

# A Performance-Based Procurement for Real-Time Predictions in Two Phases

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TRB Annual Meeting  
13 January 2020

# cross-agency collaboration



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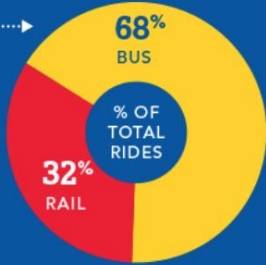
... and contributors from across operations, IT, and communications

**80.6 million** RIDES

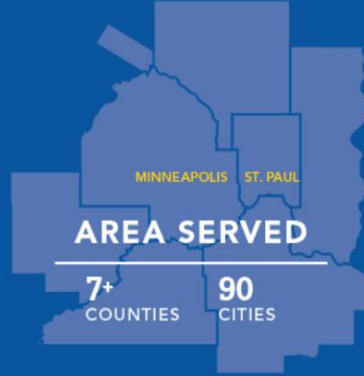
**260,486** AVERAGE WEEKDAY RIDERSHIP

**54.91 million**  
RIDES

**25.74 million**  
RIDES



**907** SQ. MILES

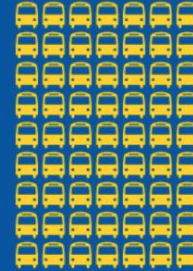


**130** ROUTES

**55**  
URBAN LOCAL



**63\***  
EXPRESS



**9**  
SUBURBAN LOCAL



**2**  
LIGHT RAIL

**1**  
COMMUTER RAIL

\* Includes Maple Grove Transit routes operated by Metro Transit



**NexTrip**

Get real-time departure times for your routes (?)

**Johnson St NE - Lowry Ave NE**  
Stop Number: 16031

**NexTrip departs in 9 Min**

Current Time: 1:48 pm

Route	Departs
4P Bryant-Penn/Southtown/82St-35...	9 Min
4 Downtown / MCTC	1:59
4 Downtown / MCTC	2:14
4 Downtown / MCTC	2:43
4 Downtown / MCTC	3:08
4 Downtown / MCTC	3:28

• Real Time • Scheduled

[← BACK TO STOP](#) [SHOW MY BUS →](#)



T-Mobile 1:51 PM 64%

272-99

5B 5 min / 5E 5 min / 22H 16 min / 5B 17 min - This free service provided by Metro Transit.

Mt11167

5B due / 5E 3 min / 5B 13 min / 22H 16 min - This free service provided by Metro Transit.

Mt34

5B 12 min / 5E 15 min / 5B sched@ 2:15pm / 5E sched@ 2:25pm - This free service provided by Metro Transit.

Text Me...

**DON'T CHASE!**  
NEVER run after a moving bus.  
The next trip is only a few minutes away!

**NexTrip** NOW: 1:46 PM


A Line Test Display Station STOP#: 11167

ROUTE	DESTINATION	DEPARTS
7E	Minnehaha / 46St Sta / 34Av-Hwy 62	1:48
46C	42St-46St/Eden-Vernon/Via Bryant	1:48
A Line	46 ST Station/Rapid	1:53
9A	E 25St - 36Av / 46St Station	1:55
A Line	46 ST Station/Rapid	2:03
74A	Randolph / Via Edgcombe / 46St Sta	2:06

• Real Time • Scheduled

# NexTrip

- homebrew system deployed 2010
- adherence from CAD/AVL reports
- challenges
  - basic assumption of constant speed
  - off-route buses
  - doesn't "learn" from past trips
  - not in GTFS-realtime



The screenshot shows a web browser window titled "Metro Transit - NexTrip" with the URL "https://www.metrotransit.c...". The main content is a photograph of a bus stuck in a heavy snowstorm. The bus's destination sign reads "61 DOWNTOWN". Below the photo, the interface displays "5M Fremont Av/Brklyn Ctr/Transit Ctr" and a time of "5:52". There are radio buttons for "Real Time" (selected) and "Scheduled". A blue button labeled "BACK TO STOP" is at the bottom.

