B-Line Bus Running Time Performance

Alan Tobin 2022-09-08





Presentation Outline

- Objectives
- Definitions and Metrics of Bus Delays
- Data Description
- Analyses and Results
- Conclusions and Further Work

Objectives: Is B1 Bus "Late All the Time"?

Delay can be defined in various ways:

Later bus arrival at a stop than

- scheduled (this project addresses only this)
- passenger expects
 - late at destination
 - late at origin

Other definitions possible.

Definition Used in This Project:

Delay = Actual minus Scheduled Arrival Time at a Stop

Timetables

4:32 am first bus from Mona Vale

1:18 am last bus arrives at Mona Vale

43 min shortest scheduled trip
58 min longest scheduled trip ~8 am

Neutral Bay Junction, Military Rd, Neutral Bay

Monday to Friday

Wynyard Station

Trips Frequencies:

6-10 min most of the day
2-6 min 7am-8am from Mona Vale

Every 10 min, 15 min at night

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07:34

07:43 07:50

07:41

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08:45

08:55

~300 trips per day

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06:38

06:44

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06:31

06:37

Service Information	*		*	*		*	*		*
Mona Vale B-Line, Mona Vale	04:32	every	05:51	05:56	every	06:49	06:54	every	07:57
Warriewood B-Line, Warriewood	04:35	6-10	05:54	05:59	6-10	06:53	06:58	2-6	08:01
Narrabeen B-Line, Narrabeen	04:38	mins.	05:57	06:03	mins.	06:57	07:02	mins.	08:05
Collarov B-Line, Collarov	04:41		06:00	06:07		07:01	07:06		08:09

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05:09

05:15

Narrabeen b-Line, Narrabeen	04.36 111115.	05.57 00	5.U5 IIIIIIS.	06.57	07.02 11111	15. 00.05
Collaroy B-Line, Collaroy	04:41	06:00 06	5:07	07:01	07:06	08:09
Dee Why B-Line, Dee Why	04:46	06:06 06	5:13	07:07	07:12	08:16
Warringah Mall, Pittwater Rd, Brookvale	04:51	06:12 06	5:19	07:13	07:18	08:22
Manly Vale B-Line, Manly Vale	04:55	06:16 06	5:23	07:17	07:23	08:27
Spit Junction B-Line, Mosman	05:04	06:26 06	6:33	07:28	07:35	08:39

Data Description

Real Time trip updates and vehicle positions have been collected **every 10 seconds** for **48 hours** from **Wednesday** 31 August 3 am till **Friday** 2 September 3 am.

Data Files (for the entire Sydney bus network): Trip Updates in real time ~600 MB Vehicle Position ~100 MB

- ~15,000 trip updates (feed entities) data collected, containing
- ~500,000 stop times updates (for all bus routes)

Data: Content

Data Feed Elements

FeedHeader

Incrementality

FeedEntity

- TripUpdate
 - TripDescriptor
 - ScheduleRelationship
 - VehicleDescriptor
 - StopTimeUpdate
 - StopTimeEvent
 - ScheduleRelationship

Most Useful Variables

Arrival Delay at a Stop (forecast)

Arrival time at a Stop (forecast)

Server timestamp for Trip Update

trip_id Daily trip identifier
stop_id Stop identifier
start_date Date of trip
start_time Trip scheduled to start

Real Time Feed Variables

HEADER	moment when content of				
Cilies Calify 1001030100 - 2022-00-30_11.10.00	this feed was created				
incrementality 0	(in server time)				
gtfs_realtime_version "1.0"					
ENTITY_ list_of_24 [0] = 24 trip updates					
id "43264_206347437_2508_B1_1" EntityID=TripUpdateID					
TRIP UPDATE					
TRIP					
trip_id "1580253"					
start_time "20:42:00"					
start_date "20220830"					
schedule_relationship 0 Moment at which vehicle's real-time					
route_id "2508_B1" venicle's real-time progress was measured.					
VEHICLE	Delay (in seconds) can be				
id "43264_ 206347437 _2508_B1_1"	positive (vehicle is late) or				
timestamp 1661858143 = 2022-08-30_ 11:15:43	negative (vehicle is ahead of schedule).				
STOP_TIME_UPDATE_list_of_2 [0]	STOP_TIME_UPDATE_list_of_2 [1]				
stop_sequence 9	stop_sequence 10				
stop_id "208914" neutral bay	stop_id "200035" wynyard				
schedule_relationship 0 Event as	schedule_relationship 0				
ARRIVAL absolute time.	ARRIVAL				
delay -199	delay -156				
time 1661858261 = 2022-08-30_11:17:41	time 1661858664 = 2022-08-30_11:24:24				
DEPARTURE	DEPARTURE				
delay -173	delay -156				
time 1661858287 = 2022-08-30_11:18:07	time 1661858664 = 2022-08-30_11:24:24				

