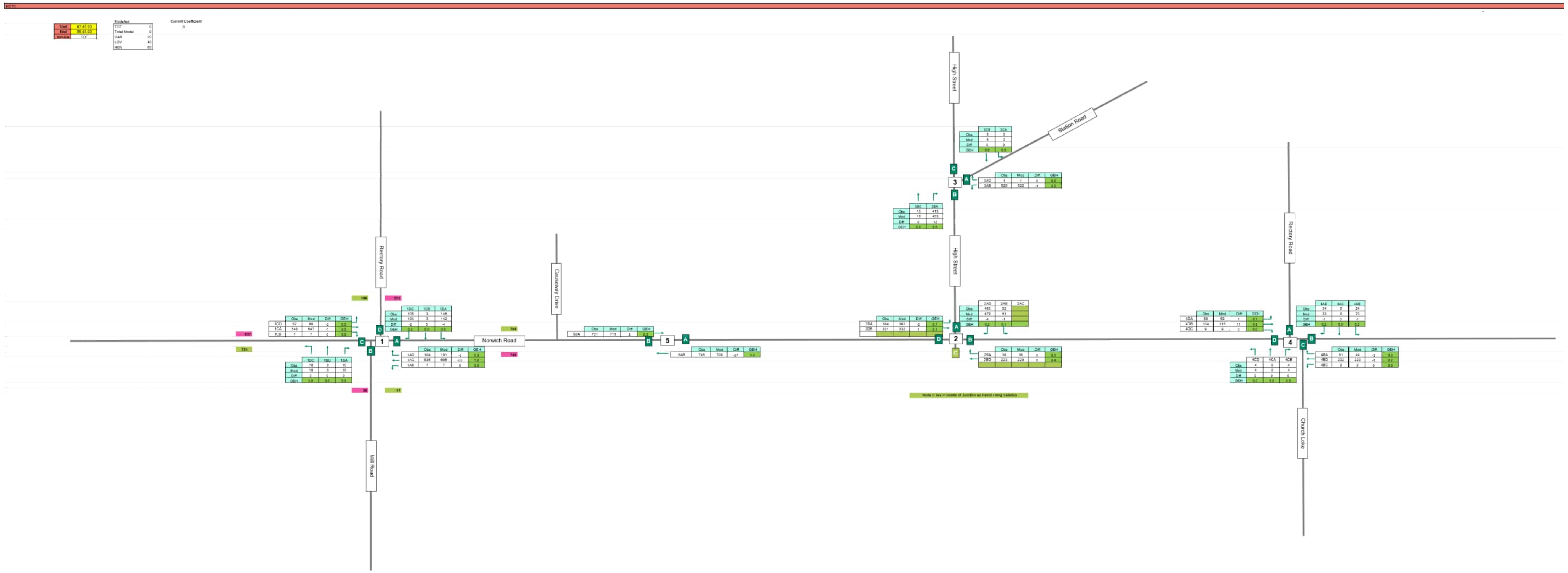
7.1 Coltishall is a village located on the B1150 between Norwich and North Walsham and the road network is therefore busy at peak times. In the AM period there is a small amount of congestion on the eastbound approach to the petrol station due to the vehicles waiting to turn right into B1150 northwards, as explained in paragraph 6.8, whilst in the PM period parked cars on the High Street were seen to cause a significant amount of queuing, particularly in the southbound direction.

7.2 The base models have been calibrated and validated against the observed data in line with the required criteria. The calibration/ validation results exceed the requirements for turning counts and journey times and the models are therefore closely aligned with observed data. The models also replicate observed queueing patterns well. The models are therefore validated to industry standard guidelines.

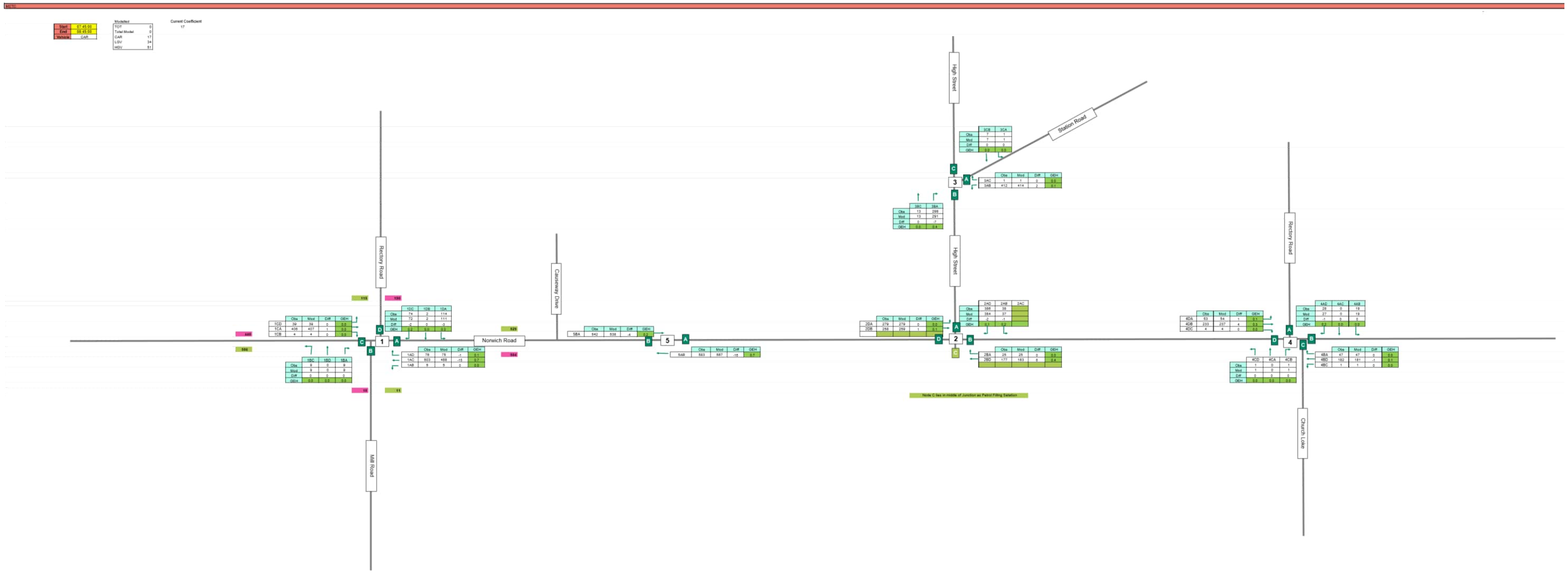
7.3 It is considered the base models provide a close representation of the queues and delays in the network, as well as the observed driving behaviour in the area, and are fit for the purpose of testing future traffic levels/ patterns or potential changes to the road network.

Appendix A MCTC Turning Counts

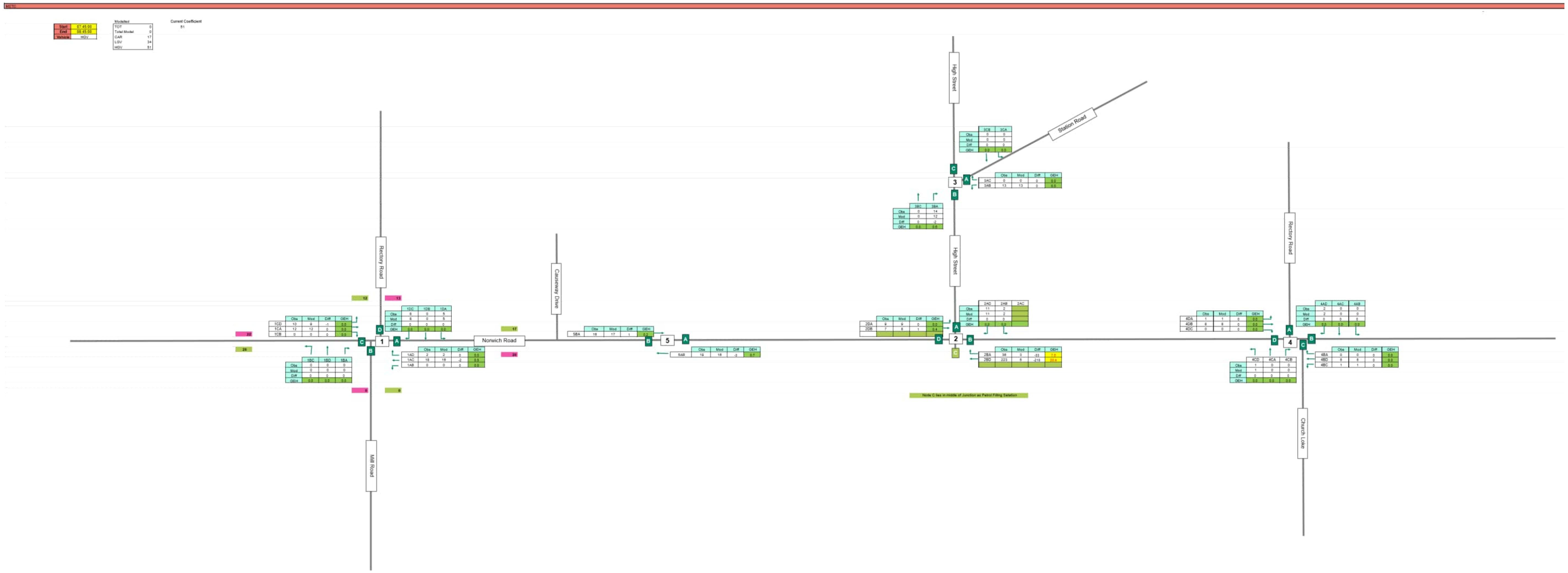
AM – All vehicles



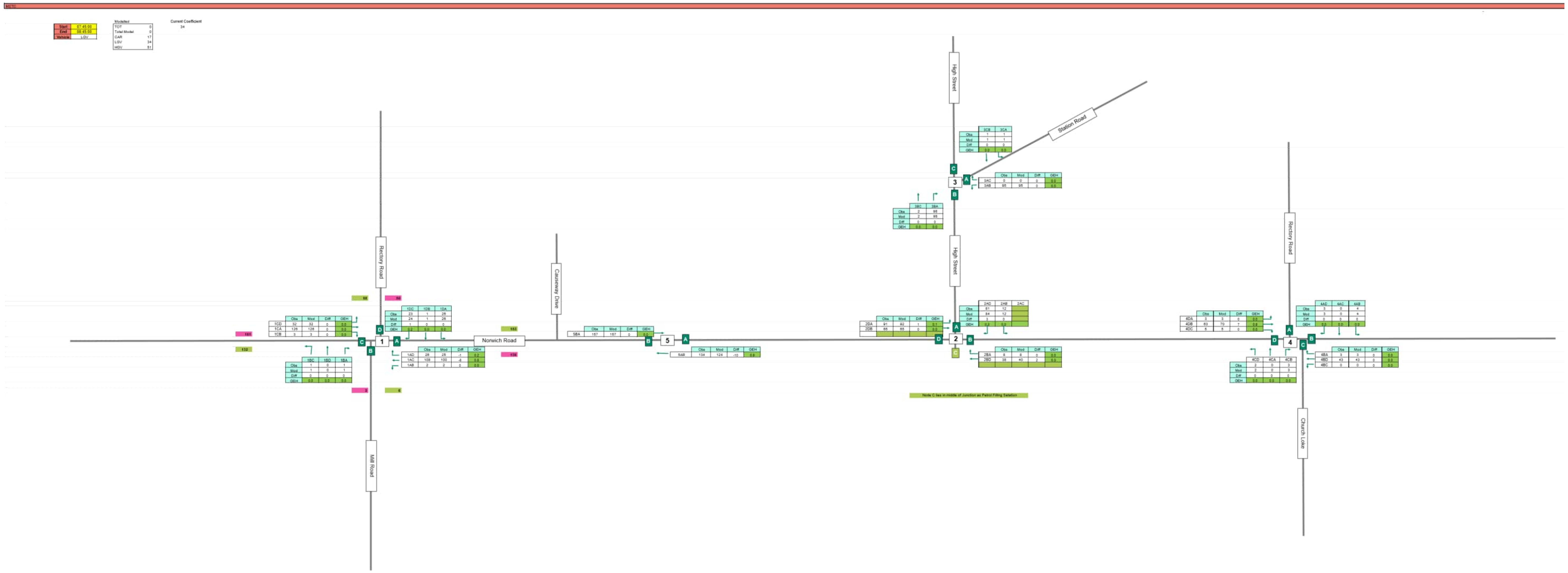
AM – Cars


High Street
Station Road
Rectory Road
Causeway Drive
Norwich Road
Mill Road
High Street
Rectory Road
Church Loke

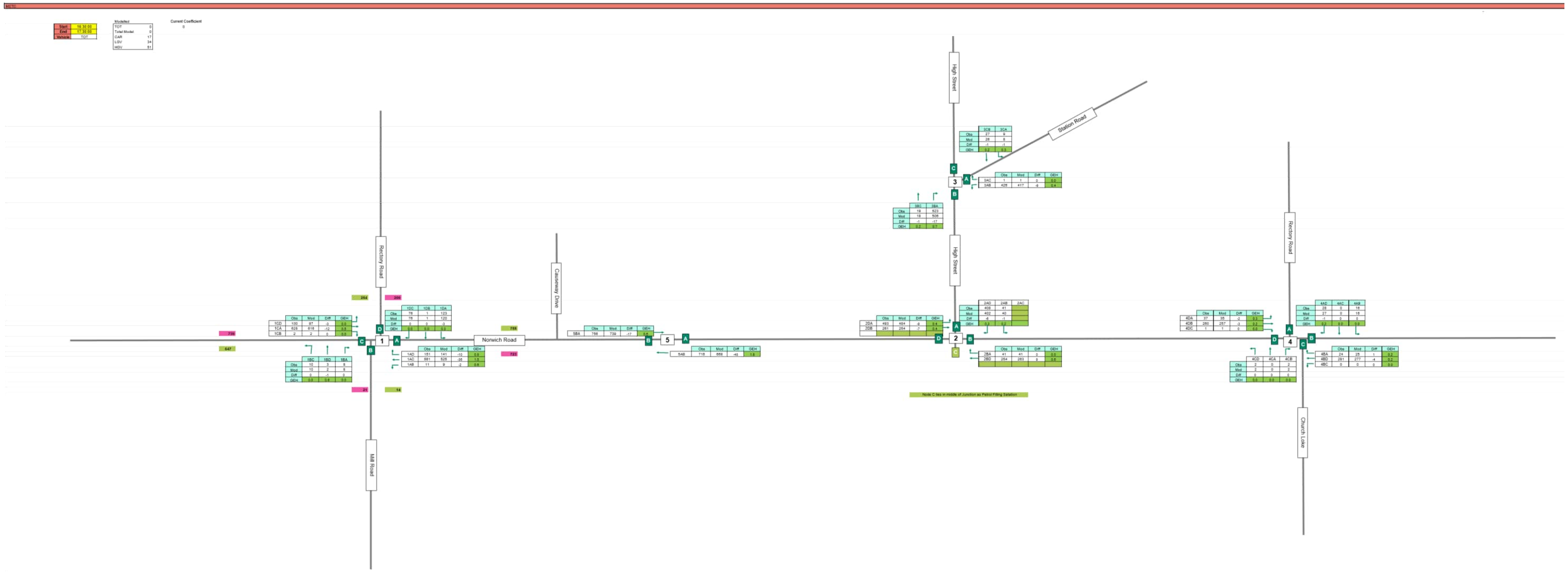
AM – HGV


Start 07:45:00
End 08:45:00
Vehicle HGV
Modelled
TOT 0
Total Model 0
CAR 17
LGV 34
HGV 51
Current Coefficient
51
High Street
Station Road
Rectory Road
Causeway Drive
Norwich Road
Rectory Road
Mill Road
Church Lane
Node C lies in middle of Junction as Petrol Filling Station

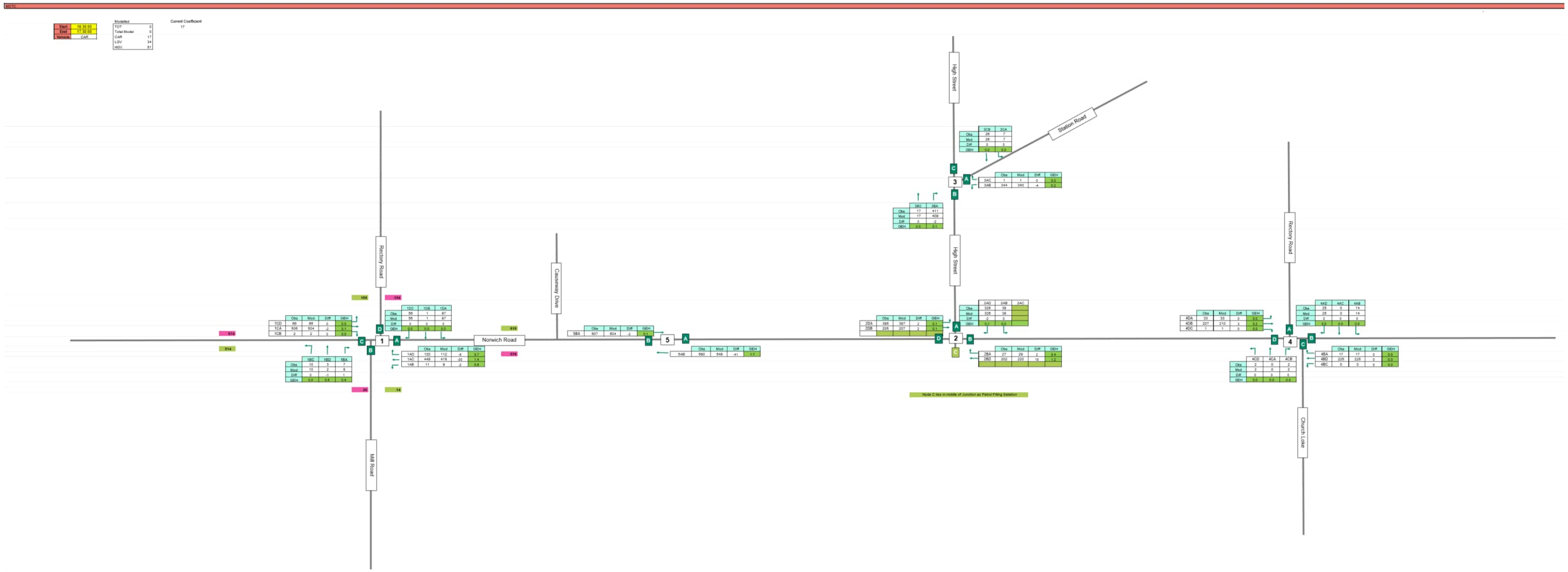
AM – LGV


High Street
Station Road
Rectory Road
Causeway Drive
Norwich Road
Mill Road
High Street
Rectory Road

PM – All Vehicles

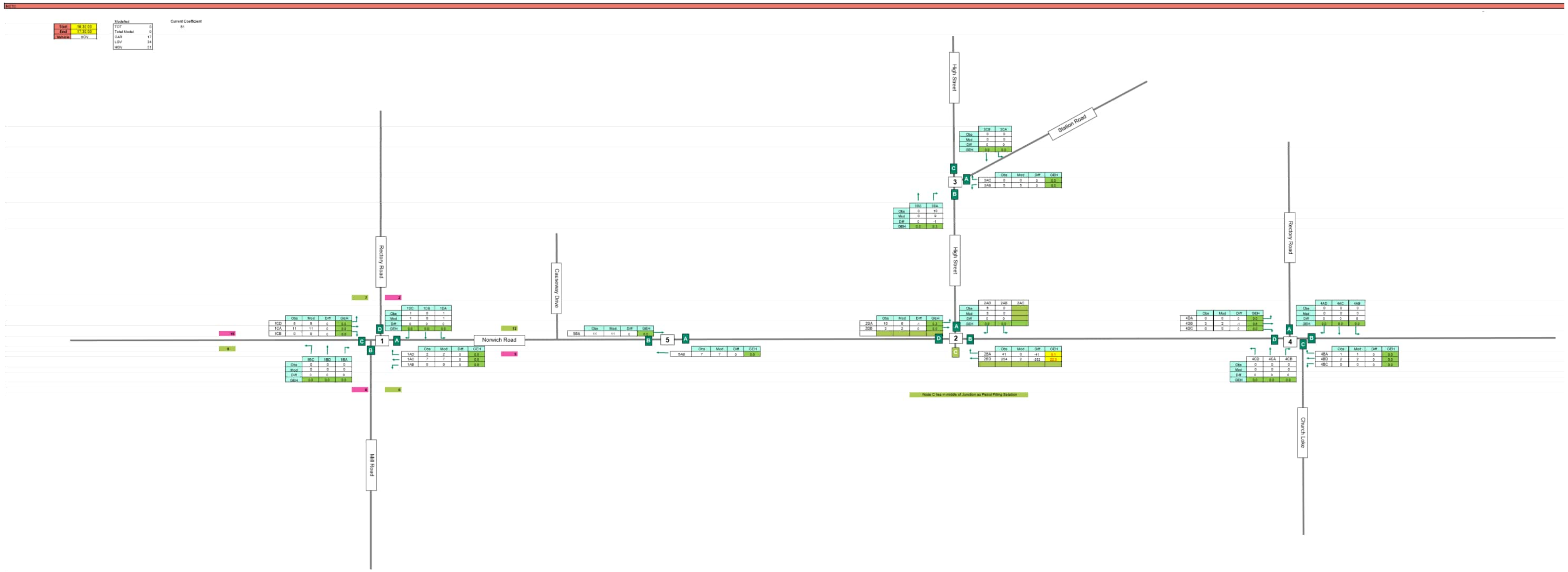


PM – Cars

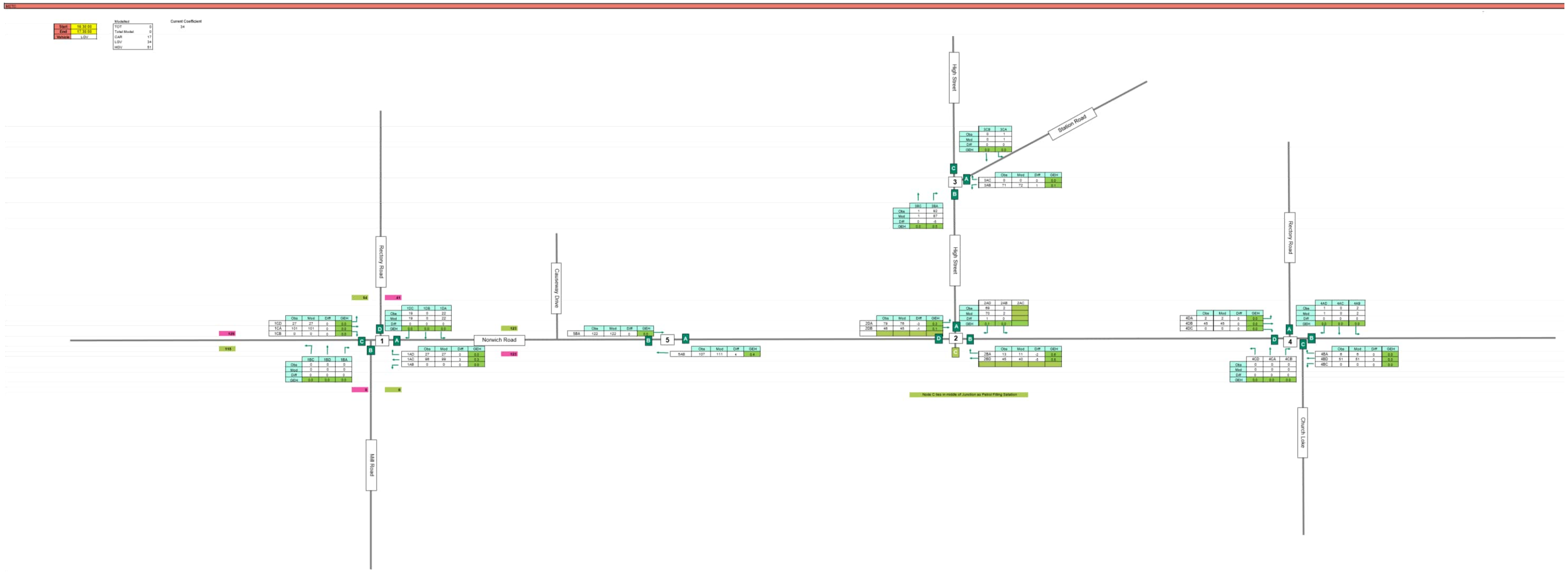


Start 16:30:00
End 17:30:00
Vehicle CAR
Modelled
TOT 0
Total Model 0
CAR 17
LGV 34
HGV 51
Current Coefficient
17
Rectory Road
Mill Road
Norwich Road
Causeway Drive
High Street
Station Road
Church Lane

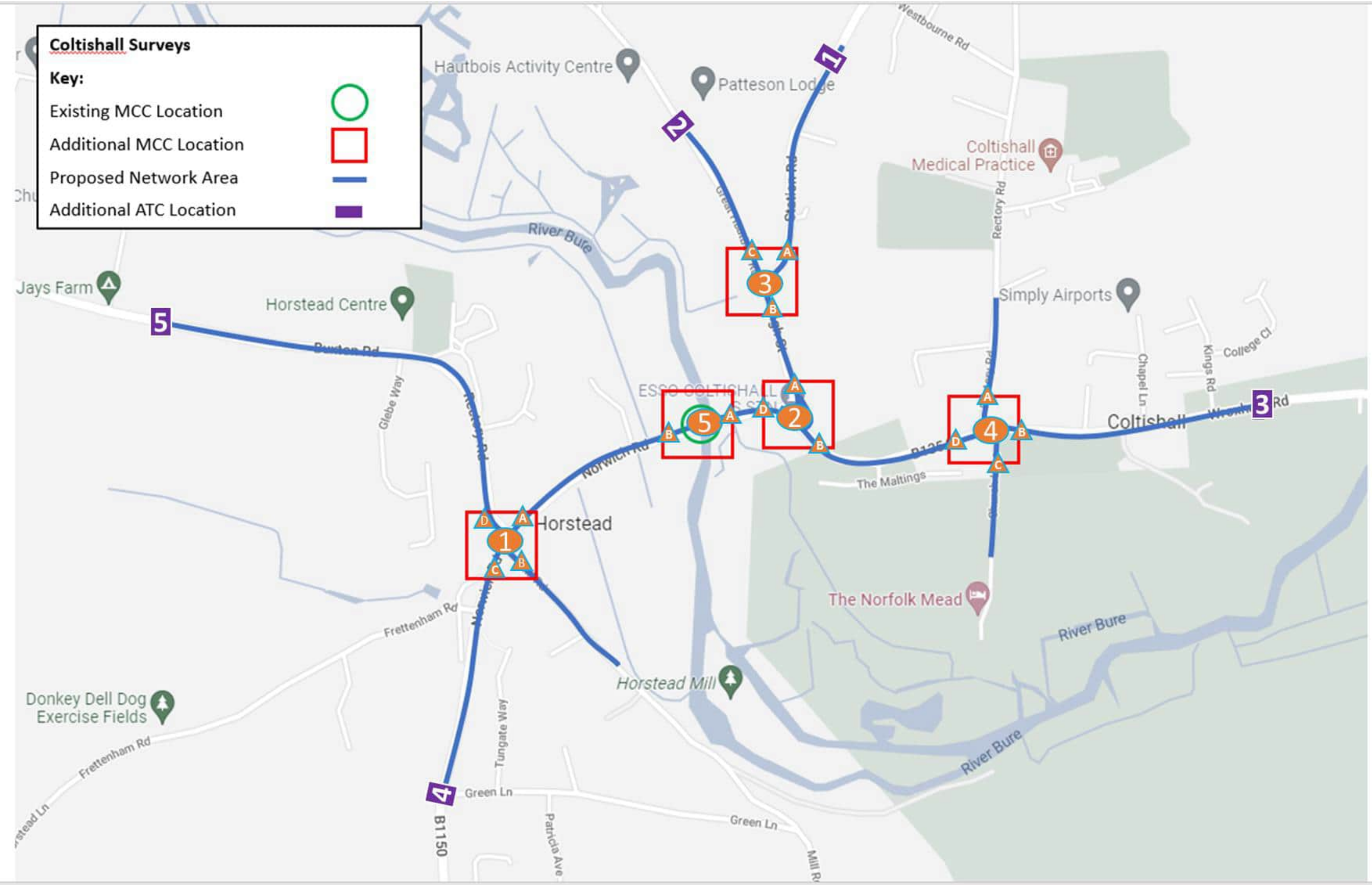
PM – HGV


High Street
Station Road
Rectory Road
Causeway Drive
Norwich Road
High Street
Rectory Road
Mill Road
Church Loke

PM – LGV


Rectory Road
Causeway Drive
Norwich Road
High Street
Station Road
Mill Road
Church Loke

Appendix B Consistency Checks



From		Traffic Flow		to		Traffic Flow		Difference		GEH	
Site	Arm	CAR	LGV	Site	Arm	CAR	LGV	CAR	LGV	CAR	LGV
1	A	3398	714	5	B	3390	701	8	13	0.1	0.5
5	B	3410	809	1	A	3427	788	-17	21	0.3	0.7
5	A	3390	701	2	D	3312	659	78	42	1.3	1.6
2	D	3403	808	5	A	3410	809	-7	-1	0.1	0.0
2	A	2384	474	3	B	2339	472	45	2	0.9	0.1
3	B	2343	549	2	A	2348	558	-5	-9	0.1	0.4
2	B	1383	288	4	D	1405	266	-22	22	0.6	1.3
4	D	1481	334	2	B	1556	357	-75	-23	1.9	1.2

Appendix C Desired Speed Distributions

Description	Posted Limit	Normal Distributions (mph)			
		LVs		HVs	
		Lower	Upper	Lower	Upper
DfT's Motorways	70	50	89	50	89
DfT's Dual Carriageways	70	58	80	48	80
DfT's Single Carriageways	60	20	70	20	69

Appendix D Turning Count Calibration Tables

AM – All vehicles

VISSIM Node 101 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Rectory Road roundabout	1	101	A	38	A	3	1AA	0	2	2	-	2	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	7	7	0	0%	0	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	635	605	-30	-5%	1	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	104	101	-3	-3%	0	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	10	10	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	10	10	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	548	547	-1	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	B	19	1CB	7	7	0	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	82	80	-2	-2%	0	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	146	142	-4	-3%	0	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	3	3	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	106	104	-2	-2%	0	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0	Y	OK

VISSIM Node 102 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	52	51	-1	-2%	0	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	483	479	-4	-1%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	36	36	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	223	229	6	3%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	384	382	-2	-1%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	331	332	1	0%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	1	1	-	1	Y	OK

VISSIM Node 103 **Vehicle Type** Total

Junction Name	MCC Site		From Arm	FromLink	To Arm	ToLink		Flow Peak Time		Difference			GEH	

		Node No.					MCC ID	Observed	Modelled	Value	%	Value	<5	Individual Flows
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	526	522	-4	-1%	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	415	403	-12	-3%	1	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	15	15	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	2	2	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	8	8	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0	Y	OK

VISSIM Node 104 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	B	29	4AB	24	23	-1	-4%	0	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	D	26	4AD	34	33	-1	-3%	0	Y	OK
Church Loke	4	104	B	6	A	23	4BA	51	49	-2	-4%	0	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	C	27	4BC	2	2	0	0%	0	Y	OK
Church Loke	4	104	B	6	D	26	4BD	232	229	-3	-1%	0	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	B	29	4CB	4	4	0	0%	0	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	D	26	4CD	4	4	0	0%	0	Y	OK
Church Loke	4	104	D	10	A	23	4DA	58	59	1	2%	0	Y	OK
Church Loke	4	104	D	10	B	29	4DB	304	315	11	4%	1	Y	OK
Church Loke	4	104	D	10	C	27	4DC	9	9	0	0%	0	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0	Y	OK

VISSIM Node 105 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	745	708	-37	-5%	1	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	721	713	-8	-1%	0	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0	Y	OK

AM – Cars

VISSIM Node 101 **Vehicle Type** Car

Junction Name			From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time	Difference		GEH	

	MCC Site	Node No.						Observed	Modelled	Value	%	Value	<5	Individual Flows
Rectory Road roundabout	1	101	A	38	A	3	1AA	0	1	1	-	1	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	5	5	0	0%	0	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	503	488	-15	-3%	1	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	76	75	-1	-1%	0	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	9	9	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	9	9	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	406	407	1	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	B	19	1CB	4	4	0	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	39	39	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	114	111	-3	-3%	0	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	2	2	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	74	72	-2	-3%	0	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0	Y	OK

VISSIM Node 102 **Vehicle Type** Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	38	37	-1	-3%	0	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	386	384	-2	-1%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	25	25	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	177	183	6	3%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	279	279	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	258	259	1	0%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	1	1	-	1	Y	OK

VISSIM Node 103 **Vehicle Type** Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	412	414	2	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	298	291	-7	-2%	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	13	13	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	7	7	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0	Y	OK

VISSIM Node	104	Vehicle Type	Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	B	29	4AB	19	19	0	0%	0	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	D	26	4AD	28	27	-1	-4%	0	Y	OK
Church Loke	4	104	B	6	A	23	4BA	47	47	0	0%	0	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	C	27	4BC	1	1	0	0%	0	Y	OK
Church Loke	4	104	B	6	D	26	4BD	182	181	-1	-1%	0	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	B	29	4CB	1	1	0	0%	0	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	D	26	4CD	1	1	0	0%	0	Y	OK
Church Loke	4	104	D	10	A	23	4DA	53	54	1	2%	0	Y	OK
Church Loke	4	104	D	10	B	29	4DB	233	237	4	2%	0	Y	OK
Church Loke	4	104	D	10	C	27	4DC	4	4	0	0%	0	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0	Y	OK

VISSIM Node	105	Vehicle Type	Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	583	567	-16	-3%	1	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	542	538	-4	-1%	0	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0	Y	OK

AM – LGV

VISSIM Node	101	Vehicle Type	LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Rectory Road roundabout	1	101	A	38	A	3	1AA	0	1	1	-	1	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	2	2	0	0%	0	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	108	100	-8	-7%	1	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	26	25	-1	-4%	0	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	1	1	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	1	1	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	126	126	0	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	B	19	1CB	3	3	0	0%	0	Y	OK

Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	32	32	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	26	26	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	1	1	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	23	24	1	4%	0	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0	Y	OK

VISSIM Node 102 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference		GEH		Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	12	12	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	81	84	3	4%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	8	8	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	38	40	2	5%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	91	92	1	1%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	65	65	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	0	0	-	0	Y	OK

VISSIM Node 103 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference		GEH		Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	95	95	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	98	98	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	2	2	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0	Y	OK

VISSIM Node 104 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference		GEH		Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	B	29	4AB	4	4	0	0%	0	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	D	26	4AD	3	3	0	0%	0	Y	OK
Church Loke	4	104	B	6	A	23	4BA	3	3	0	0%	0	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	C	27	4BC	0	0	0	-	0	Y	OK

Church Loke	4	104	B	6	D	26	4BD	43	43	0	0%	0	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	B	29	4CB	3	3	0	0%	0	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	D	26	4CD	2	2	0	0%	0	Y	OK
Church Loke	4	104	D	10	A	23	4DA	3	3	0	0%	0	Y	OK
Church Loke	4	104	D	10	B	29	4DB	63	70	7	11%	1	Y	OK
Church Loke	4	104	D	10	C	27	4DC	5	5	0	0%	0	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0	Y	OK

VISSIM Node 105 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	134	124	-10	-7%	1	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	157	157	0	0%	0	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0	Y	OK

AM – HGV

VISSIM Node 101 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Rectory Road roundabout	1	101	A	38	A	3	1AA	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	18	16	-2	-11%	0	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	2	2	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	12	12	0	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	B	19	1CB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	10	9	-1	-10%	0	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	5	5	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	8	8	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0	Y	OK

VISSIM Node 102 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	

Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	2	2	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	11	11	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	3	3	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	5	5	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	9	9	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	7	8	1	14%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	0	0	-	0	Y	OK

VISSIM Node 103 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	13	13	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	14	12	-2	-14%	1	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0	Y	OK

VISSIM Node 104 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	B	29	4AB	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	D	26	4AD	2	2	0	0%	0	Y	OK
Church Loke	4	104	B	6	A	23	4BA	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	C	27	4BC	1	1	0	0%	0	Y	OK
Church Loke	4	104	B	6	D	26	4BD	5	5	0	0%	0	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	B	29	4CB	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	D	26	4CD	1	1	0	0%	0	Y	OK
Church Loke	4	104	D	10	A	23	4DA	1	1	0	0%	0	Y	OK
Church Loke	4	104	D	10	B	29	4DB	8	8	0	0%	0	Y	OK
Church Loke	4	104	D	10	C	27	4DC	0	0	0	-	0	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0	Y	OK

VISSIM Node 105 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference		GEH		
								Observed	Modelled	Value	%	Value	<5	Individual Flows
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	19	16	-3	-16%	1	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	16	17	1	6%	0	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0	Y	OK

PM – All Vehicles

VISSIM Node 101 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference		GEH		
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Rectory Road roundabout	1	101	A	38	A	3	1AA	1	2	1	100%	1	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	11	9	-2	-18%	1	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	561	525	-36	-6%	2	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	151	141	-10	-7%	1	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	8	8	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	10	10	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	3	2	-1	-33%	1	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	628	616	-12	-2%	0	Y	OK
Rectory Road roundabout	1	101	C	1	B	19	1CB	2	2	0	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	100	97	-3	-3%	0	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	123	120	-3	-2%	0	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	1	1	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	76	76	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0	Y	OK

