B-Line Bus Running Time Performance

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LYNXX
data inspired by people

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

Trips Frequencies:

6-10 min most of the day
2-6 min 7am-8am from Mona Vale
Every 10 min, 15 min at night

~300 trips per day

Monday to Friday	♿			♿	♿		♿	♿		♿
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
Collaroy B-Line, Collaroy	04:41			06:00	06:07		07:01	07:06		08:09
Dee Why B-Line, Dee Why	04:46			06:06	06:13		07:07	07:12		08:16
Warringah Mall, Pittwater Rd, Brookvale	04:51			06:12	06:19		07:13	07:18		08:22
Manly Vale B-Line, Manly Vale	04:55			06:16	06:23		07:17	07:23		08:27
Spit Junction B-Line, Mosman	05:04			06:26	06:33		07:28	07:35		08:39
Neutral Bay Junction, Military Rd, Neutral Bay	05:09			06:31	06:38		07:34	07:41		08:45
Wynyard Station	05:15			06:37	06:44		07:43	07:50		08:55

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

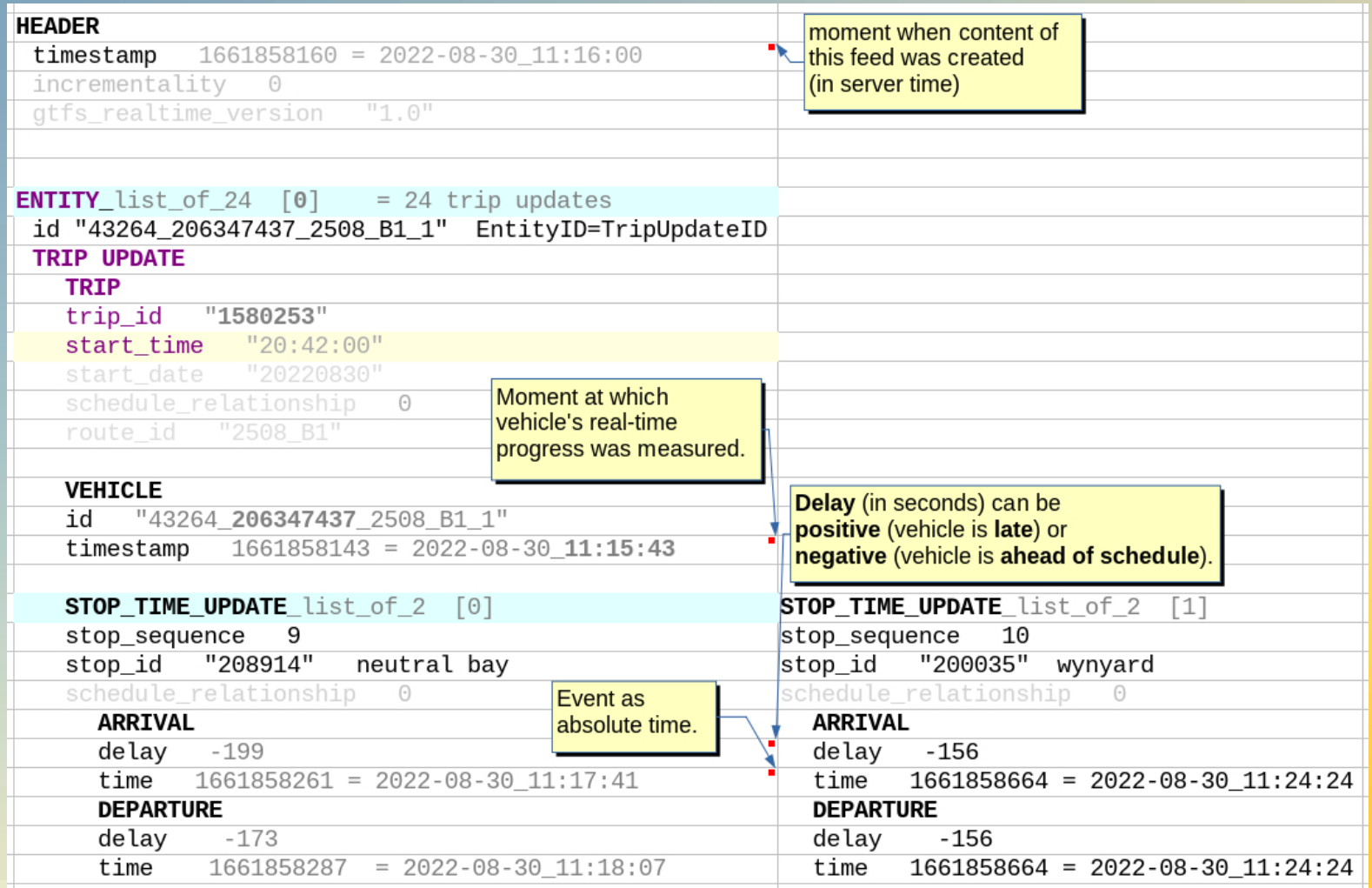
Arrival Delay at a Stop (forecast)

