



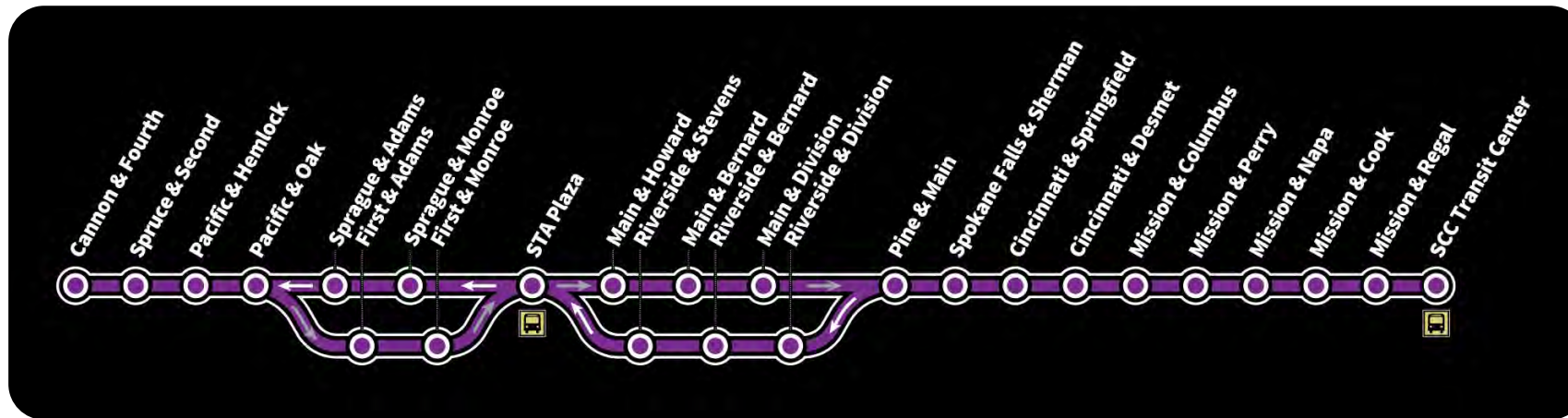
The City Line

What We Didn't Know We Didn't Know

or...