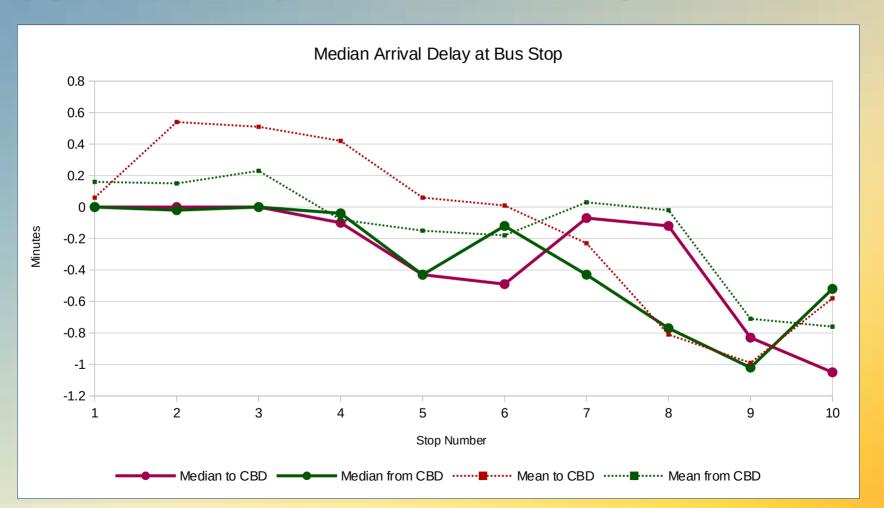
Data Quality Filter

If server time and arrival time differ by more than 10 minutes, then discard observations - stale or incorrect data.

The **latest record** of arrival delay and time for each trip-stop combination is taken as the best measure, and is used in the analyses =>

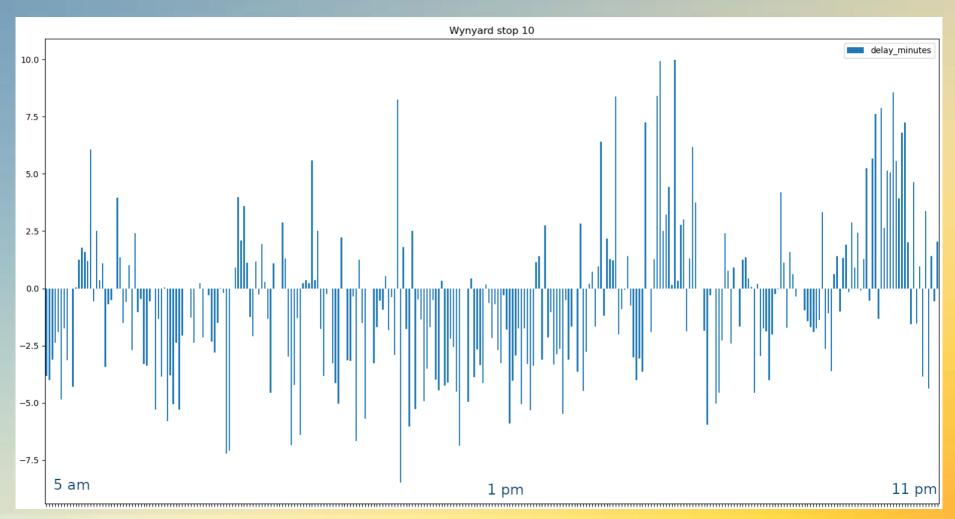
- ~600 latest trip updates in the sample, that is
- ~150 trips in each direction per day.