VISSIM Node 102 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference		GEH		
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	41	40	-1	-2%	0	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	408	402	-6	-1%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	41	41	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	254	263	9	4%	1	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	493	484	-9	-2%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	261	254	-7	-3%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	3	3	-	2	Y	OK

VISSIM Node 103 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	426	417	-9	-2%	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	523	506	-17	-3%	1	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	19	18	-1	-5%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	9	8	-1	-11%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	27	26	-1	-4%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0	Y	OK

VISSIM Node 104 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	B	29	4AB	16	16	0	0%	0	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	D	26	4AD	28	27	-1	-4%	0	Y	OK
Church Loke	4	104	B	6	A	23	4BA	24	25	1	4%	0	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	C	27	4BC	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	D	26	4BD	281	277	-4	-1%	0	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	B	29	4CB	2	2	0	0%	0	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	D	26	4CD	2	2	0	0%	0	Y	OK
Church Loke	4	104	D	10	A	23	4DA	37	35	-2	-5%	0	Y	OK
Church Loke	4	104	D	10	B	29	4DB	260	257	-3	-1%	0	Y	OK
Church Loke	4	104	D	10	C	27	4DC	1	1	0	0%	0	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0	Y	OK

VISSIM Node 105 **Vehicle Type** Total

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	716	668	-48	-7%	2	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	756	739	-17	-2%	1	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0	Y	OK

PM – Cars

VISSIM Node 101 **Vehicle Type** Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Rectory Road roundabout	1	101	A	38	A	3	1AA	1	1	0	0%	0	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	11	9	-2	-18%	1	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	448	418	-30	-7%	1	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	120	112	-8	-7%	1	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	7	8	1	14%	0	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	10	10	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	3	2	-1	-33%	1	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	506	504	-2	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	B	19	1CB	2	2	0	0%	0	Y	OK
Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	66	66	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	97	97	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	1	1	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	56	56	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0	Y	OK

VISSIM Node 102 **Vehicle Type** Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	38	38	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	328	326	-2	-1%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	27	29	2	7%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	202	220	18	9%	1	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	395	397	2	1%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	205	207	2	1%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	1	1	-	1	Y	OK

VISSIM Node 103 **Vehicle Type** Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	344	340	-4	-1%	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	411	409	-2	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	17	17	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	7	7	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	26	26	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0	Y	OK

VISSIM Node	104	Vehicle Type	Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time Observed	Flow Peak Time Modelled	Difference Value	Difference %	GEH Value	GEH <5	Individual Flows
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	B	29	4AB	14	14	0	0%	0	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	D	26	4AD	25	25	0	0%	0	Y	OK
Church Loke	4	104	B	6	A	23	4BA	17	17	0	0%	0	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	C	27	4BC	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	D	26	4BD	225	225	0	0%	0	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	B	29	4CB	2	2	0	0%	0	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	D	26	4CD	2	2	0	0%	0	Y	OK
Church Loke	4	104	D	10	A	23	4DA	33	33	0	0%	0	Y	OK
Church Loke	4	104	D	10	B	29	4DB	207	210	3	1%	0	Y	OK
Church Loke	4	104	D	10	C	27	4DC	1	1	0	0%	0	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0	Y	OK

VISSIM Node	105	Vehicle Type	Car

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time Observed	Flow Peak Time Modelled	Difference Value	Difference %	GEH Value	GEH <5	Individual Flows
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	590	549	-41	-7%	2	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	607	604	-3	0%	0	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0	Y	OK

PM – LGV

VISSIM Node	101	Vehicle Type	LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time Observed	Flow Peak Time Modelled	Difference Value	Difference %	GEH Value	GEH <5	Individual Flows
Rectory Road roundabout	1	101	A	38	A	3	1AA	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	96	99	3	3%	0	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	27	27	0	0%	0	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	101	101	0	0%	0	Y	OK

Rectory Road roundabout	1	101	C	1	B	19	1CB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	27	27	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	22	22	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	0	0	0	-	0	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	19	19	0	0%	0	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0	Y	OK

VISSIM Node 102 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	2	2	0	0%	0	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	69	70	1	1%	0	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	13	11	-2	-15%	1	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	45	40	-5	-11%	1	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	79	76	-3	-4%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	46	45	-1	-2%	0	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	1	1	-	1	Y	OK

VISSIM Node 103 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	71	72	1	1%	0	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	92	87	-5	-5%	1	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	1	1	0	0%	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	0	0	0	-	0	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0	Y	OK

VISSIM Node 104 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	B	29	4AB	2	2	0	0%	0	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0	Y	OK
Church Loke	4	104	A	24	D	26	4AD	1	1	0	0%	0	Y	OK
Church Loke	4	104	B	6	A	23	4BA	6	6	0	0%	0	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0	Y	OK

Church Loke	4	104	B	6	C	27	4BC	0	0	0	-	0	Y	OK
Church Loke	4	104	B	6	D	26	4BD	51	51	0	0%	0	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	B	29	4CB	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0	Y	OK
Church Loke	4	104	C	28	D	26	4CD	0	0	0	-	0	Y	OK
Church Loke	4	104	D	10	A	23	4DA	2	2	0	0%	0	Y	OK
Church Loke	4	104	D	10	B	29	4DB	45	45	0	0%	0	Y	OK
Church Loke	4	104	D	10	C	27	4DC	0	0	0	-	0	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0	Y	OK

VISSIM Node 105 **Vehicle Type** LGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	107	111	4	4%	0	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	122	122	0	0%	0	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0	Y	OK

PM – HGV

VISSIM Node 101 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	Individual Flows
								Observed	Modelled	Value	%	Value	<5	
Rectory Road roundabout	1	101	A	38	A	3	1AA	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	A	38	B	19	1AB	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	A	38	C	22	1AC	7	7	0	0%	0%	Y	OK
Rectory Road roundabout	1	101	A	38	D	18	1AD	2	2	0	0%	0%	Y	OK
Rectory Road roundabout	1	101	B	20	A	3	1BA	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	B	20	B	19	1BB	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	B	20	C	22	1BC	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	B	20	D	18	1BD	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	C	1	A	3	1CA	11	11	0	0%	0%	Y	OK
Rectory Road roundabout	1	101	C	1	B	19	1CB	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	C	1	C	22	1CC	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	C	1	D	18	1CD	5	5	0	0%	0%	Y	OK
Rectory Road roundabout	1	101	D	17	A	3	1DA	1	1	0	0%	0%	Y	OK
Rectory Road roundabout	1	101	D	17	B	19	1DB	0	0	0	-	0%	Y	OK
Rectory Road roundabout	1	101	D	17	C	22	1DC	1	1	0	0%	0%	Y	OK
Rectory Road roundabout	1	101	D	17	D	18	1DD	0	0	0	-	0%	Y	OK

VISSIM Node 102 **Vehicle Type** HGV

Junction Name			From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time	Difference		GEH	

	MCC Site	Node No.						Observed	Modelled	Value	%	Value	<5	Individual Flows
Petrol Station Gyratory	2	102	A	10011	A	15	2AA	0	0	0	-	0%	Y	OK
Petrol Station Gyratory	2	102	A	10011	B	10	2AB	0	0	0	-	0%	Y	OK
Petrol Station Gyratory	2	102	A	34	D	12	2AD	5	5	0	0%	0%	Y	OK
Petrol Station Gyratory	2	102	B	11	A	15	2BA	0	0	0	-	0%	Y	OK
Petrol Station Gyratory	2	102	B	11	B	10	2BB	0	0	0	-	0%	Y	OK
Petrol Station Gyratory	2	102	B	11	D	12	2BD	2	2	0	0%	0%	Y	OK
Petrol Station Gyratory	2	102	D	37	A	15	2DA	10	9	-1	-10%	32%	Y	OK
Petrol Station Gyratory	2	102	D	37	B	10	2DB	2	2	0	0%	0%	Y	OK
Petrol Station Gyratory	2	102	D	37	D	12	2DD	0	0	0	-	0%	Y	OK

VISSIM Node 103 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Great Hautbois Road / Station Road	3	103	A	4	A	33	3AA	0	0	0	-	0%	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	B	34	3AB	5	5	0	0%	0%	Y	OK
Great Hautbois Road / Station Road	3	103	A	4	C	31	3AC	0	0	0	-	0%	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	A	33	3BA	10	9	-1	-10%	32%	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	B	34	3BB	0	0	0	-	0%	Y	OK
Great Hautbois Road / Station Road	3	103	B	15	C	31	3BC	0	0	0	-	0%	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	A	33	3CA	0	0	0	-	0%	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	B	34	3CB	0	0	0	-	0%	Y	OK
Great Hautbois Road / Station Road	3	103	C	32	C	31	3CC	0	0	0	-	0%	Y	OK

VISSIM Node 104 **Vehicle Type** HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
Church Loke	4	104	A	24	A	23	4AA	0	0	0	-	0%	Y	OK
Church Loke	4	104	A	24	B	29	4AB	0	0	0	-	0%	Y	OK
Church Loke	4	104	A	24	C	27	4AC	0	0	0	-	0%	Y	OK
Church Loke	4	104	A	24	D	26	4AD	0	0	0	-	0%	Y	OK
Church Loke	4	104	B	6	A	23	4BA	1	1	0	0%	0%	Y	OK
Church Loke	4	104	B	6	B	29	4BB	0	0	0	-	0%	Y	OK
Church Loke	4	104	B	6	C	27	4BC	0	0	0	-	0%	Y	OK
Church Loke	4	104	B	6	D	26	4BD	2	2	0	0%	0%	Y	OK
Church Loke	4	104	C	28	A	23	4CA	0	0	0	-	0%	Y	OK
Church Loke	4	104	C	28	B	29	4CB	0	0	0	-	0%	Y	OK
Church Loke	4	104	C	28	C	27	4CC	0	0	0	-	0%	Y	OK
Church Loke	4	104	C	28	D	26	4CD	0	0	0	-	0%	Y	OK
Church Loke	4	104	D	10	A	23	4DA	0	0	0	-	0%	Y	OK
Church Loke	4	104	D	10	B	29	4DB	3	2	-1	-33%	63%	Y	OK
Church Loke	4	104	D	10	C	27	4DC	0	0	0	-	0%	Y	OK
Church Loke	4	104	D	10	D	26	4DD	0	0	0	-	0%	Y	OK

VISSIM Node	105		**Vehicle Type**	HGV

Junction Name	MCC Site	Node No.	From Arm	FromLink	To Arm	ToLink	MCC ID	Flow Peak Time		Difference			GEH	
								Observed	Modelled	Value	%	Value	<5	Individual Flows
B1150 Bridge	5	105	A	12	A	37	5AA	0	0	0	-	0%	Y	OK
B1150 Bridge	5	105	A	12	B	12	5AB	7	7	0	0%	0%	Y	OK
B1150 Bridge	5	105	B	37	A	37	5BA	11	11	0	0%	0%	Y	OK
B1150 Bridge	5	105	B	37	B	12	5BB	0	0	0	-	0%	Y	OK

Appendix E – Forecast Reports

AECOM

North Walsham Modelling

Forecast Report

ESCO Developments, Flagship Housing Group and Lovell Partnerships

22nd September 2023

Delivering a better world

Quality information

Prepared by	Checked by	Verified by	Approved by
			
B Stock Graduate Consultant	M Drapier Gomis Senior Consultant	Javier Navarro Pardo Principal Consultant	Phil Arnold Associate Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

ESCO Developments, Flagship Housing Group and Lovell Partnerships

Prepared by:

Ben Stock
Graduate Consultant

Contact:

Martin Drapier Gomis
Senior Consultant
M: +44 7921646161
E: martin.drapiergomis@aecom.com

AECOM Limited
AECOM House
63-77 Victoria Street
St Albans
Hertfordshire AL1 3ER
United Kingdom

T: +44(0)1727 535000
aecom.com

Table Of Contents

1. Introduction

Base VISSIM Model

1.1 The 2022 VISSIM Base model for North Walsham has been used as a starting point to develop the forecast scenarios. AECOM developed and validated the Vissim Base model at the end of 2022.

1.2 The 2022 Base model was successfully calibrated and validated to replicate the existing operation during the traffic surveys for the North Walsham Model area, shown in Figure 1-1. Further details regarding the Base model operation and the calibration and validation results can be found in the VISSIM Local Model Validation Report for North Walsham: “North Walsham - Local Model Validation Report.”

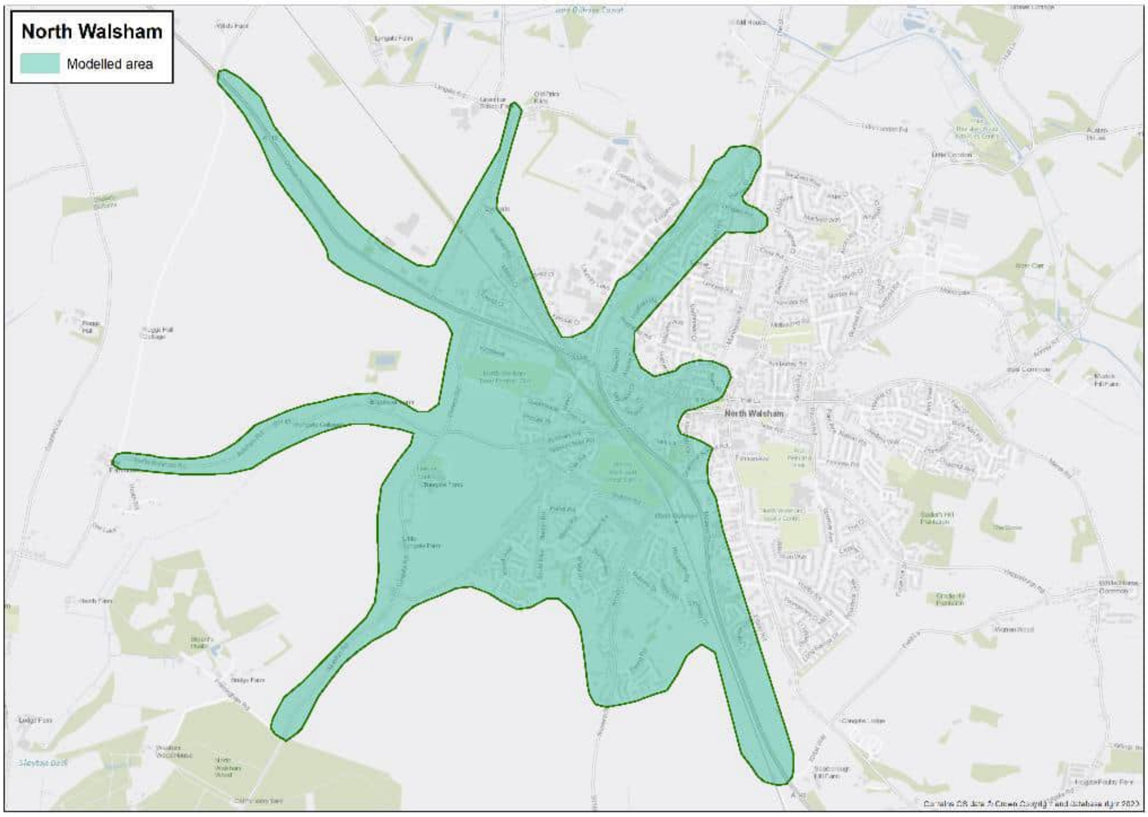


Figure 1-1 – North Walsham Modelled Area

1.3 The forecast year models have been developed for the 2036 forecast year. The models were developed for the Weekday AM and PM peak hours defined as 07:45 – 08:45 in AM and 16:30 – 17:30 in PM. Thirty-minute warm-up and fifteen-minute cool-down periods have also been modelled to saturate the network with traffic and allow journeys to be completed after the peak hour.

Model Purpose

1.4 The forecast models have been used to assess the operation of the network in 2036 in line with the forecast assumptions contained in the Transport Assessment (TA) for North Walsham Western Urban Extension (NWWUE). Three different scenarios: ‘Do Minimum’, ‘Do Something’, and ‘Do Something with Mitigation’ have been developed for the 2036 forecast year.

1.5 The Do Minimum scenario includes the estimated traffic growth in the area for the forecast year and proposed infrastructure changes at the Norwich Road/A149/Grammar School Road junction. The infrastructure changes are discussed in the Network Coding section.

1.6 The Do Something scenario has been developed using the Do Minimum scenario as a starting point. In addition to the same demand and network changes included in the Do Minimum scenario, the Do Something scenarios include the additional trips generated by the NWWUE which were added on top of the Do Minimum demand and the proposed Link Road through the NWWUE development.

1.7 The Do Something with Mitigation scenario is the Do Something scenario with a proposed mitigation on Aylsham Road. Further detail on the differences between scenarios can be found in Table 2-1.

1.8 The operation of the Do Minimum model has been used as a benchmark to assess the impact of the trip generation and infrastructure changes linked to the NWWUE included in the Do Something scenarios.

Report Structure

1.9 The remainder of the report is structured as follows:

- Section 2 provides an overview of the forecast scenarios and outlines the development of the forecast model networks;
- Section 3 describes the demand development methodology for future scenarios;
- Section 4 describes the assignment methodology;
- Section 5 presents and analyses the forecast modelling results;
- Section 6 provides an analysis of key areas/ locations in the models; and
- Section 7 provides a summary and conclusions.

2. Forecast Model Development

Overview

2.1 The North Walsham forecast models were coded using the same software version (Vissim 21.00-12) as used to develop the 2022 Base models. This section outlines the changes made to the Base models to build the forecast models.

2.2 Three forecast model scenarios were developed:

- 2036 'Do Minimum' model for AM and PM peak periods;
- 2036 'Do Something' model for AM and PM peak periods; and
- 2036 'Do Something + Mitigation' model for AM and PM peak periods.

2.3 The demand and network assumptions included in each scenario have been summarised in Table 2-1.

Table 2-1 – Forecast Scenarios

Scenario	Network	Demand
Do Minimum	Base Model network + B1150/A149 Improvement	2022 Base * 2022-2036 Growth Factor
Do Something	Do Minimum network + Link Road	Do Minimum + WUE 2036 Demand
Do Something + Mitigation	Do Something network + Aylsham Road Improvement	Do Minimum + WUE 2036 Demand

Network Coding

2.4 This section discusses the committed schemes and development sites coded in the forecast scenarios. Unless otherwise stated, all the modelling elements not affected by the proposed schemes – such as the desired speed decisions, reduced speed areas, public transport, and priority rules – have been coded consistently with the 2022 Base model.

Network Coding – Do Minimum

2.5 The Do Minimum network has been updated to include the proposed new layout for the B1150 / A149 / Grammar School Road junction. The layout for this junction is shown below in Figure 2-1.

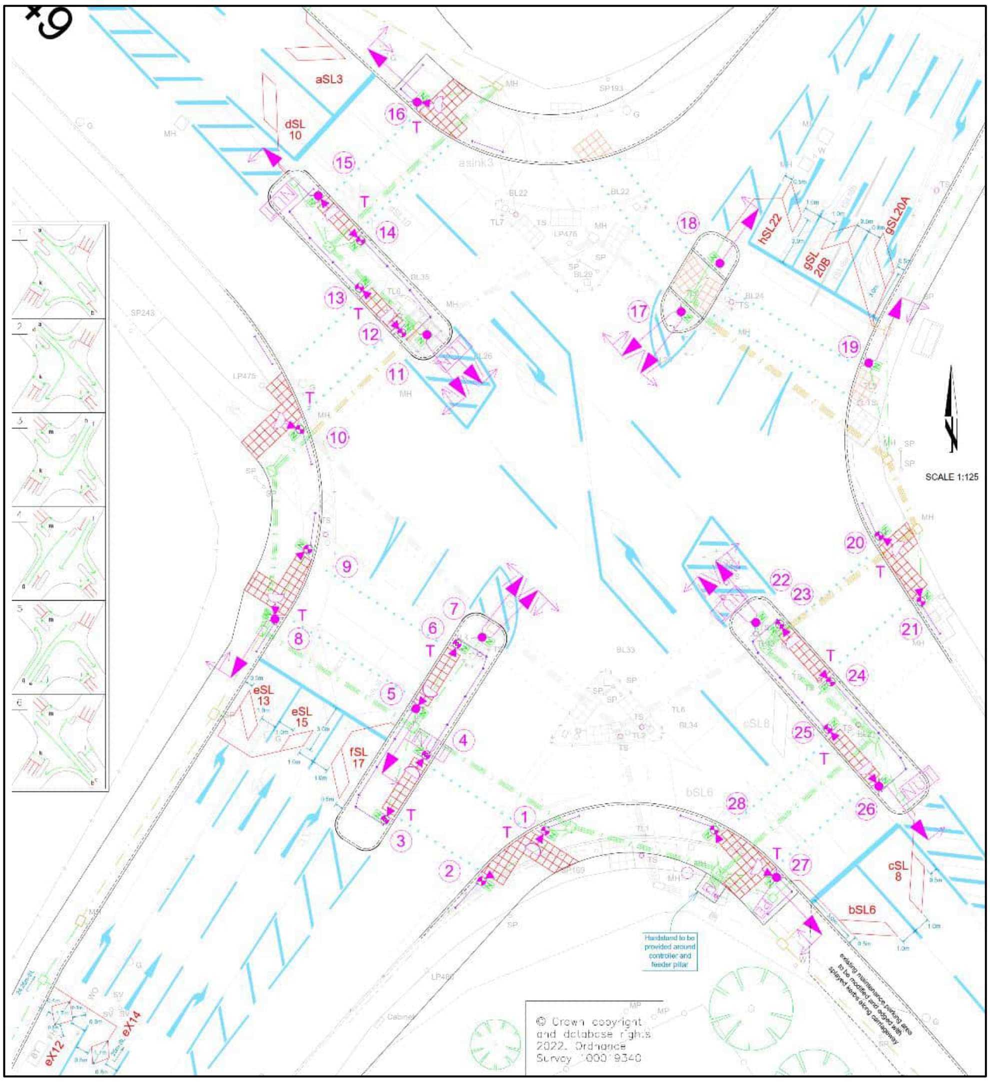


Figure 2-1 – B1150 / A149 / Grammar School Road Traffic Signal Layout

2.6 The timings at the signalised junctions have been optimised to reflect the predicted growth in traffic flows. The proposed signal optimisation has been consistently applied in all the forecast scenarios and assumes that the existing signal controllers will be appropriately maintained and updated in the future.

2.7 Furthermore, some additional priority rules have been added to the models to accurately represent the expected cooperative/ keep clear driving behaviours at locations which become more congested in the future year models, due to higher traffic flows. These rules would have no impact in the base year as this congestion is not present.

Network Coding – Do Something

2.8 The Do Something scenarios have been developed using the Do Minimum as a starting point, including the B1150 / A149 / Grammar School Road junction improvement shown in Table 2-1. In addition to the changes and optimisation included in the Do Minimum scenarios, the Do Something scenarios also include the new link road through the NWWUE development and the roundabout junctions at either end to connect to the existing network.

2.9 The 2036 scenarios include the full extent of the proposed link road within the existing road network. Figure 2-2 shows the alignment of the NWWUE link road, highlighting the key junctions and signalised crossings included in the model, which include the access junctions with the B1150 and A149, the junctions with Aylsham Road and Skeyton Road and the crossing of Weavers Way.

Figure 2-2 – Do Something Network

Network Coding – Do Something with Mitigation

2.10 The Do Something with Mitigation scenarios have been developed using the Do Something as a starting point. In addition to the changes included in the Do Something scenarios, the Do Something with Mitigation scenarios also include the proposed one-way signalised layout on Aylsham Road under the bridge. The proposed layout is shown below in Figure 2-3.

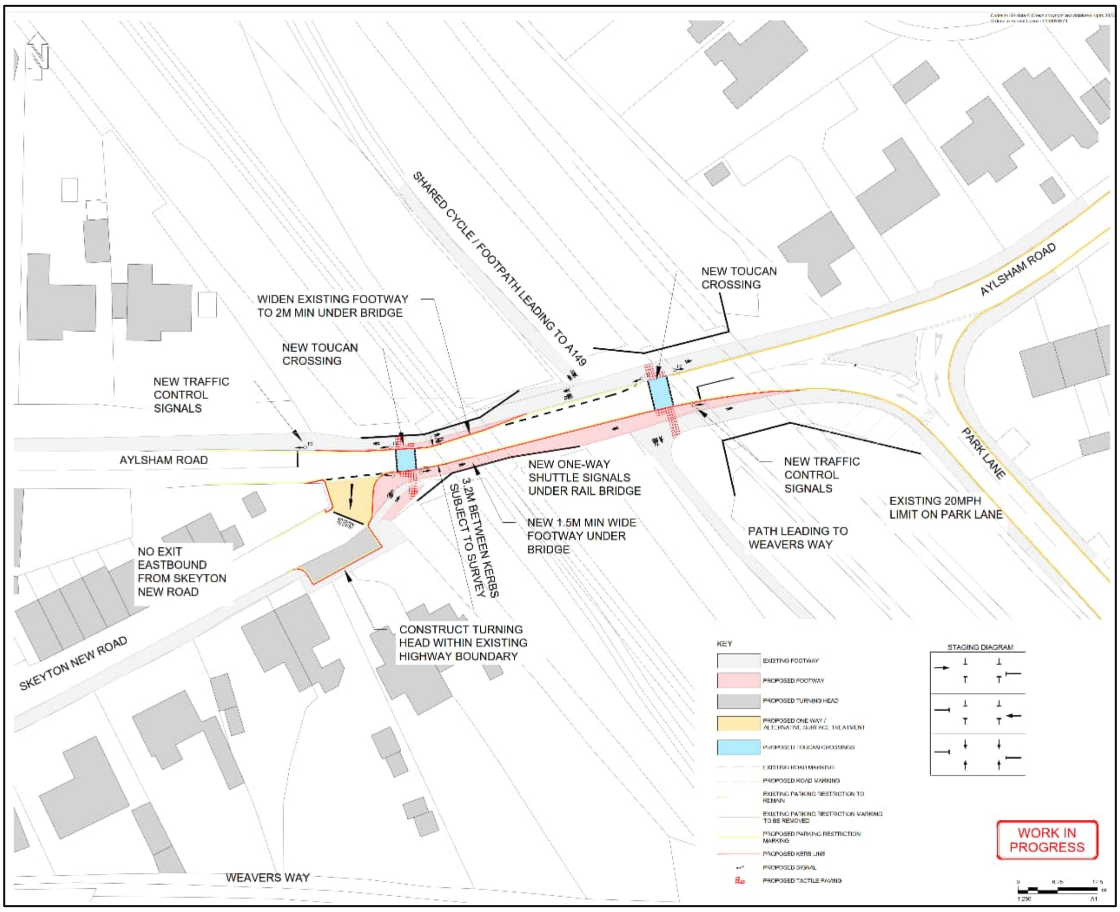


Figure 2-3 – Aylsham Road One-way Signalised Layout

2.11 The signals at the proposed one-way signalised junction have been optimised, with signal timings adapting to arrival patterns, allowing the model to provide a more realistic representation of the proposed signal operation, minimising delay.

3. Future Year Demand

Zoning

3.1 The zoning system developed for the Vissim Base model has also been used for the Do Minimum models.

3.2 The zoning system included in the Do Something scenarios has been updated to include the additional loading points for the NWWUE demand. In the Do Something scenario, seven additional zones have been added to represent access points to the development.

3.3 Table 3-1 shows the correspondence between the zone numbers and the development sites.

Table 3-1 – Development Zones

Development Site	Zone
Residential Zone South	25
Residential Zone Central	26
Residential Zone North Central	27
Residential Zone North	28
Local Centre / School	29
Employment North Central	30
Employment North	31

3.4 Figure 3-1 shows the locations of the VISSIM zones in the Do Something networks.

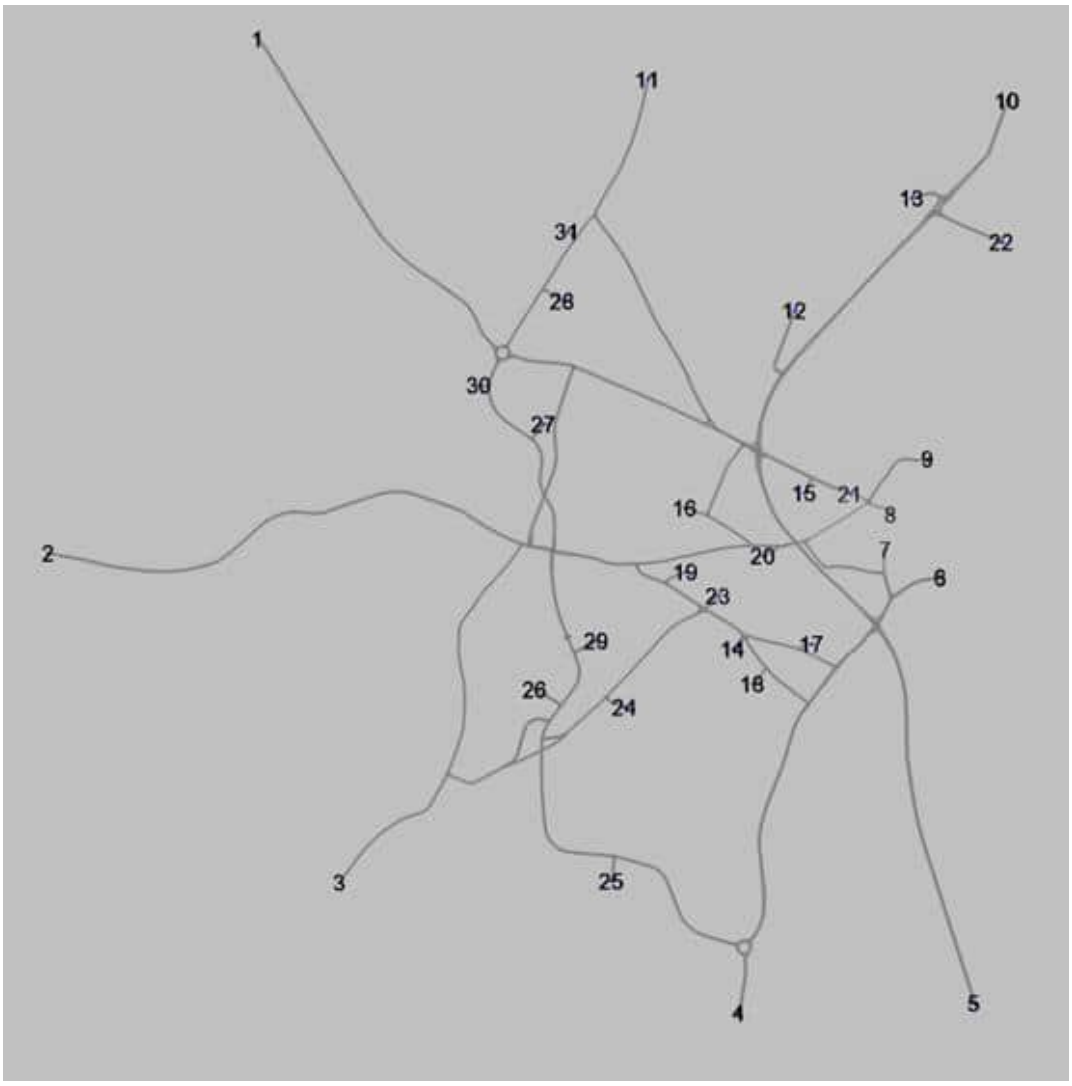


Figure 3-1 – Do Something Scenario Zones

Demand Methodology

3.5 The forecast Vissim demand matrices were derived using the growth factors and the trip distribution from the Transport Assessment (TA) developed by AECOM.

3.6 Table 3-2 shows the growth factors derived for each forecast year based on TEMPRO, as set out in the TA. These growth factors were applied to the Base model demand matrices to uplift traffic volumes for the 2036 Do Minimum scenarios.

Table 3-2 – Growth Factors

Vehicle	2036 AM	2036 PM
Car/LGV	1.084	1.080
HGV	1.039	1.039

3.7 The NWWUE trip generation and trip distribution assumptions included in the TA have been used to derive the number of additional trips associated with the NWWUE and the distribution in North Walsham. These trips have been added to the Do Minimum scenarios to develop the Do Something forecast demand matrix forecasts.

3.8 Table 3-3 details the additional trips included in the Do Something models for each forecast year.

Table 3-3 – Do Something Development Demand

Development Demand	2036 AM	2036 PM
Car/LGV	1,261	1,013
HGV	12	7

3.9 It should be noted that the development trip totals were provided in two vehicle types: Cars/Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs). However, since the Vissim models categorise Cars and LGVs as separate vehicle types, Car and LGV proportions were calculated from the base matrix and used to split the development demand.

3.10 The absolute demand changes for each Origin-Destination (O-D) pair were applied by vehicle class (Cars, LGVs and HGVs) to the base peak hour matrices from the Vissim base model to develop the Forecast demand matrices.

3.11 The forecast peak hour matrices were profiled into 15-minute periods using the same profiles used in the Vissim base model matrices to develop each 15-minute matrix, creating six matrices for each vehicle type.

Routing Assumptions

3.12 There are multiple routes available between the development zones and the eastern side of the town centre. For a few O-D pairs, the assignment of trips within the model area was not considered realistic, due to some town-centre networks not being included in the model area, such as King's Arms Street or Yarmouth Road (due to lack of survey data). In these cases, the model was unable to dynamically adjust routeing to respond to delay increases, as the destinations were fixed.

3.13 The O-D patterns were therefore adjusted in a few cases. Google Maps was used to indicate which routes would be attractive, as shown in Figure 3-2, to define adjustments to the preferred town centre destination zones for each of the development zones. These routing assumptions have been developed consistently with the TA to provide a realistic representation of the trip distribution expected in the area.

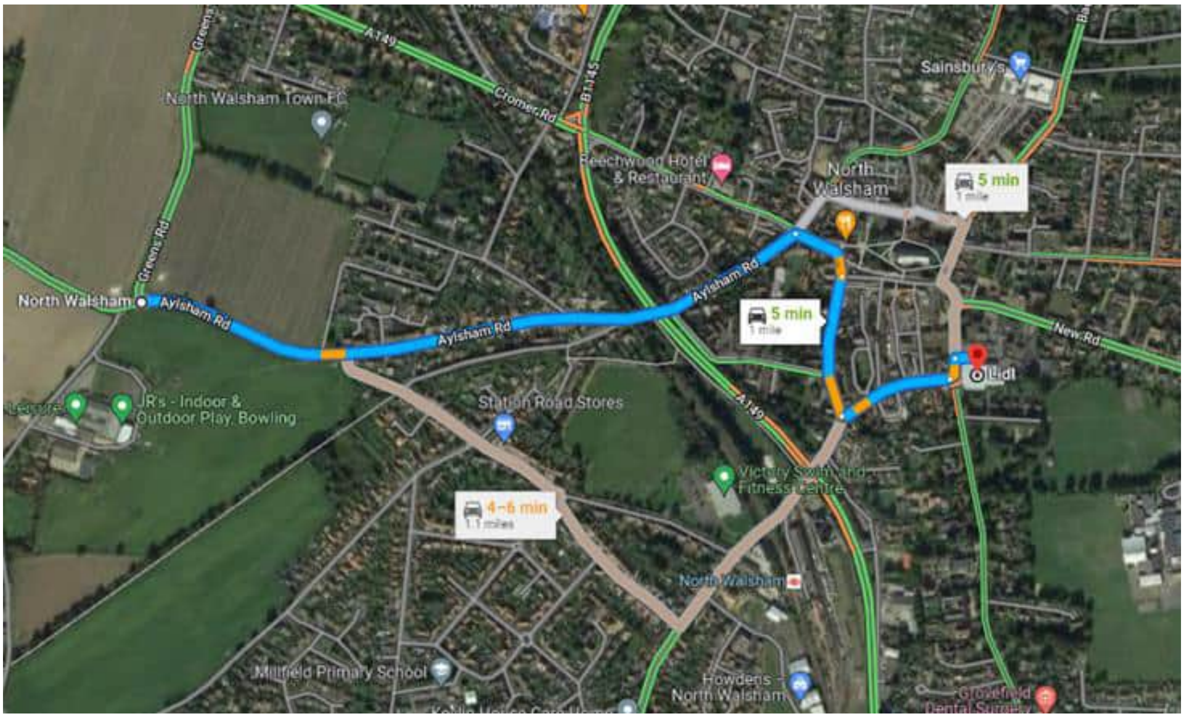


Figure 3-2 – Route Comparison from Development Location to Zone 6

4. Model Assignment

Convergence

4.1 The model assignment and convergence parameters for the 2036 models used the same settings as the base year models with a minor change in the Kirchhoff parameter (it was changed from 10 to 3.5), as it was not possible to converge the 2036 Do Something PM model using the same parameters defined in the Base model, as there are significant changes in future congestion patterns. The Kirchhoff parameter is consistent in all the 2036 scenarios to allow reliable comparison of Do Minimum and Do Something scenarios. Further details of the convergence process followed can be found in the North Walsham Vissim Local Model Validation Report (LMVR).

4.2 Fixed signal timings, based on average green times, were used during forecast model convergence, allowing the model to reach a stable convergence.

