Call to Reduce Overly Long Down Time of Barrier Arms at Level Crossings close to Rail Stations

In accordance with Standing Orders, please place the following Notice of Motion on the agenda for the Albert-Eden Local Board meeting being held on Wednesday 1st May, 2019

Recommendation/s

a) That the report be received.

b) That the Albert-Eden Local Board notes that:

- complaints have been received about long delays and queues at some railway level crossings in our area as detailed in the Background to the report.
- there is a marked discrepancy between the down-time of the barrier arms at level crossings located close to rail stations depending on whether the train that tripped the cycle of warning signals and barriers is arriving at or departing from that station.
- this discrepancy frequently exceeds 30 seconds and can be up to 50 seconds per cycle, during which time the train is stationary and posing no safety risk.
- at peak times when there are six trains per hour in both directions this discrepancy totals at least 4 minutes per hour (6.7% of unnecessary barrier down-time).
- prolonged down time of the level crossing half-arm barriers causes long traffic queues that may involve dozens of vehicles and stretch for hundreds of metres.
- overly long delays at level crossings is clearly an inefficient use of road-users' time and clearly causes considerable frustration that may impact negatively on driver behaviour and tolerance of other road users.
- although each level crossing is slightly different it appears that the cycle times could be adjusted to be more or less equal for in-coming and out-going trains while retaining an appropriate safety margin.
- although Auckland Transport's 10-year plan includes $424.3 million for a programme of grade separating level crossings it will be years before construction begins and there is only sufficient allocated funding to deal with a minority of the 45 level crossings so it is likely to take several decades to complete the job.

c) That the Albert-Eden Local Board urges Auckland Transport and KiwiRail to assess any opportunity to reduce the cycle time of the warning signals and barrier arms at level crossings near rail stations while maintaining safety for all affected users.

d) That this resolution be addressed to the Chief Executive and Chair of the Board of Auckland Transport and to the Auckland Operations Manager of KiwiRail.

e) That this resolution be also drawn to the attention of other Local Boards who have one or more railway level crossings in their area and may have similar issues.

Background

Some railway level crossings are located relatively close to a station, and in such situations the delay to traffic caused by the cycle of warning bells/flashing lights and lowered half-arm barriers can be up to twice as long for trains which pass over the level crossing **after** leaving the station as for trains in the opposite direction which pass over the level crossing **before** entering the station.

In the discussion below I have used average times for 6-car EMU trains which are 144 metres long. The station platforms are 151-163 metres long. Full data is in an appendix at the end of the report.

In Albert-Eden there are three situations where level crossings and stations are close together:

Morningside Drive Level Crossing is 27 metres from the island platform of Morningside Station for out-bound trains, and 31 metres from the platform for in-bound trains

Woodward Road Level Crossing is 451 metres from the island platform of Mount Albert Station

Rossgrove Terrace Level Crossing is 14 metres from the East side platform of Baldwin Avenue Station, and 34 metres from the West side platform; the side platforms are offset by 20 metres.

[related to Rossgrove Terrace is the **Asquith Avenue Level Crossing** which is about 90 metres North East of Rossgrove Terrace and has its signals/barrier arms triggered just before or after those at the Rossgrove Terrace level crossing, depending on train direction.]

In each case trains crossing the level crossing **before** they pull in to the station trigger a cycle of warning signals that last 45-60 seconds – but trains crossing the level crossing **after** they leave the station trigger a cycle that lasts 95-113 seconds as detailed below. This large discrepancy is caused by overly cautious settings for the signal triggers that add at least 30 unnecessary seconds.

Morningside Drive Level Crossing Analysis (see details of events and timing in the Appendix):

The current situation:

- Out-bound (West-bound) trains trigger the warning-signal cycle 24 seconds before they first become visible from the platform (rounding a bend some 150 metres East of the level crossing), and 35 seconds before the front of the train enters the level crossing. The cycle ends after 61 seconds with the half-arm barriers returned to the vertical and the bells and flashing lights cease – just before the train halts at Morningside Station with its rear end about 28 metres from the level crossing.

  The resultant interruption to the flow of traffic on Morningside Drive averages 61 seconds.
- In-bound trains from the West pulling in to the station trigger the warning-signal cycle 8 seconds **before** they halt with their nose some 34 metres from the nearby level crossing on Morningside Drive. The trains then sit stationary for about 47 seconds (varying from 35 seconds up to a minute depending on numbers of passengers, etc.), before starting to leave, very slowly at first, entering the level crossing about 65 seconds after the bells first started. The cycle ends with the half-arm barriers again vertical 95 seconds after the cycle began.

