

Timetable calculations – Adelaide to Mount Barker

Adelaide to Goodwood 5km

Bluebird Timetable: 6mins

Belair Line (3000 Class Railcars): 9mins (2 stops)

Seaford Line (4000 Class EMUs): 8mins (2 stops)

Stops at 60kph Braking time (from $v=u+a.t$) $T(d) = u/a = (60000/(60 \times 60))/1.12 = 16.7/1.12 = 14.9s$

Standing at station $T(s) = 25s$ (measured)

Accelerating time (from $v=u+a.t$) $T(a) = v/a = 16.7/0.8 = 20.9s$

Distance travelled while decelerating to stop $s(d) = a./2 = 1.12 \times 14.9 \times 14.9 / 2 = 124m$

Distance travelled while accelerating to 60kph $s(a) = a./2 = 0.8 \times 20.9 \times 20.9 / 2 = 175m$

Time taken to travel decel. + accel. distance @ 60kph = $(124 + 175) / 16.7 = 17.9s$

Therefore, time lost per stop $T = 14.9 + 25 + 20.9 - 17.9 = 43s$

So, for travel without stops Adelaide to Goodwood: Bluebird 6mins

3000 Class DMU $9 - (43/60) \times 2 = 7m34s$

4000 Class EMU $8 - (43/60) \times 2 = 6m34s$

For Average Speed of 60kph, Transit Time = $(5000 - 124 - 175)/16.7 + 20.9 + 14.9 + 25 = 342s = 5m42s$

USE 6mins

Goodwood to Mitcham 2.5km

Bluebird Timetable 4mins

Belair Line 6mins less two stops = $6m - (43/60) \times 2 = 4m34s$

For Av 60kph Transit Time = $(2500 - 124 - 175)/16.7 + 20.9 + 14.9 + 25 = 192.6s = 3m13s$

USE 4mins

The SG Line now enters the climb into the Hills. Some indicative running times:

Bluebird Mitcham to Belair – 21m; Belair to Mitcham – 17m Average descent speed = $13/(17/60) = 46kph$

Overland Keswick to Belair – 27m; Belair to Keswick – 23m Average descent speed = $17.5/(23/60) = 46kph$

Noted speed limit on much of Belair Line is 50kph

Stops at 50kph Braking time (from $v=u+a.t$) $T(d) = u/a = (50000/(60 \times 60))/1.12 = 13.9/1.12 = 12.4s$

Standing at station $T(s) = 25s$ (measured)

Accelerating time (from $v=u+a.t$) $T(a) = v/a = 13.9/0.8 = 17.4s$

Distance travelled while decelerating to stop $s(d) = a./2 = 1.12 \times 12.4 \times 12.4 / 2 = 86m$

Distance travelled while accelerating to 50kph $s(a) = a./2 = 0.8 \times 17.4 \times 17.4 / 2 = 121\text{m}$

Time taken to travel decel. + accel. distance @ 50kph = $(86 + 121) / 13.9 = 15\text{s}$

Therefore, time lost per stop $T = 12.4 + 25 + 17.4 - 15 = 40\text{s}$

Mitcham to Blackwood 9.5km

Bluebird 12m (to Adelaide); 15m (from Adelaide) less, say, 1minute for stop at Eden Hills, so 11mins

Belair Line 18m (to and from Adelaide); less 4 stops = $4 \times 40/60 \approx 3$ mins, so 15mins

For average speed 55kph, transit time = $(9500 - 144 - 105)/15.3 + 19 + 14 + 25 = 663\text{s} = 11\text{mins} = \text{Bluebird}$

So, for average speed 60kph, transit time = $(9500 - 175 - 124)/16.7 + 20.9 + 14.9 + 25 = 612\text{s} = 10\text{m}12\text{s}$

Using downhill speed of Bluebird as an indicator of track geometry and stability (which would be better now on concrete sleepers and CWR), plus higher Power to weight ratio of newer DMU's $((2 \times 360\text{kW})/66\text{t} = 11\text{kW/t}$ for Bluebirds cf $(2 \times 390\text{kW})/48\text{t} = 16\text{kW/t}$ for 3000 Class;

USE 10mins

Blackwood to Belair 3.5km

Line similar to Goodwood to Mitcham

Bluebird 6m to Belair, 5m from Belair

Belair Line 6m less 2 stops of 40s = $280\text{s} = 4\text{m}40\text{s}$

At 60kph Transit Time = $(3500 - 175 - 124)/16.7 + 20.9 + 14.9 + 25 = 252\text{s} = 4\text{m}12\text{s}$; Since no stop is planned, just passing,

USE 4mins

Belair to Mt Lofty 9.5km

Bluebird 16m to Mt Lofty, 14m from Mt Lofty, less one stop, so 13m.