4.3 The Kirchoff parameter affects the flow balance between the lowest cost route for each O-D pair and the alternative routes. Analysis was undertaken of the 2036 AM model assignments, which converged using both settings, which showed that the routing changes caused by the different Kirchhoff values had a negligible effect on the model operation.

5. Model Evaluation

Introduction

5.1 This section presents the analysis of results for the Do Minimum, Do Something and Do Something with Mitigation forecast scenarios. The results were extracted for the following models and analysed:

- Base (2022) – AM and PM peak hours;
- Do Minimum (2036) – AM and PM peak hours;
- Do Something (2036) – AM and PM peak hours; and
- Do Something with Mitigation (2036) – AM and PM peak hours.

5.2 The analysis in the following section has been divided into the peak hours for each scenario, as each has unique characteristics.

5.3 The results were extracted from the models and averaged for 20 simulation runs with different random seeds. Different seeds randomise the release of vehicles into the network, resulting in a different chain of events, replicating daily variability.

AM Peak Hour Results

5.4 This section presents results for the modelled network in the AM period and includes an analysis of total delay, plots of average speeds and journey times within the modelled area.

Network Performance – AM Peak

5.5 The Network Performance results and average speed plots have been extracted from the models to assess the operation of the overall network. These results show the overall delays for each scenario to enable comparison of the performance of the network.

Average Delay

5.6 Average delay, including latent delay, has been extracted from the models in seconds per vehicle for the AM peak. The average delay is higher in all forecast scenarios when compared to the Base model, which has an average delay of 69 seconds per vehicle. The Do Minimum has 82 seconds per vehicle; the Do Something has 100 seconds per vehicle and Do Something with Mitigation has 105 seconds per vehicle.

5.7 The increase in average delay in the Do Something with Mitigation scenario is caused by the additional delay and routing changes in the area as a result of the proposed mitigation scheme. The results are shown in Figure 5-1 below.

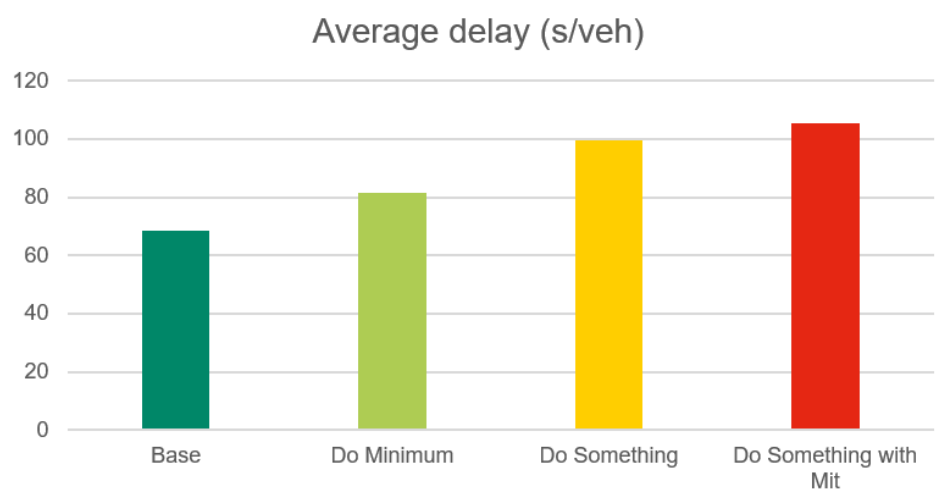


Figure 5-1 – AM Average Delay Per Vehicle (In Seconds)

5.8 The AM forecast models have an average of 2 vehicles in latent demand. This result is caused by vehicles trying to join the network just as the model is finishing and is considered negligible.

Average Speed Plots

5.9 The average speeds have been plotted on the network for the Base and Forecast models (Do Minimum, Do Something and Do Something with Mitigation) in Figure 5-2 to Figure 5-5.

5.10 A comparison between the speed plots for the Base AM model and the speed plots for the forecast models indicates that the main congestion points across the network remain consistent (darker blue areas) although the increased demand results in longer queues in future.

5.11 The Do Minimum scenario results predict slow moving traffic/ queues which extend along B1150 Norwich Road northbound, approaching the A149 / Norwich Road / Grammar School Road signalised junction. Although there are a significant number of additional trips from the NWSUE in the Do Something model, the Do Something scenario only predicts slightly lower speeds along B1150 Norwich Road compared to the Do Minimum scenario, since the Link Road mitigates for much of the impact of the NWWUE trips.

5.12 The Do Something with Mitigation scenario shows a very similar performance to the Do Something. The main differences are observed in Aylsham Road, where the proposed mitigation scheme results in a minor increase in delays and queues approaching the underpass, since the signals mean vehicles have to stop. The changes on the B1150 Norwich Road are caused by the routing changes predicted by the model, as drivers change their route to avoid the additional delays on Aylsham Road.

5.13 The operation of other key locations identified in the model, such as Cromer Road, or the A149/ B1150 junction are broadly consistent with the existing traffic conditions in all the forecast models.

Figure 5-2 – AM Base Speeds

Figure 5-3 – AM Do Minimum 2036 Speeds

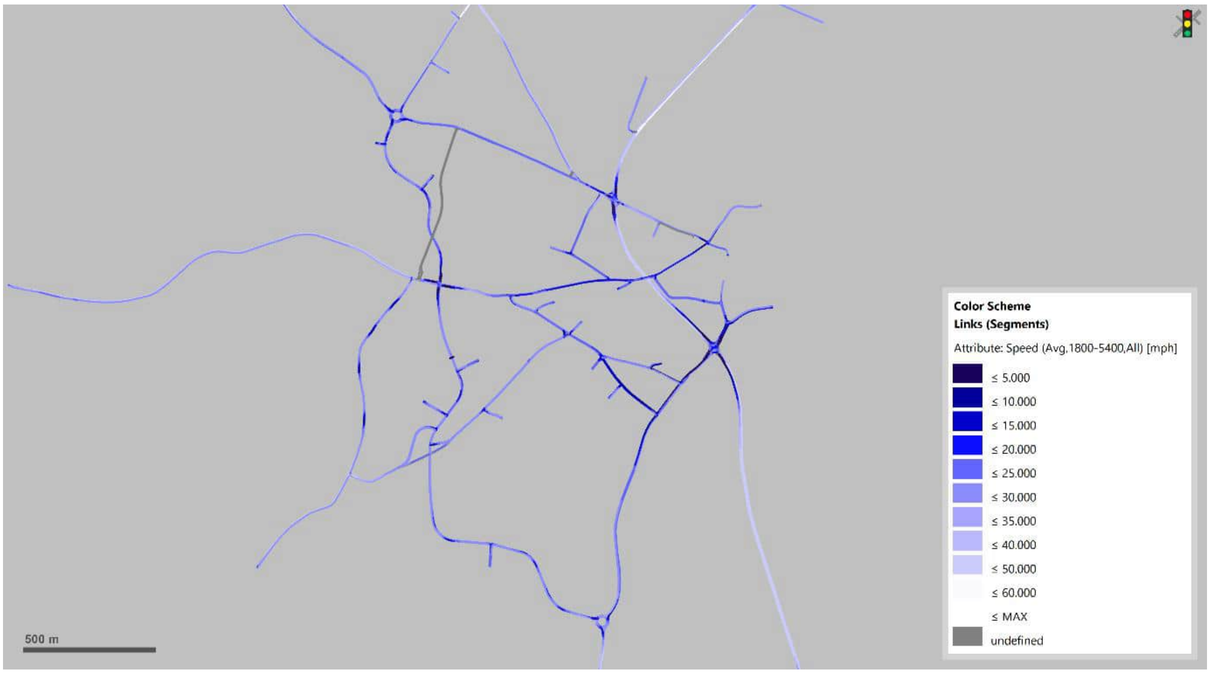


Figure 5-4 – AM Do Something 2036 Speed Plot

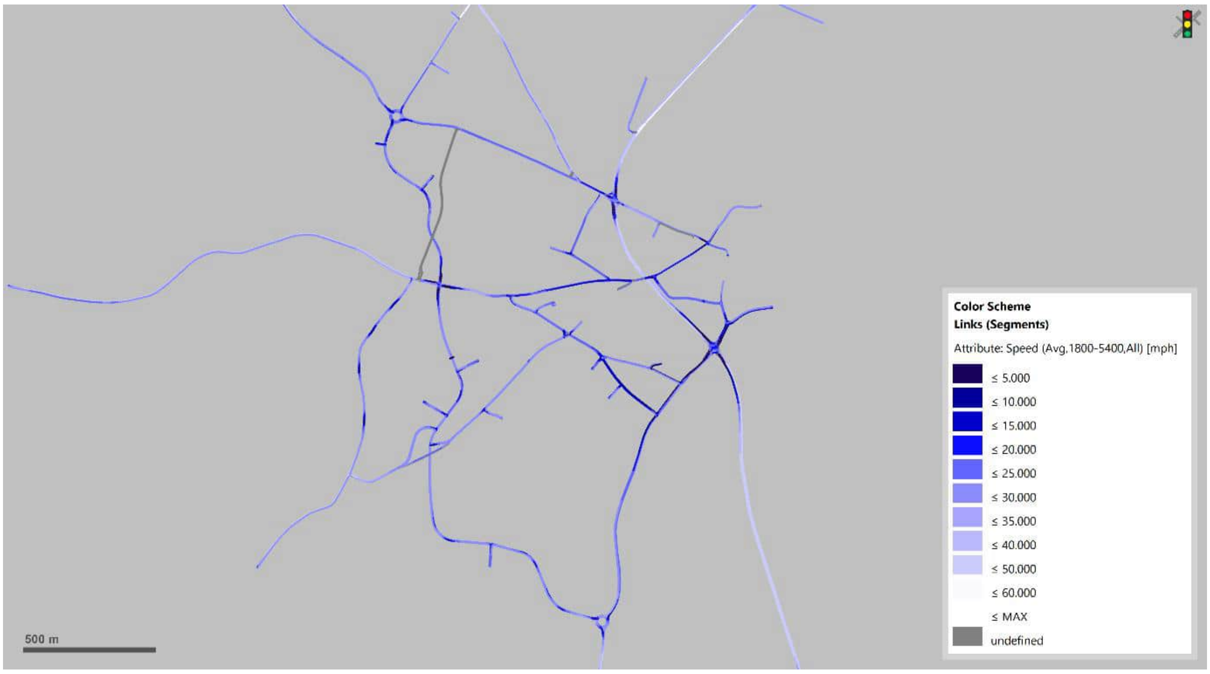


Figure 5-5 – AM Do Something with Mitigation 2036 Speed Plot

Journey Times

5.14 As part of the performance assessment carried out in the present study, the key journey time routes have been analysed to compare delays across the forecast scenarios in the AM peak hour.

5.15 Figure 5-6 and Figure 5-9 show the journey time routes selected within the model area, Journey Time Route 2 (A149 and B1145), and Journey Time Route 8 (B1150 Norwich Road, A149, and B1145).

Journey Time Route 2 – A149 and B1145

5.16 Figure 5-6 below shows Journey Time Route (JTR) 2, along the A149 and B1145.

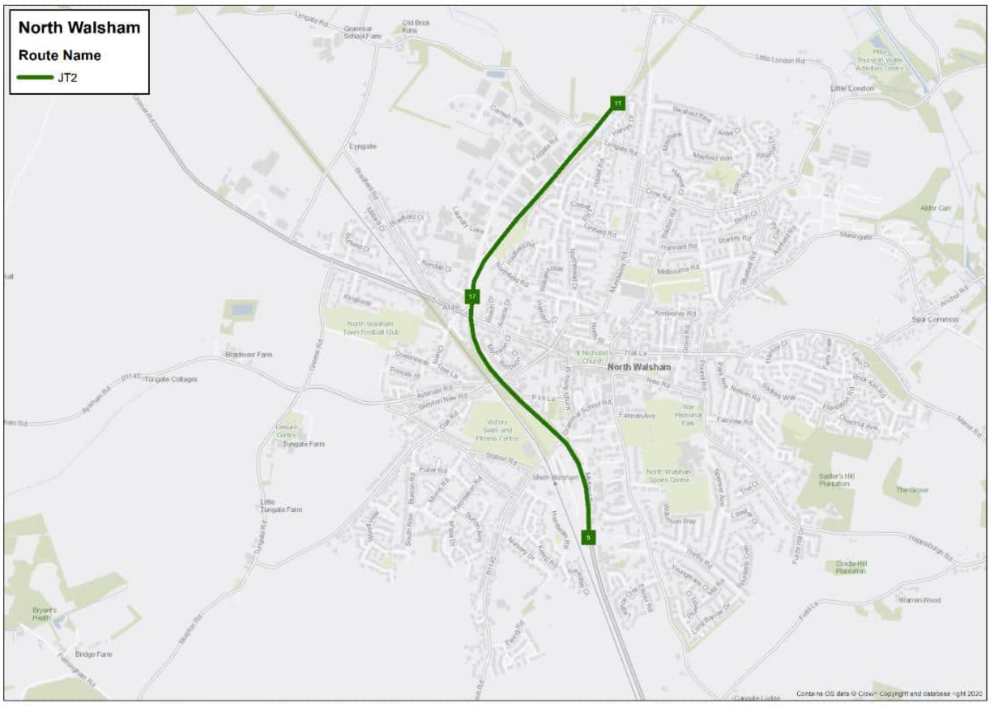


Figure 5-6 – Journey Time Route 2 Diagram

5.17 Figure 5-7 and Figure 5-8 show the modelled results for the Base and all Forecast scenarios in the AM peak hour, for Journey Time Route 2.

5.18 Consistent with the average speed analysis above, the journey time results for JTR 2 show that the increase in demand included in the forecast scenarios does not significantly affect the operation of the A149 route, with only a slight increase in journey times in the Do Minimum scenario, relative to the Base year, and a more significant increase in the Do Something scenarios (with and without mitigation).

5.19 The additional delay in the Do Something scenarios, in both directions, is focused on the southern section, which includes the Norwich Road (B1150) junction with the A149. In the northbound direction, the overall journey time is 24 seconds higher in the Do Something scenario and 26 seconds higher for the Do Something with Mitigation, relative to the Do Minimum. In the southbound direction, the overall journey time in the Do Something is 30 seconds higher than the Do Minimum and 35 seconds higher for the Do Something with Mitigation, relative to the Do Minimum.

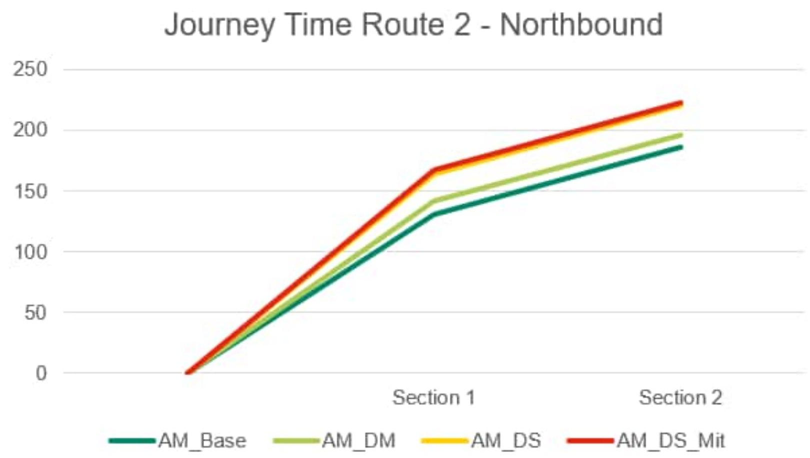


Figure 5-7 – Journey Time 2 Northbound AM

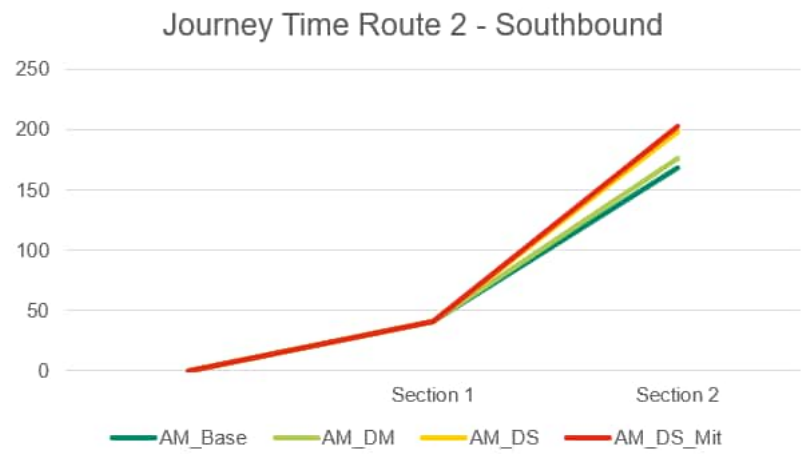


Figure 5-8 – Journey Time 2 Southbound AM

Journey Time Route 8 – B1150, A149, and B1145

5.20 Figure 5-9 below shows Journey Time Route (JTR) 8, along the B1150, A149 and B1145.

Figure 5-9 – Journey Time Route 8 Diagram

5.21 Figure 5-10 and Figure 5-11 show the modelled results for the Base and all Forecast scenarios in the AM peak hour, for Journey Time Route 8.

5.22 The northbound journey times on JTR 8 in the forecast models are higher than the Base, especially on the two southernmost sections, which include the effects of the congestion at the A149/Norwich Road/Grammar School Road Junction. The overall journey time on this route for the Do Minimum is 400 seconds, with the journey times for the Do Something and the Do Something with Mitigation 40 seconds and 41 seconds higher respectively.

5.23 There is a smaller difference between the journey times on JTR 8 southbound between the different scenarios, with the Do Something and Do Something with Mitigation models have a journey time 26 seconds higher (for both scenarios) across the route compared to the Do Minimum.

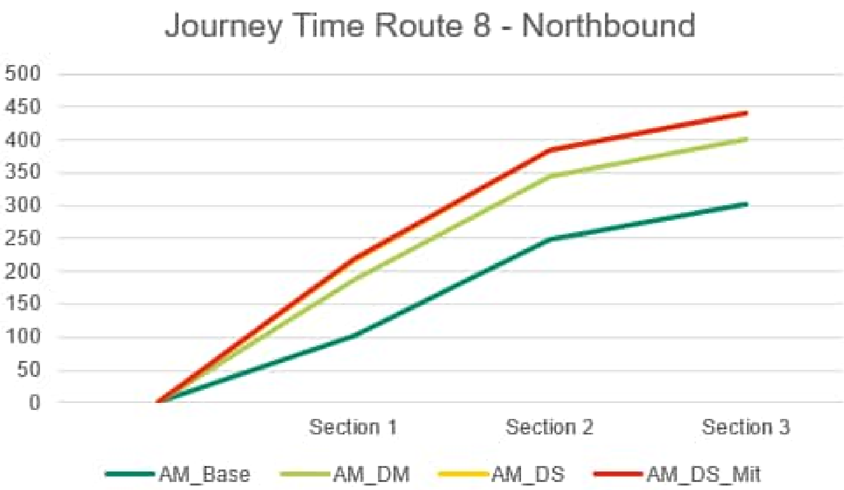


Figure 5-10 – Journey Time 8 Northbound AM

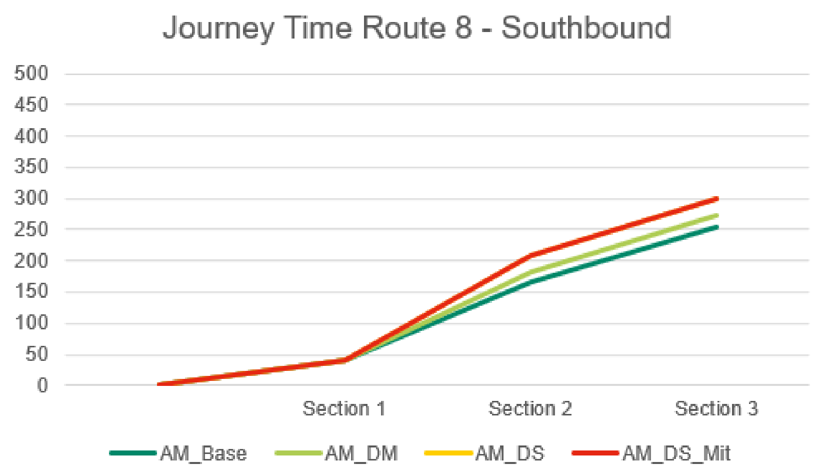


Figure 5-11 – Journey Time 8 Southbound AM

PM Peak Hour Results

5.24 This section presents the results for the modelled network in the PM peak hour for all modelled scenarios. It includes an analysis of total delay, average speed results and journey times within the modelled area.

Network Performance – PM Peak

5.25 The Network Performance results and average speed plots have been extracted from the models to assess the operation of the overall network. These results show the overall delays for each scenario to enable comparison of the performance of the network in each scenario.

Average Delay

5.26 Average delay, including latent delay, has been extracted from the models in seconds per vehicle for the PM peak. The average delay is higher in all forecast year scenarios when compared to the base year, where there is an average delay of 76 seconds per vehicle. There is an averaged delay of 129 seconds per vehicle in the Do Minimum, while the Do Something and Do Something with Mitigation models have an average delay of 115 and 125 seconds per vehicle respectively.

5.27 The Do Something results show that the Link road creates an alternative route in the network improving the overall performance of the model.

5.28 The increase in average delay in the Do Something with Mitigation scenario is caused by routing changes in the area resulting from the proposed mitigation scheme. The results are shown in Figure 5-12 below.

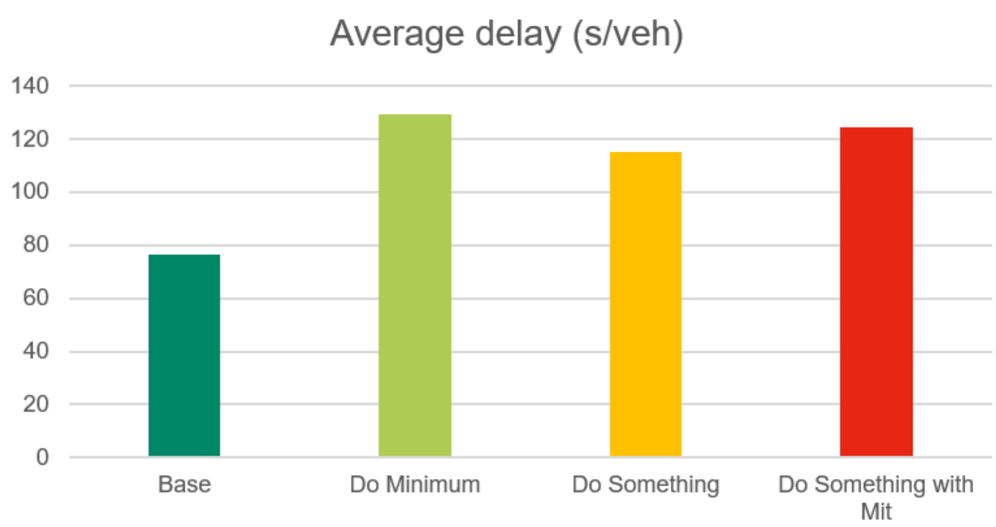


Figure 5-12 – PM Average Delay Per Vehicle (In Seconds)

5.29 The PM forecast models have an average of 3 vehicles in latent demand. This result is caused by vehicles trying to join the network just as the model is finishing and is considered negligible.

Average Speed Plots

5.30 The average speeds have been plotted on the network for the Base and Forecast PM models Figure 5-13 to Figure 5-16.

5.31 A comparison between the PM base year speed plots and the speed plots for the forecast models indicates that the main low speed areas across the network remained consistent (darker blue areas) differing only in magnitude.

5.32 There are slow speeds in the Do Minimum scenario along the B1150 Norwich Road northbound, approaching the A149 / Norwich Road / Grammar School Road signalised junction. The Do Something scenario speed plot is similar with queues along the B1150 Norwich Road, but despite the increased number of trips, the average speed is similar due to the addition of the Link Road, which reduces the number of vehicles using B1150 Norwich Road.

5.33 The Do Something with Mitigation scenario shows a very similar operation to the Do Something scenario, with only a slight reduction in speeds on Aylsham Road and the B1150 Norwich Road. The decrease in speeds on Aylsham Road is caused by the mitigation scheme, as the introduction of the signals means vehicles need to stop. The reduction in speeds on the B1150 Norwich Road is due to more vehicles choosing this route as due to the additional delay on Aylsham Road.

5.34 The operation of other key locations identified in the model, such as Cromer Road, or the A149/ B1150 junction are broadly consistent with the existing traffic conditions in all the forecast models.

Figure 5-13 – PM Base Speeds

Figure 5-14 – PM Do Minimum 2036 Speeds

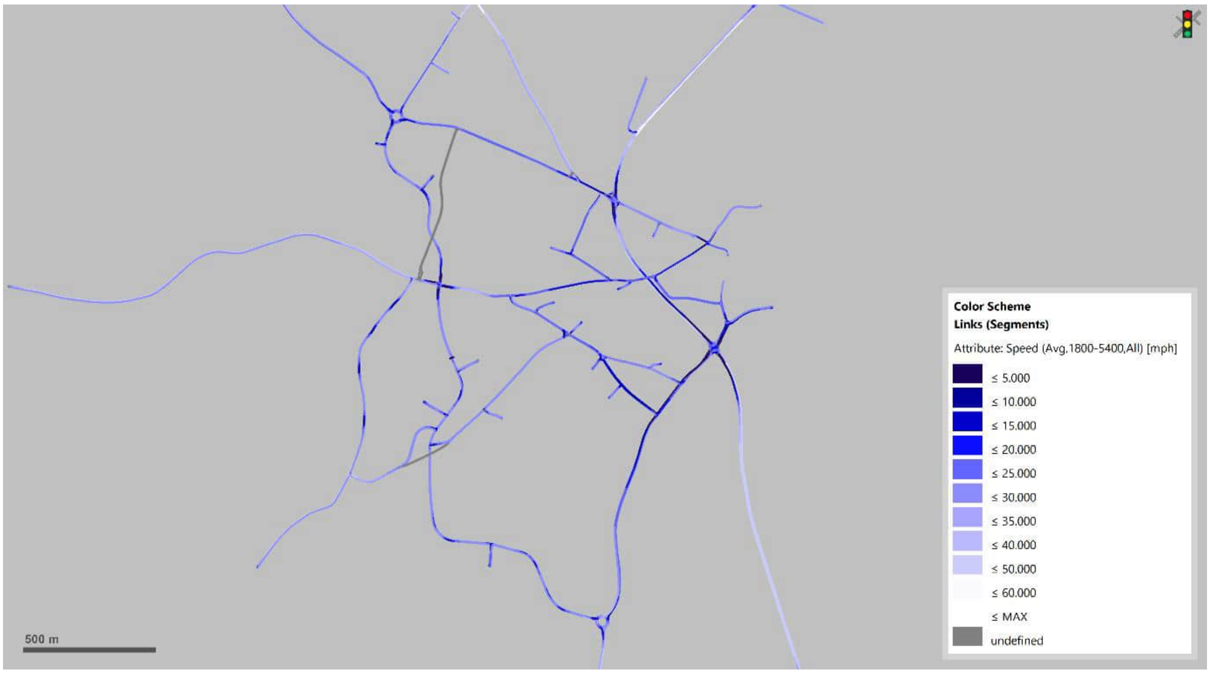


Figure 5-15 – PM Do Something 2036 Speeds

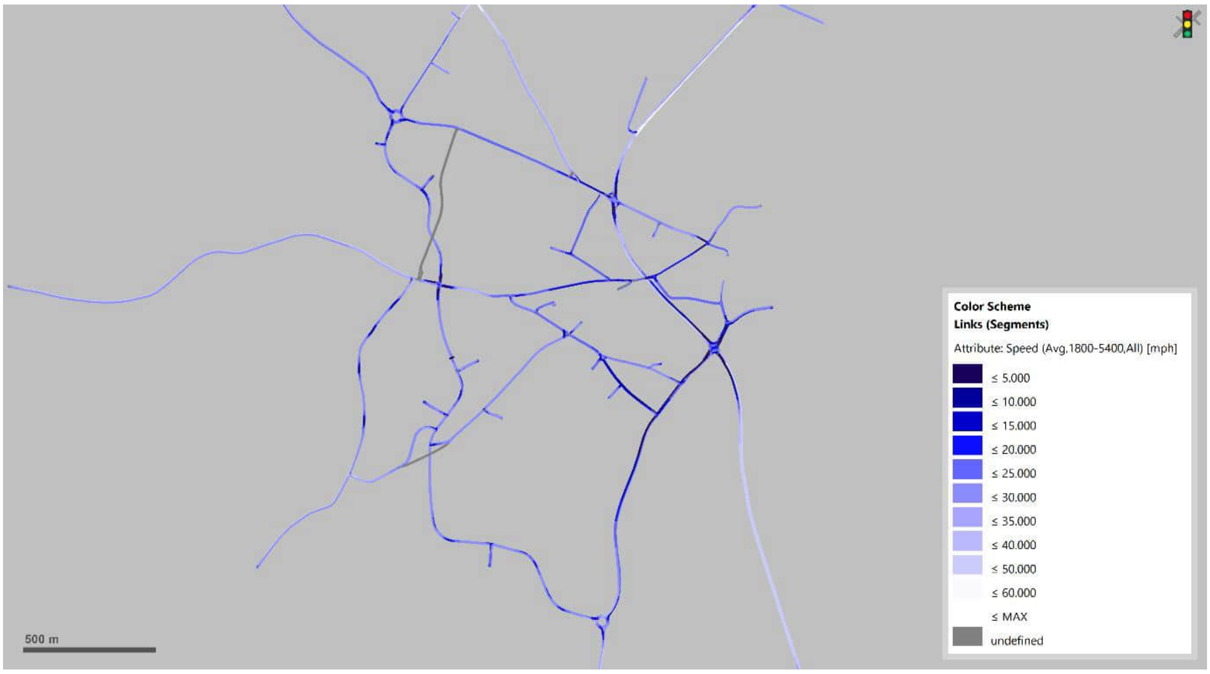


Figure 5-16 – PM Do Something with Mitigation 2036 Speeds

Journey Times – PM Peak

5.35 As part of the performance assessment carried out in the present study, the key journey time routes have been analysed to compare delays across the forecast scenarios in the AM peak hour.

5.36 Figure 5-17 and Figure 5-20 shown in the PM peak section show the key journey time routes selected within the model area, Journey Time Route 2 (A149 and B1145), and Journey Time Route 8 (B1150 Norwich Road, A149, and B1145).

Journey Time Route 2 – A149 and B1145

5.37 Figure 5-17 below shows Journey Time Route (JTR) 2, along the A149 and B1145.

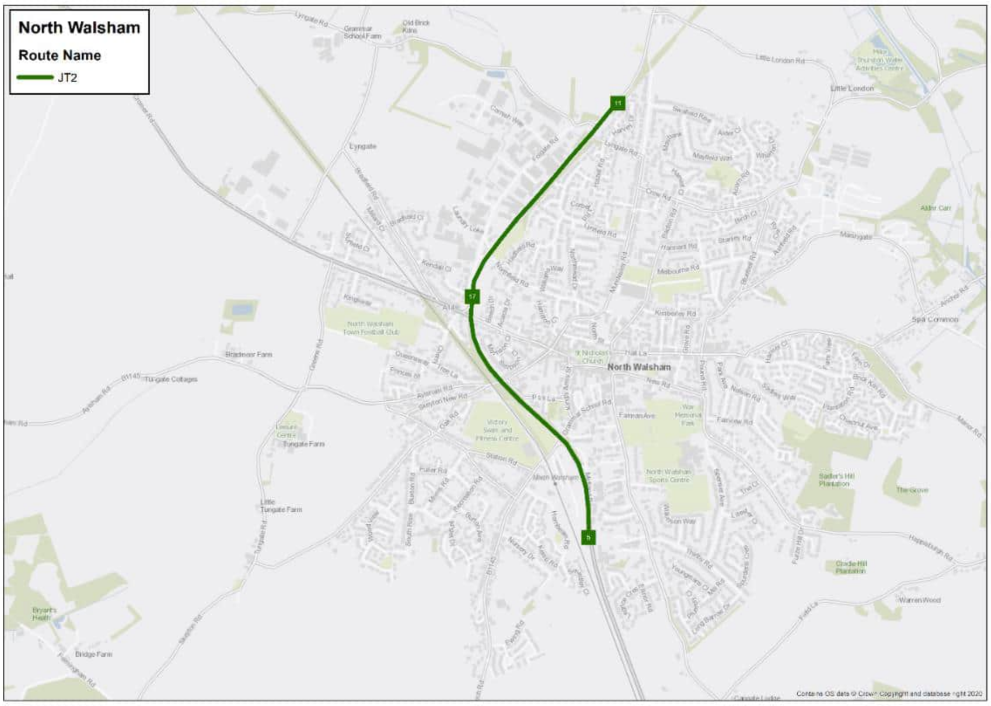


Figure 5-17 – Journey Time Route 2 Diagram

5.38 Figure 5-18 and Figure 5-19 show the modelled results for the Base and forecast scenarios in the PM peak hour, for Journey Time Route 2.

5.39 The increased demand in the Do Something and Do Something with Mitigation models translates to an increased delay on the northbound approach to the A149/Norwich Road/Grammar School Road junction. This junction cannot accommodate the forecast demand in the 2036 Do Minimum PM, so is further over capacity when the development trips are added. The Do Something shows an increase in journey time of 39 seconds, relative to the Do Minimum, while the Do Something with Mitigation show an increase of 44 seconds.

5.40 The journey time results are not significantly different between the Do Minimum and Do Something for JTR 2 southbound on the northern section of the route; there are higher journey times in the Do Something scenario, relative to the Do Minimum on the southern section of the route, but in the Do Something with Mitigation scenario the overall journey times are only slightly higher than the Do Minimum.

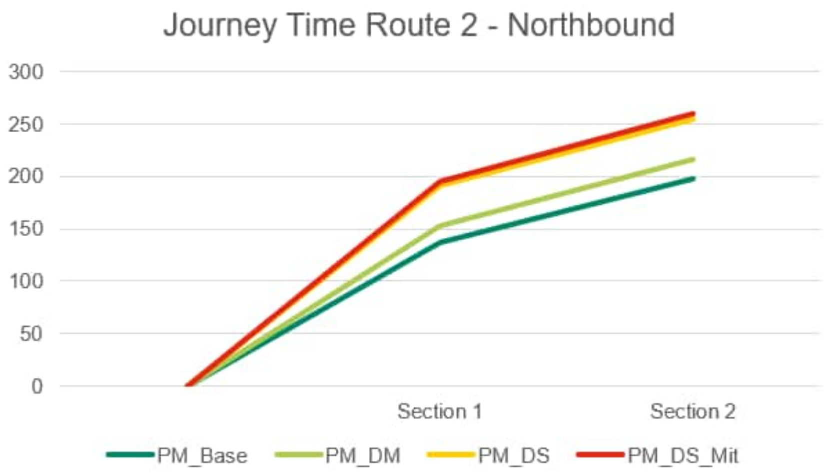


Figure 5-18 - Journey Time Route 2 Northbound PM

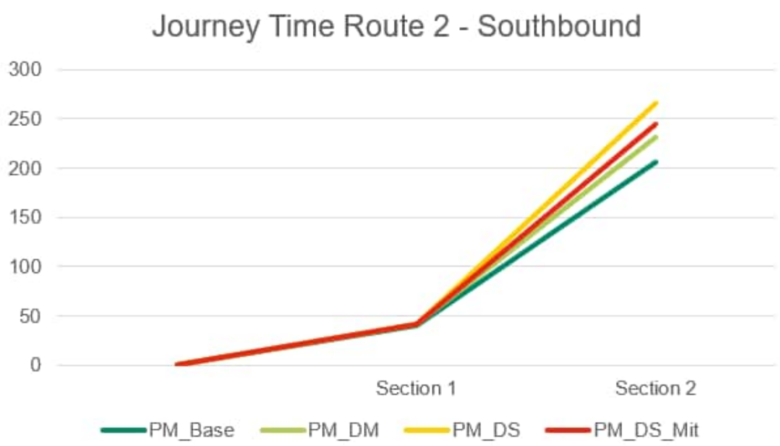


Figure 5-19 Journey Time Route 2 Southbound PM

Journey Time Route 8 – B1150, A149, and B1145

5.41 Figure 5-20 below shows Journey Time Route (JTR) 8, which runs along the B1150, A149 and B1145.

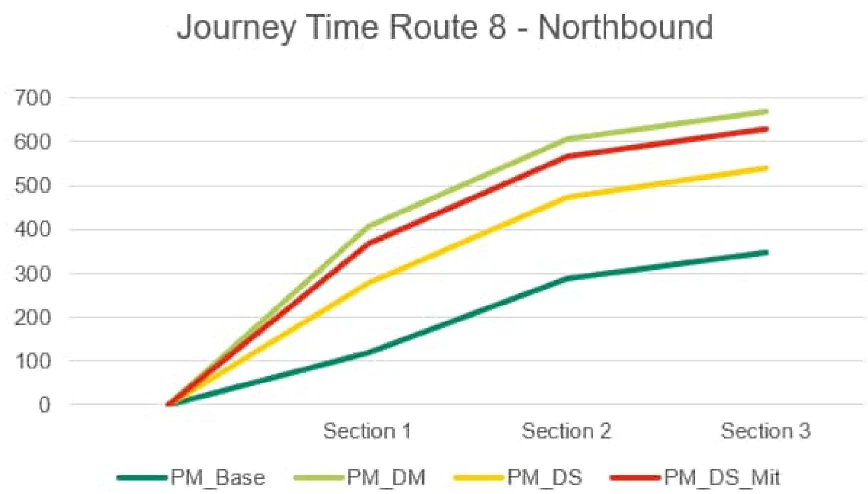
Figure 5-20 – Journey Time Route 8 Diagram

5.42 Figure 5-21 and Figure 5-22 show the modelled results for the Base and forecast scenarios in the PM peak hour, for Journey Time Route 8.