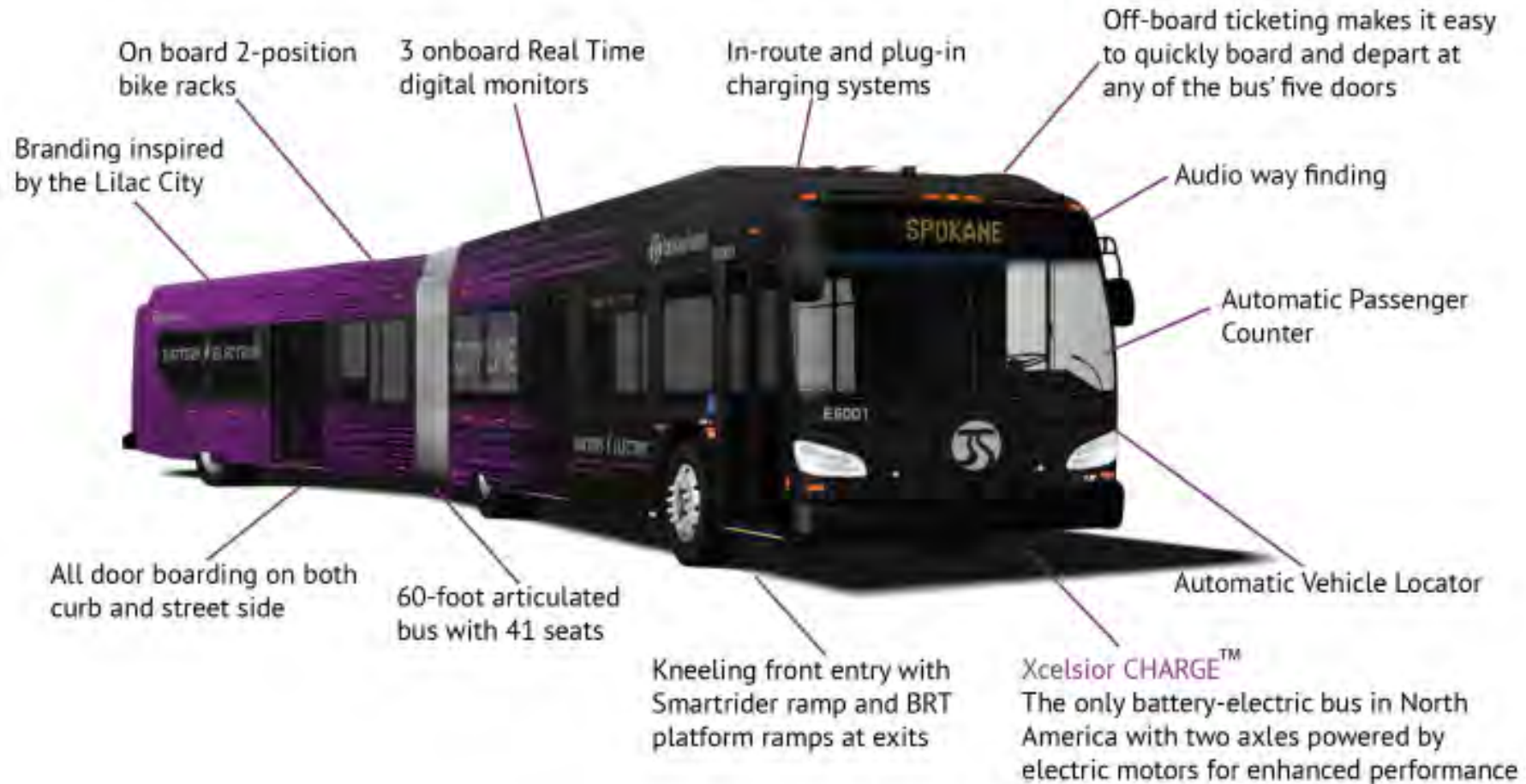
Twenty-Four Tons of Fun

CITY LINE – The Line



- Six miles one-way
- Frequency:
 - 15m—Nights and Weekends
 - 10m—Midday (Weekdays)
 - 7.5m—AM & PM Peaks
- BEB—w/end of line charging

CITY LINE – The Vehicle



Timeline Tracker

A story in three acts...



Also makes a great "boredom tracker!"