## quantifying prediction error

### 1. **predicted:** query API & store

160 stops @ 30 sec for week = ~9 million rows

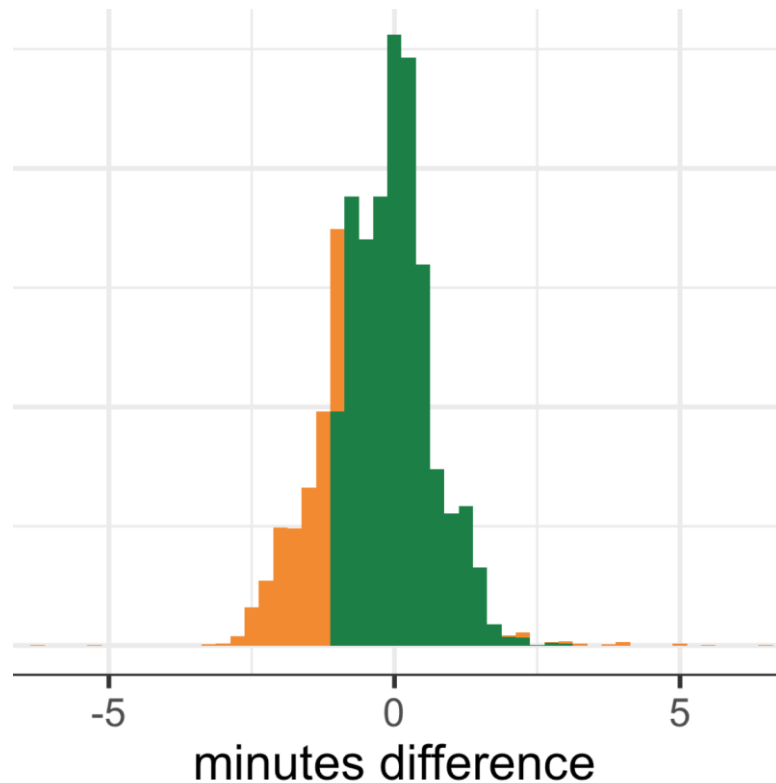
### 2. **actual:** AVL records

each stop-trip crossing for week = ~130,000 rows

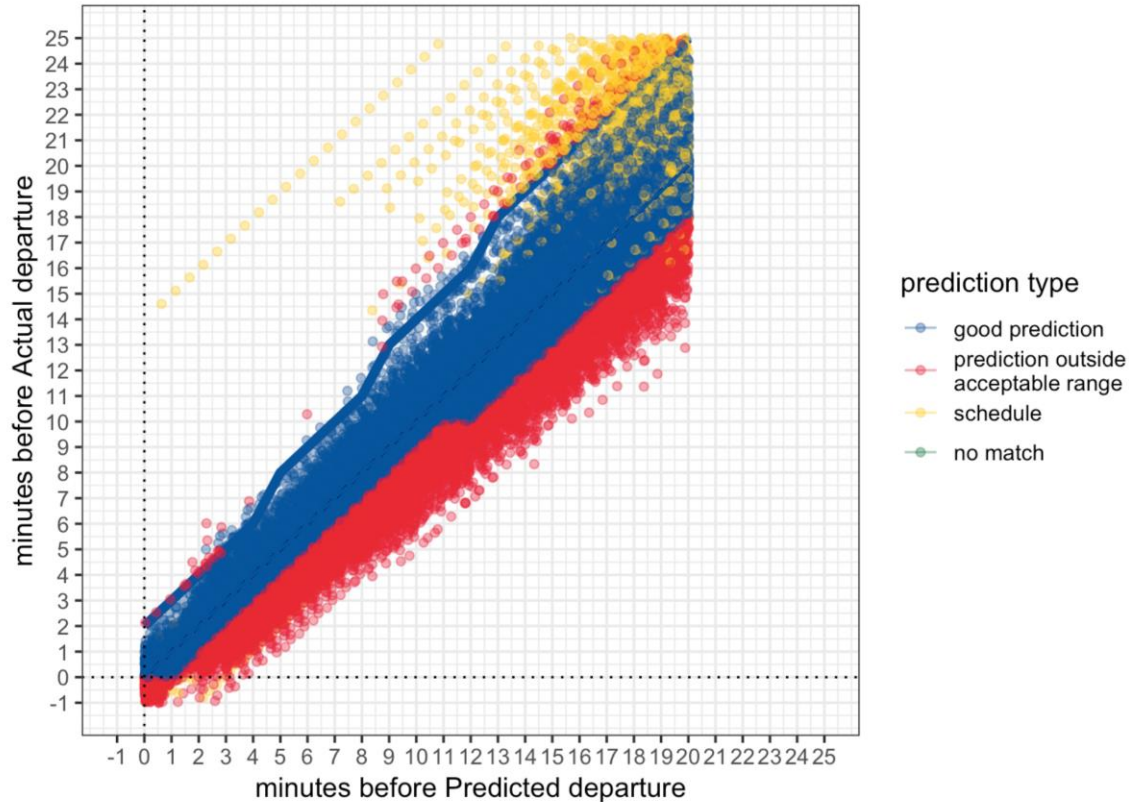
### 3. **match:**

prediction : actual :: many : 1

## ... how bad is it?



# quantifying prediction accuracy

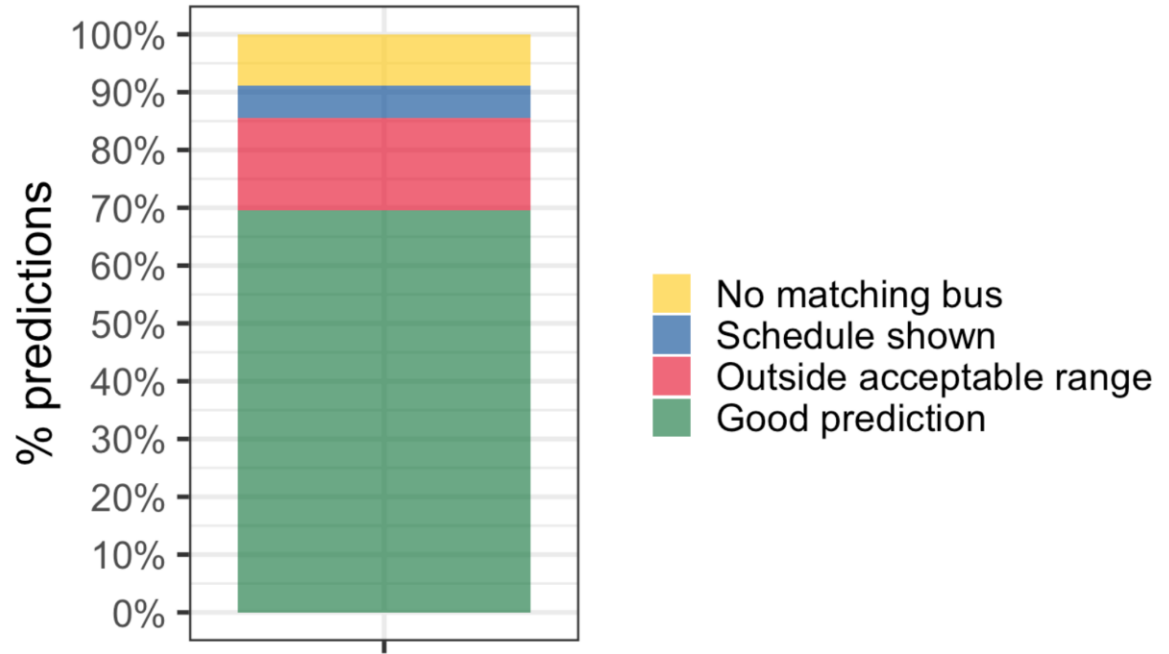


- “cone of acceptability”
- more forgiving farther from departure
- better to be early than late

# existing system

- NexTrip:
  - 65 – 70% good
  - 15 – 20% bad
  - 10 – 15% missing

Categorization of NexTrip predictions



# learning from peer agencies

## Better bus predictions (a lot better)



David Block-Schachter [Follow](#)  
Sep 24, 2018 · 8 min read



We're announcing on other venues today that bus predictions at the T are about to get a whole lot better. We think it's a big win for our riders. For us transit and government tech nerds, the back story of how we got to this point is interesting too.