5.43 The JTR 8 northbound journey times in the 2036 forecast models are higher than the Base year, especially on the two southernmost sections, which include the effects of the congestion in the A149/Norwich Road/Grammar School Road junction. The overall Do Something journey time is 130 seconds faster than the Do Minimum and the Do Something with Mitigation is 38 seconds faster. It can be observed that despite the increase in trips from the NWWUE, the Link Road releaves some of the congestion on the B1150 Norwich Road.

5.44 In the Do Something with Mitigation scenario, vehicles which are deterred from routing along Aylsham Road due to the mitigation, add to the already congested B1150 Norwich Road route, increasing the journey times through the junction. However, the journey time is still faster than the Do Minimum scenario.

5.45 There is a smaller difference on JTR 8 southbound between the different scenarios: the Do Something is 32 seconds slower than the Do Minimum, while Do Something with Mitigation is 9 seconds slower than the Do Minimum.



5.1

Figure 5-21 – Journey Time 8 Northbound PM

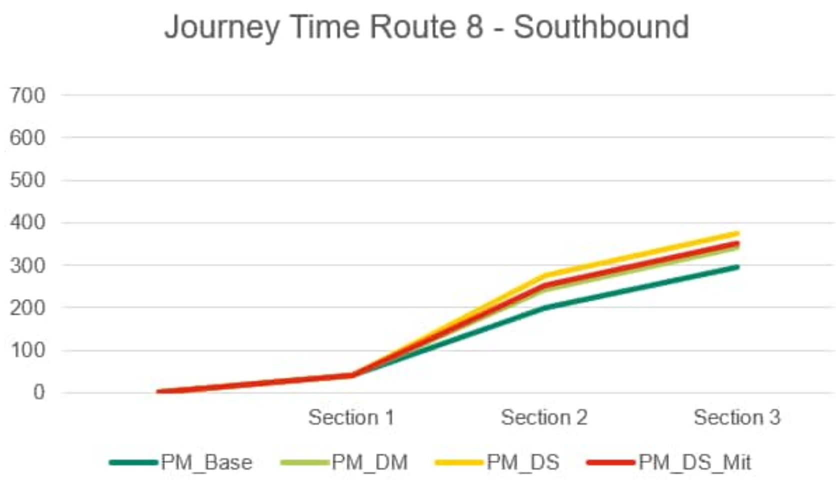


Figure 5-22 – Journey Time 8 Southbound PM

6. Junction Analysis

Introduction

6.1 This section presents the analysis of results for the junctions within the study area which have been identified from the survey data/observations in the model area as having the most significant impact on network operation.

Key Junctions

6.2 The key locations are defined as follows and can also be seen in Figure 6-1 below:

- 1 - Cromer Road / A149 / B1145 Junction;
- 2 - Cromer Road / Aylsham Road / Mundesley Road Junction;
- 3 - B1150 Norwich Road / A149 Junction; and
- 4 - Norwich Road / Millfield Road Junction.

6.3 These locations have been analysed individually in the models to extract queue and delay results for the Do Minimum, Do Something, and Do Something with Mitigation scenarios, to provide an assessment of the NWWUE development impact.

6.4 The junction analysis results have been extracted from the Forecast models for each junction. The Millfield Road junction has been run independently with the signals at B1150 Norwich Road / A149 / Grammar School Road being deactivated so that queues and delays can be accurately attributed to this junction.

6.5 It should be noted that the operation of some of these key locations depends on variable factors such as on-street parking and courtesy/give-way behaviours, which have been modelled and calibrated to observed queuing patterns/ levels of delay.

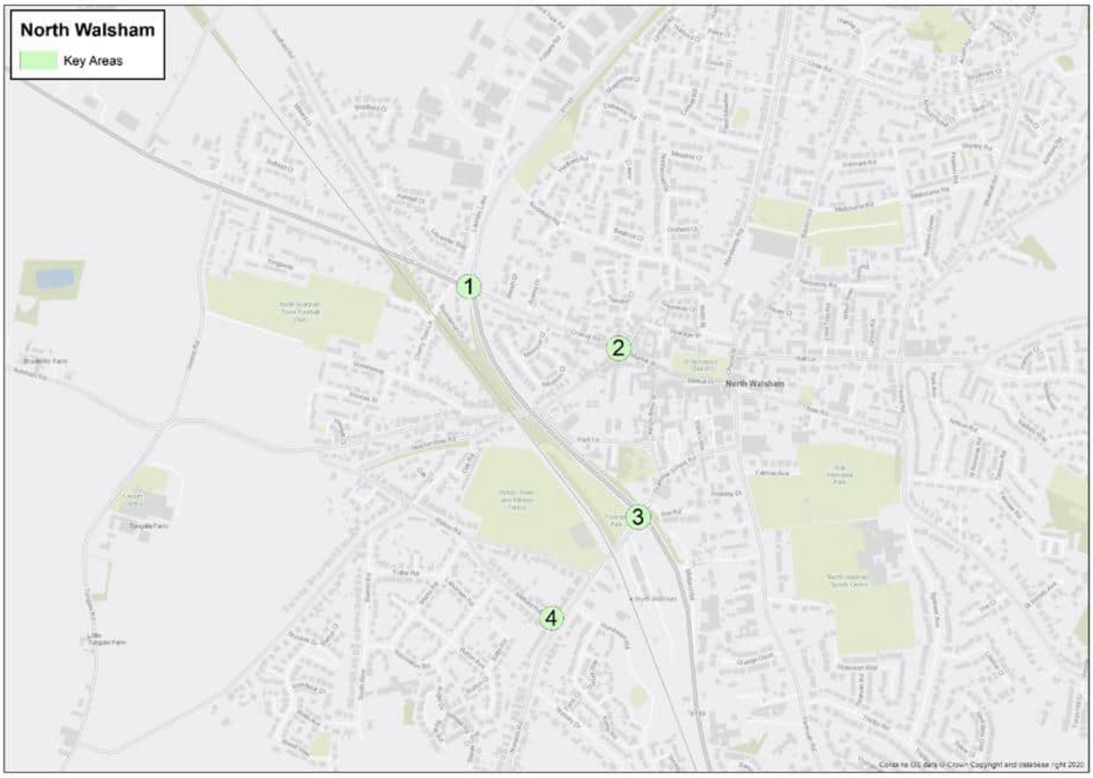


Figure 6-1 – Key Junctions in North Walsham Model Area

Cromer Road / A149 / B1145 Junction (1)

6.6 Figure 6-2 and Figure 6-3 show the queues and delays in the AM and PM peak hours at the Cromer Road / A149 / B1145 junction. The queue results are set out in the top junction layout and the delays are in the bottom junction layout.

6.7 The model results show that the NWWUE development demand included in the AM and PM Do Something / Do Something with Mitigation scenarios results in only a negligible increase in queues and delays at the junction.

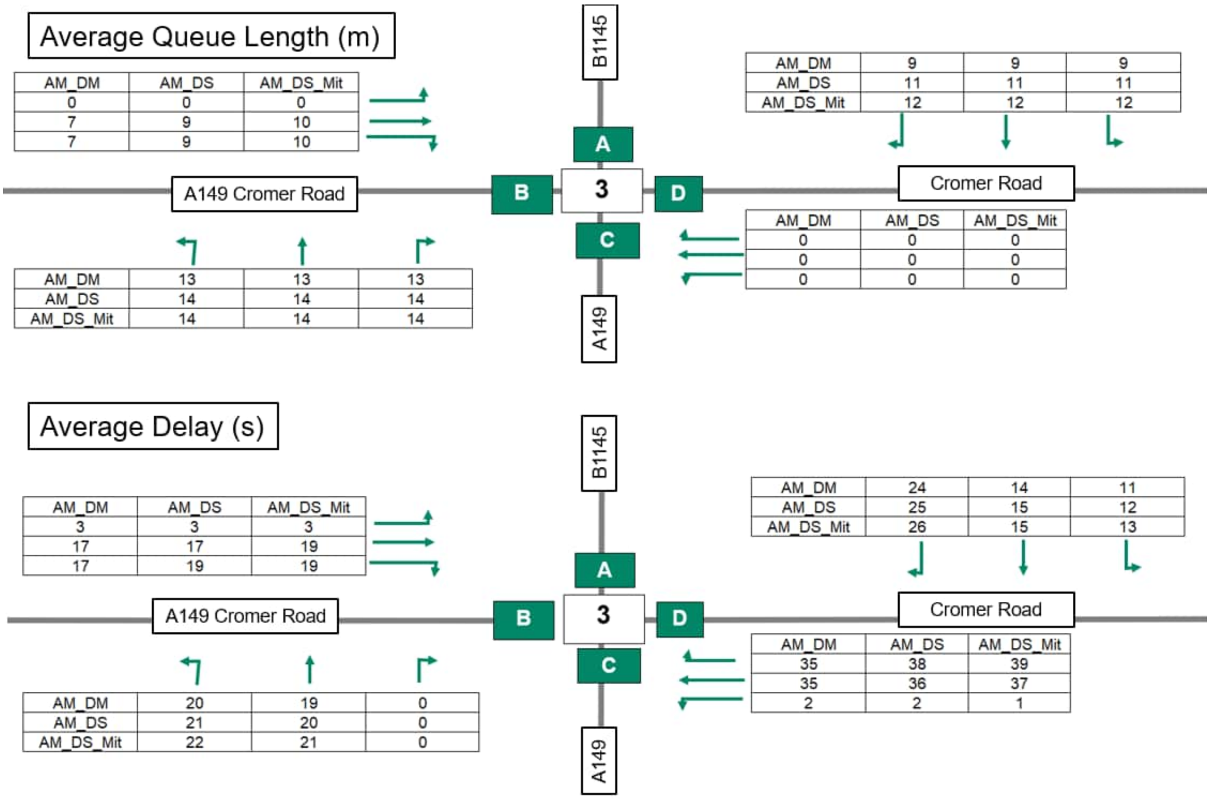


Figure 6-2 – Queues in metres and delay in seconds - AM Peak

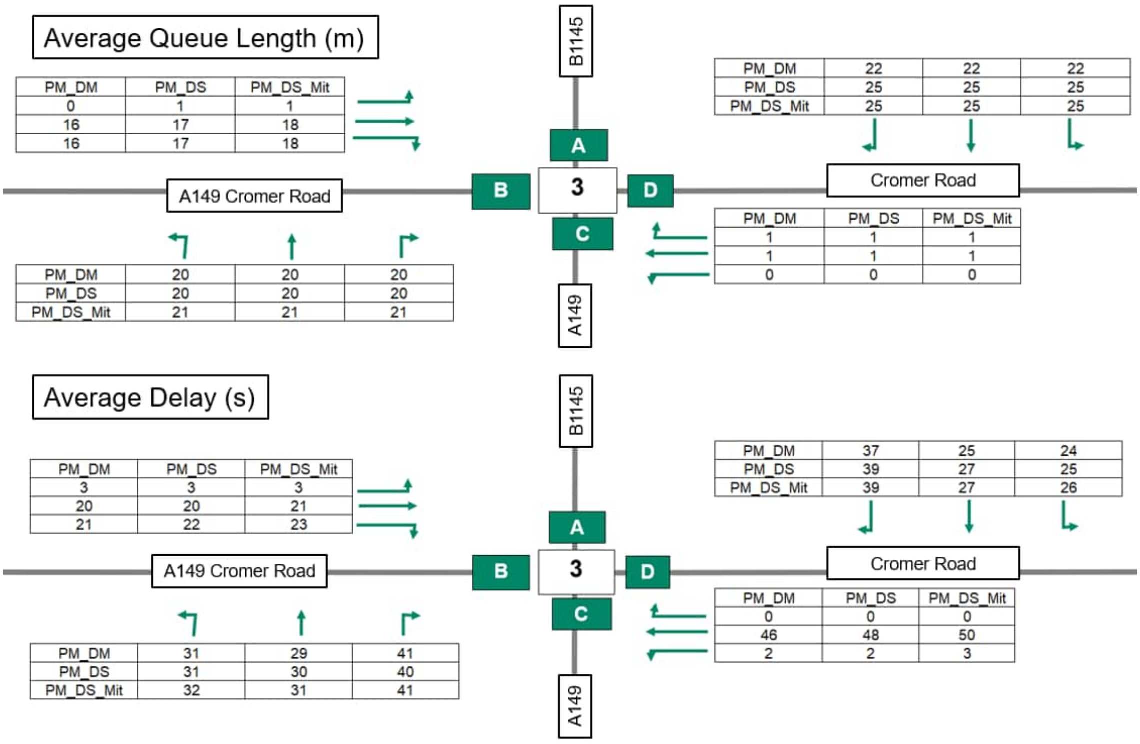


Figure 6-3 – Queues in metres and delay in seconds - PM Peak

Cromer Road / Aylsham Road / Mundesley Road Junction (2)

6.8 Figure 6-4 and Figure 6-5 show the queues and delays in the AM and PM peak hours at the Cromer Road / Aylsham Road / Mundesley Road junction. The queue results are set out in the top junction layout and the delays are in the bottom junction layout.

6.9 The model results show that the NWWUE development demand included in the AM and PM Do Something / Do Something with Mitigation scenarios results in only a negligible increase in queues and delays at the junction.

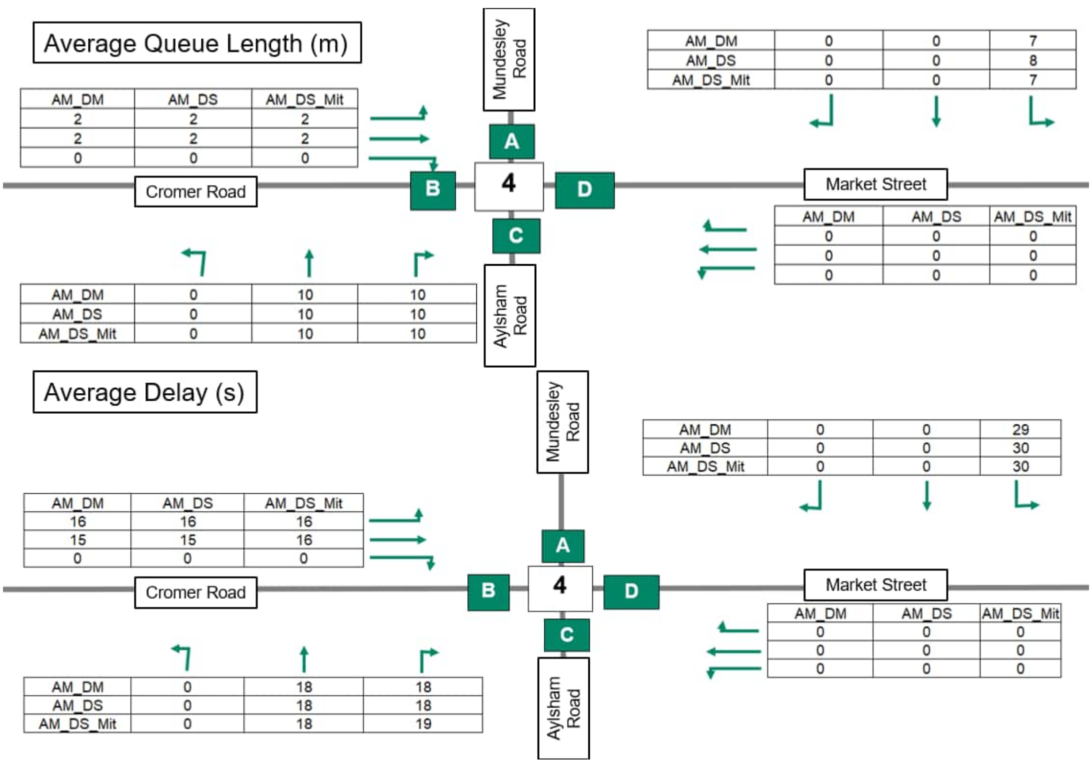


Figure 6-4 – Queues in metres and delay in seconds - AM peak

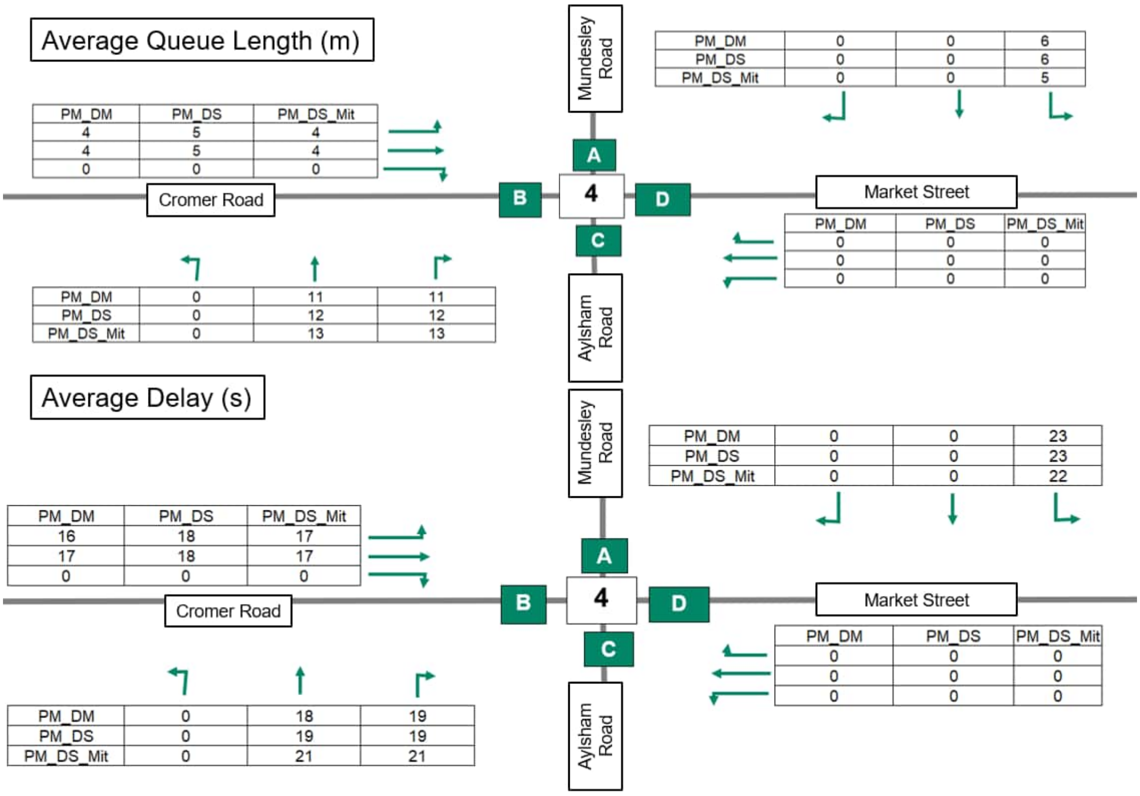


Figure 6-5 – Queues in metres and delay in seconds - PM peak

B1150 Norwich Road / A149 Junction (3)

6.10 Figure 6-6 shows the queues and delays at the signalised junction between Norwich Road and A149 (North Walsham Bypass) in the AM peak hour. The queue results are set out in the top junction layout and the delays are in the bottom junction layout.

6.11 The junction analysis results show that the A149/Norwich Road/Grammar School Road junction does not provide enough capacity to accommodate the forecasted demand in the AM Do Something / Do Something with Mitigation, resulting in significant queues and delays approaching the junction, with Norwich Road being the most affected.

6.12 When comparing the Do Minimum with the Do Something scenario, the addition of the NWWUE development trips in the AM Do Something scenario results in an increase in delay of approximately 150 seconds approaching the junction from the west for the left-turn, though this reduces to approximately 50-60 seconds for the straight-ahead and right-turn movements. The main capacity issue is for the left-turn movement from Norwich Road to the A149 northbound; due to the extensive queuing on this approach the left-turn flare struggles to be accessed, as vehicles need to change lanes twice, and is therefore inefficiently utilised and there is also limited green time allocated to the left-turn movement.

6.13 The increase in delay noted above in the Do something scenario relative to the Do Minimmum is also reflected in longer queues. Queues increase by approximately 120 metres on the Norwich Road approach. The queues generated at the A149/ Norwich Road/Grammar School Road junction reach the Norwich Road/ Millfield Road junction reducing gap availability for the vehicles from Millfield Road to access Norwich Road northbound.

6.14 When comparing the Do Something scenario with the Do Something with Mitigation, it can be observed that the mitigation scheme causes a small, but consistent increase in queues and delays at all arms of the junction. This is caused by the mitigation making Aylsham Road a less attractive route and vehicles rerouting through this junction.

6.15 The increase in delay at the other arms and movements is significantly lower at approximately 10 to 20 seconds on the remaining three arms.

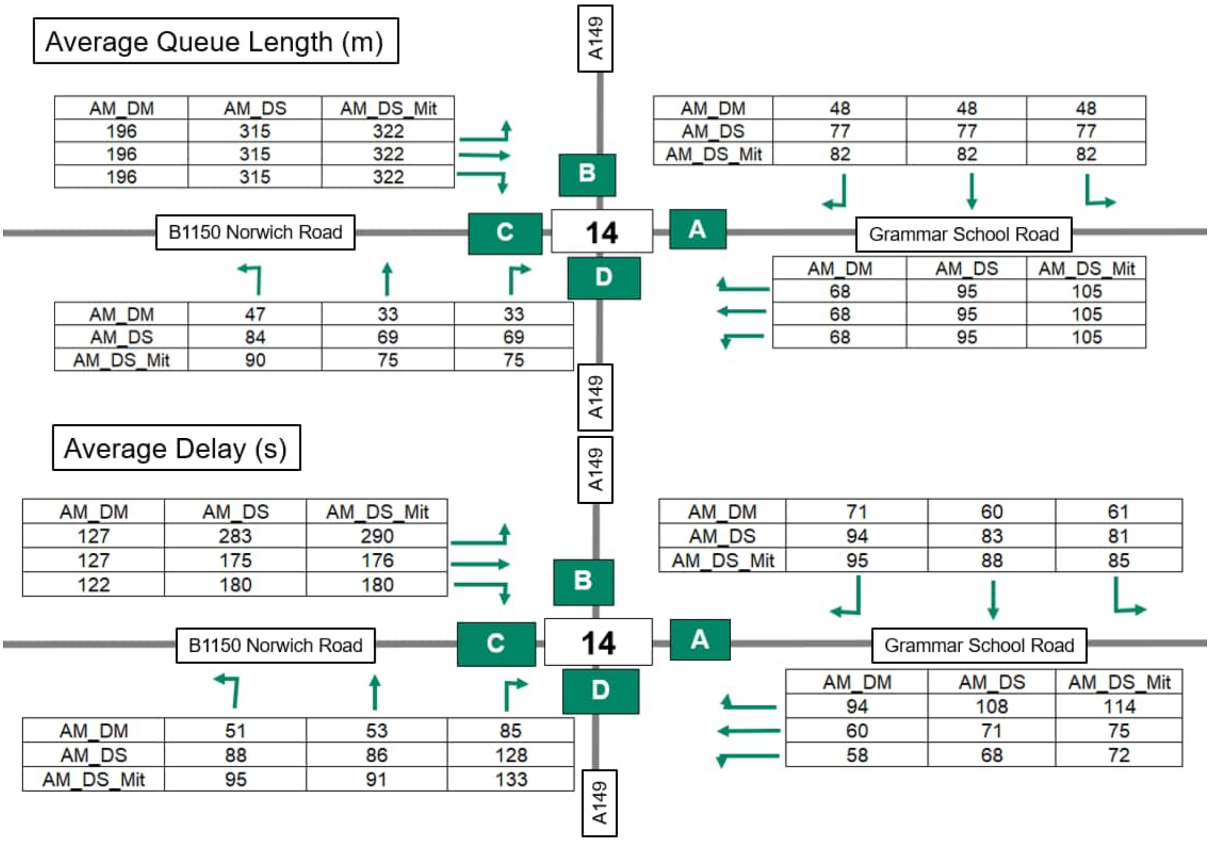


Figure 6-6 – Queues in metres and delay in seconds - AM peak

6.16 Figure 6-8 shows the queues and delays at the signalised junction between Norwich Road and A149 for the PM peak hour.

6.17 As in the AM peak, the junction analysis results show that the A149/Norwich Road/Grammar School Road junction does not provide enough capacity to accommodate the demand in any of the forecast scenarios, resulting in significant queues and delays approaching the junction, especially in Norwich Road.

6.18 The addition of the NWWUE development trips and link road in the Do Something scenario results in an approximate 10-second reduction in delay approaching the junction from B1150 Norwich Road. There are, however, increases in delay of approximately 30-50 seconds in the remaining three arms.

6.19 When comparing the Do Minimum scenario to the Do Something, the average queue length along B1150 Norwich Road was reduced by approximately 80 metres in the Do Something scenario. However, the A149 arms and Grammar School Road arm increased by approximately 50-60 metres. Delays follow similar suit as there is a decrease in the B1150 Norwich Road but an increase in the rest of the arms. This is caused by the routing allowed by the Link Road. Additionally, this effect seems to be also caused by the signals at the junction, which respond differently to the different arrival patterns.

6.20 When comparing the Do Somethingscenario to the Do Something with Mitigation scenario it can be observed that the mitigation causes more delay, which results in more vehicles routeing through the B1150 Norwich Road junction, increasing delay in this location. This changes the arrival patterns at the junction, meaning these is less queueing on the A149 southbound but an increased queue on Norwich Road in the Do Something with Mitigation.

6.21 The routing patterns in the PM peak are mainly formed by vehicles travelling to North Walsham town centre from the main access points (Norwich road and A149). The Link Road together with Aylsham Road provides a suitable alternative route that allows some of these vehicles to reach the town centre and avoid the delays at Norwich road / A149 junction. Figure 6-7, shows the different routes in blue, orange and green.

6.22 It should be noted that the additional delay in Aylsham Road created by the proposed mitigation makes both routes (Link Road in blue and Millfield Road in orange) less attractive, reducing the number of vehicles that choose this route over the B1150 Norwich Road / A149 junction (green in the figure).

6.23 This difference between Do Something and Do Something with Mitigation is not apparent in the AM peak due to the different routing patterns and the tidal nature of flows.

Figure 6-7 Alternative routes into North Walsham town centre from the south.

6.24 Changes in delay and queues on Grammar School Road and the A149 Northbound are negligible between the Do Something and the Do Something with Mitigation.

6.25 The difference in queues and delays between the Do Minimum and Do Something is lower than in the AM Peak, due to higher congestion levels in the PM Do Minimum scenario and the different travel patterns generated by the NWWUE development.

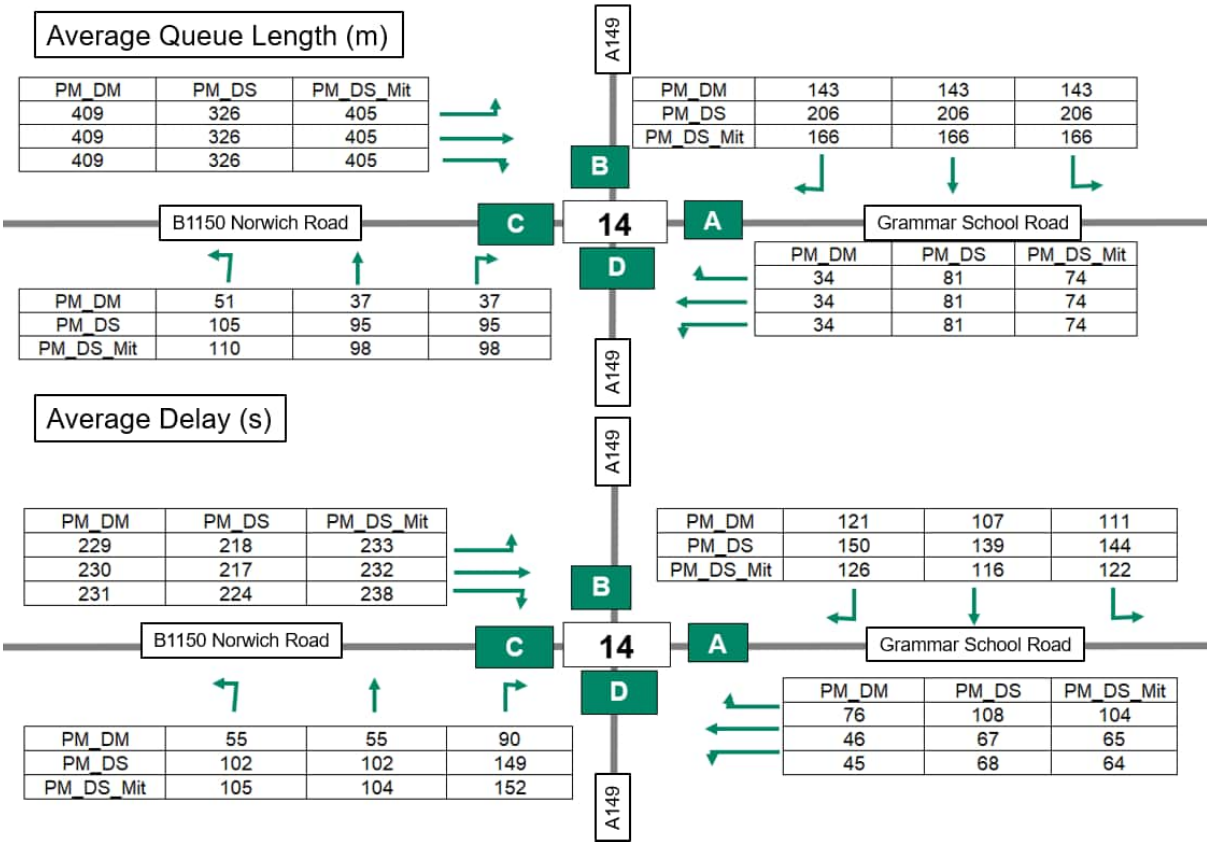


Figure 6-8 – Queues in metres and delay in seconds - PM peak

Norwich Road / Millfield Road Junction (4)

6.26 Figure 6-9 shows the queues and delays at the signalised Norwich Road/ Millfield Road junction for the AM peak hour. The queue results are set out in the top junction layout and the delays are in the bottom junction layout.

6.27 The results show no significant impact on this junction in the AM and PM peaks as the queues and delays are relatively stable after additional trips from the NWWUE development. It should be noted that the operation of this junction is likely to be affected by the queues generated at the A149/Norwich Road/Grammar School Road junction.

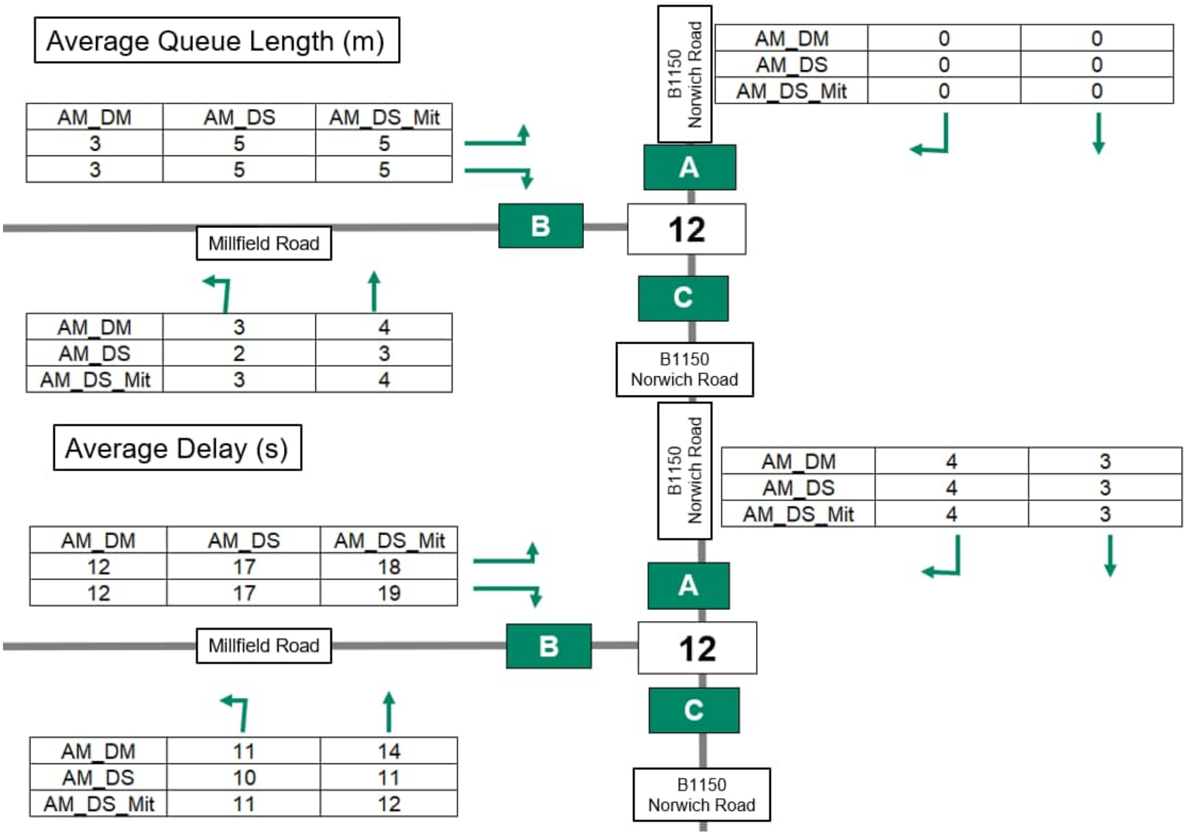


Figure 6-9 – Queues in metres and delay in seconds - AM peak

6.28 Figure 6-10 shows the queues and delays at the Norwich Road/ Millfield Road junction in the PM peak hour.

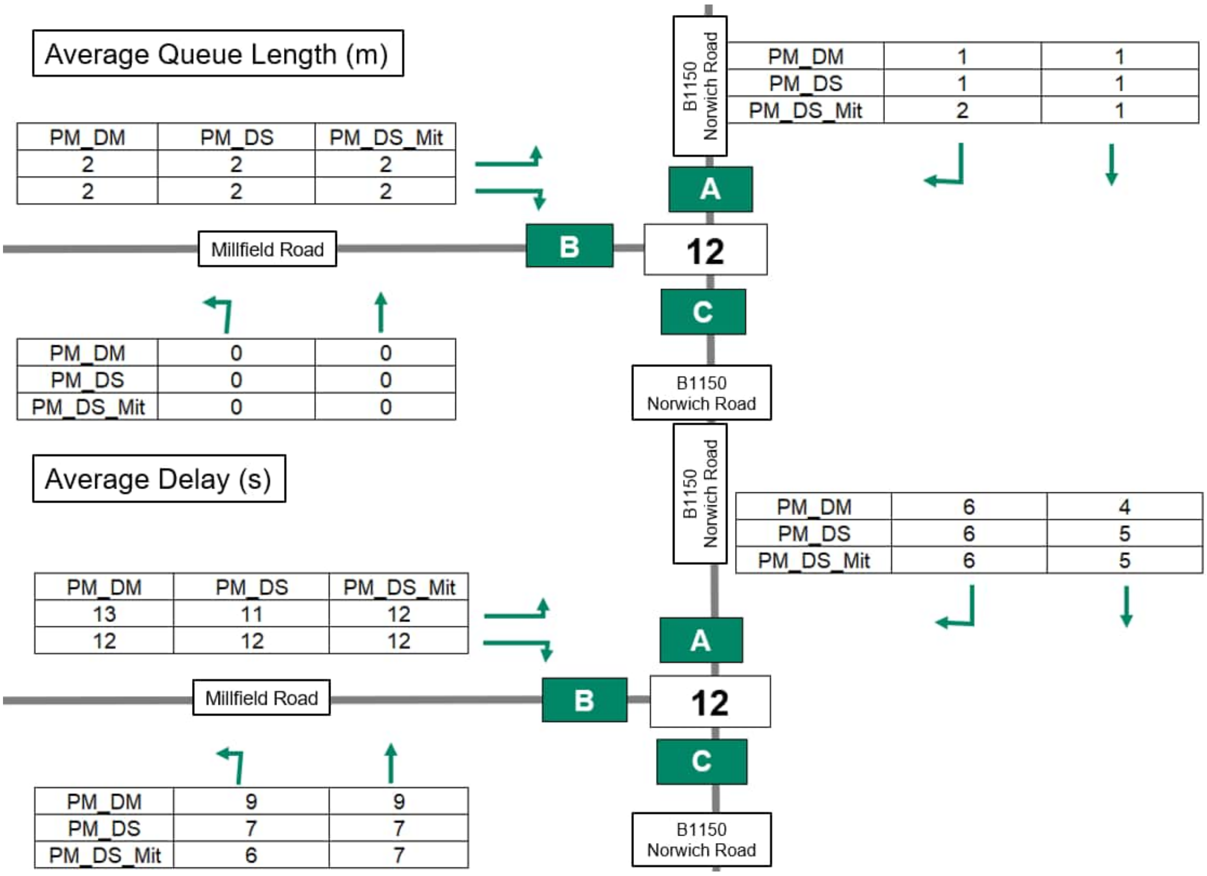


Figure 6-10 – Queues in metres and delay in seconds - PM peak

7. Conclusions

7.1 The forecast Vissim models have been developed and updated to represent the 2036 future year scenarios for the Do Minimum (future growth without North Walsham Western Urban Extension (NWWUE) but including the proposed infrastructure changes at the B1150 / A149 signalised junction) and Do Something (with NWWUE). A further Do Something with Mitigation model has also been developed to include the Aylsham Road one-way signalised junction under the bridge. The comparison of the Do Something and Do Minimum has been made to assess the impact of the NWWUE development.