2013-2014

2021

2022

2023




July 2023

Today

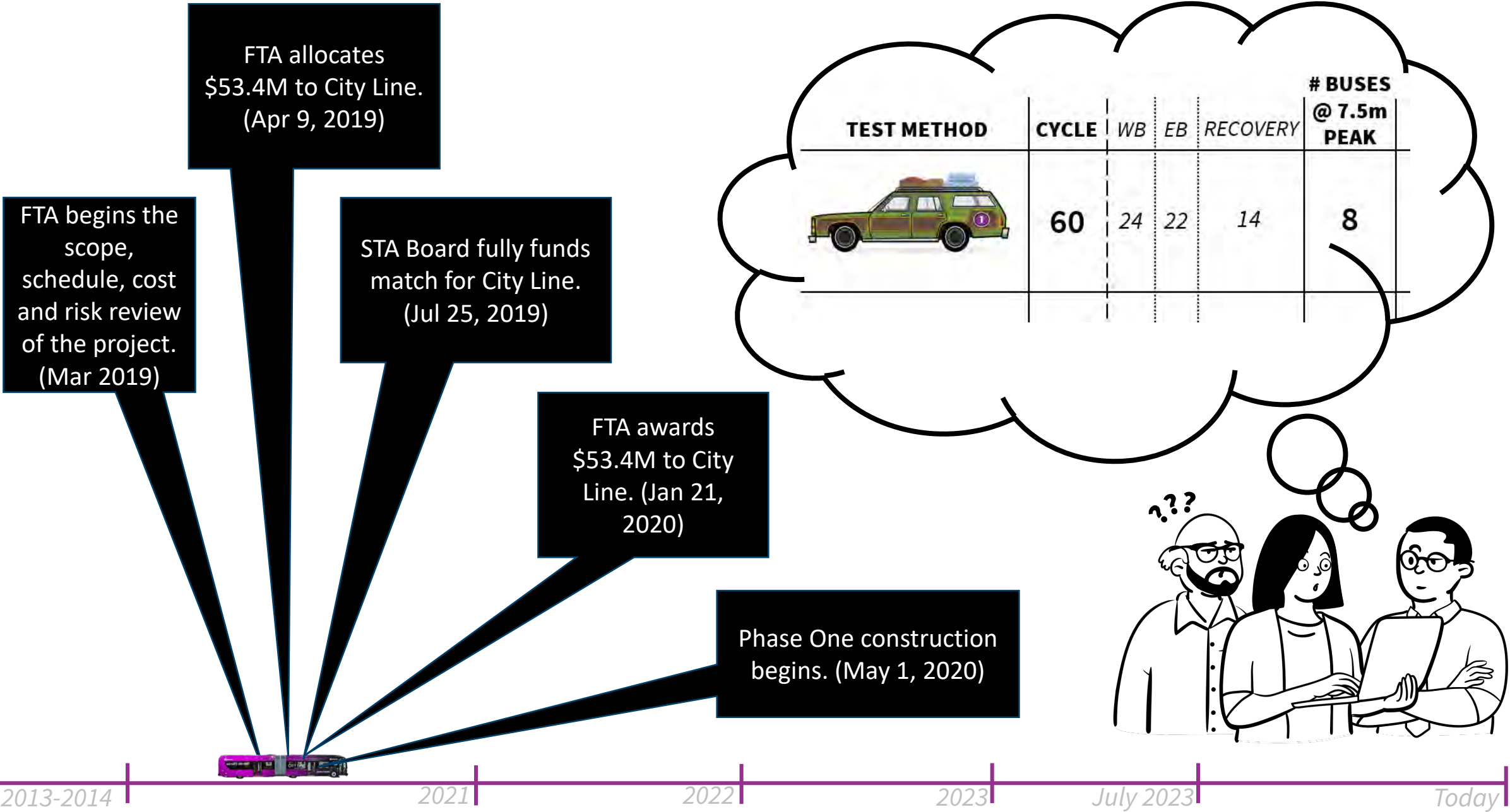
Act I


In the beginning... Early Assumptions

TEST METHOD	CYCLE				# BUSES	
		WB	EB	RECOVERY	@ 7.5m PEAK	
	60	24	22	14	8	<input type="checkbox"/> Stop Simulation <input type="checkbox"/> Lane Use Simulation ?



2013-2014 | 2021 | 2022 | 2023 | July 2023 | Today



TEST METHOD	CYCLE	WB	EB	RECOVERY	# BUSES @ 7.5m PEAK
	60	24	22	14	8

???




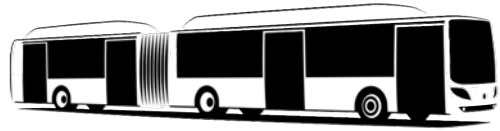
We need to re-test.

I have a bad feeling about this...