Overland 11m to Mt Lofty, 14m from Mt Lofty

For average speed 60kph, (as above) transit time = $(9500 - 175 - 124)/16.7 + 20.9 + 14.9 + 25 = 612\text{s} = 10\text{m}12\text{s}$

This compares well with the Overland time, and as no stop is proposed at Mt Lofty, but passing halt possible,

USE 10mins

Mt Lofty to Aldgate 3.5km

Bluebird 5m or 6m

Overland Mt Lofty to Ambleside average speed = $12.5/(13/60) = 58\text{kph}$, so 65kph reasonable for Railcars = 18m/s

At average 65kph, Transit Time = $(3500 - 212 - 143)/18 + 23 + 16 + 25 = 239\text{s} = 3\text{m}59\text{s}$

USE 4mins

Aldgate to Bridgewater 3km

Bluebird 4m

At 60kph Transit Time = $(3000 - 175 - 124)/16.7 + 20.9 + 14.9 + 25 = 223s = 3m43s$

USE 4mins

Bridgewater to Balhannah 8.5km

Bluebird 13 or 14 mins

At 65kph (just above Overland average) Transit Time = $(8500 - 212 - 143)/18 + 23 + 16 + 25 = 517s = 8m37s$

USE 9mins

Balhannah to Mount Barker Junction 4km

Bluebird 5m or 6m

Overland 4m or 5m but no stop at Balhannah. Average speed = $4/(4/60) = 60kph$

For average speed 65kph Transit Time = $(4000 - 212)/18 + 23 = 233s = 3m53s$

USE 4mins

Mount Barker Junction to Littlehampton 3.7km

Use average speed 65kph Transit Time = $(3700 - 124)/18 + 16 + 25 = 239s = 3m59s$

USE 4mins

Littlehampton to Mount Barker Central 1.5km

At average speed 60kph Transit Time = $(1500 - 175 - 124)/16.7 + 21 + 15 + 25 = 133s = 2m13s$

For average speed 65kph Transit Time = $(1500 - 212 - 143)/18 + 23 + 16 + 25 = 128s = 2m8s$

USE 2mins (Similar to times for Lynton/Torrens Park and Mitcham/Unley Park on Belair Line)

Total Travel Time Adelaide to Mount Barker Central = 61 minutes

Mount Barker Central to Mount Barker South 1.4km

USE 2mins (Similar to times for Lynton/Torrens Park and Mitcham/Unley Park on Belair Line)

Mount Barker South to Heysen Boulevard 1.5km

USE 2mins (Similar to times for Lynton/Torrens Park and Mitcham/Unley Park on Belair Line)

Additional Stopping Time and Distance Calculations (used above)

For 55kph $v = 55000/(60 \times 60) = 15.3\text{m/s}$

Deceleration Time = $v/a = 15.3/1.12 = 13.7 \approx 14\text{s}$

Deceleration Distance = $a./2 = (1.12 \times 13.7 \times 13.7)/2 = 105\text{m}$
144m

Acceleration Time = $15.3/0.8 = 19.1\text{s} \approx 19\text{s}$

Acceleration Distance = $(0.8 \times 19 \times 19)/2 =$

For 65kph $v = 65000/(60 \times 60) = 18\text{m/s}$

Deceleration Time = $18/1.12 = 16.1\text{s} \approx 16\text{s}$

Deceleration Distance = $(1.12 \times 16 \times 16)/2 = 143\text{m}$

Acceleration Time = $18/0.8 = 22.5\text{s} \approx 23\text{s}$

Acceleration Distance = $(0.8 \times 23 \times 23)/2 = 212\text{m}$

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