7.2 The models show that the Norwich Road / A149 signalised junction struggles to accommodate the forecasted demand, resulting in longer queues and delays on all approaches which can impact other junctions such as the Norwich Road / Millfield Road junction. While there is an increase in queue and delay in the AM peak, in the PM peak, the Do Something model has a shorter queue length and lower delay when compared to the Do Minimum PM. The Do Something with Mitigation PM peak has a similar queue length and delay as the Do Minimum PM model.

7.3 The Do Something with Mitigation models increase slightly queue lengths and delays at other locations in the network, such as Aylsham Road with the Link Road junction, due to the mitigation reducing the attractiveness of the Aylsham Road underpass. However, these rerouting effects are considered negligible when comparing the Do Something and Do Something with Mitigation scenarios.

7.4 The model operation and results from the other key locations identified in the area, such as Aylsham Road or the Cromer Road/ B1145 signalised junction, show that the additional NWWUE trip generation in the 2036 forecast year will not significantly increase queues and delays at these locations.

8. Appendix A – Demand Development

External Residential Trips – AM Peak

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1																														16	4	8	2			
2																														9	2	5	1			
3																														0	0	0	0			
4																														42	11	21	5			
5																														14	4	7	2			
6																														12	3	6	1			
7																																				
8																																				
9																														5	1	3	1			
10																														3	1	1	0			
11																																				
12																														5	1	3	1			
13																																				
14																																				
15																																				
16																																				
17																																				
18																																				
19																																				
20																																				
21																																				
22																																				
23																																				
24																																				
25																														3	1	2	0			
26																														2	0	1	0			
27																														1	0	1	0			
28																														0	0	0	0			
29																														0	0	0	0			
30	45	26	1	118	38	33			15	8		15													9	5	3	1	1							
31	12	7	0	31	10	9			4	2		4													2	1	1	0	0							
32	22	13	0	58	19	17			8	4		8													5	2	2	0	0							
33	5	3	0	14	4	4			2	1		2													1	1	0	0	0							
34																																				
35																																				
36																																				

Internal Residential Trips – AM Peak

Zone	30	31	32	33	34	35	36
30					87	7	7
31					23	2	2
32					43	4	4
33					10	1	1
34	31	8	16	4			
35	3	1	1	0			
36	3	1	1	0			

External Residential Trips – PM Peak

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1																														40	11	20	5			
2																														23	6	12	3			
3																														1	0	0	0			
4																														104	28	52	12			
5																														34	9	17	4			
6																														30	8	15	3			
7																																				
8																																				
9																														13	4	7	2			
10																														7	2	3	1			
11																																				
12																														13	4	7	2			
13																																				
14																																				
15																																				
16																																				
17																																				
18																																				
19																																				
20																																				
21																																				
22																																				
23																																				
24																																				
25																														8	2	4	1			
26																														4	1	2	0			
27																														3	1	1	0			
28																														1	0	0	0			
29																														1	0	0	0			
30	22	13	0	58	19	16			7	4		7													4	2	1	0	0							
31	6	3	0	15	5	4			2	1		2													1	1	0	0	0							
32	11	6	0	29	9	8			4	2		4													2	1	1	0	0							
33	3	1	0	7	2	2			1	0		1													1	0	0	0	0							
34																																				
35																																				
36																																				

Internal Residential Trips – PM Peak

Zone	30	31	32	33	34	35	36
30					2	3	3
31					1	1	1
32					1	1	1
33					0	0	0
34	4	1	2	0			
35	5	1	2	1			
36	5	1	2	1			

Employment Trips (Car/LGV) – AM Peak

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1																																		2	14	14
2																																		1	6	6
3																																		0	0	0
4																																		2	15	15
5																																		2	10	10
6																																		1	9	9
7																																				
8																																				
9																																				
10																																		1	6	6
11																																				
12																																				
13																																				
14																																		1	7	7
15																																				
16																																				
17																																				
18																																				
19																																				
20																																				
21																																				
22																																		1	7	7
23																																				
24																																				
25																																				
26																																				
27																																				
28																																				
29																																				
30																																				
31																																				
32																																				
33																																				
34	0	0	0	0	0	0				0				0								0														
35	3	1	0	3	2	2				1				1								1														
36	3	1	0	3	2	2				1				1								1														

Employment Trips (HGV) – AM Peak

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1																																				
2																																				
3																																				
4																																				
5																																			4	4
6																																				
7																																				
8																																				
9																																				
10																																				
11																																				
12																																				
13																																				
14																																				
15																																				
16																																				
17																																				
18																																				
19																																				
20																																				
21																																				
22																																				
23																																				
24																																				
25																																				
26																																				
27																																				
28																																				
29																																				
30																																				
31																																				
32																																				
33																																				
34																																				
35					2																															
36					2																															

Employment Trips (Car/LGV) – PM Peak

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1																																		0	4	4
2																																		0	1	1
3																																		0	0	0
4																																		0	4	4
5																																		0	2	2
6																																		0	2	2
7																																				
8																																				
9																																				
10																																		0	2	2
11																																				
12																																				
13																																				
14																																		0	2	2
15																																				
16																																				
17																																				
18																																				
19																																				
20																																				
21																																				
22																																		0	2	2
23																																				
24																																				
25																																				
26																																				
27																																				
28																																				
29																																				
30																																				
31																																				
32																																				
33																																				
34	2	1	0	2	1	2				1				1								1														
35	10	4	0	11	7	6				4				5								5														
36	10	4	0	11	7	6				4				5								5														

Employment Trips (HGV) – PM Peak

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1																																				
2																																				
3																																				
4																																				
5																																			1	1
6																																				
7																																				
8																																				
9																																				
10																																				
11																																				
12																																				
13																																				
14																																				
15																																				
16																																				
17																																				
18																																				
19																																				
20																																				
21																																				
22																																				
23																																				
24																																				
25																																				
26																																				
27																																				
28																																				
29																																				
30																																				
31																																				
32																																				
33																																				
34																																				
35					2																															
36					2																															

aecom.com

AECOM

Coltishall Forecast Model Report

The Client ESCO Developments, Flagship Housing Group and Lovell Partnerships

22nd September 2023

Delivering a better world

Quality information

Prepared by	Checked by	Verified by	Approved by
Martin Drapier Gomis Senior Consultant Graduate Consultant	Martin Drapier Gomis Senior Consultant	Javier Navarro Pardo Principal Consultant	Phil Arnold Associate Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

The Client ESCO Developments, Flagship Housing Group and Lovell Partnerships

Prepared by:

Martin Drapier Gomis
Senior Consultant
M: +44 7921646161
E: martin.drapiergomis@aecom.com

AECOM Limited
Aldgate Tower
2 Leman Street
London E1 8FA
United Kingdom
aecom.com

Table of Contents

Figures

Tables

1. Introduction

Background

1.1 ESCO Developments, Flagship Housing Group and Lovell Partnerships ('The Client Group') have commissioned AECOM to develop Vissim forecast models of the village of Coltishall to assess the future operation of the road network and the potential impact of the North Walsham Western Urban Extension (NWWUE).

1.2 The Vissim models have been developed for the 2036 year to assess the impact of the NWWUE development and predict the future traffic conditions in the model area. The growth in traffic demand and the additional demand generated by the NWWUE has been calculated in line with the Transport Assessment (TA) developed by AECOM.

1.3 This Forecast Modelling Report documents the development of the models from the base year scenario and presents the results of the future year assessments.

Base Vissim Model

1.4 The 2022 Vissim Base model for Coltishall has been used as a starting point to develop the forecast scenarios. AECOM developed and validated the Vissim Base model in late 2022.

1.5 The Base model was successfully calibrated and validated to replicate the existing operation during the traffic surveys, for the Coltishall modelled area, as shown in Figure 1-1. Further details regarding the Base model operation and the calibration and validation results can be found in the Vissim Local Model Validation Report (LMVR) for Coltishall.

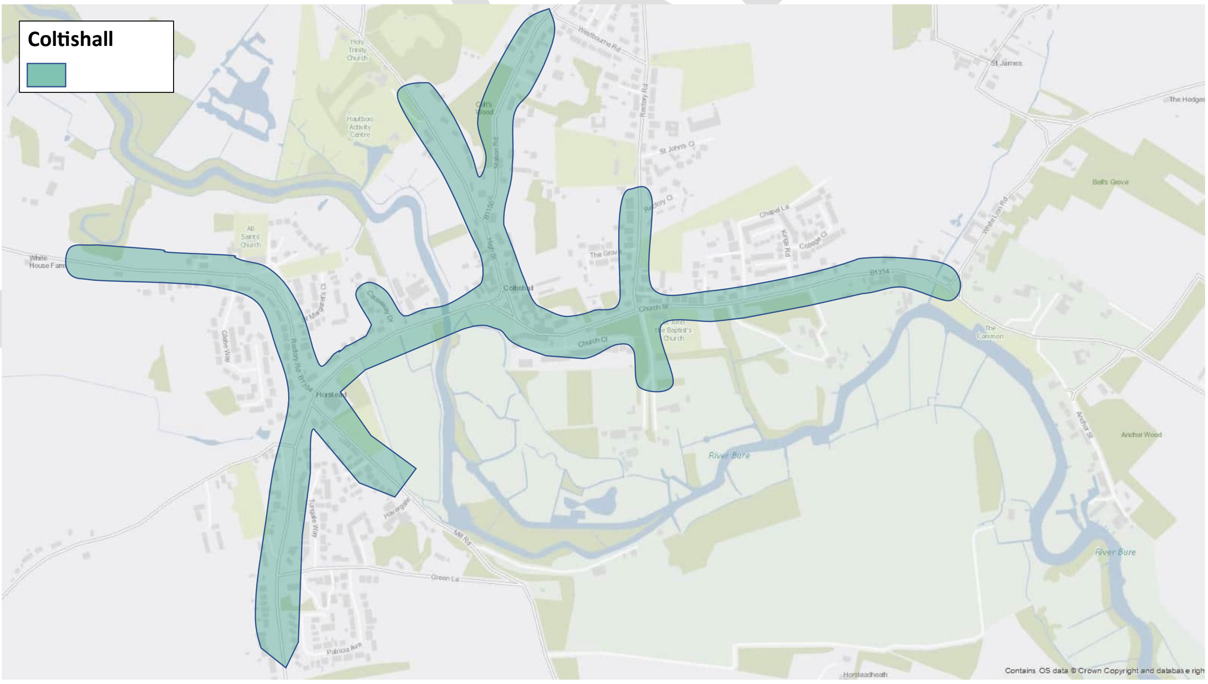


Figure 1-1 Coltishall Vissim Model Area

1.6 The forecast year models have been developed for the 2036 forecast year. The models were developed for the Weekday AM and PM peak hours, defined as 07:45 – 08:45 and 16:30 – 17:30. Fifteen-minute warm-up and cool-down periods have also been modelled to saturate the network with traffic, before the evaluated peak hour, and allow journeys to complete after the peak hour.

Model Purpose

1.7 The forecast models have been used to assess the operation of the network in 2036 in line with the forecast assumptions contained in the Transport Assessment for the NWWUE. Three different scenarios: 'Do Minimum', 'Do Something', and 'Do Something with Mitigation' have been developed for the 2036 forecast year. Definition of these scenarios and the changes they include from the base modelling can be found in Table 2-1.

1.8 The operation of the Do Minimum model was used as a benchmark to assess the impact of the trips generated by the NWWUE which were included in the Do Something scenarios.

Report Structure

1.9 The remainder of the report is structured as follows:

- Section 2 outlines the development of the forecast models and scenarios that have been tested;
- Section 3 describes the demand development methodology for the future year;
- Section 4 describes the assignment methodology;
- Section 5 presents and analyses the forecast modelling results;
- Section 6 presents and analyses the operation of the key areas; and
- Section 7 provides a summary and concludes the forecast modelling.

2. Forecast Model Development

Overview

2.1 The Coltishall forecast models were coded using the same version of Vissim 21.00-12 (64-bit) used to develop the 2022 Base models. This section outlines the changes made to the Base models to build the forecast models.

2.2 Three forecast model scenarios were developed:

- 2036 'Do Minimum' model for AM and PM peak periods;
- 2036 'Do Something' model for AM and PM peak periods; and
- 2036 ‘Do Something with Mitigation’ model for AM and PM peak periods.

2.3 The networks and demand flows used for each of the scenarios are set out in Table 2-1 below.

Table 2-1 Forecast Scenarios

Scenario	Network	Demand
2036 Do Minimum	Base Model network	2022 Base * 2022-2036 Growth Factor
2036 Do Something	Base Model network	2036 Do Minimum + NWWUE 2036 Demand
2036 Do Something with Mitigation	Base Model network + Right-turn lane on Norwich Road + Removal of on-street parking on High Street	2036 Do Minimum + NWWUE 2036 Demand

Network Coding

2.4 There are no proposed changes to the network in the 2036 Do Minimum and Do Something scenarios, so all modelling features - such as the desired speed decisions, reduced speed areas, public transport and priority rules remain consistent with the Base models.

2.5 The Do Something with Mitigation scenario includes a network change along B1150 Norwich Road, where a 20-metre right turn pocket is introduced to avoid right turners to the B1354 Church Street blocking northbound traffic on B1150 Norwich Road. The general layout of this infrastructure change can be seen in Figure 2-1 below.

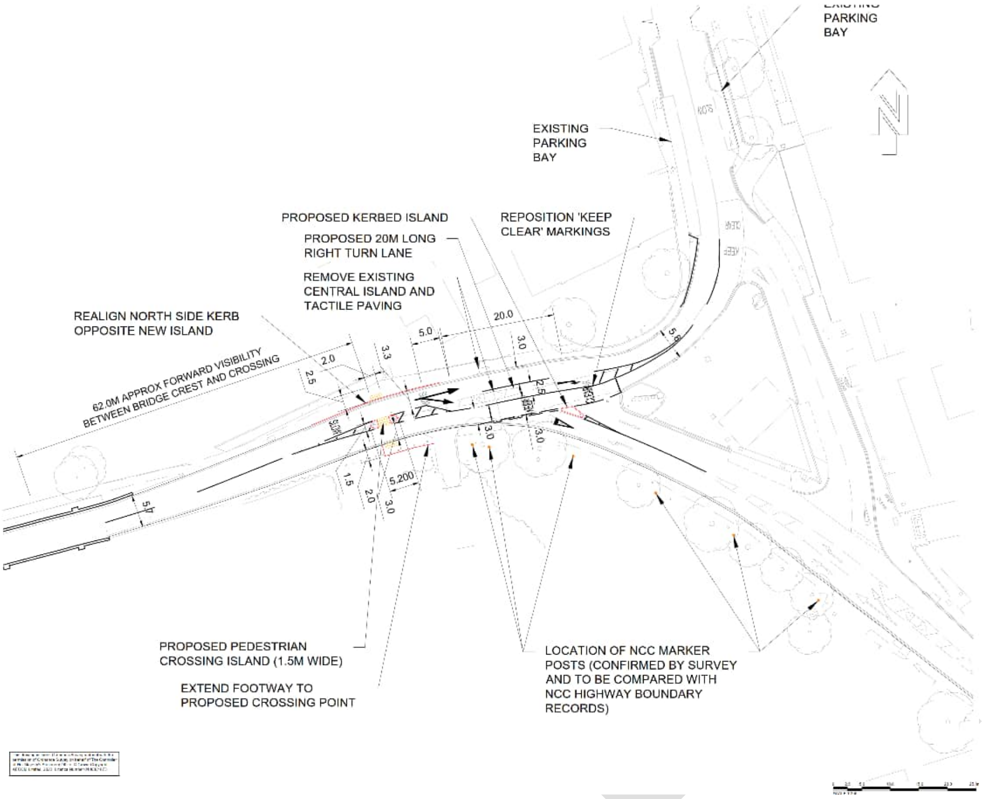


Figure 2-1 B1150 Norwich Road Proposed Infrastructure Change Layout

2.6 The Do Something with Mitigation scenario also includes removal of on-street parking along High Street in the PM peak. The PM base model includes a section of carriageway where traffic cannot pass in both directions at the same time, to replicate observed behaviour caused by the on street parking. This is not included in the AM peak base year as this behaviour/ parking was not observed, with traffic flowing freely along this section. The presence of parked cars can be seen in Figure 2-2, in an image taken from Google StreetView. This image shows that cars are parked on both sides of the street, which limits the road space available for vehicles to pass. In addition, Figure 2-3 shows a still taken from the in-vehicle footage used to survey journey times in the PM period, which shows how parked cars impede the free flow of traffic in both directions.

Figure 2-2 Parked cars on High Street

Figure 2-3 PM queuing on High Street, from floating car footage

2.7 It should be noted that the links at the edges of the forecast models have been extended to allow the models to capture the full extent of longer queues caused by the increased traffic volumes in future years. These are only theoretical extensions, so the full extent of the delay is reported in the results, however, this does not represent any change to the modelled area.

3. Future Year Demand

Introduction

3.1 The forecast demand included in the Vissim models has been derived from the Transport Assessment (TA) developed by AECOM.

Zoning

3.2 Since the forecast models do not include any significant network changes from the base models, the zoning system developed for the Vissim Base models remains unchanged in the forecast scenarios.

3.3 A map of the zones from the forecast scenarios has been reproduced below in Figure 3-1.

Figure 3-1 Vissim Forecast Model Zone Map

Demand Methodology

3.4 The forecast Vissim demand matrices were derived using the growth factors and the trip distribution from the TA developed by AECOM. A complete list of the development demand matrices can be found in Appendix A.

3.5 Table 3-1 shows the growth factors derived from the Trip End Model Presentation Program (TEMPro) for each forecast year. These have been taken from the TA. These growth factors were applied to the base model demand matrices to uplift traffic volumes for the Do Minimum scenarios.

Table 3-1 Growth Factors

Vehicle Type	2036 AM	2036 PM
Car	1.084	1.080
LGV	1.084	1.080
HGV	1.050	1.050

3.6 The NWWUE trip generation and trip distribution assumptions included in the TA have been used to derive the number of additional trips and routes through Coltishall associated with the NWWUE. Table 3-2 details the additional development-related trips included in the Do Something and Do Something with Mitigation models which would travel through Coltishall on their journey to and from the development. Full details of the forecast demand changes can be found in Appendix A.

Table 3-2 WUE Development Demand

Development Demand	2036 AM	2036 PM
Car / LGV	260	251
HGV	0	0

3.7 It should be noted that the development trip totals were provided split into two vehicle types: Cars/Light Good Vehicles (LGVs) and Heavy Goods Vehicles (HGVs). However, the Vissim models categorise Cars and LGVs as separate vehicle types. To account for this, Car and LGV proportions were calculated from the base matrix and used to split the development demand.

3.8 The development of additional demand from Zone 4 to itself included in the figures provided by the TA was manually reduced to 0 in the Vissim model. These trips were determined to be U-turns that would realistically occur outside the modelled area.

3.9 The absolute demand changes for each Origin-Destination (OD) pair were applied by vehicle class (Cars, LGVs and HGVs) to the base peak hour matrices from the Vissim base model to develop the Forecast demand matrices.

3.10 The forecast peak hour matrices were profiled into 15-minute periods using the same profiles used in the Vissim base model matrices to develop each 15-minute matrix, creating six matrices for each vehicle type.

4. Model Assignment and Evaluation

4.1 The assignment methodology used in the forecast models has been kept consistent with the base models and as set out in the LMVR.

4.2 The evaluation results are based on the average of 20 simulation runs with different random seeds. Different random seeds randomise the release of vehicles into the network, resulting in a different chain of events, replicating daily variability.

5. Model Results

Introduction

5.1 This section presents the analysis of results for the Base, Do Minimum, Do Something, and Do Something with Mitigation forecast scenarios. The results were extracted for the following models:

- Base (2022) – AM and PM peak hours;
- Do Minimum (2036) – AM and PM peak hours;
- Do Something (2036) – AM and PM peak hours; and
- Do Something with Mitigation (2036) – AM and PM peak hours.

5.2 The analysis in the following section has been divided into the AM and PM peak hours which have unique characteristics. A detailed analysis of the critical areas in the network is provided in Section 6.

AM Results

5.3 This section presents results for the full modelled network in the AM period and includes an analysis of average delay, plots of average speeds and journey times within the modelled area.

Network Performance – AM Peak

5.4 The Network Performance results and average speed plots have been extracted from the models to assess the operation of the overall network. These results provide the overall delays for each scenario to enable comparison of the performance of the network in each scenario.

Average Delay

5.5 Figure 5-1 shows the average delay per vehicle within the network for the four scenarios for the AM peak hour.

5.6 The graph shows that there is a large increase in average delay per vehicle in the Do Minimum, Do Something, and Do Something with Mitigation scenarios, when compared to the base scenario. The Do Minimum scenario increases to an average of 118 seconds per vehicle from 84 seconds per vehicle in the Base. While the Do Something scenario has the greatest average delay, increasing to 236 seconds per vehicle. However, when the mitigation is in place, the average delay is reduced to 141 seconds per vehicle, so the mitigation is predicted to offset most of the impact of the additional NWWUE trips, so the development would only increase delay by 23 seconds on average.

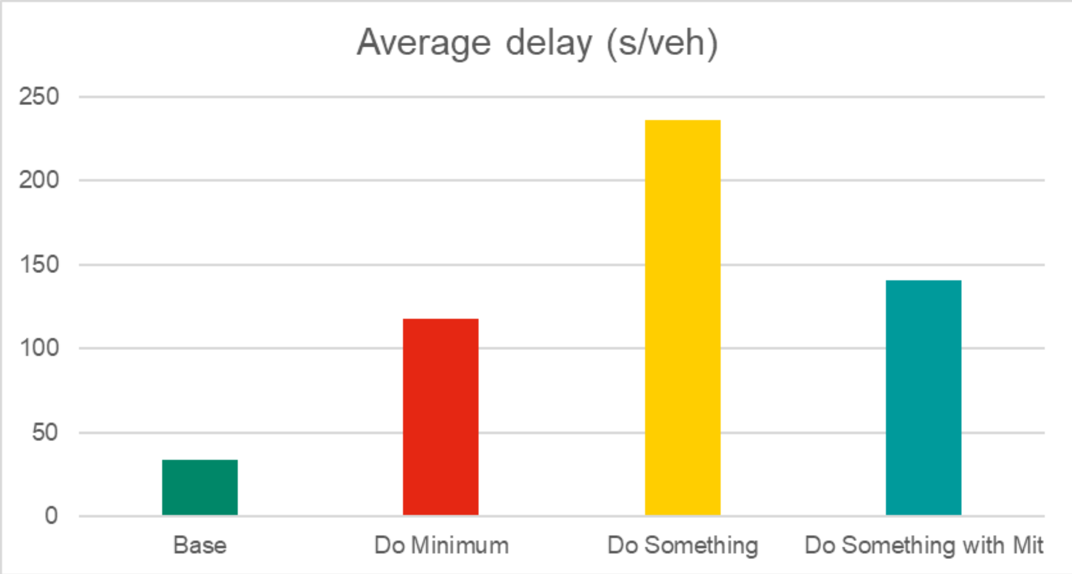


Figure 5-1 Average AM Delay

Average Speed Plots

5.7 The average speed results have been plotted on the modelled network for the AM Base and the three AM forecast scenarios and these are shown in Figure 5-2 through to Figure 5-5.

5.8 The increase in NWWUE demand included in the Do Something scenario increases queues through Colitshall, as shown in Figure 5-4. A significant proportion of this congestion originates from the right turn from Norwich Road to the B1354, just before the garage; the increase in southbound traffic volumes significantly reduces the gaps available for right-turning vehicles, blocking the eastbound and northbound movements. The speeds are higher in the Do Something with Mitigation scenario, due to the provision of a right-turn pocket, allowing traffic to flow more freely on the B1150 Norwich Road northbound.

Figure 5-2 Base AM Average Speeds

Figure 5-3 2036 AM Do Minimum Speeds

Figure 5-4 2036 AM Do Something Speeds

Figure 5-5 2036 AM Do Something with Mitigation Speeds

Journey Time Results – AM Peak

5.9 Journey time data has been extracted for the forecast model for the two journey time routes which were validated in the base model. The results have been used to compare delays across the forecast scenarios for the AM peak hour. Figure 5-6 shows the two journey time routes defined within the model area.

Figure 5-6 Coltishall Routes

5.10 Journey Time Route (JTR) 1 is along the B1150 Station Road and High Street to the junction of the B1150 and B1354 to the south of the Petrol Filling Station (PFS) in the centre of Coltishall. Journey Time Route

(JTR) 2 extends along the B1150 Norwich Road from the junction with Green Lane, over the river bridge and along the B1354 to the junctions with Kings Road.

5.11 Figure 5-7 to Figure 5-10 show the modelled results for the Base and all forecast scenarios in the AM peak hour, for the defined routes.

5.12 The journey time results for the forecast models are broadly similar for all routes when compared to the Base. For the JTR 1 in the northbound direction, the Do Minimum, Do Something and Do Something with Mitigation scenarios have similar journey times to the Base in both directions, although the Do Something journey times are slightly longer overall.

5.13 The journey times for JTR 2 westbound are also broadly similar for all forecast scenarios, although there is an increase of just under 20 seconds in the Do Something scenarios.

5.14 The journey times on JTR 2 eastbound are consistent with the average speed analysis above, with significant increase in journey times in the Do Something scenario, relative to the Do Minimum due to blocking back from the right turn into the B1354, which results in longer queues. However, it can be seen than the provision of the right turn pocket in the Do Something with Mitigation scenario, significantly reduces journey times, bringing them down to a similar level to the Do Minimum scenario.

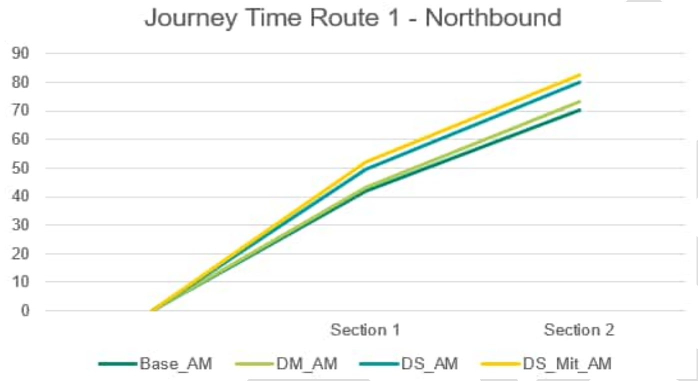


Figure 5-7 Journey Time Route 1 – Northbound

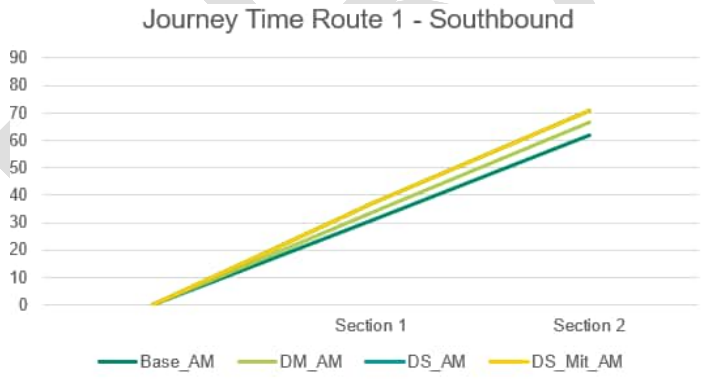


Figure 5-8 Journey Time Route 1 – Southbound

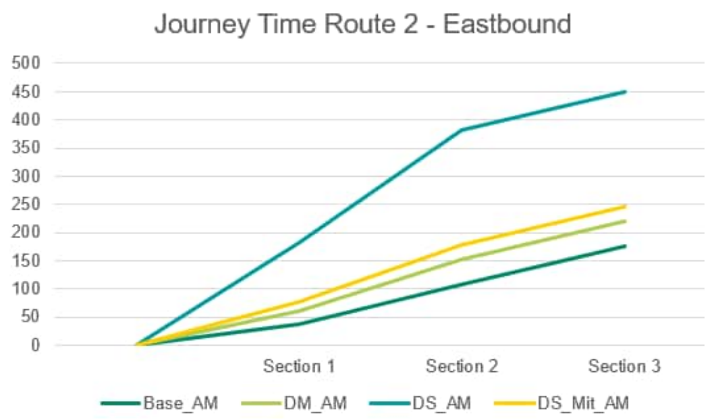


Figure 5-9 Journey Time Route 2 – Eastbound

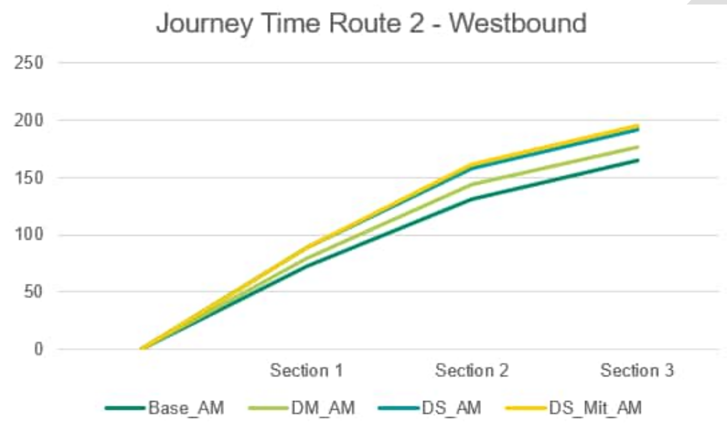


Figure 5-10 Journey Time Route 2 – Westbound

PM Results

5.15 This section presents the network performance results for the modelled network in the PM peak hour. It includes an analysis of average delay, average speed results and journey times within the modelled area as a whole.

PM – Overall Network Performance

5.16 The Network Performance results and average speed plots have been extracted from the model to assess the operation of the entire network. These results provide an overview of the delays in each scenario for comparison.

Average Delay

5.17 Figure 5-13 shows the average delay per vehicle within the network across the four PM scenarios.

5.18 The graph shows there is a significant predicted increase in delay in the Do Minimum scenario relative to the Base year, with delay increasing from 48 seconds per vehicle to 145 seconds per vehicle. When the additional NWWUE trips are added this delay increases to 321 seconds per vehicle. The main causes of this additional delay is queuing at the parked cars (observed in the PM scenario and modelled in the base year) which allow only one direction of traffic to pass at a time.

5.19 The average delay per vehicle is reduced to 137 seconds per vehicle in the Do Something with Mitigation scenario, showing that the proposed mitigation offsets the impact of the development traffic in the PM peak, with average delay below the level in the Do Minimum.

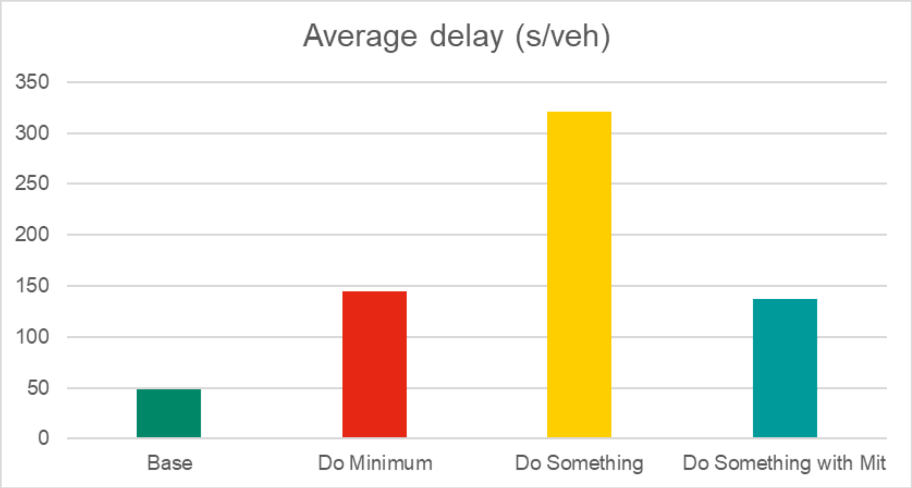


Figure 5-11 Average PM Delay

Average Speed Plots

5.20 The average speed results for the Base PM models and the three forecast scenarios are shown in Figure 5-12 to Figure 5-15 below.

5.21 The speed plots show how the additional demand added in the Do Minimum, Do Something and Do Something with Mitigation scenarios increases the queue lengths (red and dark red areas) in the network, especially along the High Street area.

5.22 The results show how the additional demand added to each scenario gradually increases the queue lengths (red and dark red areas) in the network, especially along the High Street area, as shown in Figure 5-14. This queue along the B1150 is caused by a section of the High Street effectively being a single lane due to on-street parking in the PM peak. Furthermore, over 90% of the NWWUE development trips that travel through Coltishall do so via the High Street, resulting in queues building up along the B1150.

5.23 It should be noted that the operation of this movement was highlighted as a capacity pinch point in the base model. The operation and cooperative behaviour along the one-way section of the High Street is dependent on the arrival patterns and demand levels in northbound and southbound directions.

5.24 The Do Something with Mitigation scenario assumes that parking restrictions will avoid vehicles parking on street in this short section of the High Street which has such a significant impact on two-way flow. The models predict that the queues and delay along High Street would be reduced significantly, increasing the speeds of vehicles along that route.

Figure 5-12 Base PM Speeds

Figure 5-13 2036 PM Do Minimum Speeds

Figure 5-14 2036 PM Do Something Speeds

Figure 5-15 2036 PM Do Something with Mitigation Speeds

Journey Time Results – PM Peak

5.25 Modelled journey times have been extracted for the two routes which were validated in the base model and compared across scenarios. These are shown in Figure 5-6.

5.26 Figure 5-16 to Figure 5-19 show the modelled results for all the forecast scenarios along the base year journey time routes in the model.

5.27 The journey time results show that the operation of High Street, where traffic cannot pass in both directions at once at the parked cars, has an impact on the results for Journey Time Route (JTR) 1 (northbound and southbound) in the Do Minimum and Do Something scenarios, with the delay increasing as traffic volumes increase.

5.28 In the northbound direction, the journey time is 103 seconds in the Do Minimum and 60 seconds higher in the Do Something. In the Do Something with Mitigation scenario, where the on-street parking on the High Street is restricted, the journey time is reduced and is 17 seconds faster than the Do Minimum.

5.29 Similarly, in the southbound direction, the 2036 Do Minimum results show that it will take 161 seconds to travel along the full route. The journey times along this route are predicted to increase significantly in the Do Something scenario, as a result of the additional development demand. However, the model results show that the two way operation due to removal of parked cars in the Do Something with Mitigation scenario will completely offset the development impact, reducing the journey times along this route to only 67 seconds.

5.30 For JTR 2 eastbound the removal of on-street parking also has a positive effect, reducing the Do Something with Mitigation journey time to a similar level as the Do Minimum scenario.

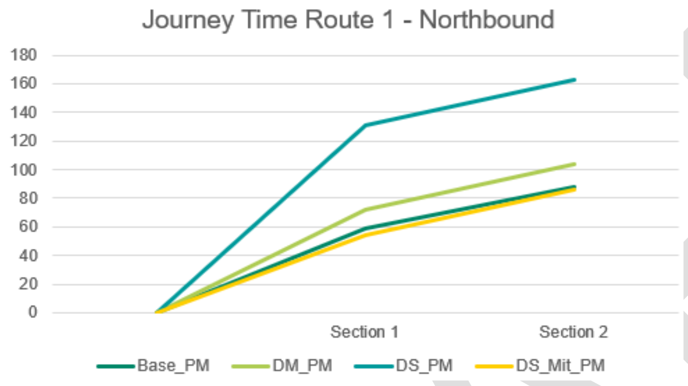


Figure 5-16 Journey Time Route 1 – Northbound

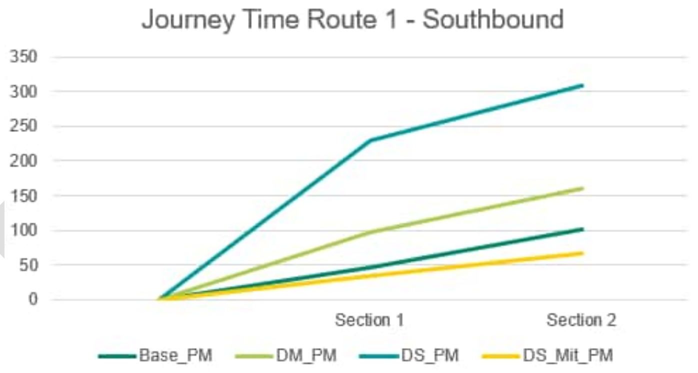


Figure 5-17 Journey Time Route 1 – Southbound

Figure 5-18 Journey Time Route 2 – Eastbound

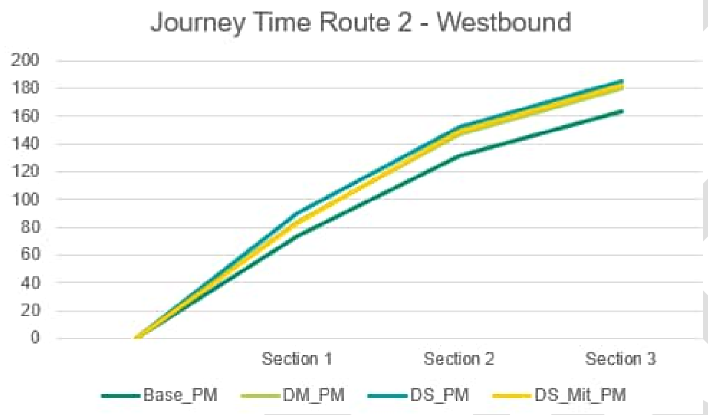


Figure 5-19 Journey Time Route 2 – Westbound

6. Junction Analysis

Introduction

6.1 Figure 6-1 below shows the key junctions/ locations identified from the survey data/ observations in the model area that most impact network operation.