...

This time around we changed that. Yes, we have the other [requirements](#). And we care about price. [But, for the first time in real-time information system procurements, \(that we know about — let us know if we're wrong!\) the main basis for our contract award was the accuracy of the predictions.](#)

Here's how we did it:

1. We provided our bidders with a historical feed, so they could calibrate their systems.
2. We then provided them with an actual real-time feed for 2 weeks.
3. We compared their predicted arrival times to our own record of actual arrival times to see which predictions were more accurate.



## Next Generation

### Customer Information System

Stakeholder Engagement Report



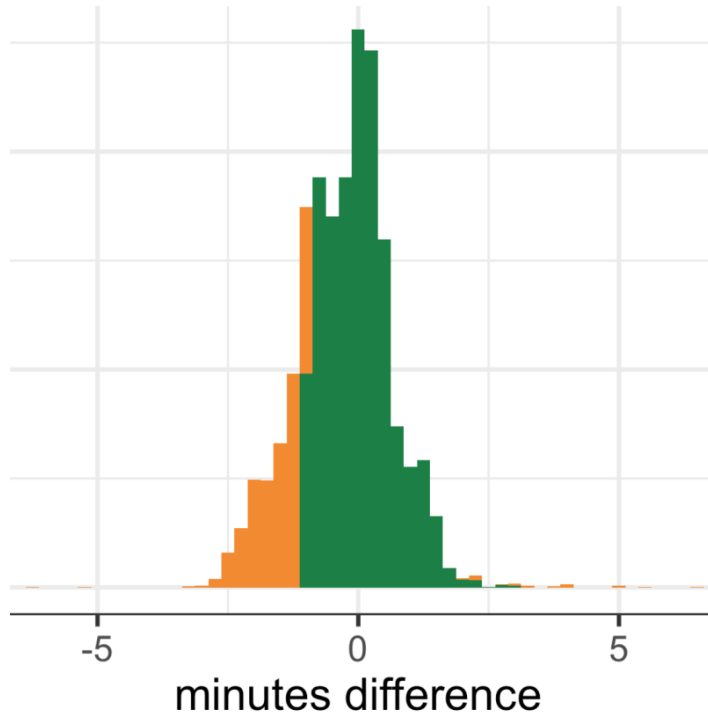
# competitive procurement: bus prediction engine

- **RFP:**
  - ingest GTFS & bus locations
  - produce GTFS-realtime Trip Updates feed
  - provide tools for measuring accuracy
- **Two Stage Proposal**
  - *Pilot:* implement and test prediction accuracy on live system
  - *Long-term Implementation:* one- to many-year costs and schedule
- both stages submitted together with *separate* pricing

# prediction engine pilot timetable (2019)

<b>January</b>	RFP published
<b>July 1</b>	Pilot period begins – Phase 1 <ul style="list-style-type: none"><li>- Vendors calibrate systems and refine prediction engines</li><li>- Vendors develop data reporting platform</li></ul>
<b>July 25</b>	Contracts signed; Notice to Proceed
<b>Sept. 1</b>	Vendors make predictions for all routes, trips and stops
<b>Oct. 1 – 31</b>	Prediction accuracy evaluation
<b>Nov. 15</b>	Vendors submit final report – implementation plans and costs
<b>Nov. 26</b>	Evaluation panel convenes, recommends vendor