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



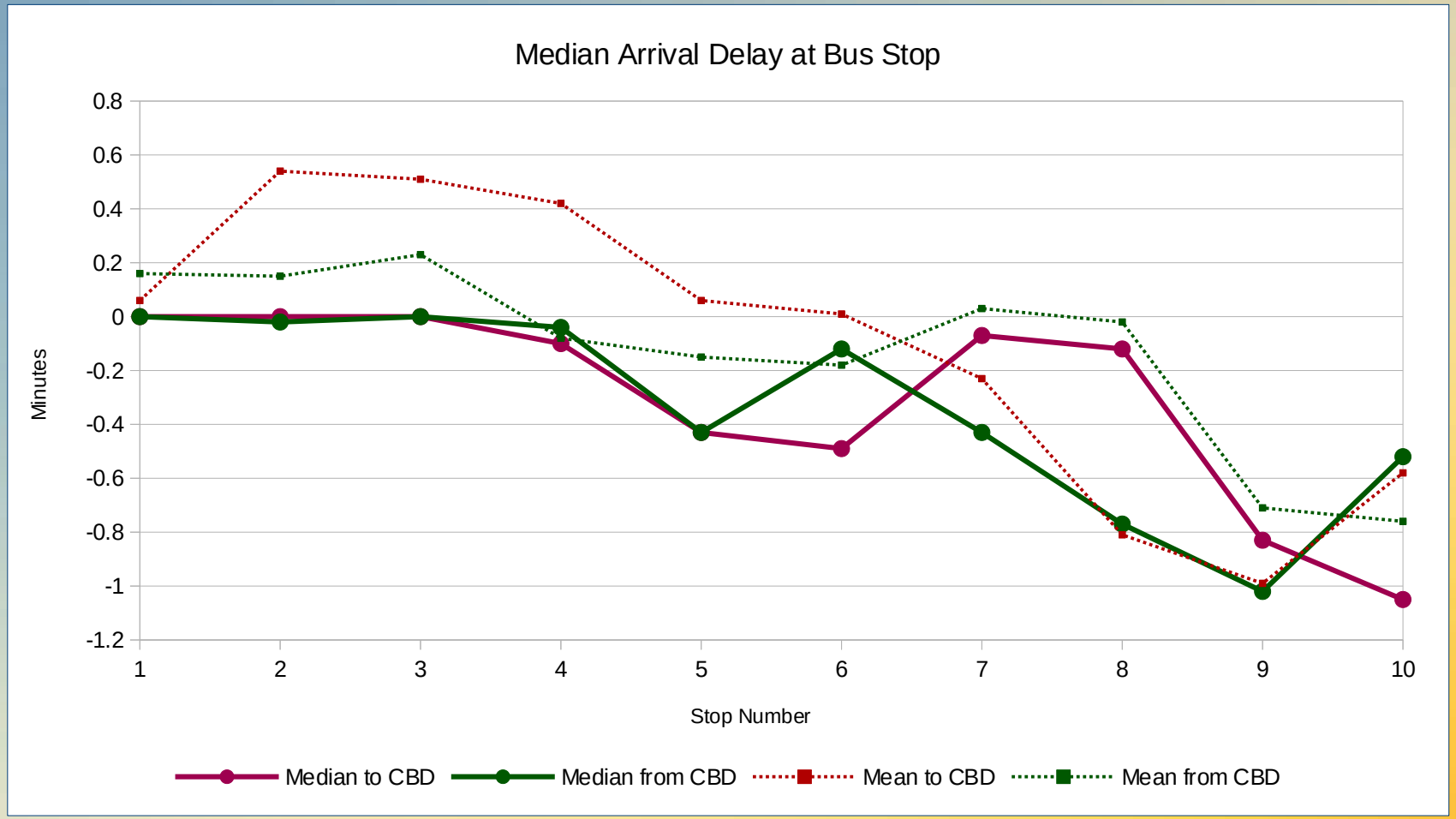
Data Quality Filter

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

stop_id	stop_number	max	min	median	mean
210318	**1**	**12.9**	0	**0**	0.1
210143	2	**109.1**	-4.8	**0.0**	0.5
210125	3	**109.1**	-5.3	**0**	0.5
209722	4	**108.8**	-5.4	**0.0**	0.4
209924	5	**107.7**	-6.4	-0.4	0.1
2100145	6	9.1	-6.2	-0.1	0.0
209325	7	8.9	-6.3	-0.4	-0.2
2088243	8	8.9	-8.1	-0.8	-0.8