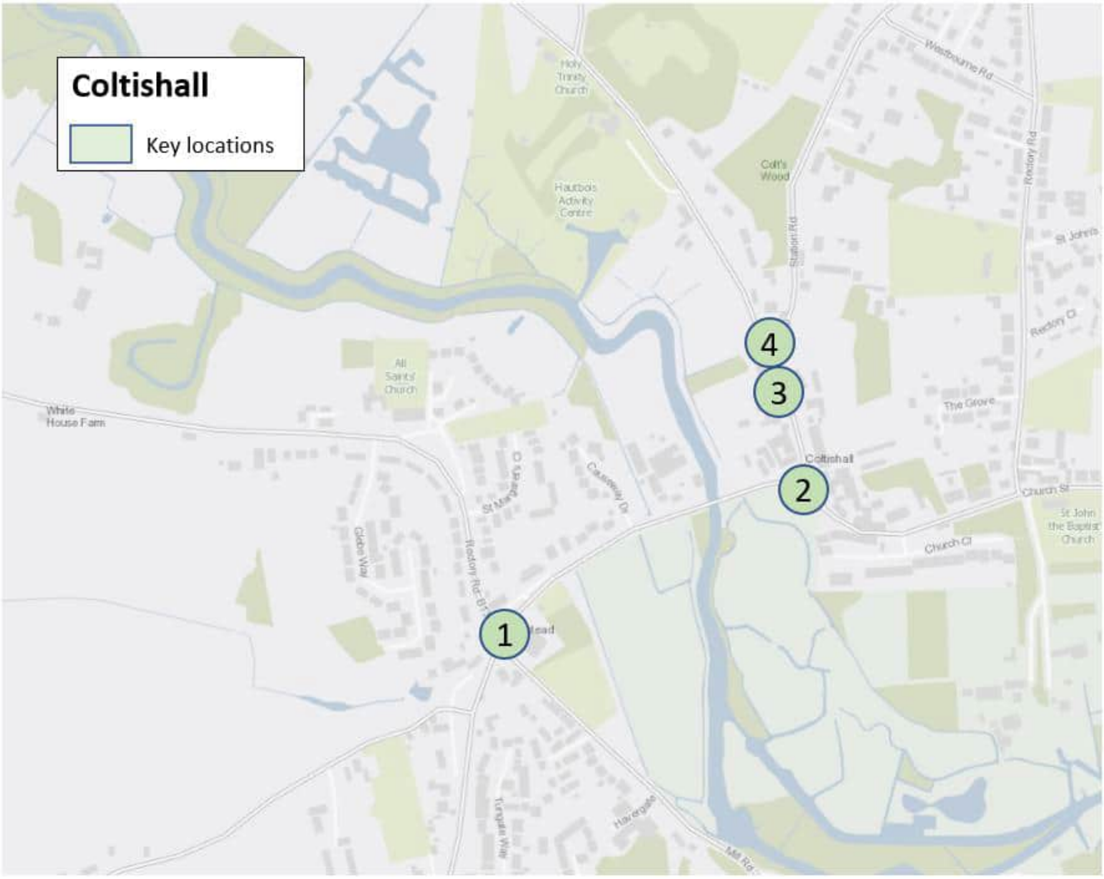


Figure 6-1 Key locations in Coltishall

6.2 The key locations are defined as follows:

1.Rectory Road/ B1150 roundabout;

2. High Street/ B1354 gyratory at the Petrol Filling Station;

3. High Street at the war memorial; and

4. High Street / Great Hautbois Road priority junction.

6.3 These locations have been analysed individually in the models to extract queue and delay results for the Do Minimum, Do Something and Do Something with Mitigation scenarios, to provide an assessment of the NWWUE development impact.

6.4 It should be noted that the operation of some of these critical locations depends on variable factors such as on-street parking and courtesy/give-way behaviours, which have been modelled and calibrated to observed queuing patterns/ levels of delay.

Rectory Road / Norwich Road Roundabout (1)

6.5 Figure 6-2 shows the queues and delays at the AM peak hour at the Rectory Road / Norwich Road Roundabout. The queue results are set out in the top junction layout and the delays are in the bottom junction layout.

6.6 The model results show that the NWWUE development demand included in the Do Something scenario results in a small increase in queues and delays at the junction.

6.7 It is worth noting that this delay and queue have been analysed with this junction operating in isolation – the full model results show that the queue from B1150 Norwich Road at the gyratory would impact this junction in some scenarios.

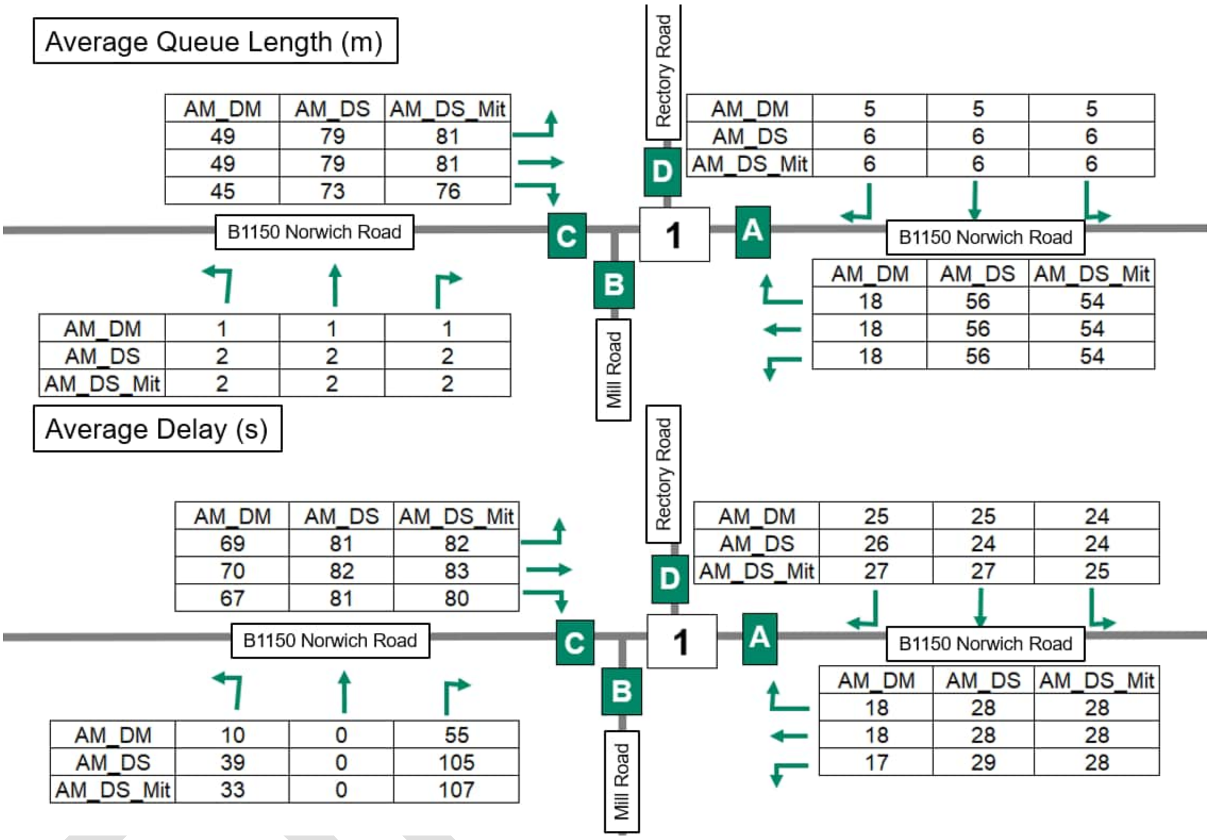


Figure 6-2 Queues in metres and delay in seconds - AM peak

6.8 Figure 6-3 shows the queues and delays in the PM peak hour at the Rectory Road / Norwich Road mini-roundabout.

6.9 The model results show that the NWWUE development demand included in the Do Something scenario results in approximately 30 seconds more delay on Norwich Road northbound. The delay increase is also reflected in a longer section of slow-moving traffic approaching the roundabout, approximately 100 metres in length. The queues and delay in the Do Something with Mitigation scenario are similar.

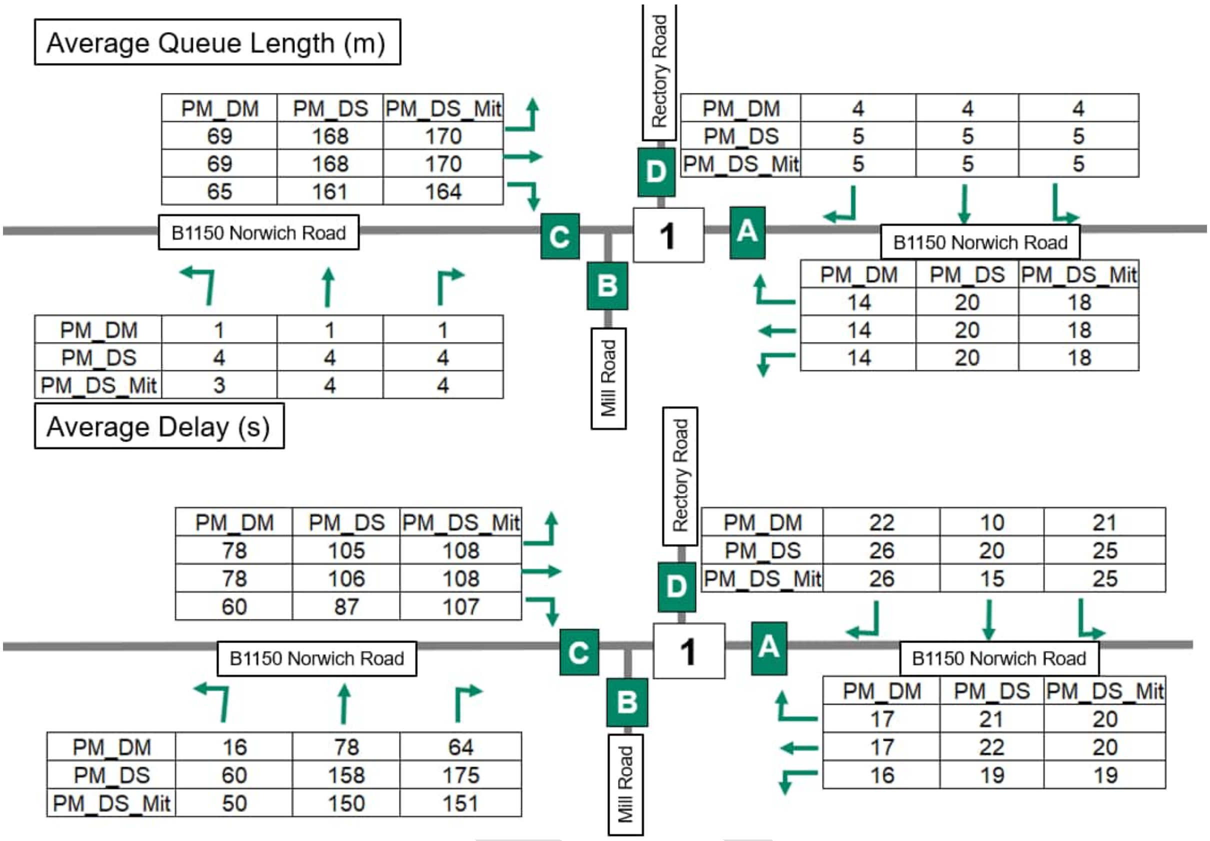


Figure 6-3 Queues in metres and delay in seconds - PM peak

Norwich Road and B1354 Gyratory (PFS) (2)

6.10 Figure 6-4 shows the queues and delays at the gyratory between Norwich Road and B1354 in the AM peak hour.

6.11 The model results show that the NWWUE development trips in the Do Something scenario result in approximately 80 seconds more delay on the eastbound approach to the gyratory. The increase in delay is also reflected in longer queues, approximately 390 metres in length, on the eastbound approach.

6.12 The junction analysis results show that the right turn from Norwich Road to the B1354, just before the Petrol Filling Station (PFS), is over capacity with the Do Something forecast trips. The additional southbound traffic volumes in this scenario result in fewer gaps for right turners, so right turners block vehicles travelling ahead.

6.13 The results for Do Something with Mitigation scenario, where a right turn pocket is provided, has a similar queue length and delay as the Do Minimum scenario along B1150 Norwich Road eastbound, effectively mitigating the impacts of the NWWUE development.

6.14 There are no significant increases or reductions in delay across the other arms.

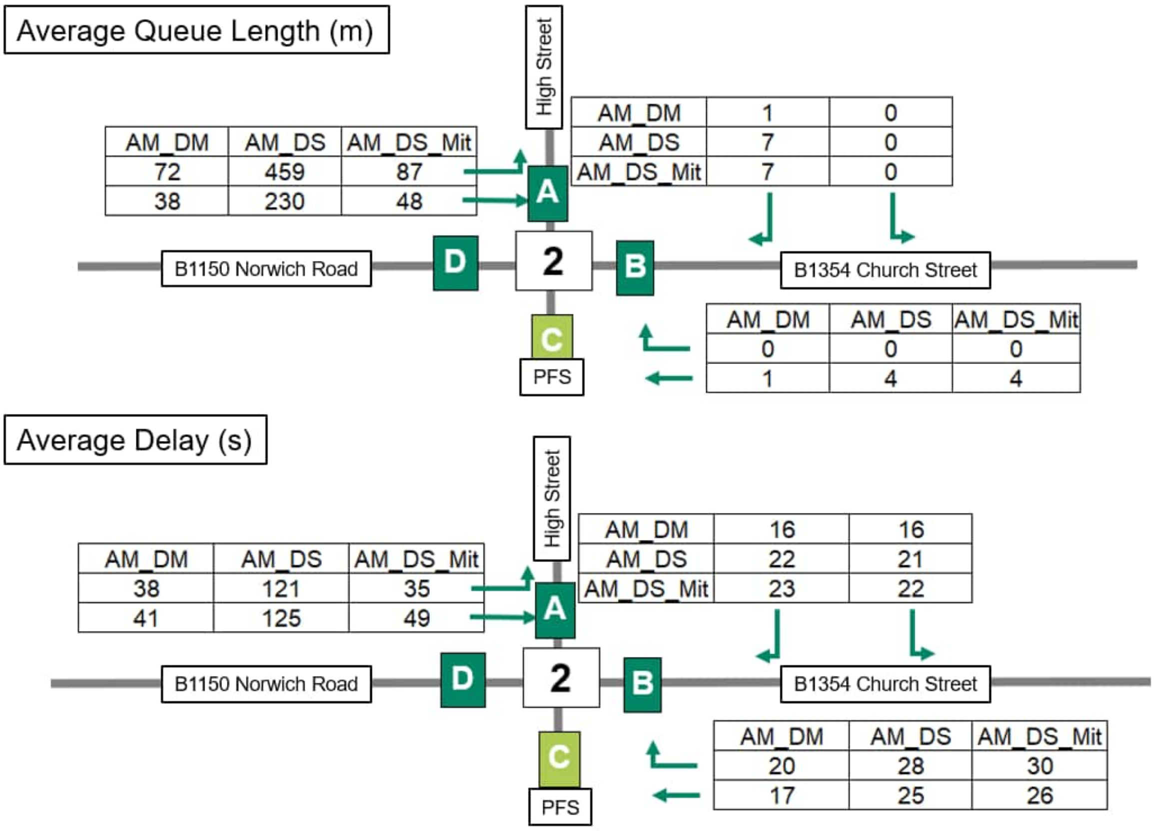


Figure 6-4 Queues in metres and delay in seconds - AM peak

6.15 Figure 6-5 shows the queues and delays at the gyratory between Norwich Road and B1354 (PFS) in the PM peak hour.

6.16 The model results show that the NWWUE development demand in the Do Something scenario increases queues and delays along B1150 Norwich Road eastbound by approximately 150 metres and 40 seconds respectively. The Do Something with Mitigation scenario, however, reduces the queues and delays to lower levels that in the Do Minimum scenario; the mitigations (right turn pocket and removal of on-street parking o the High Street), effectively mitigate the impacts of both the NWWUE and the projected growth in the area.

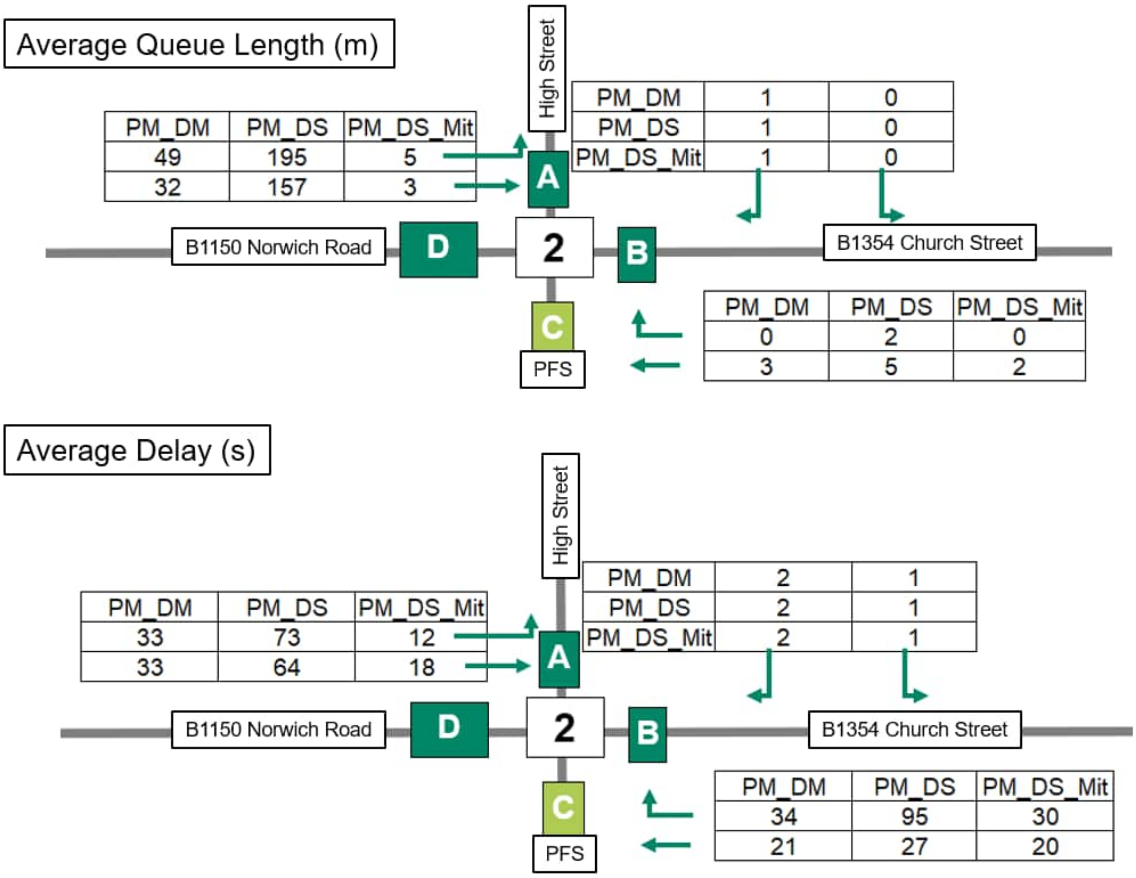


Figure 6-5 Queues in metres and delay in seconds - PM peak

High Street (3)

6.17 Figure 6-6 shows the queues and delays at High Street northbound and southbound in the AM peak hour.

6.18 There are no queues and no significant delays in any scenarios, which is consistent with the Base model where there are no vehicles parked on-street in the AM causing vehicles to give way.

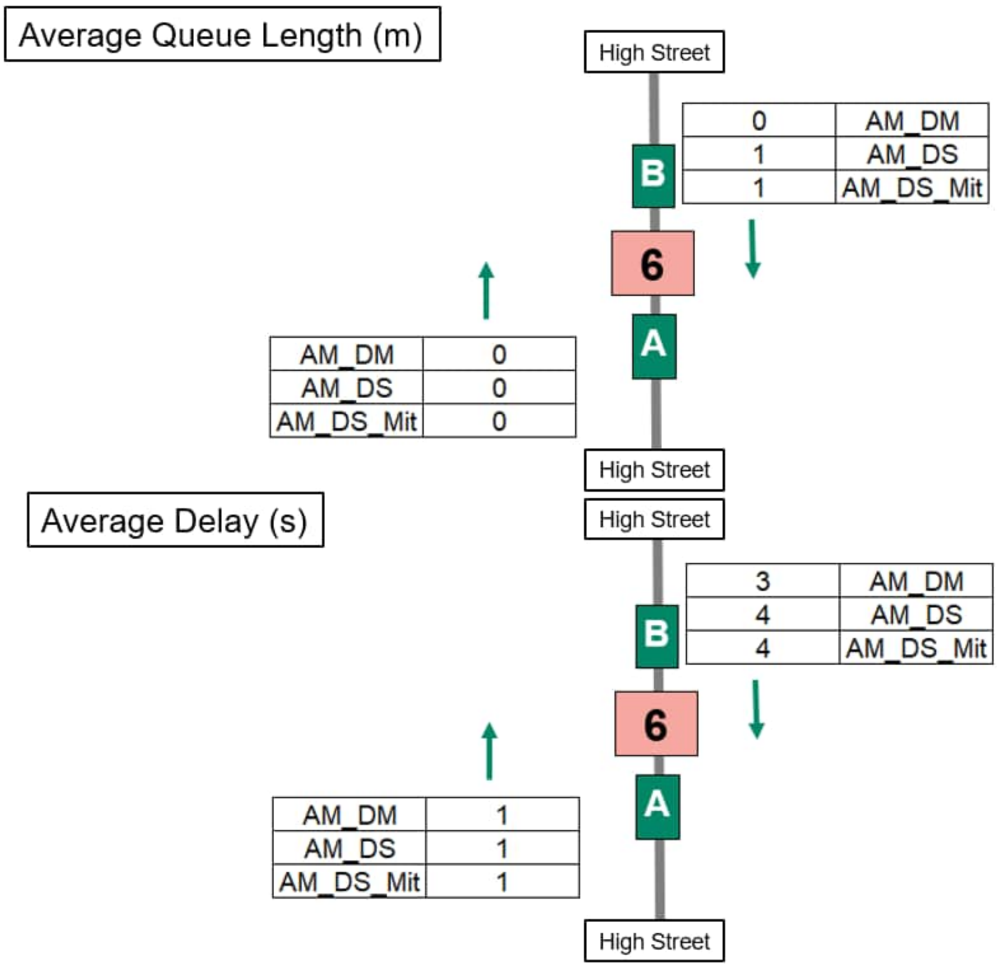


Figure 6-6 Queues in metres and delay in seconds - AM peak

6.19 Figure 6-7 shows the queues and delays on the High Street in the PM peak hour.

The Do Minimum model results show a southbound queue of approximately 120 metres long and 108 seconds of delay caused by the section where two way flow isn't possible, which is caused by the on-street parking.

6.20 The Do Something scenario shows a significant increase in the queues and delays due to the NWWUE development demand along this route. It should be noted that due to the cooperative nature of the calibrated driving behaviour in the model where parking limits capacity, the increase in queue lengths is not directly related to the direction of the flow.

6.21 The Do Something with Mitigation scenario, which removes the on-street parking on High Street, removes all restrictions along the road therefore allowing traffic to flow freely without having to give way. This means that there are average queue lengths of one metre and an average delay of 14 seconds along the southbound movement.

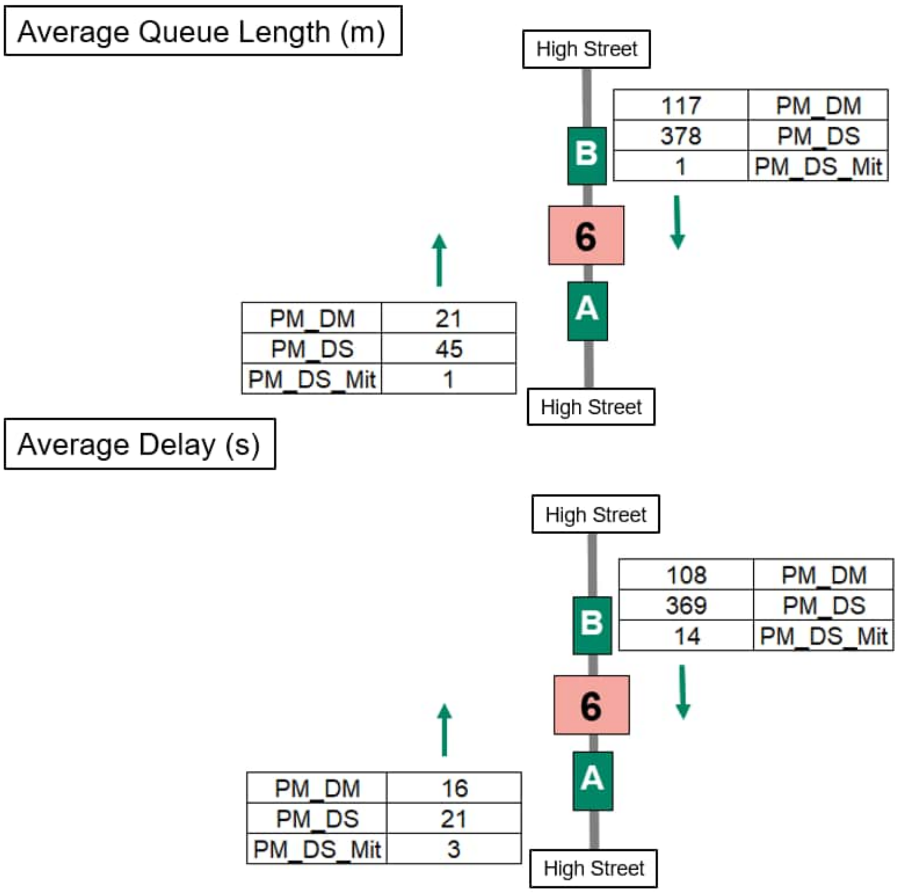


Figure 6-7 Queues in metres and delay in seconds - PM peak

High St / Gt Hautbois Rd / Station Rd Junction (4)

6.22 Figure 6-8 shows the queues and delays at the High Street / Great Hautbois Road / Station Road priority junction in the AM peak hour.

6.23 There are no average queues along High Street or Great Hautbois Road and an insignificant average queue length on Station Road in any of the forecast scenarios. There is a slight increase in delay and queue lengths from the Do Minimum to Do Something scenario along the Station Road arm, but this junction is predicted to operate within capacity when assessed in isolation.

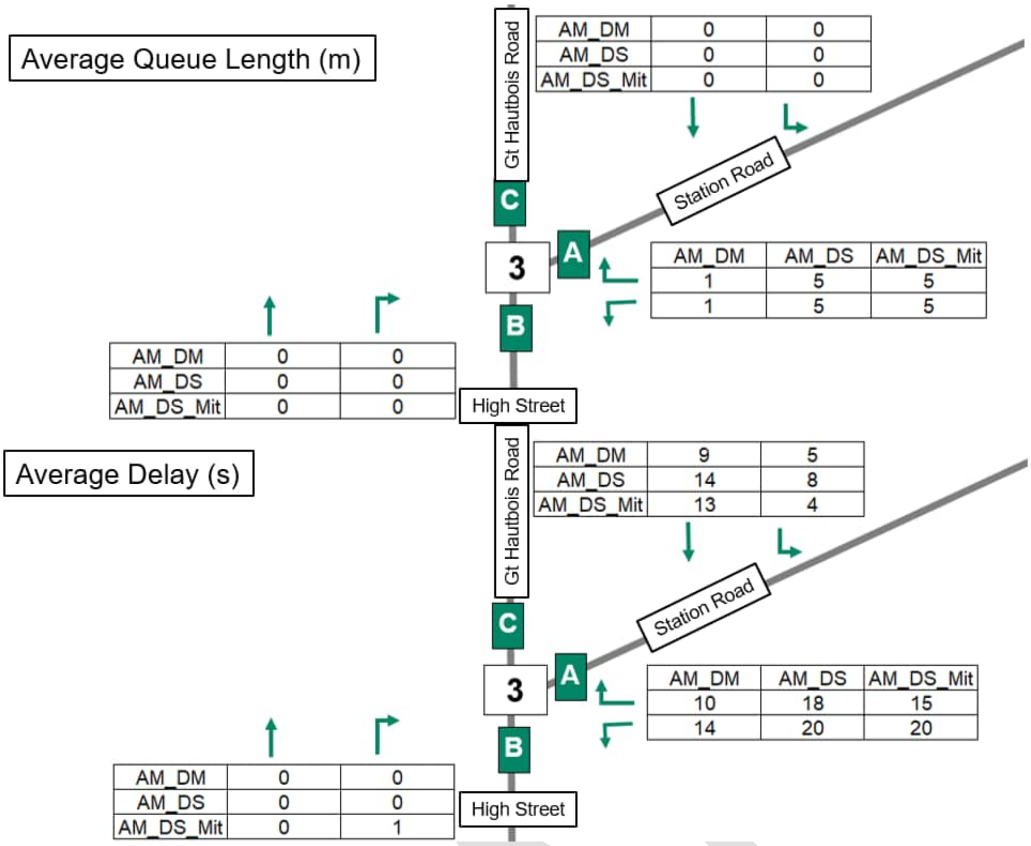


Figure 6-8 Queues in metres and delay in seconds - AM peak

6.24 Figure 6-9 shows the queues and delays on the High Street in the PM peak hour for the different scenarios tested. There is a slight increase in delay on Great Hautbois Road, however the junction operates within capacity when assessed in isolation.

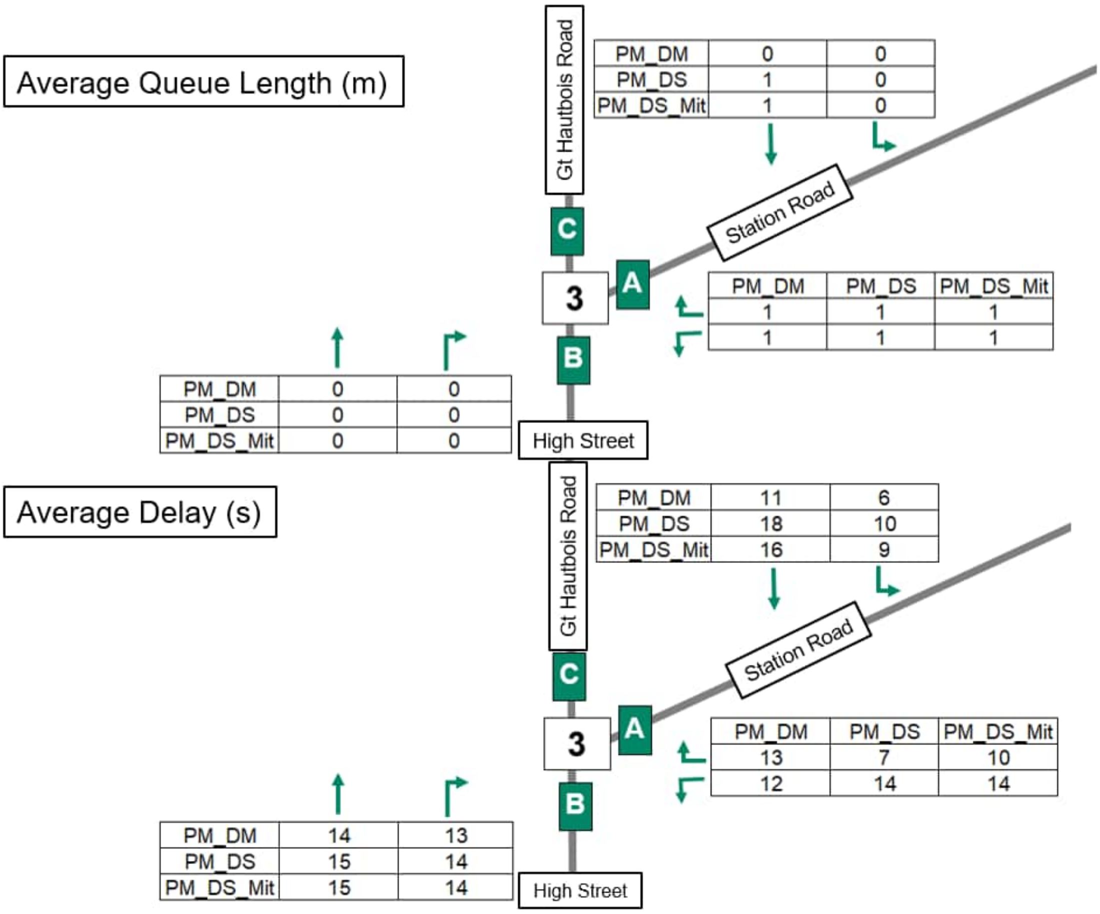


Figure 6-9 Queues in metres and delay in seconds - PM peak

7. Conclusions

7.1 The 2036 forecast Vissim models were developed to assess future network conditions and the impact of the North Walsham Western Urban Extension (NWWUE) development.

7.2 The predicted demand growth and the additional demand generated by the NWWUE taken from the Transport Assessment (TA) was added to the 2022 Vissim Base model demand to calculate the Vissim forecast demand for all the modelled scenarios.

7.3 The analysis of the modelling results has highlighted two key locations in Coltishall where increased queuing and delay are predicted in 2036 withinout the NWWUE development (the Do Minimum scenario). The models predict that these queues and delays will be significantly worsened as a result of the increase in traffic from the NWWUE.

7.4 Mitigations were identified and tested in the Do Something with Mitigation scenario: provision of a right turn pocket into the B1354 from Norwich Road to avoid blocking of the Norwich Road and removal of on street parking on a short stretch of the High Street to allow two-way movement. The models predict that almost all the development impact observed in the Do Something scenario in the AM and PM peaks would be mitigated for and that the performance of the network through Coltishall would be similar to the Do Minimum scenario with the mitigations in place.