And so...

Another test...

TEST METHOD	CYCLE				# BUSES	
		WB	EB	RECOVERY	@ 7.5m PEAK	
	60	24	22	14	8	<input type="checkbox"/> Stop Simulation <input type="checkbox"/> Lane Use Simulation
	72	35	36.5	10.5	9 (w/8m peak)	<input checked="" type="checkbox"/> Stop Simulation <input checked="" type="checkbox"/> Lane Use Simulation



TEST METHOD	CYCLE	WB	EB	RECOVERY	# BUSES @ 7.5m PEAK
			22	14	8
	72	35	36.5	10.5	9 (w/8m peak)

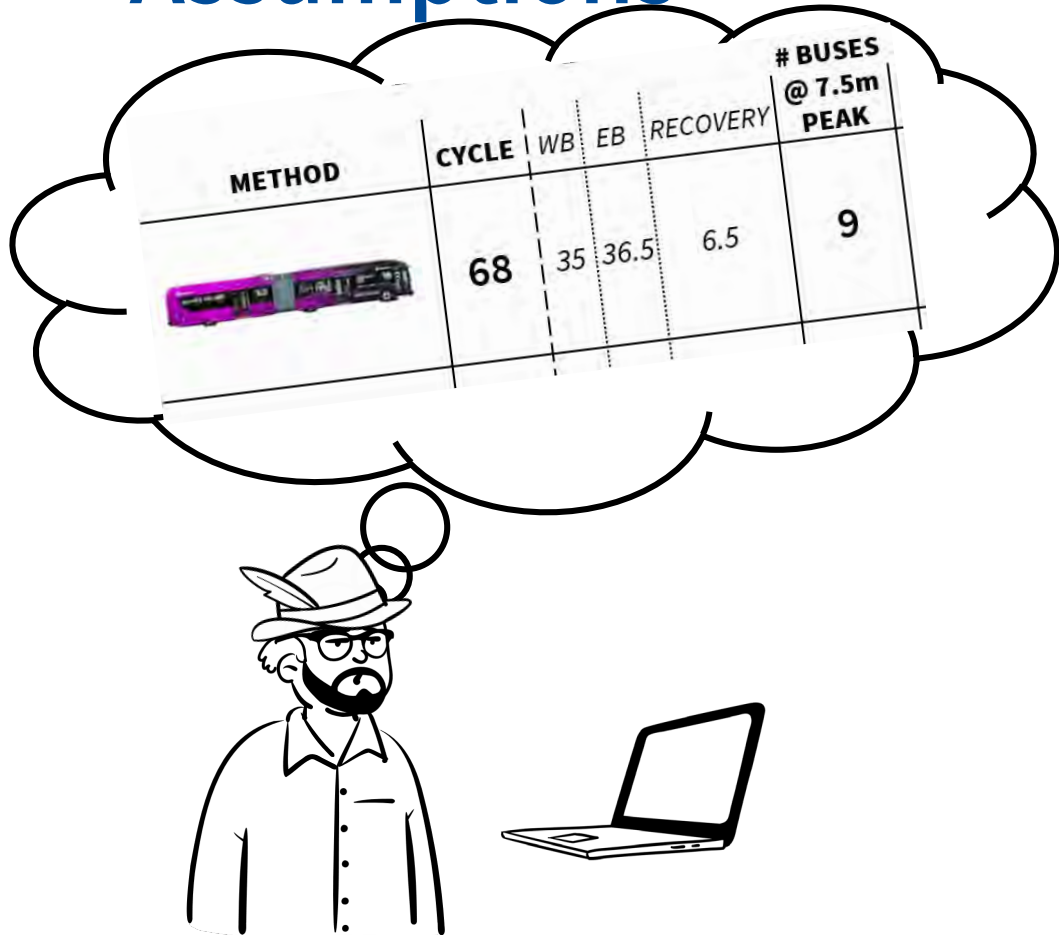
METHOD	CYCLE	WB	EB	RECOVERY	# BUSES @ 7.5m PEAK
	68	35	36.5	6.5	9