208914	9	9.2	**-8.7**	-1.0	-1.0
200035	10	**10.0**	**-8.5**	**-0.5**	**-0.6**

Delay from CBD, minutes

stop_id	stop_number	max	min	median	mean
200023	**1**	**8.3**	0	**0**	**0.2**
208948	2	9.4	-3.4	**0**	**0.2**
2088180	3	9.4	-4.6	**0**	**0.2**
209326	4	10.3	-4.9	-0.1	-0.1
210012	5	**69.7**	-6.7	-0.4	-0.2
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**

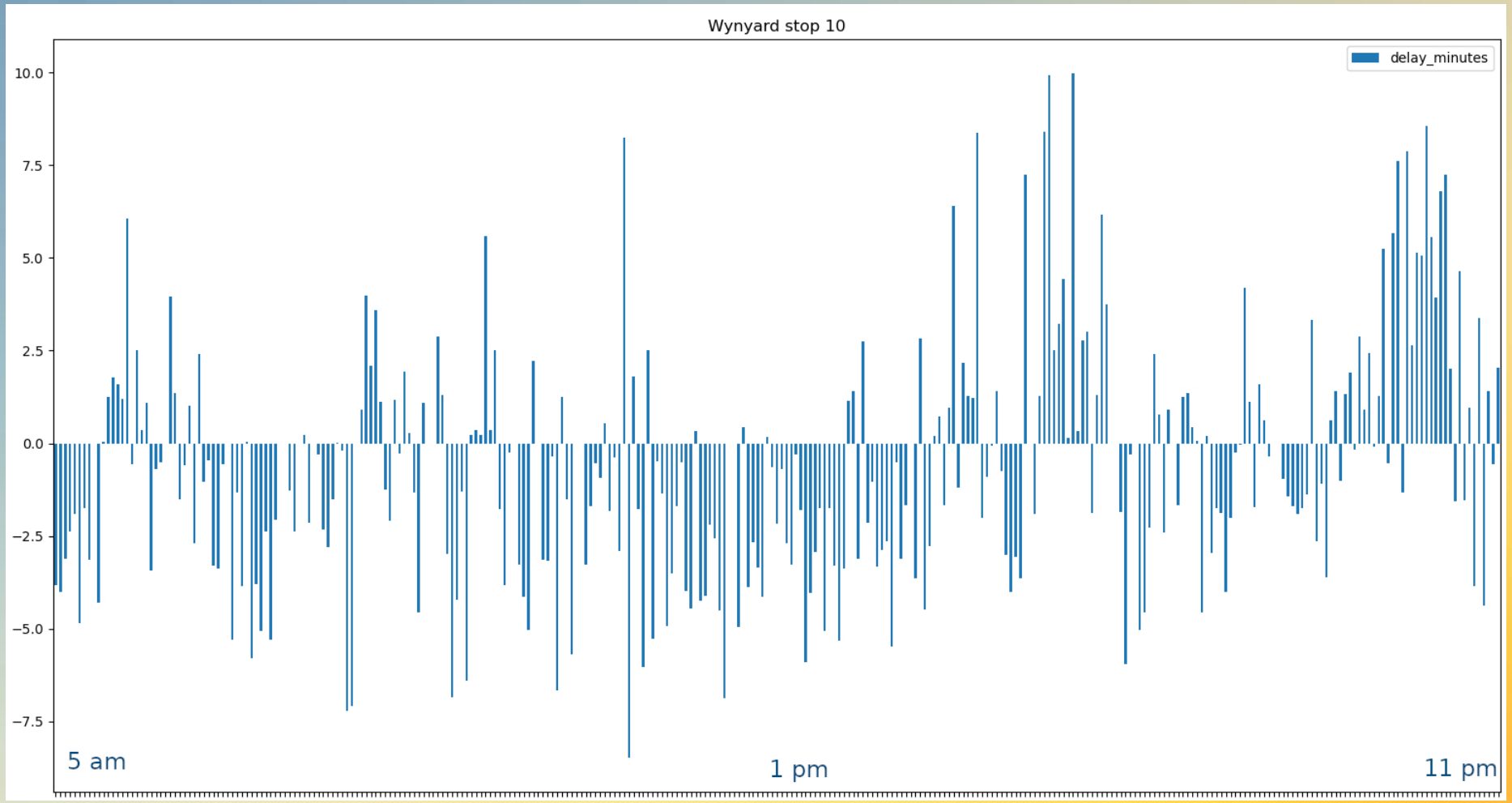
Typical and Extreme Delays Across All Trips