  The resultant interruption to the flow of traffic on Morningside Drive averages 95 seconds.
- The discrepancy between the in-bound and out-bound trains averages 34 seconds
- The barrier half-arms begin descending to the horizontal about 4 seconds after the bells and flashing lights start and are horizontal after 12 seconds. For an out-bound train the barriers are fully down 23 seconds before it enters the level-crossing at high speed but an in-bound train enters the level-crossing 53 seconds after the barrier arms are down and at a relatively slow pace as it gradually accelerates from a standing start.

Possible solution:

- If the trigger point for in-bound trains was adjusted by 30 seconds so that the cycle began 22 seconds **after** the train halted, there would still be at least 25 seconds before the train started again, and at least 35 seconds before the train entered the crossing (and 23 seconds after the half-arm barriers were fully down) – exactly the same safety margin as for out-bound trains.

Woodward Road Level Crossing Analysis (see details of events and timing in the Appendix):

The current situation:

- Unlike the other crossings discussed here, trains cross the Woodward Road level crossing at the maximum permitted speed in this block of 80 kmph (22.22 metres per second)
- In-bound trains from the South West trigger the warning-signal cycle 27seconds before they enter the Woodward Road level crossing, and enter the crossing 15 seconds after the barrier arms are fully down. The barrier arms are back up in the vertical position and the bells have stopped before the train has stopped at the Mount Albert Platform some 450 metres away.

  The resultant interruption to the flow of traffic on Woodward Road averages 46 seconds.
- Out-bound trains from the North East trigger the warning-signal cycle at the Woodward Road level crossing about 26 seconds **after** they have stopped at Mount Albert station some 450 metres away from the level crossing but about 13 seconds **before** they have left the station. It takes the train another 29 seconds on average to reach and enter the level crossing at high speed. The total cycle time for the alarm signals (bells and flashing lights) is about 95 seconds, approximately twice the time for in-coming trains.

  The resultant interruption to the flow of traffic on Woodward Road averages 95 seconds.
- The discrepancy between the in-bound and out-bound trains averages 49 seconds
- The barrier half-arms begin descending to the horizontal about 4 seconds after the bells start and are horizontal after 12 seconds. For an in-bound train the barriers are fully down 56 seconds before it enters the level-crossing at high speed but an in-bound train enters the level-crossing 27 seconds after the barrier arms are down although the speed is similar to or the same as that of out-going trains at this point — the in-bound trains have not yet begun to decelerate and the outgoing trains have had 450 metres to get up to cruising speed.

Possible solution:

- If the trigger point for out-bound trains was adjusted by 30 seconds so that the cycle began **when the train started**, there would be about 29 seconds before the train entered the crossing (and 18 seconds after the half-arm barriers were fully down) – similar to the safety margin for in-bound trains at this level crossing. This would reduce the cycle time which currently halts the flow of traffic for 95 seconds to about 66 seconds without compromising safety.

Rossgrove Terrace Crossing Analysis (see details of events and timing in the Appendix):

The current situation:

- The situation at the Rossgrove Terrace Level Crossing is more complex than at the others as there is another level crossing about 90 metres North East of it and a pedestrian-only level crossing 10 metres South West of the Baldwin Avenue Station platforms (180 metres South West of the Rossgrove Terrace Level Crossing). However, after delving through the details, the same kind of discrepancy is evident and a similar solution appears to be possible.
- In-bound trains from the South West trigger the bells at the pedestrian-only level crossing 40 seconds before entering the Baldwin Avenue Station and that cycle ends 7 seconds before the

train stops. The nose of a 6-car train halts 40 metres from the Rossgrove Terrace Level Crossing. The cycle of warning signals at the level crossing starts just 2 seconds later, even before the doors have started to open – the doors are open for 20-30 seconds so the train is not ready to leave until 38 seconds after the bells began sounding. The train begins moving very slowly until it crosses over the balise [see notes] which permits the train to accelerate and does not enter the hatched area marked on Rossgrove Terrace for a further 20-30 seconds.

The resultant interruption to the flow of traffic on Rossgrove Terrace averages 94 seconds.