2013-2014 | 2021 | 2022 | 2023 | July 2023 | Today



Building Better Assumptions



- Charging – How often?
- Recovery – How much to allow charging?
 - Time to engage/disengage
 - Assumed % increase by time
- Plaza Operations
- Frequency & Bus Requirements

Frequency	# of Buses
7.5-minute—AM/PM Peak	9
10-minute—Weekday Midday	7
15-minute—Early AM/Evenings/Weekend	5
30-minute—Late Night	2



Every 2 – 3 trips

Most recovery at SCC/chargers

2 minutes

1% increase per min.

1 minute dwell



- Charging – How often?
- Recovery – How much to allow charging?
 - Time to engage/disengage
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- Frequency & Bus Requirements

Frequency	# of Buses
7.5-minute—AM/PM Peak	9
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2013-2014

2021

2022

2023

July 2023

Today



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Most recovery at
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minute dwell



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30-minute—Late Night	2

2013-2014

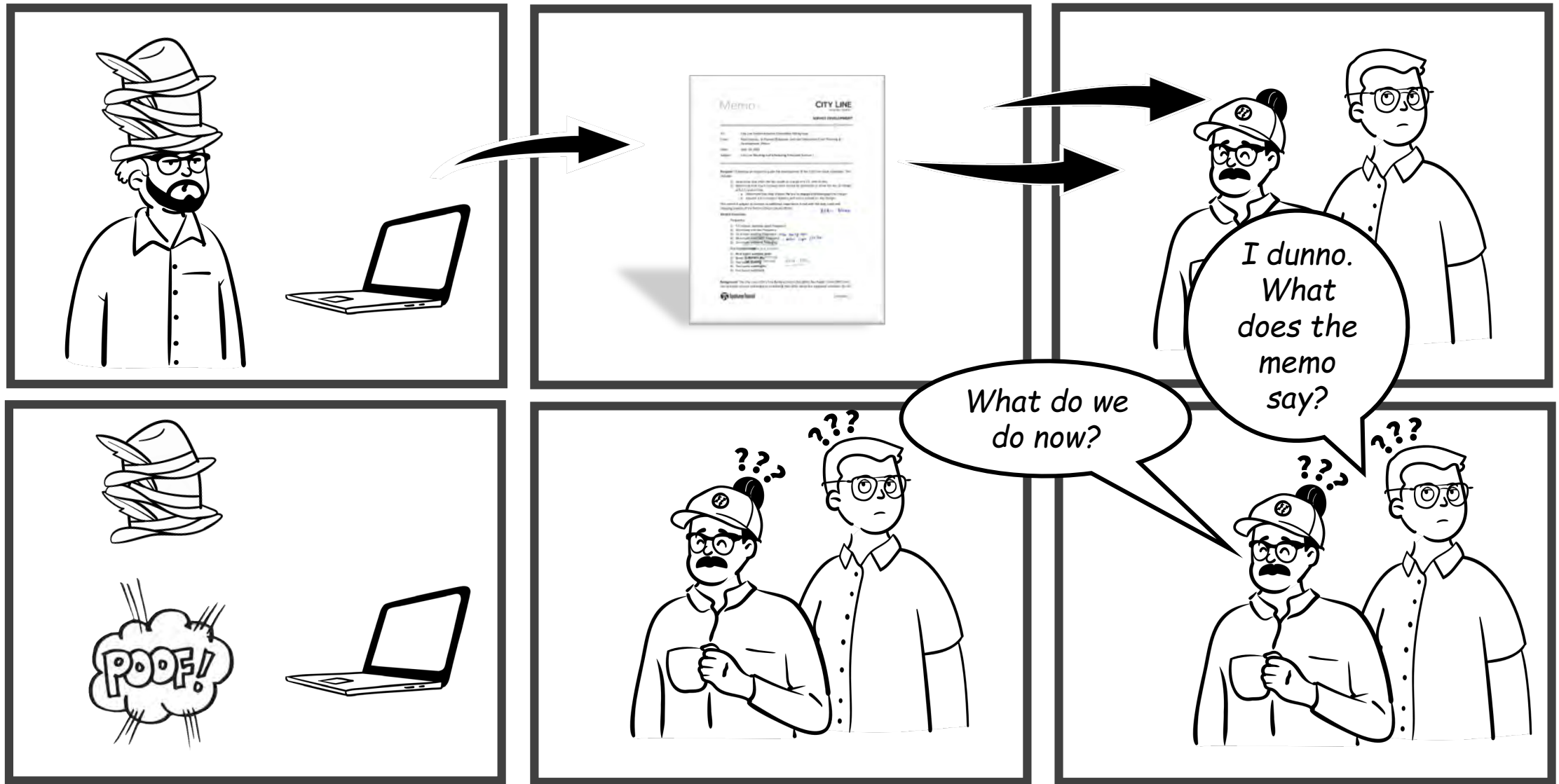
2021

2022

2023

July 2023

Today



2013-2014

2021

2022

2023

July 2023

Today



Summer 2022—One Year to Launch

Act 2



Chad Johnson

- STA Coach Operator: 2002-2015
 - Dubious Feat—Ollied a bus
- Operations Scheduling Analyst: 2015-2022
 - Satisfying Moments:
 - Finally making a phone/online bid.
 - Finishing a 23-year college degree.
- Senior Transit Planner/Scheduler 2022-???



Summer 2022—One Year to Launch

Act 2



STA unveils first of 10 City Line buses. (Mar 17, 2021)

Washington State Governor Jay Inslee tours STA and City Line progress. (Feb 18, 2022)

Phase II station construction and amenity installation begins. (Feb 18, 2022)



Team One Training/Testing

Meanwhile...

*In Fall 2022, a crack coach operator unit was sent to bid on training work by STA management. These folks promptly escaped from Extra-Board duty to the Training Department underground. Today, they survive as drivers of fortune. If you have a problem, if no one else can help, and if you can find them...
Maybe you can hire Team One.*



70m Cycle

Frequency	# of Buses
7.5-minute—AM/PM Peak	9
10-minute—Weekday Midday	7
15-minute—Early AM/Evenings/Weekend	5
30-minute—Late Night	2

Westbound to Browne's Addition

Eastbound and down to S.C.C.

One Hour!