Appendix A – Demand Development Matrices

Table 7-1 2036 AM Forecast Demand

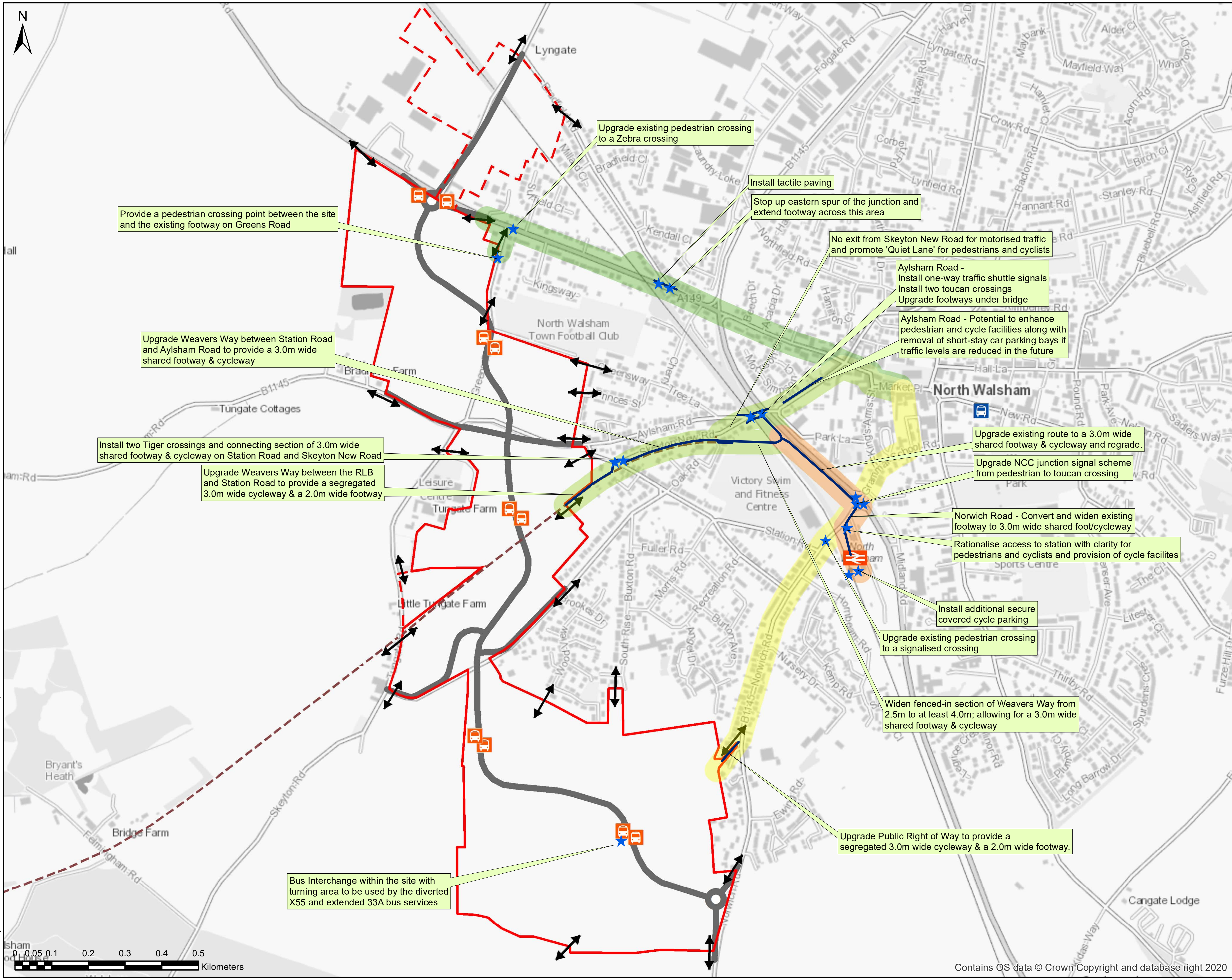
Zone	1	2	3	4	5	6	7	8	9	Sum
1				0.6						0.6
2				2.5						2.5
3										0.0
4	0.4	0.7		2.8		1.5			188.3	193.7
5										0.0
6				1.1						1.1
7				0.6						0.6
8										0.0
9				61.4						61.4
Sum	0.4	0.7	0.0	69.0	0.0	1.5	0.0	0.0	188.3	

Table 7-2 2036 PM Forecast Demand

Zone	1	2	3	4	5	6	7	8	9	Sum
1				0.4						0.4
2				0.6						0.6
3										0.0
4	0.7	2.9		2.9		1.3			71.8	79.6
5										0.0
6				1.4						1.4
7				0.4						0.4
8										0.0
9				168.6						168.6
Sum	0.7	2.9	0.0	174.3	0.0	1.3	0.0	0.0	71.8	

aecom.com

Appendix F – Proposals and Design Drawings



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Proposed Improvement
- Proposed Improvement
- Town Travel Hub
- Proposed Bus Stop (Spine Rd)
- Mobility Corridor 1 (2m wide footway; on-road cycling)
- Mobility Corridor 2 (including off-carriageway cycling)
- Mobility Corridor 3 (2m wide footway; on-road cycling)
- Mobility Corridor Rail Extension (including off-carriageway cycle)
- Walk and Cycle RLB Connection
- Weavers Way
- RLB
- RLB Emerging Allocation
- Link Road

Purpose of Issue
DRAFT

Client
ESCO DEVELOPMENTS
FLAGSHIP HOUSING GROUP
LOVELL PARTNERSHIPS

Project Title
NORTH WALSHAM WESTERN URBAN EXTENSION

Drawing Title
PROPOSED IMPROVEMENTS NORTH WALSHAM

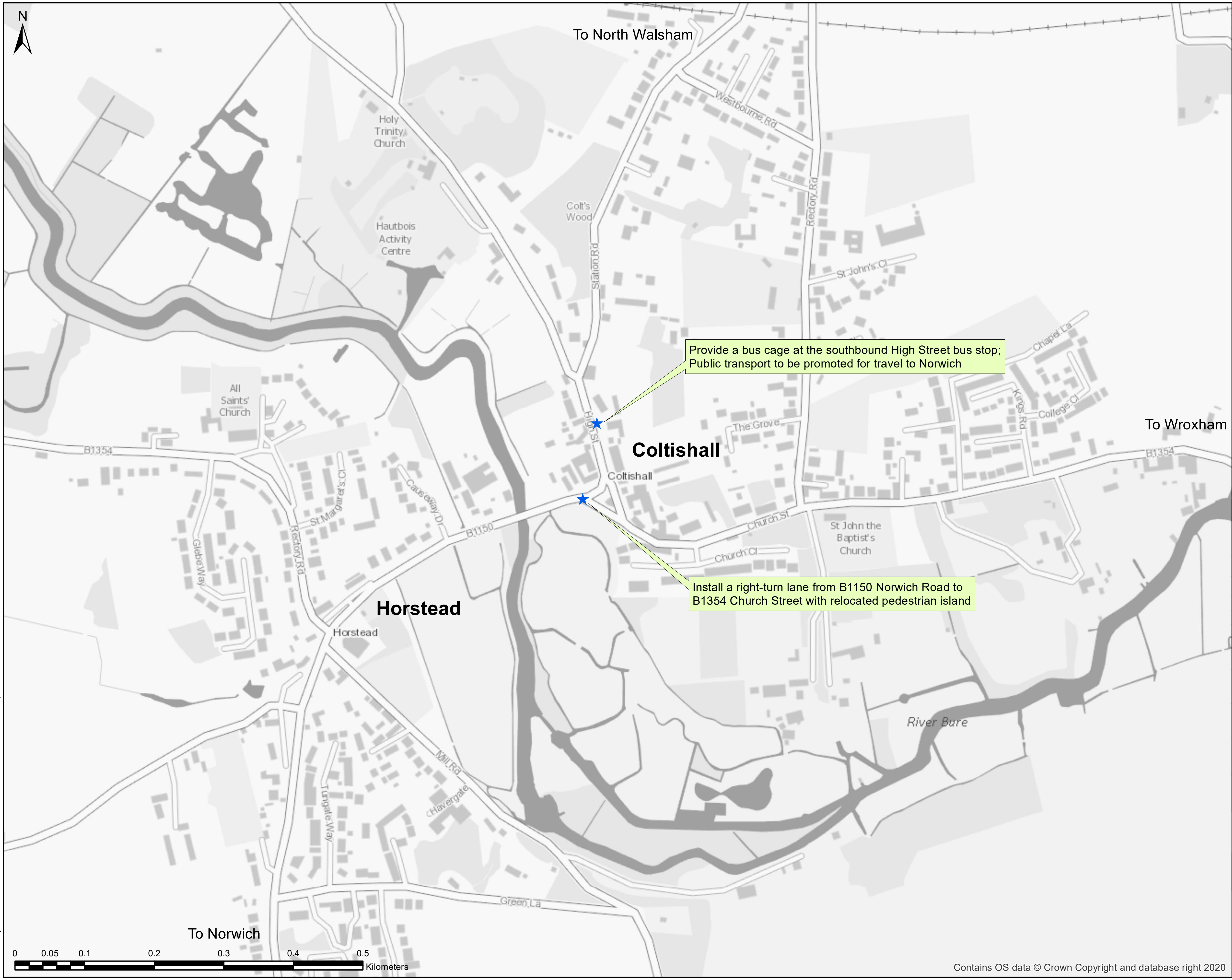
Drawn	Checked	Approved	Date
BS	TJ	BC	23/08/2023

AECOM Internal Project No.	Scale @ A3
60685223	1:9,500

AECOM
Cavell House
St Crispins Road
Norwich
NR3 1YE
www.aecom.com

AECOM

Drawing Number	Rev
FIGURE A.001	04



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

★ Proposed Improvement

Purpose of Issue
DRAFT

Client
ESCO DEVELOPMENTS
FLAGSHIP HOUSING GROUP
LOVELL PARTNERSHIPS

Project Title
NORTH WALSHAM WESTERN URBAN EXTENSION

Drawing Title
PROPOSED IMPROVEMENTS COLTISHALL

Drawn	Checked	Approved	Date
BS	TJ	BC	23/08/2023

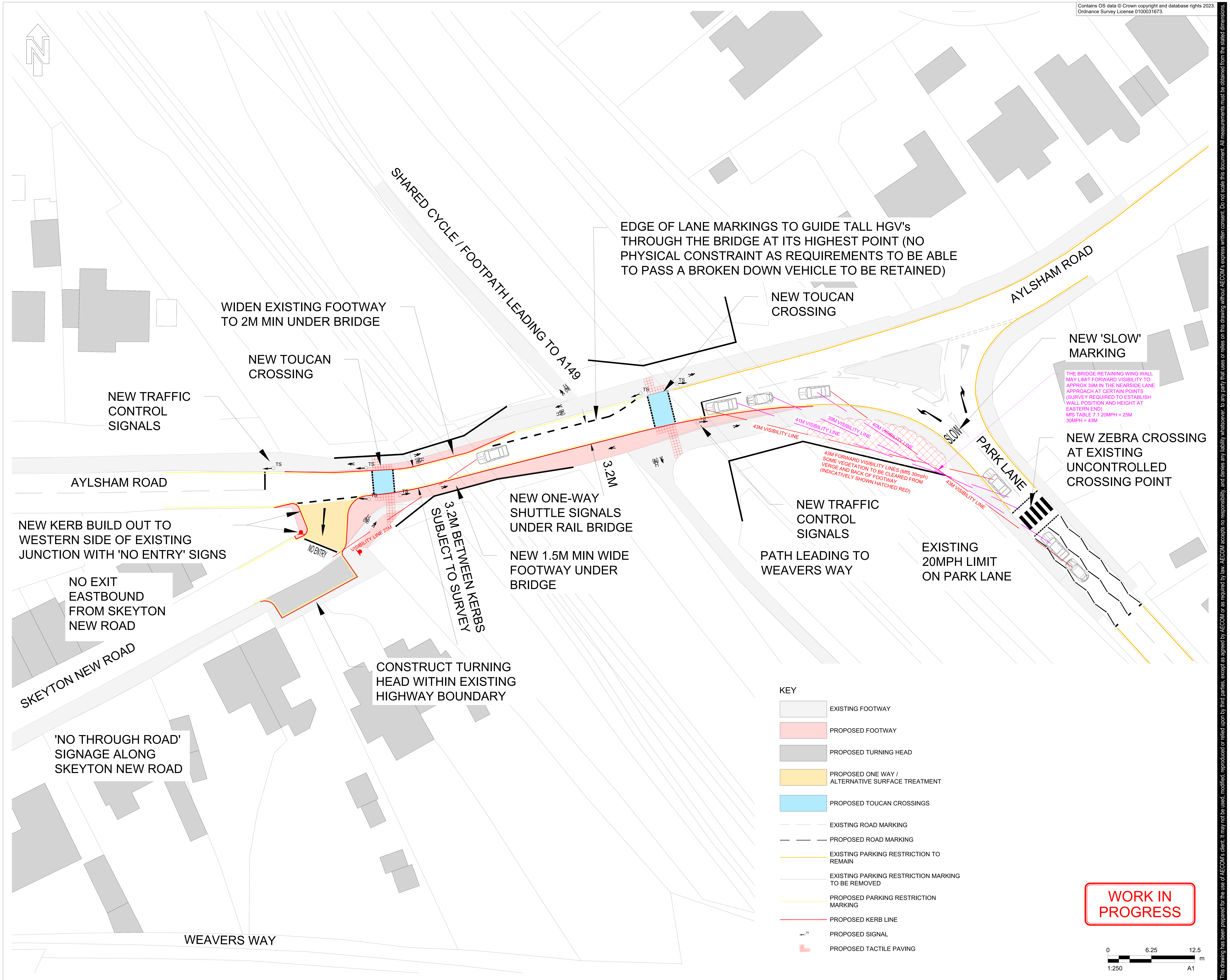
AECOM Internal Project No.	Scale @ A3
60685223	1:5,000

AECOM
Cavell House
St Crispins Road
Norwich
NR3 1YE
www.aecom.com

AECOM

Drawing Number	Rev
FIGURE A.003	02

File Name:A:\Projects\60685223 - North Walsham WUE\900_CAD_GIS\960_GIS\230822_NW WUE Proposals_V10.mxd



AECOM

PROJECT

North Walsham
Western Urban Extension

CLIENT

Esco Developments
Flagship Group
Lovel

CONSULTANT

AECOM
CAVELL HOUSE, STANNARD PLACE
ST CRISPINS ROAD
NORWICH, NR3 1YE, UK
www.aecom.com

NOTES

LEGEND

SUITABILITY

S0 WORK IN PROGRESS

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P03	05/09/2023	FORWARD VISIBILITY ON PARK RD ADDED
P02	07/08/2023	AMENDMENTS TO LAYOUT
P01	25/07/2023	LAYOUT FOR DISCUSSION

KEY PLAN

PROJECT NUMBER

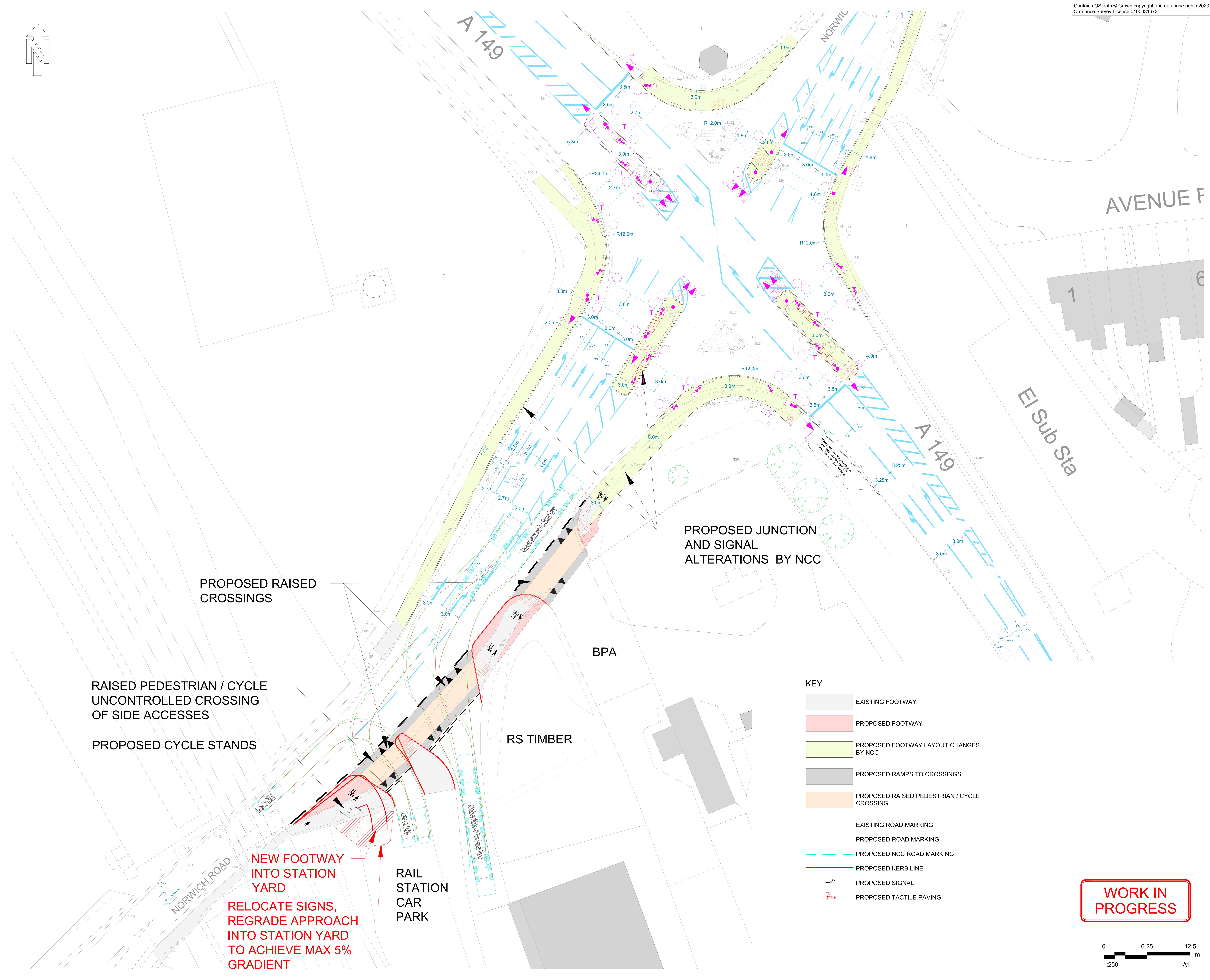
60685223

SHEET TITLE

SKEYTON NEW ROAD
JUNCTION DETAIL AND VISIBILITY
LINES AT AYLSHAM ROAD END

SHEET NUMBER

60685223-ACM-XX-XX-DR-CE-0154



ISO A1 594mm x 841mm

Project Management Initials: Designer: Checked: Approved:

Filename: A:\PROJECTS\60685223 - NORTH WALSHAM WUE\900_CAD_GIS\930_SHEETS\60685223-ACM-XX-XX-DR-CE-0155.DWG
Last saved by: DAVID.BALL(2023-09-11) Last Plotted: 2023-09-27

AECOM

PROJECT

North Walsham
Western Urban Extension

CLIENT

Esco Developments
Flagship Group
Lovel

CONSULTANT

AECOM
CAVELL HOUSE, STANNARD PLACE
ST CRISPINS ROAD
NORWICH, NR3 1YE, UK
www.aecom.com

NOTES

LEGEND

SUITABILITY

S0 WORK IN PROGRESS

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P01	02/08/2023	LAYOUT FOR DISCUSSION

KEY PLAN

PROJECT NUMBER

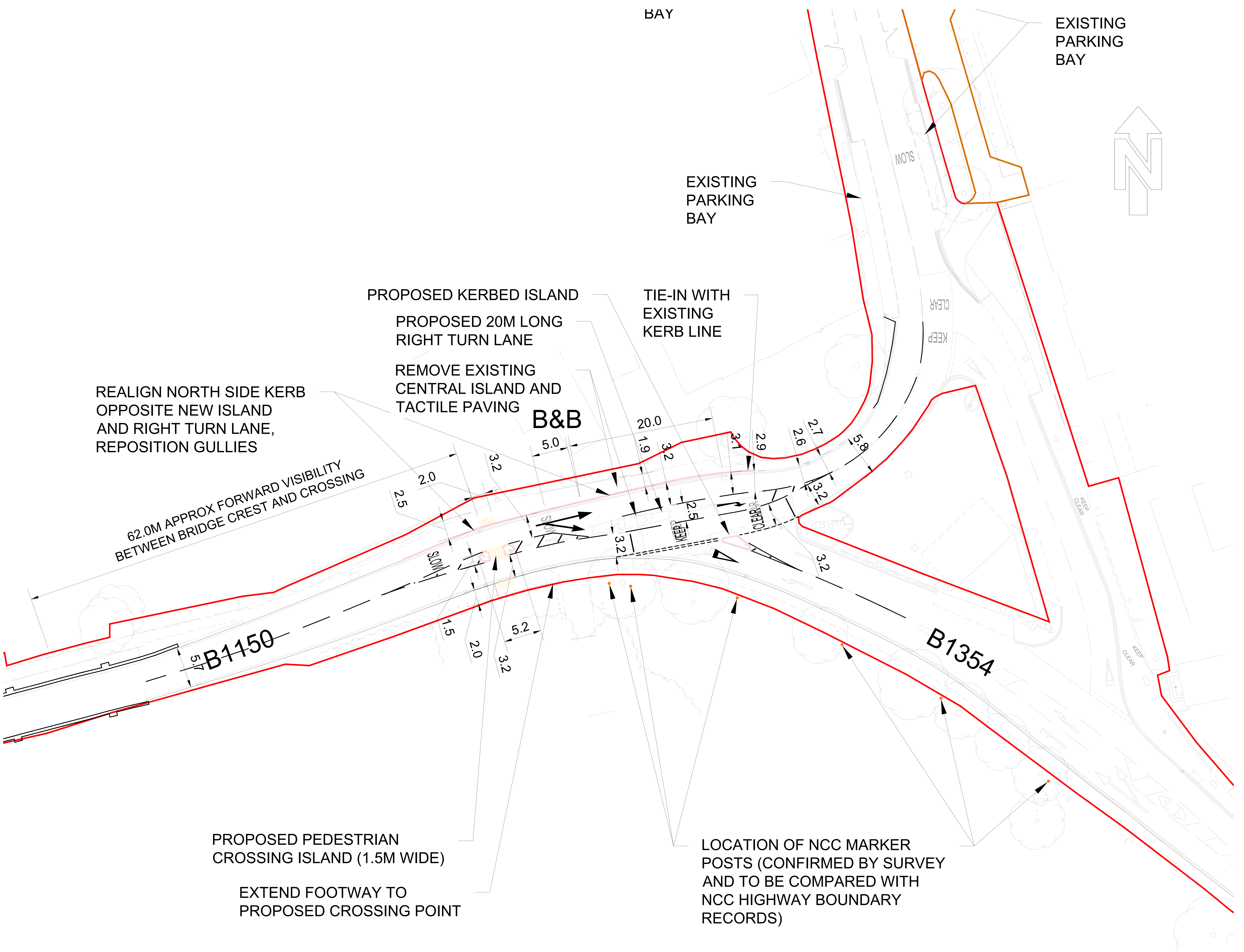
60685223

SHEET TITLE

NORWICH ROAD
CYCLE PROVISION TO A149
IN CONJUNCTION WITH NCC SCHEME

SHEET NUMBER

60685223-ACM-XX-XX-DR-CE-0155



0 2.5 5.0 10.0 15.0 20.0 25.0m
SCALE 1:250

ISO A1 594mm x 841mm

Last saved by: DAVID.BALL(2023-09-07) Last Plotted: 2023-09-07
Filename: A:\PROJECTS\60685223 - NORTH WALSHAM WUE\900_CAD_GIS\930_SHEETS\60685223-ACM-XX-XX-DR-CE-0130-0131-0132-0134.DWG

Printed on ___% Post-Consumer Recycled Content Paper

AECOM

PROJECT

North Walsham Western Urban Extension

CLIENT

Esco Developments
Flagship Group
Lovell

CONSULTANT

AECOM
ALDGATE TOWER
2 LEMAN STREET
LONDON, E1 8FA, UK
www.aecom.com

NOTES

KEY

New Kerb Line

Boundaries Created BY NCC - Received in pdf format: 29 Aug 2023

Boundary recreated IN CAD BY DJB 31/08/2023:

Public Highway Boundary

Public Right of Way Boundary

FOR INFORMATION ONLY

SUITABILITY

S0 WORK IN PROGRESS

ISSUE/REVISION

DRAWN: CHECKED: APPROVED:

I/R	DATE	DESCRIPTION
P04	31/08/2023	THRO' LANES 3.2M WIDE, HIGHWAY BOUNDARIES ADDED
P03	09/08/2023	KEEP CLEAR / SLOW MARKINGS ADDED
P02	07/08/2023	LAYOUT REV'D TO SUIT TOPO SURVEY
P01	26/06/2023	ISSUED FOR INFORMATION

KEY PLAN

PROJECT NUMBER

60685223

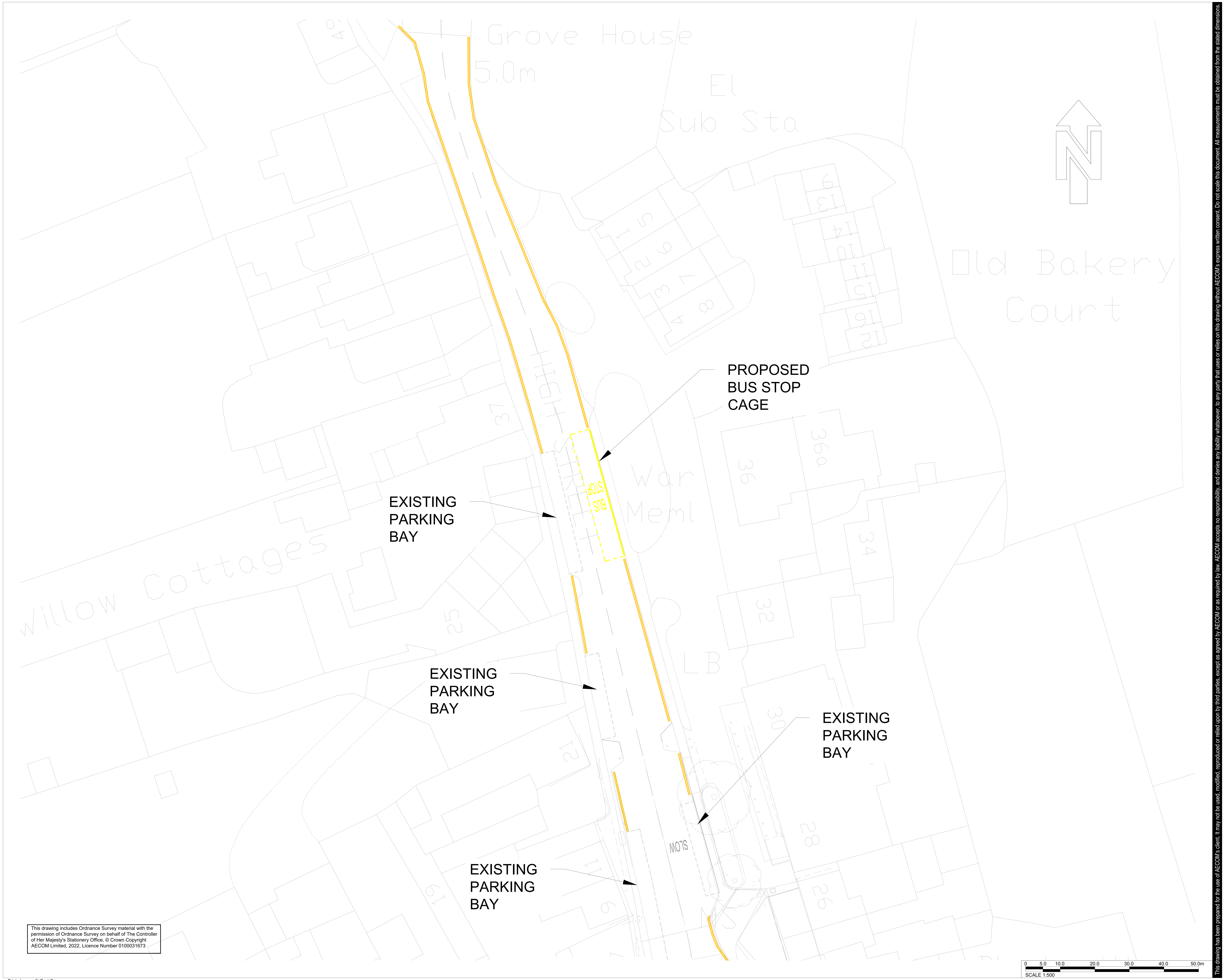
SHEET TITLE

B1150 CHURCH ST COLTISHALL
PROPOSED ROAD LAYOUT
SHEET 1 OF 2

SHEET NUMBER

60685223-ACM-XX-XX-DR-CE-0130

SCALE: 1:500 @A1 REV: P04



ISO A1 594mm x 841mm

Last saved by: DAVID.BALL(2023-08-07) Last Plotted: 2023-08-07
Filename: A:\PROJECTS\60685223 - NORTH WALSHAM WUE\900_CAD_GIS\930_SHEETS\60685223-ACM-XX-XX-DR-CE-0133.DWG

Printed on ___% Post-Consumer Recycled Content Paper

AECOM

PROJECT

North Walsham Western Urban Extension

CLIENT

OWNER/CLIENT

Esco Developments
Flagship Group
Lovell

CONSULTANT

AECOM
ALDGATE TOWER
2 LEMAN STREET
LONDON, E1 8FA, UK
www.aecom.com

NOTES

FOR INFORMATION ONLY

SUITABILITY

S0 WORK IN PROGRESS

ISSUE/REVISION

DRAWN:	CHECKED:	APPROVED:

I/R	DATE	DESCRIPTION
P01	07/08/2023	ISSUED FOR INFORMATION

KEY PLAN

PROJECT NUMBER

60685223

SHEET TITLE

NORTH WALSHAM ROAD COLTISHALL
PROPOSED BUS STOP

SHEET NUMBER

60685223-ACM-XX-XX-DR-CE-0133

SCALE: 1:500 @A1 **REV:** P01

Appendix G – Stage 1 Road Safety Audit Report and Designers Response

NORTH WALSHAM WESTERN EXTENSION: B1150 NORWICH RD CYCLE IMPROVEMENTS & AYLSHAM RD SHUTTLE WORKING

STAGE 1 SAFETY AUDIT

REPORT REF: B1150/025
August 2023

Report Prepared for: AECOM

Report Author: **Nevil Calder** BSc(Hons) CEng MICE MCIHT MSoRSA NH Cert Comp

Report Status:

Issue	Status	Purpose	Name/Signature	Date
1	Stage 1 Safety Audit Report	Client issue	Nevil Calder N Calder ……………………	22/08/23
2	Designer's Response	Designer response to Safety Issues raised	…Bevin Carey…. Bevin Carey ……….	29/09/23
Choose an item.	Choose an item.	Choose an item.	…………………… ……………………	

INTRODUCTION

This report contains the results of a Stage 1 Safety Audit carried out on the above scheme. The Audit was carried out at the request of AECOM on behalf of Norfolk County Council Growth and Development. A formal Audit Brief was not provided.

The Audit Team is independent of the project design team and has had no involvement with the project. The Audit Team membership was as follows:-

Nevil Calder BSc(Hons) CEng MICE, MCIHT, MSoRSA (Audit Team Leader)	Principal Engineer Highway Safety WSP
Kevin Allen BEng (Hons), I Eng, MCIHT, MSoRSA (Audit Team Member)	Project Engineer Network Safety + Sustainability Norfolk County Council

The Audit took place via online conferencing on 16 August 2023. The audit comprised an examination of the supplied documentation (see Appendix A) and a site inspection by the Audit Team Leader on 22 August 2023 at 10:20 which lasted around 30 minutes. During the site visit the weather was sunny and the road surface dry. Traffic flows were moderate and generally free flowing.

The terms of reference are as described in Community and Environmental Services Highways Service Manual Procedure SP03-07-P01. The Auditors have examined and reported only on the road safety implications of the scheme within the main report.

The proposal involves traffic management improvements in North Walsham in connection with the western urban extension of the town. The audited scheme comprises provision of shared-use foot/cycleway on approach to the railway station on Norwich Rd, together with introduction of signalised shuttle working on an existing narrow section of Aylsham Rd and foot/cycleway provision. The latter also involves a short length of one-way restriction on Skeyton New Road at its junction with Aylsham Rd.

The auditors have reviewed the five year (to end Mar 2023) collision record for the location. During this period there were 4 personal injury collisions (1 serious, 3 slight) recorded in vicinity of the Norwich Rd scheme but they appear to have no bearing on the proposals. There were no recorded collisions in vicinity of the Aylsham Rd proposals.

A comments section has been included in Appendix B. The issues noted are not necessarily safety issues. They relate either to wider network implications, safety issues identified outside the scope of the audited scheme or suitability of a particular design choice.

ITEMS RAISED AT PREVIOUS AUDIT

The Audit Team are not aware of any previous audit of this scheme.

ITEMS RAISED AT THIS STAGE 1 AUDIT

1.0 General

1.1 Problem – vehicle collisions with NMUs

Location – Aylsham Rd proposed signalised NMU crossings

The proposed location of 'toucan style' crossings within the signalised shuttle length is not one the Audit Team has met before. While the indicative signal staging is simple, the inter-green timings and mid-shuttle vehicle detection are not clear. The location of the signal controlled NMU crossings some 50m after the vehicle stop lines will require sufficient time for vehicles to clear the crossings before NMUs can safely receive a green signal. The Audit Team wonder whether such long clearance times might lead to driver adaptation? Also, since the vehicle stop lines are remote from the signal crossings; would a driver who overruns the start of vehicle red or is then delayed by some unforeseen event, subsequently stop 50m later at the NMU crossing's red signal without a further stop line? Any failure to stop would pose a risk of vehicle/NMU collision

Recommendation – that proposals for vehicle detection, inter-green timings and stop line location are subject to early design discussion with traffic signals specialists to ensure safe operation.

Designer's Response:

The vehicle detection, inter-green timings and stop line locations are to be implemented where appropriate at as part of the next stage of design.

Network Management Decision:

2.0 Alignment

2.1 Problem – vehicle/cycle overtake collisions

Location – Aylsham Rd under the rail bridge

The length of shuttle working is such that some drivers following an on-road cyclist may be tempted to overtake within it. The Audit Team note that proposed carriageway width under the rail bridge varies between 3.2m and approx. 4.5m. This could lead to driver misjudgement and inadequate safe overtaking clearance, resulting in collision.

Recommendation – that the carriageway width is regularised, avoiding tapering widths between 3.2 and 4.0m.

Designer's Response:

The carriageway width within the shuttle working length is to be reviewed once a Topo survey has been carried out, and the tapered width reduced in length to minimise the risk of collision between vehicles overtaking cyclists.

Edge of lane markings on the northern side of the carriageway are to be retained but realigned to achieve a clear width of 3.2m along the shuttle one way signalled working length and to guide high HGV's into the middle of the road when going under the arched rail bridge.

Network Management Decision:

2.2 Problem – tail-end collisions

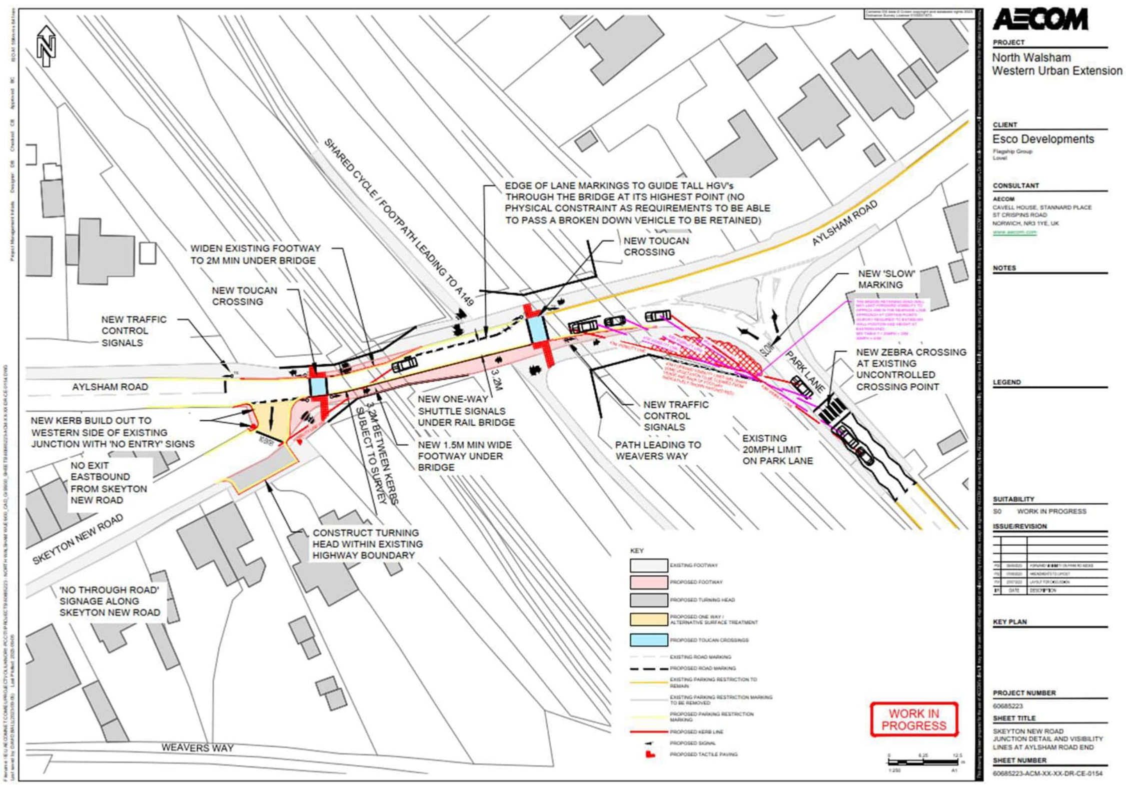
Location – Park Lane into Aylsham Rd westbound

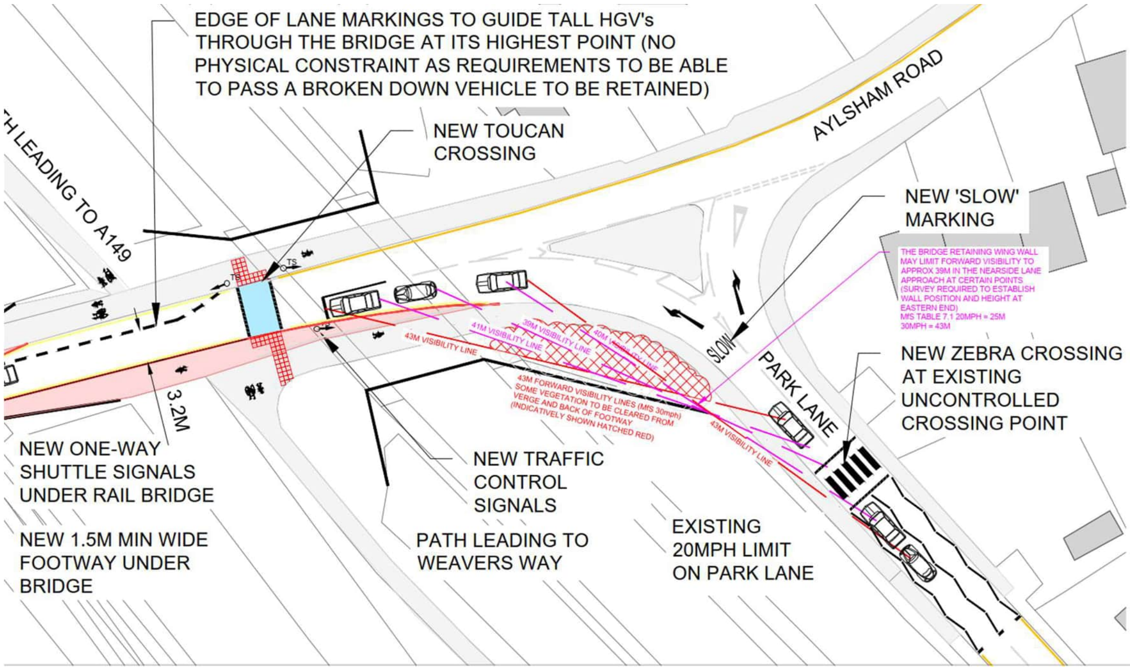
Traffic leaving the Park Lane gyratory into Aylsham Rd westbound may encounter stationary traffic at the proposed signals. A forward visibility splay of 25m is proposed here which is appropriate for speeds of 20mph. However the Audit Team consider that actual traffic speeds on this one-way un-calmed approach may be somewhat higher, leading to a risk of tail-end collision.

