# 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 x 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.$t^2$/2 = 1.12 x 14.9 x 14.9 / 2 = 124m

Distance travelled while accelerating to 60kph s(a) = a.$t^2$/2 = 0.8 x 20.9 x 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) x 2 = 7m34s

4000 Class EMU 8 – (43/60) x 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) x2 = 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 x 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.$t^2$/2 = 1.12 x 12.4 x 12.4 / 2 = 86m

Distance travelled while accelerating to 50kph s(a) = a.$t^2$/2 = 0.8 x 17.4 x 17.4 / 2 = 121m

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

Therefore, time lost per stop T = 12.4 + 25 + 17.4 – 15 = 40s

**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 x 40/60 ≈ 3 mins, so 15mins

For average speed 55kph, transit time = (9500 – 144 – 105)/15.3 + 19 + 14 + 25 = 663s = 11mins = Bluebird

So, for average speed 60kph, transit time = (9500 – 175 – 124)/16.7 + 20.9 + 14.9 + 25 = 612s = 10m12s

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 x 360kW)/66t = 11kW/t for Bluebirds cf (2 x 390kW)/48t = 16kW/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 = 280s = 4m40s

At 60kph Transit Time = (3500 – 175 – 124)16.7 + 20.9 + 14.9 + 25 = 252s = 4m12s; 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 = 612s = 10m12s

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) = 58kph, so 65kph reasonable for Railcars = 18m/s

At average 65kph, Transit Time = (3500 – 212 – 143)/18 + 23 + 16 +25 = 239s = 3m59s

**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 x 60) = 15.3m/s

Deceleration Time = v/a = 15.3/1.12 = 13.7 ≈ 14s

Deceleration Distance = a.$t^2$/2 = (1.12 x 13.7 x 13.7)/2 = 105m

Acceleration Time = 15.3/0.8 = 19.1s ≈ 19s

Acceleration Distance = (0.8 x 19 x 19)/2 = 144m

**For 65kph** v = 65000/(60 x 60) = 18m/s

Deceleration Time = 18/1.12 = 16.1s ≈ 16s

Deceleration Distance = (1.12 x 16 x 16)/2 = 143m

Acceleration Time = 18/0.8 = 22.5s ≈ 23s

Acceleration Distance = (0.8 x 23 x 23)/2 = 212m

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