- Out-bound trains from the North East trigger the alarm signals at Asquith Avenue about 4 seconds before the cycle at Rossgrove Terrace Level Crossing begins. The train enters the Rossgrove Terrace Level Crossing 32 seconds after the cycle of bells and barrier arms begins and the cycle ends 11 seconds after the train has cleared the level crossing.

  The resultant interruption to the flow of traffic on Rossgrove Terrace averages 49 seconds.

- The discrepancy between the in-bound and out-bound trains averages 45 seconds.

Possible solution:

- A similar reduction in the cycle time for in-coming (North bound) services could be achieved by moving the trigger point from the arrival of the train to a time delay similar to that which applies at Mount Albert Station for south-bound trains. So instead of the cycle beginning just seconds after an in-bound train halts at Platform 1, it should start much later, say when the plug doors close 38 seconds after the train halts and 36 seconds before the train enters the level crossing. This would reduce the interruption to the flow of traffic to about 56 seconds, but that time could vary (depending largely on the time that the doors were open) from about 45 seconds to 65 seconds or more.
- Alternatively, there could be a fixed delay of say 30 seconds after the train stops, which would be easier to apply and would give a consistent outcome with an interruption of 64 seconds, just 11 seconds longer than that for out-bound trains.
- If the balise set [see Appendix] currently located 12 metres North of Platform 1 had an additional module located at or just before the end of the platform then trains could begin accelerating 10 seconds or so earlier which would correspondingly reduce the delay at both level crossings (Rossgrove Terrace and Asquith Avenue).

The Appendix to this report documents current cycles and timings at the relevant level crossings. It also includes notes on train operations in Auckland which include a brief discussion of the ETCS (European Train Control System) which is used in many countries as well as in Auckland.

Signatory:

Author	Graeme Easte, Board Member

Seconder	Glenda Fryer, Deputy Chairperson

Appendix: Survey of Current Cycles and Timings at Relevant Level Crossings

- times in seconds averaged over 6-10 cycles ~
  zero point is when bells begin ~ times prior to that are expressed as negative numbers

Morningside Drive Level Crossing (MD-LC)

- 30m NE of Morningside Station platform – 151 m island (7m longer than a 6-car train)
- rear end of out-bound 6-car train is 28m West of level crossing when stopped at station
- front end of in-bound 6-car train is 35m West of level crossing when stopped at station

Out Bound Trains (heading SW) ~ Cycle time of bells averages 61 seconds

-21	Train departs Kingsland Station ~ front end of 6-car train is 700 m from MD-LC
0	**MD-LC bells and flashing lights start** ~ half-arms are in vertical (stored) position
4	MD-LC half-arm barriers begin to descend from vertical (stored) position
5	MD-LC pedestrian gates (on South side of level crossing) begin to close
6	Train about 450m North East of MD-LC, still not yet visible from station
10	MD-LC pedestrian gates (on South side of level crossing) are fully closed
12	**MD-LC half-arm barriers are down** (in horizontal position)
24	Train just visible from Morningside Station platform ~ train is 150 m NE of MD-LC
35	Train enters MD-LC ~ front of train enters East side of hatched area on road
51	Train exits MD-LC ~ rear of train exits West side of hatched area on road
54	MD-LC half-arm barriers begin lifting ~ pedestrian gates open
60	**MD-LC half-arm barriers are back up** ~ arms returned to vertical (stored) position
61	**MD-LC bells & flashing lights stop** ~ overall cycle time varies from 58-68 secs
63	**Train Stops at Morningside Station** ~ rear of 6-car train is 28 m from MD-LC
72	Plug Doors of EMU start to open ~ green lights lit, doors can open on demand
102	Plug Doors of EMU fully closed ~ all doors close on train manager instruction
112	**Train starts to leave Morningside Station** ~ time at varies from 30-55 seconds
145	Train clears platform ~ rear end of train at SW end of platform 185m from MD-LC
160	Train 430m West of MD-LC ~ rear of train enters New North Road bridge
212	Train stops at Baldwin Avenue station ~ rear of train is 1,341 m from MD-LC