Typically B1 buses arrive at destination about a minute ahead of schedule, but never more than 10 minutes.

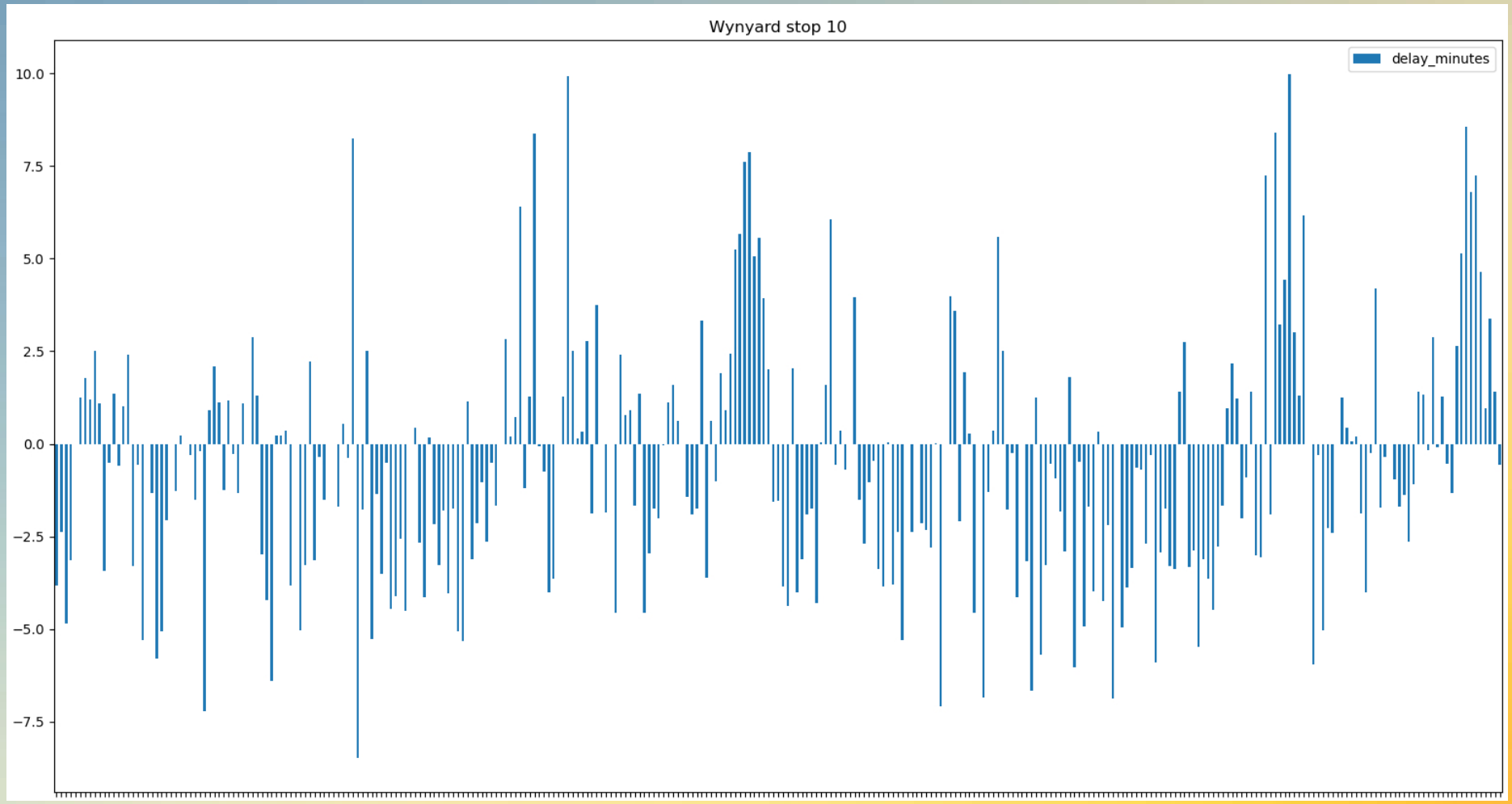
Delays at origin are extremely rare, and always less than 15 minutes.