Recommendation – that the proposed visibility splay should be based on actual measured traffic speeds.

Designer's Response:

As suggested by the RSA1 comment above, a higher traffic speed of say 30mph would require a forward stopping sight distance of 43m. If the existing vegetation is adjacent to the railway embankment and retaining wall is trimmed back it may be possible to achieve the required 43m forward visibility. This would reduce down to approx 39m over a short distance where the existing bridge retaining wall would obstruct visibility. The exact position, length and height of the wall will require further survey work to establish achievable forward visibility although at present the visibility is greatly reduced by poorly maintained and overgrown vegetation.





We also propose the introduction of a zebra crossing at the existing drop kerb and tactile paved crossing on Park Lane would provide priority for pedestrians over vehicles and also help reduce traffic speeds on the present 20mph speed restricted approach to Aylsham Road, whilst also providing a new facility to access the cycle route and the surgery on Park Lane.

Network Management Decision:

3.0 Junctions

3.1 Problem – junction collisions

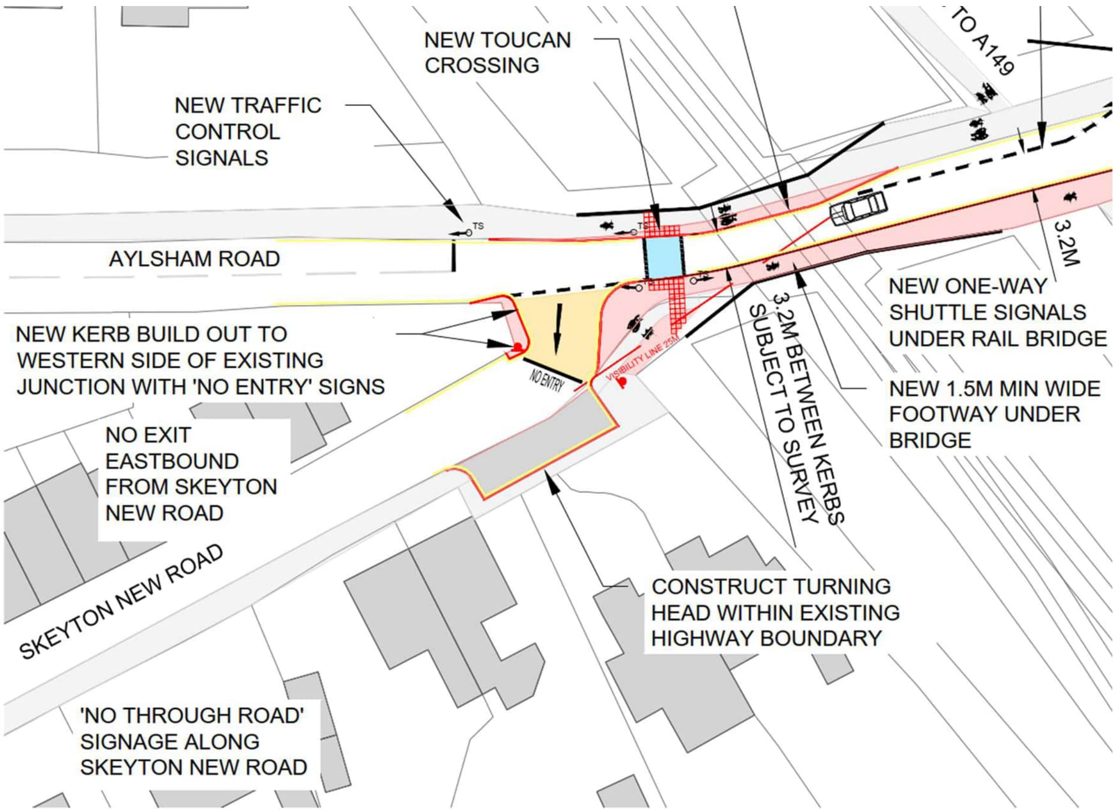
Location – Skeyton New Road one-way plug

The short length of one-way southbound operation may leave it prone to abuse. This concern is exacerbated by lack of any carriageway width restriction on the northbound side. This could result in northbound drivers emerging at the junction in collision with other traffic.

Recommendation – that the one-way section of the junction is redesigned, perhaps with a western kerbline build-out, to better deter northbound abuse of the restriction.

Designer's Response:

The junction of Skeyton New Road with Aylsham Road has been reviewed and the western side build-out widened to allow for new 'No Entry' signs facing northbound traffic. It is also proposed that access only signage is adopted on either end of Skeyton New Road.



Network Management Decision:

4.0 Non-motorised Users

4.1 Problem – collisions between NMUs and access traffic

Location – Norwich Road - RS Timber access/rail station access

The proposed RS Timber access bellmouth appears to be unnecessarily wide, increasing pedestrian and cycle exposure when crossing it, while the refuge area between this and the station access is insufficiently wide to shelter a crossing cyclist. This increases the risk of NMU collision with turning/exiting traffic.

Recommendation – that the accesses are redesigned to better protect NMUs crossing them.

Designer's Response:

Noted. Detailed design works will be undertaken in relation to the proposals in this location including a Topo survey and highway boundary information. Careful consideration of the needs of all users will be needed. Where possible the RS Timber Works access will be narrowed increasing the protected areas for pedestrians and cyclists.

Network Management Decision:

4.2 Problem – vehicle/pedestrian collisions

Location – Norwich Road rail station access junction

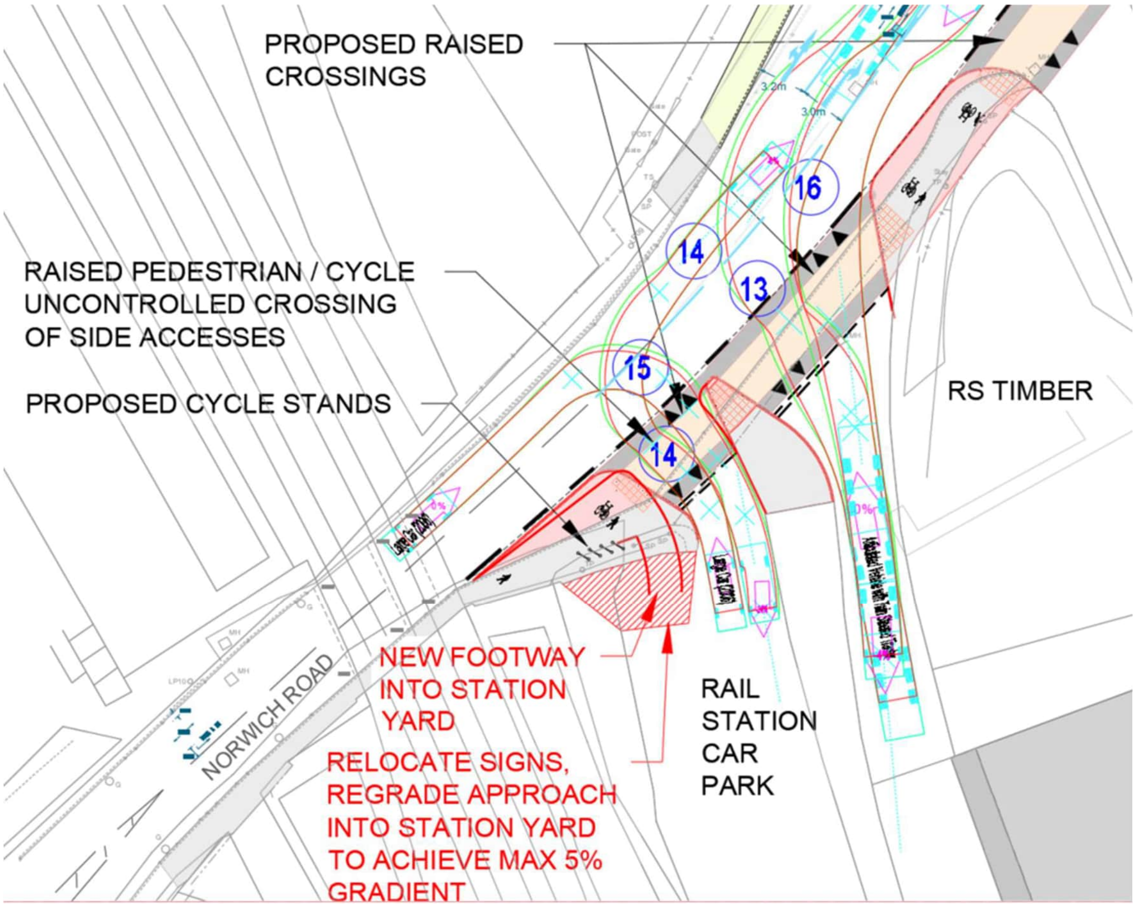
The proposal appears to perpetuate the existing situation where pedestrians accessing/exiting the rail station must share the access carriageway with vehicular traffic at the junction. This exposes them to risk of collision with turning traffic and is likely to be intimidating for some.

Recommendation – that a footway should extend at least around the bellmouth area to protect pedestrians until clear of the junction area.

Designer's Response:

The available width of the existing station access is limited by the entrance to RS Timber to the north east and existing railway station signs and cabinet equipment to the south west.

The entrance could be improved to provide a separate footway for pedestrians if the existing signs and above ground cabinet equipment were relocated, however it is assumed that these features are beyond the limits of the highway boundary, and as such would require the railway companies permission. There is a large level difference between the station access and the adjacent footpath which would mean that the station access would require regrading into the station parking area again beyond the highway boundary. See extract from the proposed layout drawing 60685225-ACM-XX-XX-DR-CE-0155 below with a schematic alternate kerb layout showing a separate footway, this or similar options to be explored during detail design stage.

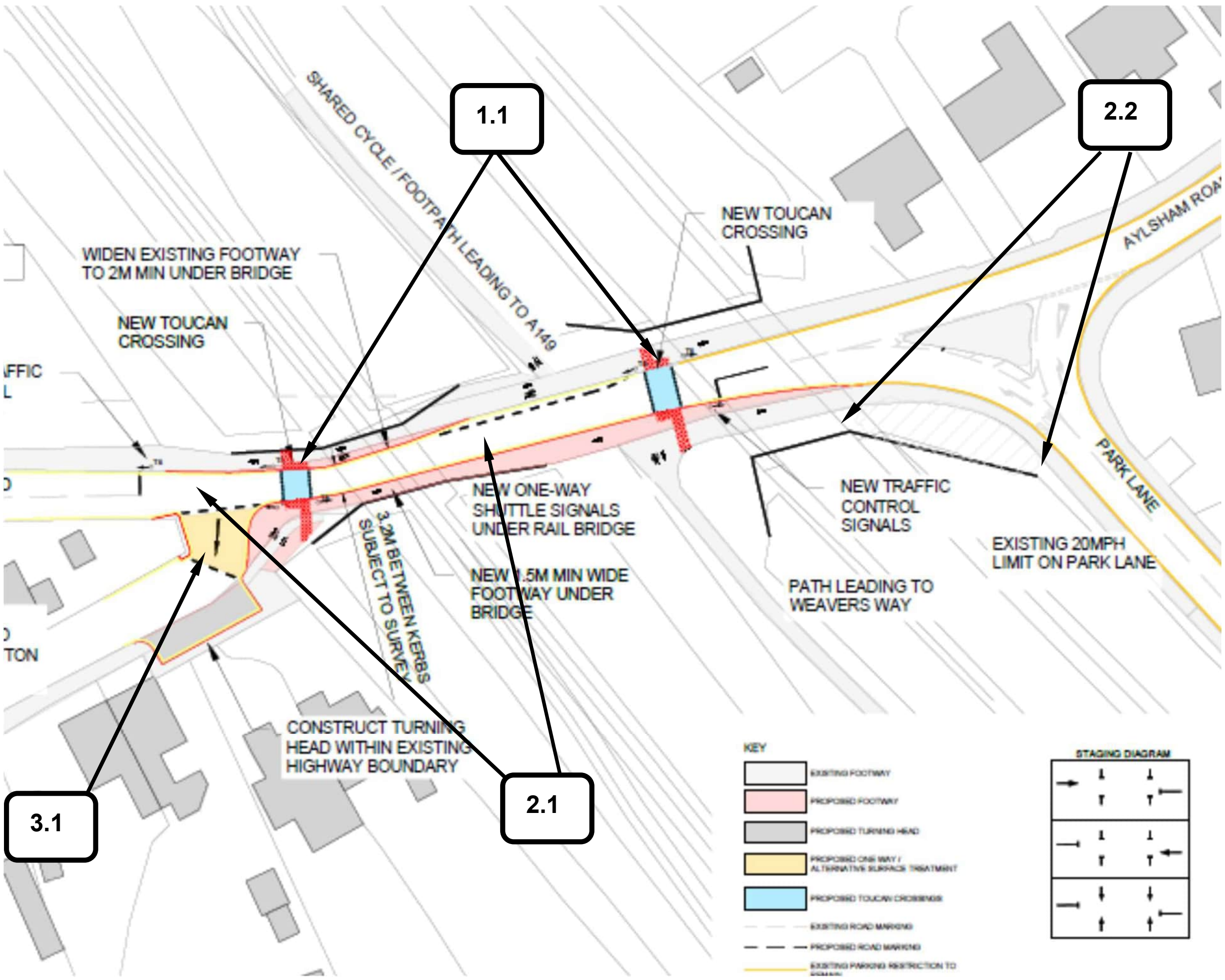


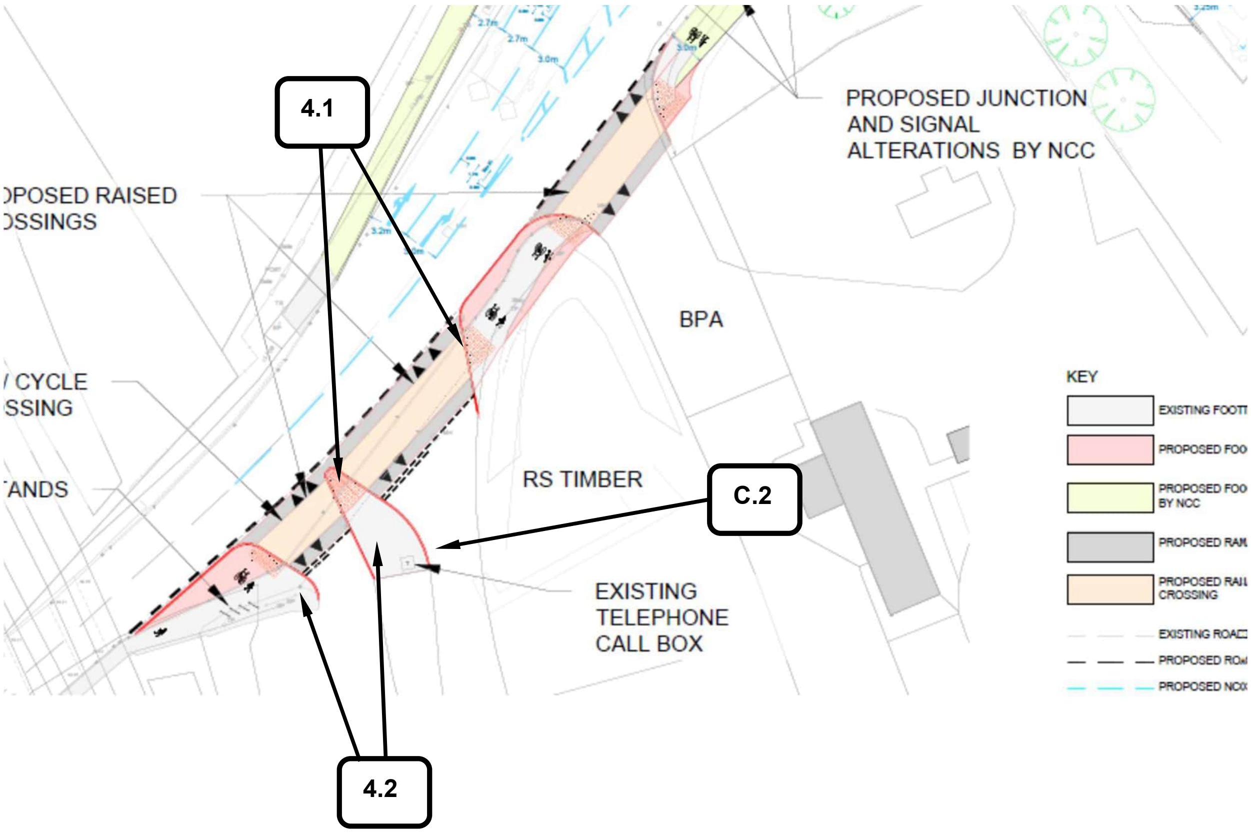
Network Management Decision:

5.0 Signs, Lighting and Markings

5.1 No comment

6.0 Problem Location Plans




4.1
PROPOSED JUNCTION
AND SIGNAL
ALTERATIONS BY NCC
)POSED RAISED
)SSINGS
BPA
/ CYCLE
SSING
'ANDS
RS TIMBER
C.2
EXISTING
TELEPHONE
CALL BOX
KEY
EXISTING FOOT
PROPOSED FOO
PROPOSED FOO
BY NCC
PROPOSED RAI
PROPOSED RAI
CROSSING
EXISTING ROAD
PROPOSED RO
PROPOSED NC
4.2

AUDIT TEAM STATEMENT

We certify that this audit has been carried out in accordance with Norfolk County Council Community and Environmental Procedure SP03-07-P01

Signed (ATL)	N G Calder	Nevil Calder
Dated	22 August 2023	
Signed	K.J. Allen	Kevin Allen
Dated	22 August 2023	

APPENDIX A: Audit Brief

The following documents were submitted for this Road Safety Audit:

Document Ref.	Scale (if applicable)	Title
60685223-ACM-XX-XX-DR-CE-0154 P02		Skeyton New Rd Junction Detail
60685223-ACM-XX-XX-DR-CE-0152 P02		Skeyton New Rd Visibility Lines
60685223-ACM-XX-XX-DR-CE-0153 P01		Skeyton New Rd Vehicle Turning Paths
60685223-ACM-XX-XX-DR-CE-0155 P01		Norwich Rd Cycle Provision
60685223-ACM-XX-XX-DR-CE-0156 P01		Norwich Rd Vehicle Turning Paths
Forecast Traffic Data		
5 yr road accident details		

No Departures from Standard were notified

APPENDIX B: Comments

C.1 The Audit Team note that visibility at the western end Skeyton New Rd is currently restricted by adjacent hedge and weed growth which has been allowed to encroach right up the carriageway edge. Although this is an existing situation, some increased use of the junction will arise from the proposed one-way plug at the other end of Skeyton New Rd. Discussion with the local highway authority is suggested with a view to remedial measures to improve visibility.

Designer's Response:

Accepted. This will be discussed with the Highway Authority as part of delivery of the works on Skeyton New Road at the next stage of design.

C.2 On Norwich Road the 'existing telephone call box' noted on the drawings at the station access no longer exists.

Designer's Response:

Noted

NORTH WALSHAM WESTERN EXTENSION: B1150 COLTISHALL TRAFFIC MANAGEMENT

STAGE 1 SAFETY AUDIT

REPORT REF: B1150/026
August 2023

Report Prepared for: AECOM

North Walsham Western Extension:
B1150 Coltishall TM
Stage 1 Safety Audit

Norfolk County Council

Report Author: **Nevil Calder** BSc(Hons) CEng MICE MCIHT MSoRSA NH Cert Comp

Report Status:

Issue	Status	Purpose	Name/Signature	Date
1	Stage 1 Safety Audit Report	Client issue	Nevil Calder ………………………….	22/08/23
2	Designer's Response	Designer response to Safety Issues raised	…Bevin Carey….	27/09/23
Choose an item.	Choose an item.	Choose an item.	……………………… ………………………	

INTRODUCTION

This report contains the results of a Stage 1 Safety Audit carried out on the above scheme. The Audit was carried out at the request of AECOM on behalf of Norfolk County Council Growth and Development. A formal Audit Brief was not provided.

The Audit Team is independent of the project design team and has had no involvement with the project. The Audit Team membership was as follows:-

Nevil Calder BSc(Hons) CEng MICE, MCIHT, MSoRSA (Audit Team Leader)	Principal Engineer Highway Safety WSP
Kevin Allen BEng (Hons), I Eng, MCIHT, MSoRSA (Audit Team Member)	Project Engineer Network Safety + Sustainability Norfolk County Council

The Audit took place via online conferencing on 16 August 2023. The audit comprised an examination of the supplied documentation (see Appendix A) and a site inspection by the Audit Team Leader on 22 August 2023 at 09:30 which lasted around 30 minutes. During the site visit the weather was sunny and the road surface dry. Traffic flows were moderate and generally free flowing. Speeds varied depending on traffic flow but were frequently observed to be above 20mph.

The terms of reference are as described in Community and Environmental Services Highways Service Manual Procedure SP03-07-P01. The Auditors have examined and reported only on the road safety implications of the scheme within the main report.

The proposal involves traffic management improvements in Coltishall in connection with the planned western urban extension of North Walsham. The audited scheme involves provision of a right turn lane at the junction of B1150 and B1354 including relocation of a pedestrian refuge, together with provision of bus stop markings on Church St approx. 100m to the north.

The auditors have reviewed the five-year (to end Mar 2023) collision record for the location. During this period there were 2 personal injury collisions (both slight) recorded in the vicinity of the scheme. One involved centreline crossover on the bend just north of the B1354 junction, reflecting the narrow carriageway there. The other occurred at the bridge to the west but appears anomalous, involving manoeuvring to give precedence to an emergency vehicle.

A comments section has been included in Appendix B. The issues noted are not necessarily safety issues. They relate either to wider network implications, safety issues identified outside the scope of the audited scheme or suitability of a particular design choice.

ITEMS RAISED AT PREVIOUS AUDIT

The Audit Team are not aware of any previous audit of this scheme.

ITEMS RAISED AT THIS STAGE 1 AUDIT

1.0 General

1.1 No comment

2.0 Alignment

2.1 Problem – kerb strikes/loss of control or head-on collisions

Location – B1150 westbound at proposed RTL

The RTL layout reduces the width of the westbound through-lane where it passes the western corner of the filing station. There is a low brick wall here immediately at the carriageway edge (see photo), raising concern over vehicle edge strikes with potential for loss of control. Alternatively, drivers' natural 'edge-shyness' may cause them to overrun the RTL resulting in head-on collision with an eastbound vehicle entering it.

Recommendation – that the westbound through-lane should be a minimum of 3.2m adjacent to the low brick wall of the filling station and 3m elsewhere. The swept paths

Template Version #11 09/14
KJA

suggest that the proposed RTL might be shortened slightly at its eastern end to facilitate this.

Designer's Response:

The Westbound through lane width has been reviewed and the design adjusted to achieve the suggested 3.2m width adjacent to the low height wall on the boundary of the service station.

Network Management Decision:

2.2 Problem – kerb strikes/loss of control

Location – B1150 westbound at proposed refuge island

The proposal indicates a westbound through-lane width of only 3m between kerbs where it passes the refuge island. On a classified road this is considered inadequate (despite the 20mph speed limit), raising the risk of vehicle kerb strikes with potential for loss of control.

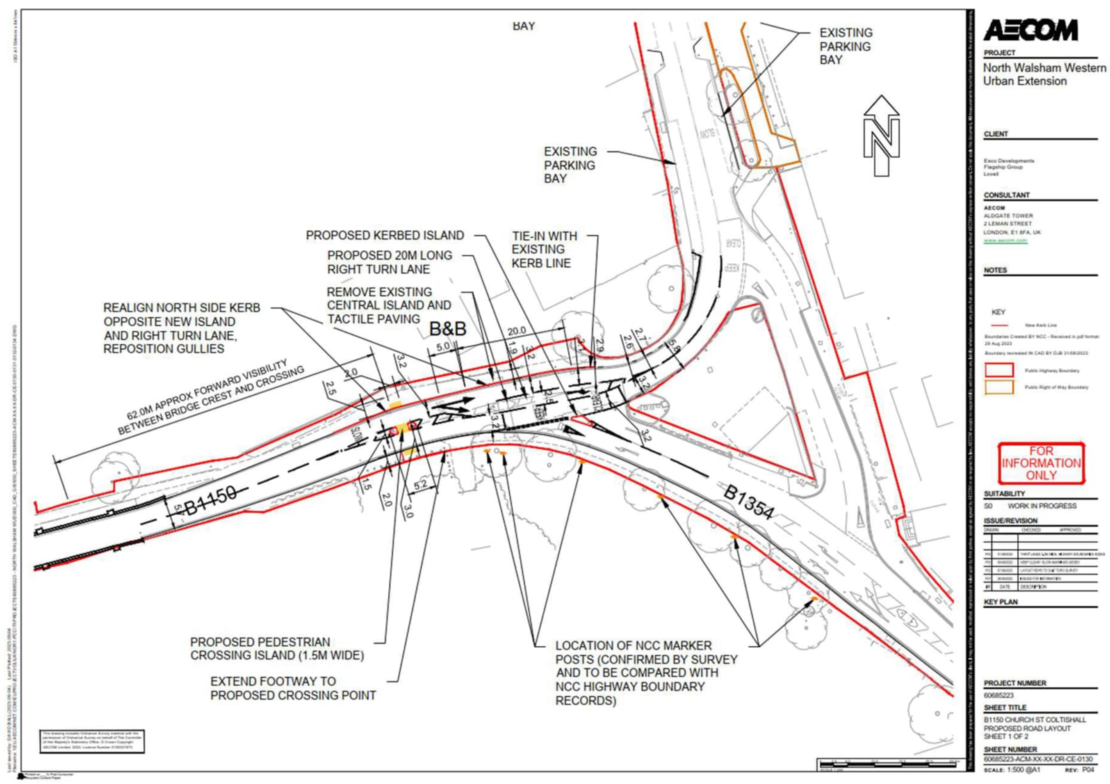
Recommendation – that the through-lanes adjacent to the refuge island should be a minimum of 3.2m between kerbs

Template Version #11 09/14
KJA

Designer's Response:

The through lane widths adjacent to the proposed pedestrian refuge island have been increased to 3.2m as recommended by para 2.2 above.

To achieve 3.2m wide through lanes each side of the pedestrian refuge, the existing northern kerb line has been shifted northwards as indicated in the extract below. The revised drawing 60685223-ACM-XX-XX-DR-CE-0130-P04 also shows the recently acquired NCC Highway boundary details.



Network Management Decision:

3.0 Junctions

3.1 No comment

4.0 Non-motorised Users

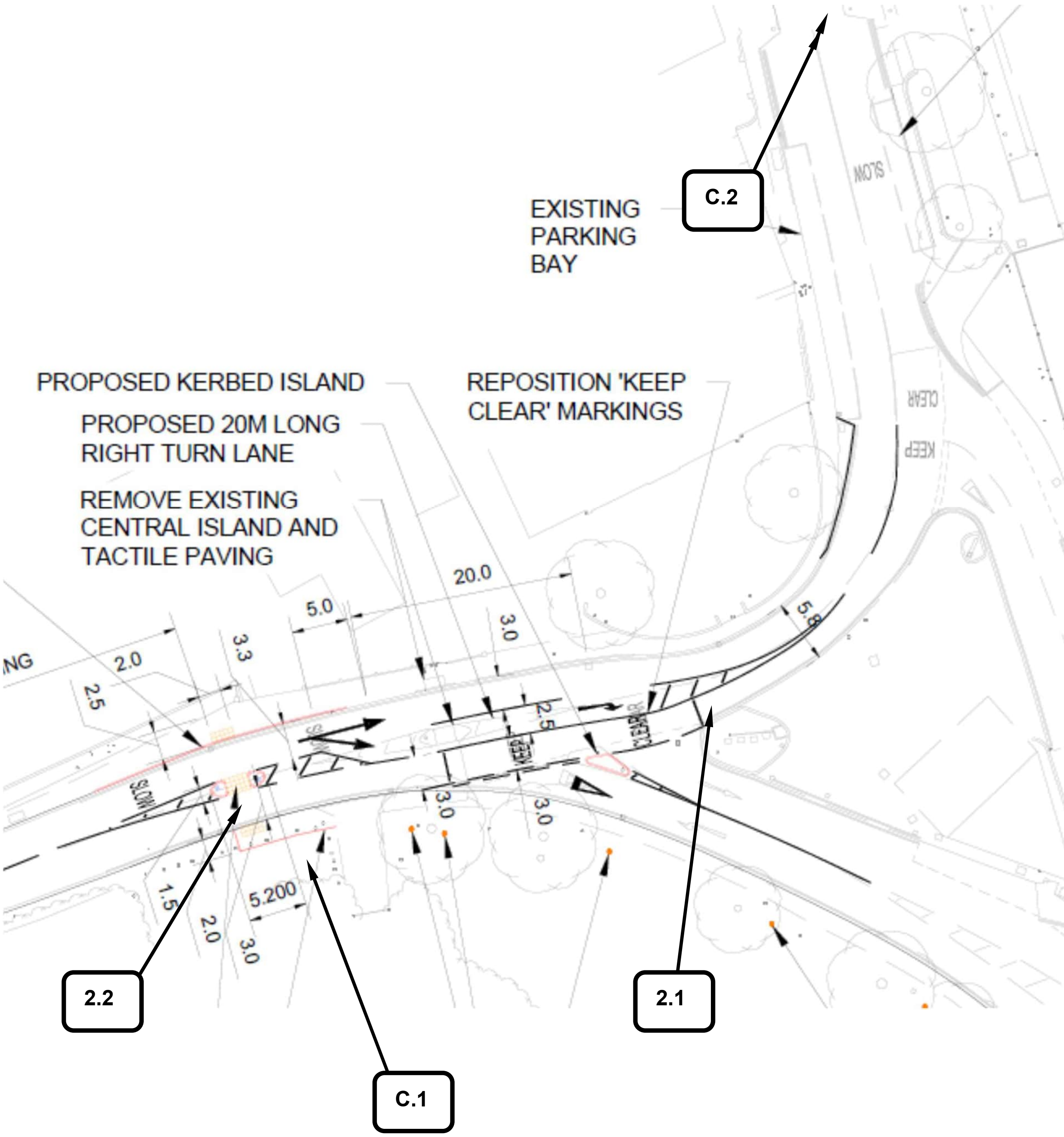
4.1 No comment

5.0 Signs, Lighting and Markings

5.1 No comment

Norfolk County Council

6.0 Problem Location Plan



Template Version #11 09/14
KJA

AUDIT TEAM STATEMENT

We certify that this audit has been carried out in accordance with Norfolk County Council Community and Environmental Procedure SP03-07-P01

Signed (ATL)	N G Calder	Nevil Calder
Dated	22 August 2023	
Signed	K.J. Allen	Kevin Allen
Dated	22 August 2023	

Template Version #11 09/14
KJA

APPENDIX A: Audit Brief

The following documents were submitted for this Road Safety Audit:

Document Ref.	Scale (if applicable)	Title
60685223-ACM-XX-XX-DR-CE-0130 P03	1:500	Proposed Road Layout (1 of 2)
60685223-ACM-XX-XX-DR-CE-0133 P01	1:500	Proposed Bus Stop
60685223-ACM-XX-XX-DR-CE-0131 P04	1:250	Vehicle Tracking (1 of 3)
60685223-ACM-XX-XX-DR-CE-0134 P03	1:250	Vehicle Tracking (2 of 3)
60685223-ACM-XX-XX-DR-CE-0135 P04	1:250	Vehicle Tracking (3 of 3)
Forecast Traffic Data		
5 yr road accident details		

No Departures from Standard were notified

APPENDIX B: Comments

C.1 The swept path shown for a tanker exiting the pump house to the west (turning left) overruns an area of third party land to the west of the access. This may not therefore be practicable, rendering the manoeuvre impossible with the proposed refuge location. It is suggested that this be discussed with Anglian Water at an early stage to confirm the viability of the proposal.

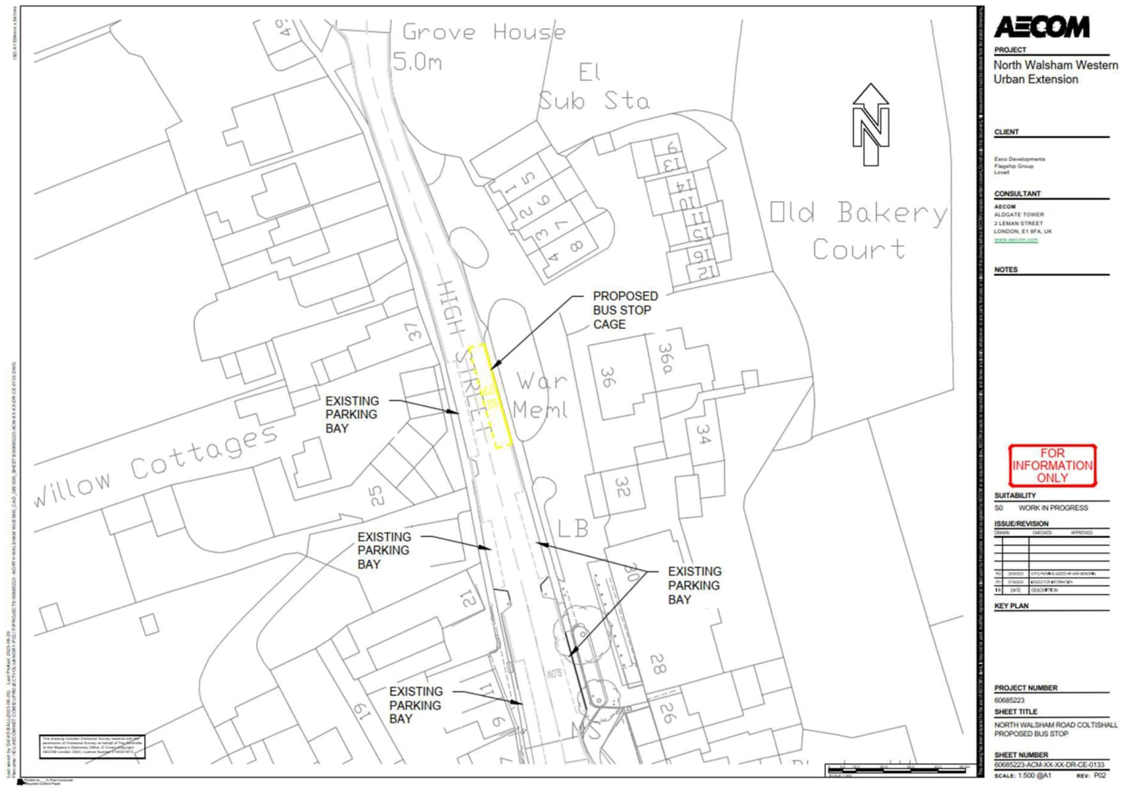
Designer's Response:

The tanker provision to the pump house facility is to be discussed in detail with Anglian Water.

C.2 It was noted that Dwg 0133 omits a section of existing on-street parking bays on the eastern side just south of the war memorial.

Designer's Response:

Noted that existing on-street parking bay was missing from drawing. This has now been added to Drg …1033-P02.


Grove House
5.0m
El
Sub Sta
Old Bakery
Court
HIGH STREET
War
Meml
Willow Cottages
LB
PROPOSED
BUS STOP
CAGE
EXISTING
PARKING
BAY
EXISTING
PARKING
BAY
EXISTING
PARKING
BAY
EXISTING
PARKING
BAY
AECOM
PROJECT
North Walsham Western
Urban Extension
CLIENT
Esco Developments
Flagship Group
Lovell
CONSULTANT
AECOM
ALDGATE TOWER
2 LEMAN STREET
LONDON, E1 8FA, UK
www.aecom.com
NOTES
FOR
INFORMATION
ONLY
SUITABILITY
S0 WORK IN PROGRESS
ISSUE/REVISION
KEY PLAN
PROJECT NUMBER
60685223
SHEET TITLE
NORTH WALSHAM ROAD COLTISHALL
PROPOSED BUS STOP
SHEET NUMBER
60685223-ACM-XX-XX-DR-CE-0133
SCALE: 1:500 @A1
REV: P02