In-Bound Trains (heading NE) ~ Cycle time of bells averages 95 seconds

-113	Train departs Baldwin Avenue Station ~ front end of train is 1,376 m from MD-LC
-48	Train starts slowing as it exits New North Road bridge, 250m W of platform
-32	Train at W end of platform ~ front of train at end of platform, 180 m from MLD-LC
-15	Train passes station shelters ~ train slowing as it passes mid-point of platform
0	**MD-LC bells and flashing lights start** ~ half-arms are in vertical (stored) position
4	MD-LC half-arms begin to descend from stored (vertical) position
5	MD-LC pedestrian gates (on North side of level crossing) begin to close
8	**Train stops at Morningside Station** ~ front of 6-car train is 35 m from MD-LC
10	MD-LC pedestrian gates (on South side of level crossing) are closed
12	**MD-LC Half-arm barriers are down** (in horizontal position)
15	Plug Doors of EMU start to open ~ green lights lit, doors can open on demand
35	Plug Doors of EMU fully closed ~ all doors close on train manager instruction
55	**Train starts to leave Morningside Station** ~ train moves very slowly at first
65	Train enters MD-LC ~ train enters West side of hatched area on road
83	Train exits MD-LC ~ train exits East side of hatched area on road
86	MD-LC half-arms begin lifting ~ pedestrian gates open
94	**MD-LC half-arm barriers are back up** ~ half-arms returned to vertical position
95	**MD-LC bells & flashing lights stop** ~ overall cycle time varies from 85-100 secs
120	Train passes out of view ~ train rounds bend about 150m East of MD-LC
148	Train stops at Kingsland Station ~ rear of 6-car train is 886 m from MD-LC

Rossgrove Terrace Level Crossing (RT-LC)

- 14-34 metres NE of Baldwin Avenue Station –side platforms (157 metres long, offset by 20 m)
- front end of in-bound 6-car train is 40m SW of level crossing when stopped at station
- rear end of out-bound 6-car train is 20m SW of level crossing when stopped at station
- times in seconds averaged over 6 cycles ~ zero point is when bells and flashing lights begin
  ~ times prior to that are expressed as negative numbers
- *times also noted for the Asquith Avenue Level Crossing (AA-LC), which is 89-97m NE of the RT-LC and for the pedestrian only level crossing 10m South of the station*

Part 1: Out-Bound Trains (heading SW)

~ Cycle time of Rossgrove Terrace Level Crossing bells averages 49 seconds

Focus is on impact of trains on the Rossgrove Terrace Level Crossing (RT-LC)

But - times etc. for Asquith Avenue Level Crossing (AA-LC) and the pedestrian-only level-crossing South of Baldwin Avenue Station are italicized and indented

-47	Train departs Morningside Station ~ front end of 6-car train is 1,150 m from RT-LC
	-4 AA-LC bells start ~ about 90 m NE of RT-LC ~ train not yet visible
0	**RT-LC bells and flashing lights start** ~ half-arms are in vertical (stored) position cycle starts 16 seconds before train becomes visible from Baldwin Avenue Station
	0 AA-LC half-arms begin to descend from vertical (stored) position
	1 AA-LC pedestrian gates begin to close on both sides of Asquith Avenue
4	RT-LC half-arms begin to descend from vertical (stored) position
5	RT-LC pedestrian gates begin to close on both sides of Rossgrove Terrace
	6 AA-LC pedestrian gates are fully closed
	8 AA-LC half-arms are down in horizontal position
10	RT-LC pedestrian gates are fully closed
12	**RT-LC half-arms are down in horizontal position**
16	Front of train appears under St. Lukes Road Bridge ~ 375m NE of RT-LC
24	Train begins slowing about 85 m before reaching Asquith Avenue
	27 Train crosses AA-LC at speed of about 18 metres per second (65kmph)
	30 AA-LC half-arm barriers start to lift
32	Train enters RT-LC ~ front of train enters North side of hatched area on road
	36 AA-LC bells stop ~ half-arm barriers are back up & pedestrian gates closed
38	Train exits RT-LC ~ rear of train exits South side of hatched area on road
40	RT-LC half-arms begin lifting from horizontal
41	RT-LC pedestrian gates begin opening
48	**RT-LC half-arms are back up** ~ half-arms returned to vertical (stored) position
49	**RT-LC bells and flashing lights stop** ~ cycle time varies from 45-55 seconds
50	**Train Stops at Baldwin Avenue Station** ~ rear of 6-car train is 20 m from RT-LC
	50 Bells & lights begin at pedestrian gate 10m S of Baldwin Avenue platform
	54 Pedestrian gate 10m S of Baldwin Avenue platform begins closing
58	Plug Doors of EMU start to open ~ green lights lit, doors can open on demand
	54 Pedestrian gate 10m S of Baldwin Avenue platform closed
80	Plug Doors of EMU fully closed ~ all doors close on train manager instruction
87	**Train starts to leave Baldwin Avenue Station** ~ overall time at station 30-50 secs
103	Train clears platform ~ end of train at SW end of platform ~ 175 m from RT-LC
	104 Pedestrian gate 10m S of Baldwin Avenue platform opens
	105 Bells and flashing lights for pedestrian crossing stop
130	Train 150m South of platform ~ rear of train rounds bend about 300 m from RT-LC
185	Train stops at Mount Albert Station ~ rear of train is 1,063 m from RT-LC