Some extreme delays observed, about 1-2 hours.

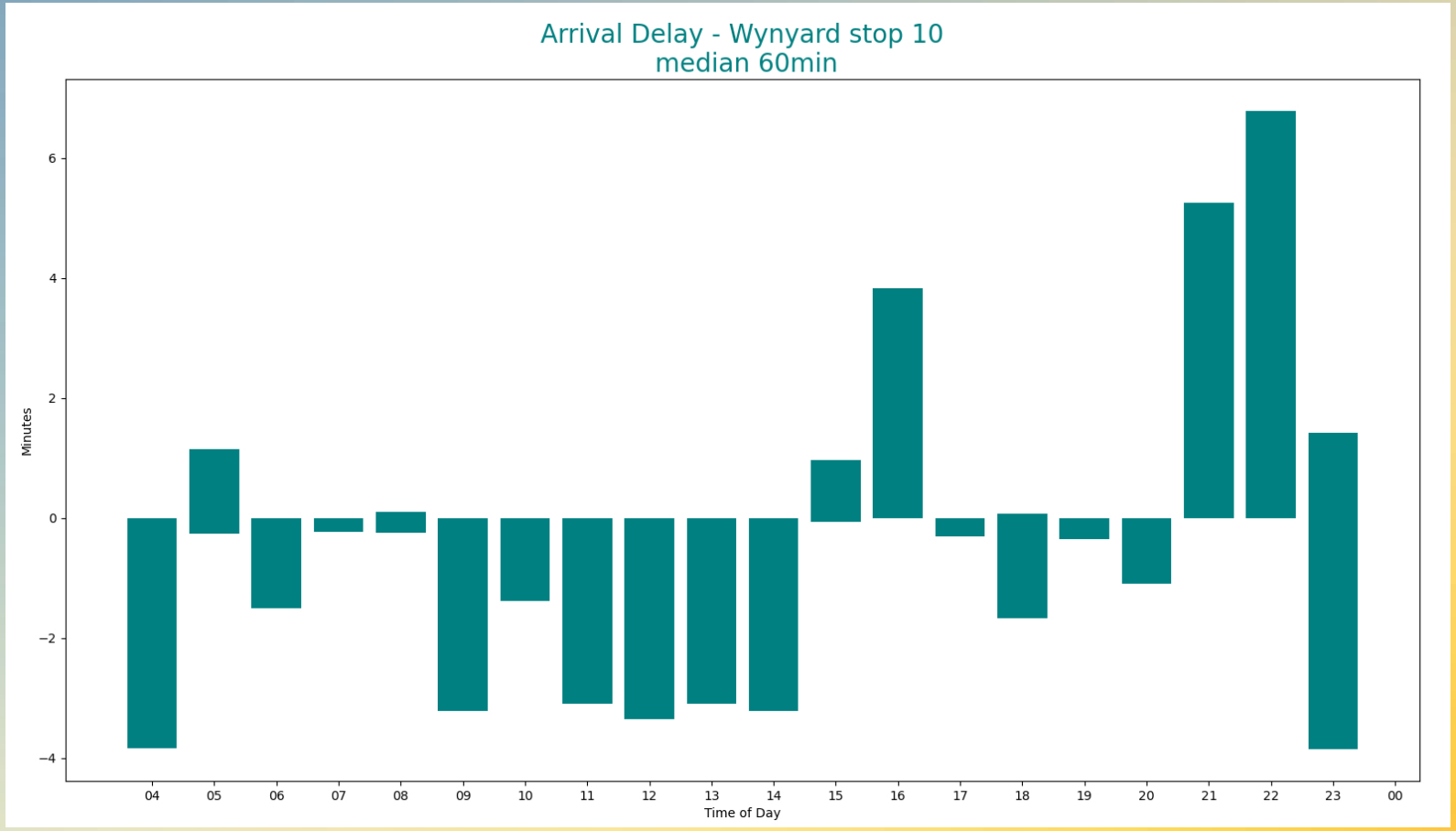
Delays for Every Trip by Start_Time