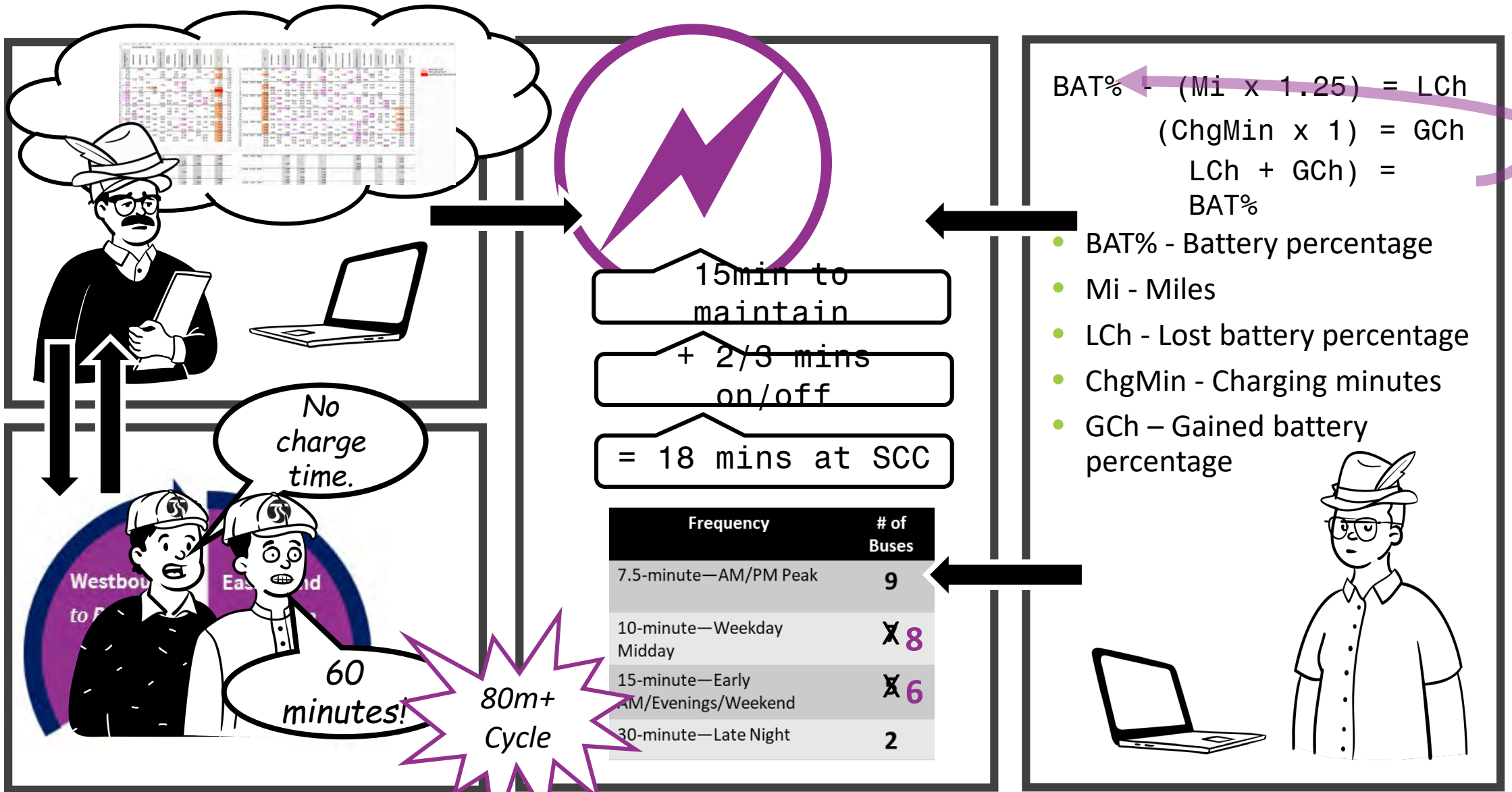
What kind of time do we need?

We don't have charge time.