In-Bound trains at Rossgrove Terrace Level Crossing are on the next page

Out-Bound trains at Rossgrove Terrace Level Crossing are on the previous page

Rossgrove Terrace Level Crossing (RTLC)

Part 2 In-Bound Trains (heading North East)

~ Cycle time of Rossgrove Terrace Level Crossing bells averages 94 seconds

Focus is on impact of trains on the Rossgrove Terrace Level Crossing (RT-LC)
But - times etc. for Asquith Avenue Level Crossing (AA-LC) and the pedestrian-only level-crossing South of Baldwin Avenue Station are italicized and indented

-109	Train departs Mt. Albert Station ~ front end of train is about 1,060m from RT-LC
-60	*Bells start at pedestrian level crossing 10m S of Baldwin Avenue Platform 1*
-58	*Pedestrian gates begin closing*
-52	*Pedestrian gates shut ~ pedestrian gates at south end of station closed*
-48	Train slows as it rounds bend 180 m South of platform ~ train 350 m Sth of RT-LC
–30	*train enters pedestrian-only level crossing ~ front end enters the crossing*
–20	train enters station ~ front end of train slowly passes South end of Platform 1
-17	*train clears pedestrian-only level crossing ~ rear end exits the crossing*
-15	*Pedestrian gates begin closing*
-9	*Pedestrian gates closed and southern signals stop*
-2	**Train Stops at Baldwin Avenue Station** ~ front of 6-car train 40m from RT-LC
	Note: time varies ~ bells can begin up to 10 seconds **prior to** train halting
0	**RT-LC bells and flashing lights start** ~. 2 seconds after the train has halted
4	RT-LC arms descend. ~ half-arm barriers begin to descend from stored position
5	*AA-LC bells start ~ 90 m NE of RT-LC ~ 85 seconds before train enters*
6	Plug Doors of EMU start to open ~ green lights lit, doors can open on demand
4	*AA-LC half-arm barriers start to descend*
10	RT-LC pedestrian gates are closed
12	**RT-LC half-arms are down (horizontal)**
15	*AA-LC pedestrian gates are closed*
17	*AA-LC half-arms are down in horizontal position*
36	Plug Doors of EMU fully closed ~ all doors close on train manager instruction
45	**Train starts to leave Baldwin Avenue Station** ~ time varies (35-55 seconds)
58	Front of train passes over balises which allow ETCS to permit driver to accelerate
73	Train enters RT-LC ~ front of train enters South side of hatched area on road
83	Train exits RT-LC ~ rear of train exits North side of hatched area on road
85	RT-LC half-arms begin lifting ~ pedestrian gates begin opening
90	*Train enters AA-LC ~ train about 90m from RT-LC*
93	**RT-LC half-arms are back up ~** pedestrian gates are closed
94	**RT-LC bells and flashing lights stop** ~ cycle time varies from 85-115 seconds
96	*Train exits AA-LC ~ train about 100m from RT-LC, speed about 20 mps*
98	*AA-LC half arm barriers start to lift*
106	*AA-LC half-arms are back up ~ pedestrian gates closed, bells stop*
118	Train disappears from view under St. Lukes Road Bridge ~ 375 m from RT-LC
159	Train stops at Morningside Station ~ rear of train is 1,150 m from RTLC

Woodward Road Level Crossing (WR-LC)

- 450 m SW of Mount Albert Station – 163m island platform (19m longer than a 6-car train)
- front end of out-bound 6-car train is 460m North of WR-LC when stopped at station
- rear end of in-bound 6-car train is 460m North of WR-LC when stopped at station
- note that the in-bound and out-bound cycles frequently overlap which can extend the cycle time by a minute or so. – this occurs when one train is well behind schedule
- times in seconds averaged over 6 cycles ~ zero point is when bells and flashing lights begin
  ~ times prior to that are expressed as negative numbers