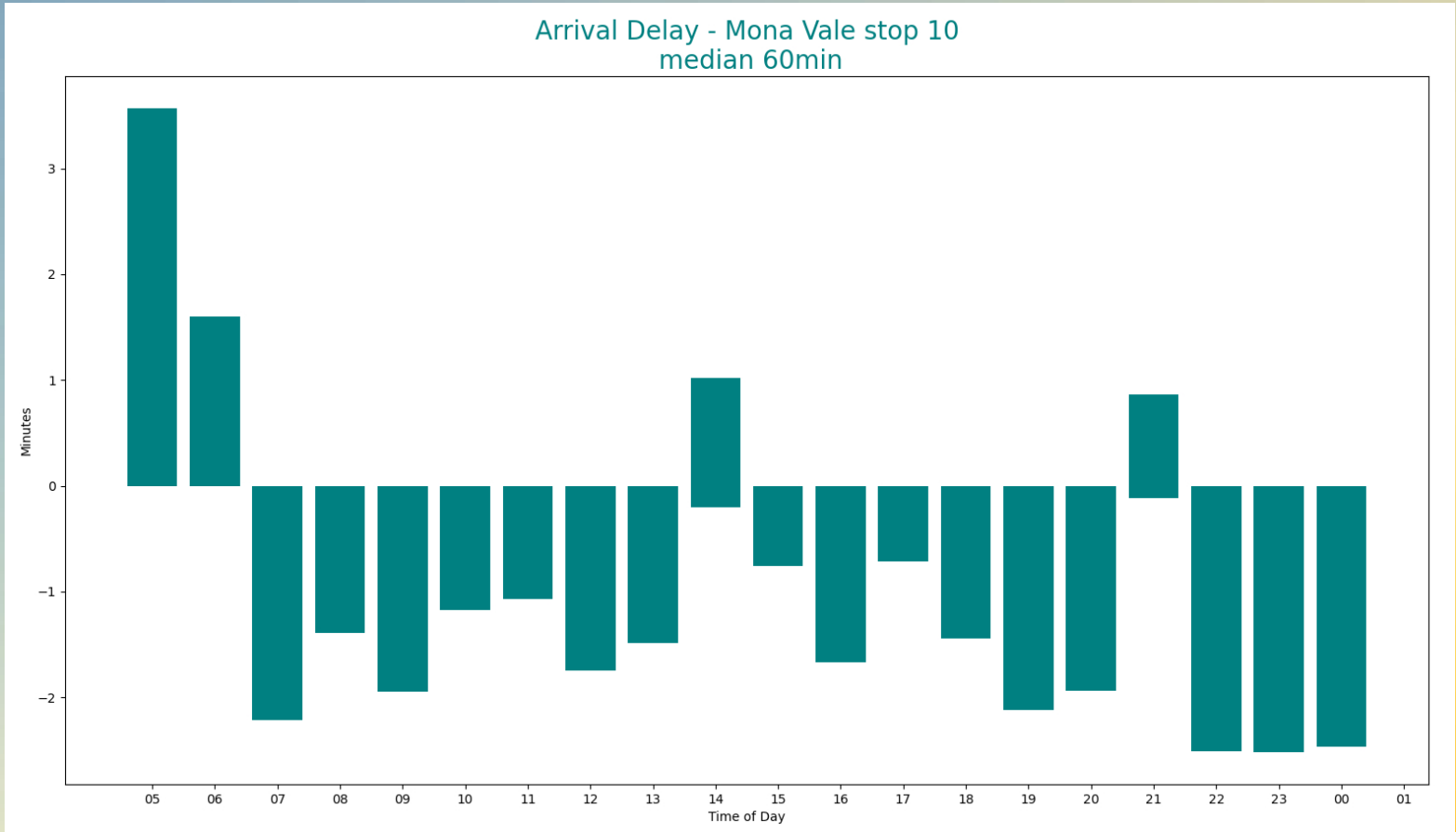
Delays for Every Trip by Start_DateTime



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