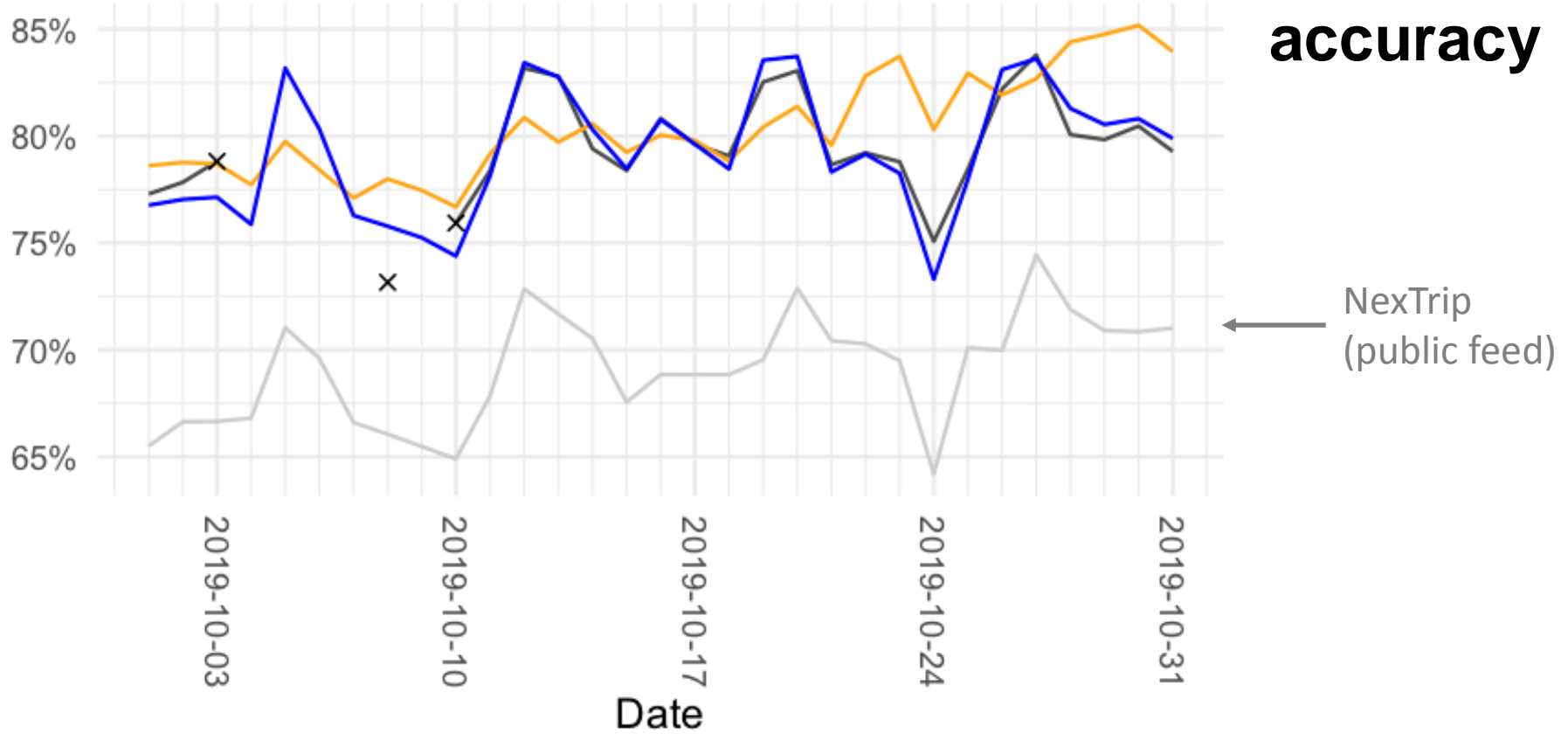
# pilot vendor evaluation process



- current system + two vendors
  - 150 constant stops
  - 850 random stops by day
- % predictions acceptable
  - *Metro Transit calculates*
- solutions to ghost or zombie buses
- uptime, reporting, other tools