February 2023

70m





2013-2014

2021

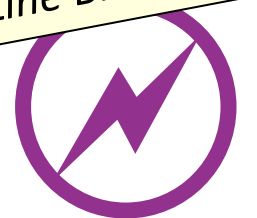
2022

2023

July 2023

Today

Tuesday February 28, 2023
 City Line Blocking Strategies Meeting



80m
 Cycle

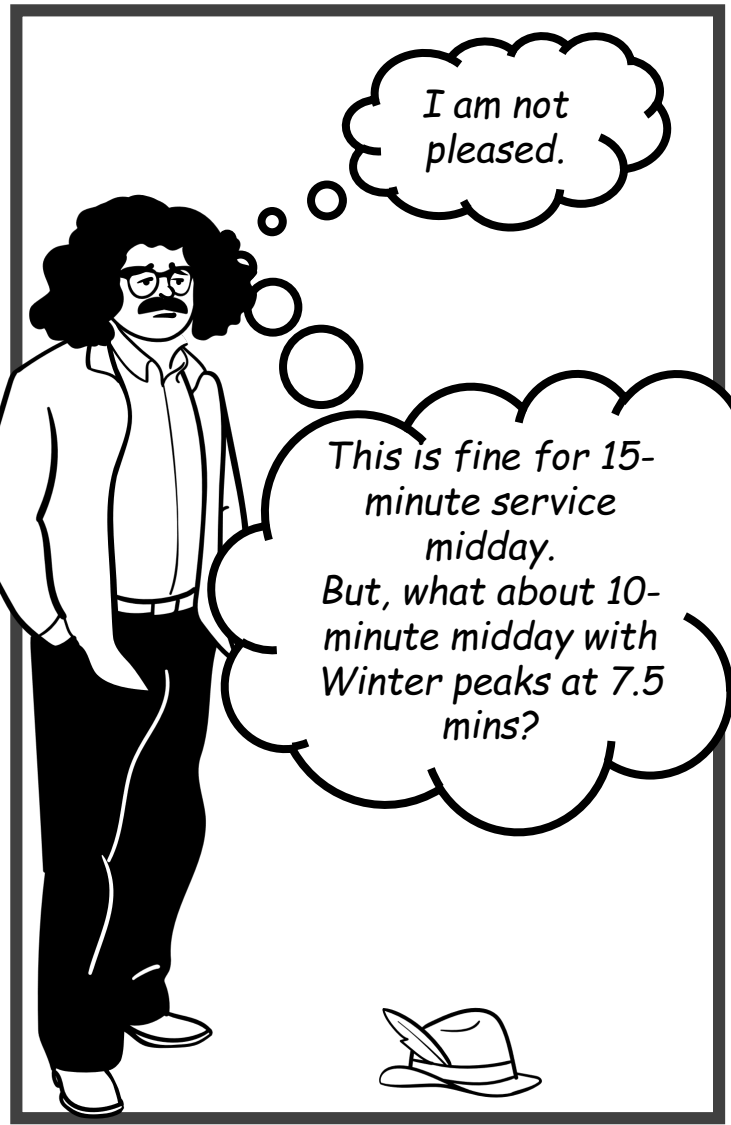
15min to
 maintain

+ 2/3 mins
 on/off

= 18 mins at SCC



Make
 it so.



@Launch
July 2023

AM Peak	15m
Midday	15m
PM Peak	15m
Evening/Sat.	15m
Sunday	30m

Weekday Span: 19h25
 Sat. Span: 18h25
 Sun. Span: 16h

January 2024

AM Peak	7.5m
Midday	15m
PM Peak	7.5m
Evening/Sat.	15m
Sunday	30m

Weekday Span: 19h25
 Sat. Span: 18h25
 Sun. Span: 16h

May 2024

AM Peak	7.5m
Midday	10m
PM Peak	7.5m
Evening/Sat.	15m
Sunday	15m

Weekday Span: **20h25**
 Sat. Span: **19h25**
 Sun. Span: 16h



Phew... Buys us some time to figure out winter.



Spring 2023



- Pulled testing data 2/27/2023 - 3/24/2023
- Great day-to-day variability
- Colder days showed electric consumption much higher than expected.



I need warm weather data to compare!

Two Months Later



- Pulled testing data 2/27/2023 – 5/27/2023
- Cold-weather variability a “thing”
 - On very cold days, buses consume almost 2x the power as mild/warm days.

Findings

	Date	Hi/Lo	Consume
Warmest:	5/19	86-62	3.12
Coldest:	2/23	16-6	5.976
Average:			3.988

How the #@\$\$ do we schedule this thing?

It's like if a diesel only got a half tank of fuel somedays.