Typical Delay Across All Trips Is Small

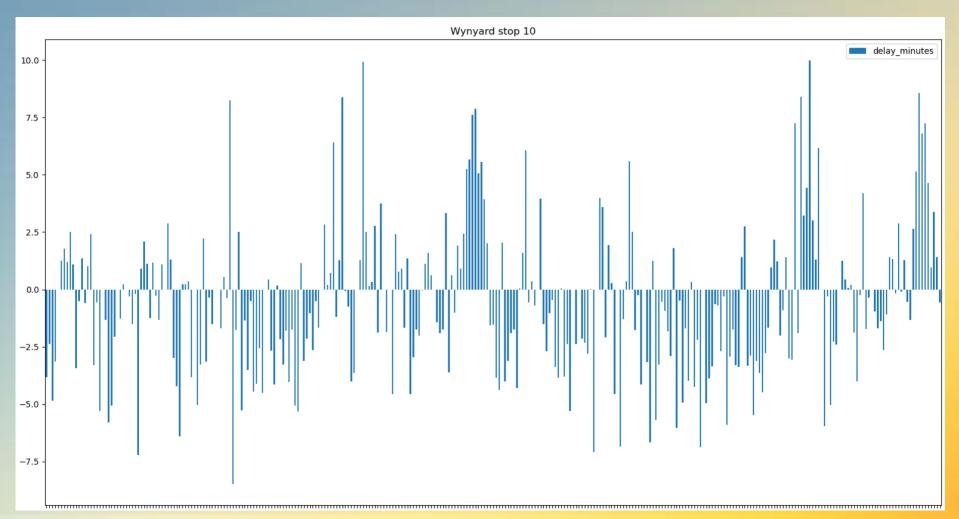


	Delay to CBD, minutes				1	
					į	Typical and Extreme
stop_id	stop_number	max	min	median	mean	Typical and Extreme
210318	1	12.9	0	0	0.1	Dala A A A A A A A A A A A A A A A A A A
210143	2	109.1	-4.8	0.0	0.5 0.5	Delays Across All Trips
210125	3	109.1	-5.3	0	0.5	Delay of torous firm impo
209722	4	108.8	-5.4	0.0	0.4	
209924	5	107.7	-6.4	-0.4	0.1	Typically B1 buses arrive at
2100145	6	9.1	-6.2	-0.1	0.0	
209325	7	8.9	-6.3	-0.4	-0.2	destination about a minute ahead
2088243	8	8.9	-8.1	-0.8	-0.8	of schedule, but never more than
208914	9	9.2	-8.7	-1.0	-1.0	
200035	10	10.0	-8.5	-0.5	-0.6	10 minutes.
					1	Dalawa at aniah ana antonya ka
	Delay from CBD, minutes			minutes		Delays at origin are extremely
					1	rare, and always less than 15
stop_id	stop_number	max	min	median	mean	
200023	1	8.3	0	0	0.2	minutes.
208948	2	9.4	-3.4	0	0.2	
2088180	3	9.4	-4.6	0	0.2	Carra autroma delaura eleganicad
209326	4	10.3	-4.9	-0.1	-0.1	Some extreme delays observed,
210012	5	69.7	-6.7	-0.4	-0.2	about 1-2 hours.
209913	6	69.9	-7.3	-0.5	-0.2	
209717	7	9.3	-7.0	-0.1	0.0	
210115	8	8.2	-7.8	-0.1	0.0	
210120	9	8.4	-8.4	-0.8	-0.7	
210323	10	7.4	-8.0	-1.1	-0.8	

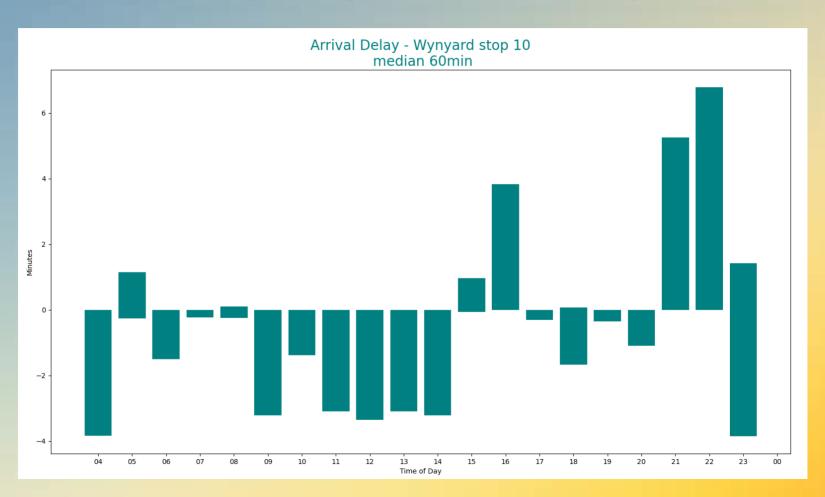
Delays for Every Trip by Start_Time



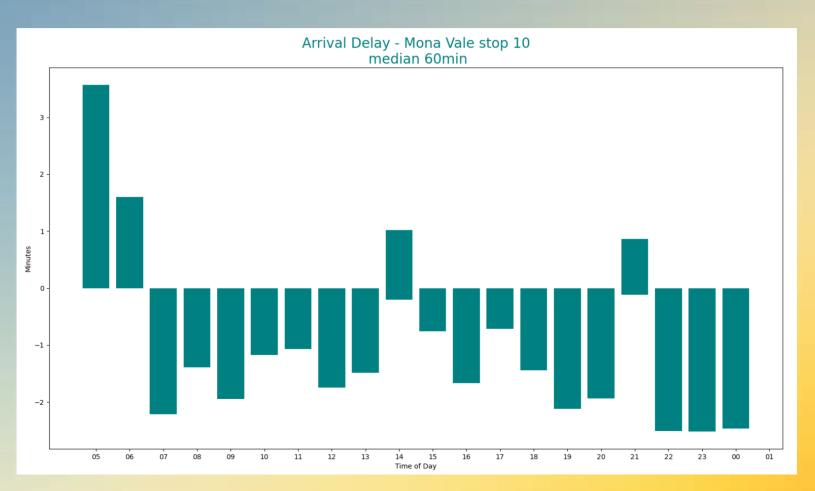
Delays for Every Trip by Start_DateTime



Delays by Time of Day



Delays by Time of Day



Conclusions

No evidence to support the claims of bus B1 being systematically late based on the used data sample and schedule-centric delay definition...

...but this can change for a passenger-centric delay definition and more longitudal data set.

Further Work

- Consult with client on a more detailed specification of the research question, focusing on the aspects of highest economic and reputational significance. This relates to the overall client's mission of providing great transportation service given constraints.
- Use passenger-centric delay metrics and additional variables to provide more precise and relevant inferences.
- Collect longer longitudal data.
- Create a software product providing real-time delay information across entire transportation networks, and license it out.

The End