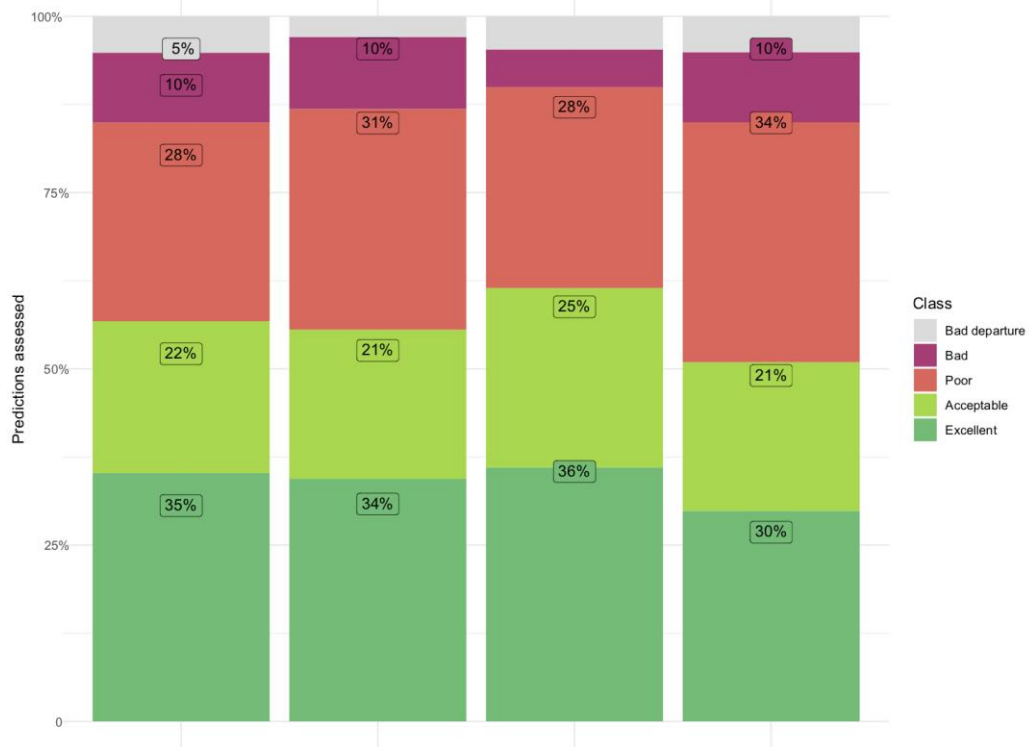
# Accuracy by Day

**pilot  
accuracy**



# pilot vendor evaluation process

5pm – 6pm October 24



Richard Tsong-Taatarii – Star Tribune

# competitive procurement: challenges

- staff expertise
  - project management
  - data science
  - operations champions
  - IT infrastructure & support
- details of evaluation
  - specifying in RFP
  - data harvesting, storing, matching
- timelines

# competitive procurement: rewards

- hands-on understanding
- procurement rules
  - conducting pilot, get long-term contract
  - from multiple *viable*, to single *awarded*
- confidence in system
  - configured & tested
  - agency knowledge base begun
  - best among potential choices
- speeds full implementation
- realistic expectations

The screenshot displays a web application interface for a transit system. At the top, there are three navigation tabs: "Trip Planner" (with a route icon), "NexTrip" (with a clock icon), and "Alerts" (with a warning icon). Below the tabs, the heading "Real-time Departures" is centered. Two filter buttons are present: "By route" (highlighted in blue) and "By stop #". Below these are three dropdown menus: "METRO C Line", "SOUTHBOUND", and "Olson & 7th St Station". A link "Use current location" with a location pin icon is visible to the right. The main content area is titled "Departures" and shows the location "7th - Olson Station Stop 56317". It lists three departure entries for "C Line Downtown / Rapid": the first is 3 minutes away, the second is 12 minutes away, and the third is at 4:21. A button with a plus icon and the text "Show more departure times" is at the bottom. A small "Real-time departures" icon is in the bottom right corner.

Route	Time
C Line Downtown / Rapid	3 Min
C Line Downtown / Rapid	12 Min
C Line Downtown / Rapid	4:21



**thank you!**

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