Out-Bound Trains (heading South West) ~ Cycle time of bells averages 95 secs

-116	Train leaves Baldwin Avenue Station ~ front of train almost 1,500m from WR-LC
-54	Train at Carrington Road Bridge ~ front of train under bridge (660m from WW-LC)
-48	Train at N end of Mount Albert Station ~ front of train passes NE end of platform
-38	Train passes mid-point ~ train slowing as it passes mid-point of platform
-26	**Train stops at Mount Albert Station** ~ front of 6-car train now 462m from WR-LC
-15	Plug Doors of EMU start to open ~ green lights lit, doors can open on demand
0	**WR-LC bells and flashing lights start** ~ half-arms are in vertical (stored) position
4	WR-LC half-arms begin to descend from vertical (stored) position
12	**WR-LC half-arms are down (horizontal)** ~ pedestrian gates are closed as well
20	Plug Doors of EMU fully closed ~ all doors close on train manager instruction
32	**Train starts to leave Mount Albert Station** ~ train moves very slowly at first
51	Train clears South end of Mount Albert Station platform ~ 450 m N of WR-LC
68	Train enters WR-LC ~ front of train enters North side of hatched area on road
75	Train exits WRLC ~ rear of train exits South side of hatched area on road
76	WR-LC half-arms begin lifting ~ pedestrian gates open
94	**WR-LC half-arms are back up** ~ pedestrian gates close
95	**WR-LC bells stop** ~ overall cycle time varies from 85-100 seconds
97	Train runs out of view from level crossing ~ train rounds bend 480m SW of WR-LC
190	Train stops at Avondale ~ rear of train about 1,365m from WR-LC

In-Bound Trains (heading North East) ~ Cycle time of bells averages 46 seconds

-108	Train leaves Avondale Station ~ front of train about 1,375m from WR-LC
0	**WR-LC bells and flashing lights start** ~ half-arms are in vertical (stored) position
	Front of train is 600m SW of level crossing ~ behind Pak'N Save Supermarket
4	WR-LC half-arm barriers begin to descend from vertical (stored) position
6	Train appears from South ~ train rounds bend about 480 metres SW of WR-LC
12	**WR-LC half-arm barriers are down** ~ pedestrian gates are closed as well
27	Train enters WR-LC ~ front of train enters South side of hatched area on road
35	Train exits WR-LC ~ rear of train exits South side of hatched area on road
38	WR-LC half-arms begin lifting ~ pedestrian gates open
40	Front of Train passes South end of platform ~ 450 m from WR-LC
45	**WR-LC half-arms are back up** ~ pedestrian gates close
46	**WR-LC bells stop** ~ overall cycle time varies from 42-52 seconds
55	**Train stops at Mt. Albert Station** ~ rear of train now 460m from WR-LC
62	Plug Doors of EMU start to open ~ green lights lit, doors can open on demand
90	Plug Doors of EMU fully closed ~ all doors close on train manager instruction
117	**Train starts to leave Mount Albert Station** ~ cycle time varies from 85-120 secs
130	Rear end of train clears NE end of platform ~ 600 m from WR-LC
228	Train stops at Baldwin Avenue Station ~ rear of train about 1,800 m from WR-LC

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Notes: applying to all level-crossings and the operation of EMU trains:

Some parts of the cycle are fully automated and consistently take the same time:

~ delay between start of cycle (bells start) and arms starting to descend	4seconds
~ time for arms to descend from stored (vertical) position to horizontal	8 seconds
~ time for arms to lift from horizontal to vertical (stored) position	8 seconds
~ delay after arms return to vertical (stored) position and bells stop	under 1 sec
~ time taken pedestrian gates to open or close	6 seconds
~ time taken for plug doors on EMUs to open or close	6 seconds

Some parts of the cycle are at least partly manual and vary a lot in the time taken:

~ delay between train halting at station and doors being able to open	6-12 seconds
~ period that doors are open – depends on last passenger entering/exiting	10-30 seconds
~ delay between all doors being closed and train starting to move off	8-16 seconds
~ thus total time between stopping and starting again can vary from about	24 to 48 secs

Much of this inconsistency could be eliminated if the systems were fully automated.

For the purposes of the measurements I have used the edges of the yellow diamond road marking to define the level crossing – measurements are taken from the nearest edge of the road marking using the measurement tool on GeoMaps.

Auckland suburban trains consist of 3-car EMUs (71.8m long) but frequently two such units are linked to make a 6-car EMU (144m long); these longer units are nearly as long as the 150 metre platforms at suburban stations.

The EMUs are capable of exceeding 36 metres per second (100kmph) and accelerating and decelerating at 1 metre per second per second, and achieved these rates during trials, but rarely operate at these rates. Frequent curves and relatively close stations limit the maximum safe operating speed as shown below – and drivers are often limited to only moderate rates of acceleration.

In general, the Southern line allows higher speeds (much of it is 90kmph and even up to 110kmph) than the Western line which has more hazards such as level crossings and relatively tight curves, and which is predominantly limited to 75 or 80 kmph maximum speed with some sections limited to under 70 kmph.

The relative spacings of the stations surveyed and speeds between them are:

Stations	distance centre-to-centre	max speed	start-to-stop time out-bound	start-to-stop time in-bound
Kingsland — Morningside	886m	70kph	86 secs	93 secs
Morningside — Baldwin Avenue	1,341m	75kph	100 secs	121 secs
Baldwin Avenue — Mount Albert	1,027m	75kph	98 secs	111 secs
Mount Albert — Avondale	1,990m	80kph	152 secs	163 secs

Axle counters are used on railways throughout New Zealand to detect the passing of a train between two points on the track (a block). The rail network is treated as a series of blocks with the axle counters performing the vitally important block signaling function which does not permit two trains to be in the same section at the same time. Axle counters are also used to switch on and off warning equipment and barrier arms at level crossings. They are widely used internationally as they are relatively simple and cheap, and are favoured on electrified lines as they are immune to some of the electrical interference issues which alternative track circuit devices are prone to. However, axle counters can fail if they ‘forget’ (lose count of) how many axles are in the block, requiring a manual over-ride, and cannot detect

problems such as broken rails. KiwiRail has centralized national control of all axle-counters in Wellington which makes them vulnerable to any break in communication.

The Auckland suburban rail network has a positive train control system known as ETCS (European Train Control System) which is increasingly used worldwide. Balise units mounted in pairs on the sleepers between the tracks at key locations communicate "contactlessly" with passing trains providing information specific to that location in the form of "telegrams". The telegrams are deliberately very brief (limited to 1 kilobyte of data) as they must be sent several times in the fraction of a second that the train antenna unit is within a metre of the balise – this repetition is in order to provide a fail-safe check against potential corruption of the signal due to stray electrical interference. The key information is the precise position of the balise (and hence the train) and the distance to the next one. There will also be coded information for the driver about track conditions ahead such as track geometry (curves and gradients), applicable speed restrictions, and features such as level crossings, points, etc. The telegrams are "fixed" – the same for every passing train – but can be updated as and when required. The balise units do not require a power source as they are "tele-powered" by a high frequency (27.095 MHz) amplitude modulation radio signal from the on-board transmission equipment on passing trains.

The information from the ETCS guides the driver in selecting the appropriate speed, rate of acceleration/deceleration and braking, but "he has the con" and can drive the train according to his training, experience and best judgement. For example wet conditions affect braking so drivers may reduce speed earlier than normal. If the ETCS detects an unsafe condition, it can override the driver and apply the brakes to slow the train or bring it to a halt. Many believe that the parameters for the ETCS are set too conservatively, leading to such things as the painfully slow movement of trains in the first 10 seconds or so as they begin moving out of a station – after 10 seconds they could be travelling at 10 metres per second (36 kmph) but ETCS limits them to about 4 metres per second (under 15 kmph). Others go further and suggest upgrading the Auckland ETCS from Level 1 to Level 2 which would give much greater flexibility of operation while maintaining safety parameters – with a doubling of train frequencies once CRL opens in 2024 this may be required soon in any case.

Time taken for trains to pass over level crossings varies, depending on their length, average speed while crossing, and the road width. An incoming train will have slowed slightly but may still be travelling at up to 20 metres per second (72kmph). An outgoing train has just started so speed is more like 10 metres per second (36kmph) or less. At the crossings covered by this report the angle between the railway tracks and the road is close to 45 degrees, so the relevant widths are measured on the diagonal as follows: Morningside Drive (about 16m), Rossgrove Terrace (11m) and Woodward Road (11m). A 144 metre long train travelling at an average of say 20 metres per second will take 7.75 seconds to traverse an 11 metre wide crossing but at 10 metres per second this will increase to 15.5 seconds.

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