2013-2014

2021

2022

2023

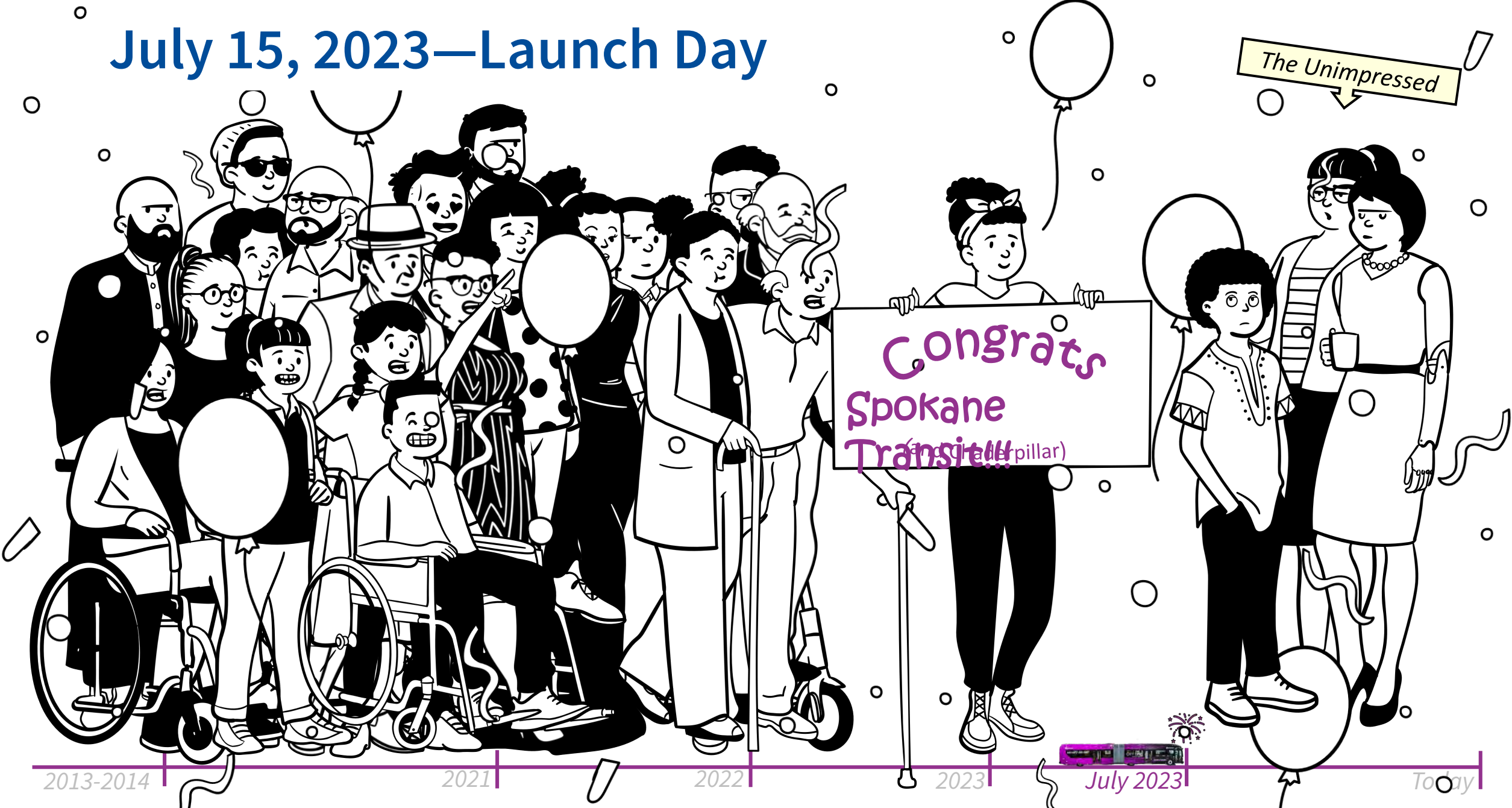


July 2023

Today

July 15, 2023—Launch Day

The Unimpressed



2013-2014

2021

2022

2023

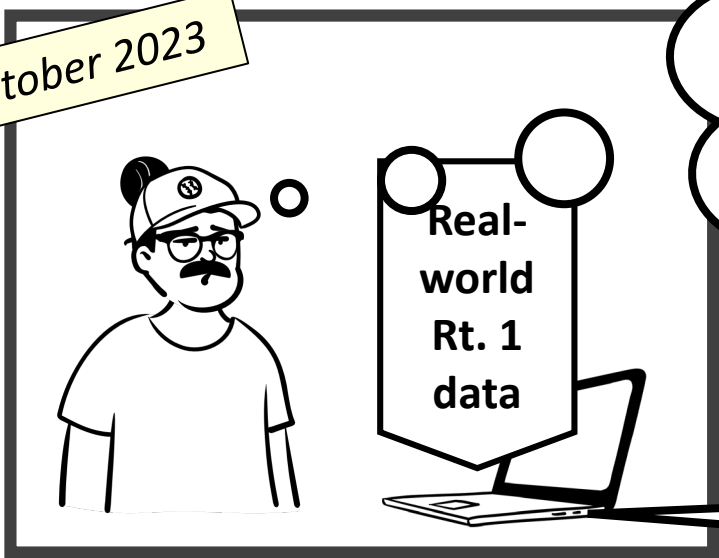
July 2023

Today

Let's Figure Out Winter Service

Act III

October 2023



Test Findings

	<u>Date</u>	<u>Hi/Lo</u>	<u>Consume</u>
Warmest:	5/19	86-62	3.12
Coldest:	2/23	16-6	5.976
<hr/>			
Average:			3.988

Jul 19th thru Oct 18th

Average Consumption:
3.119

Far Out!



Four Months Later

Rt 1
Data:
1/2/24
thru
2/7/24

2024 Findings

	Date	Hi/Lo	Consume
Warmest:	1/28	55 - 39	3.833
Coldest:	1/13	2 -10	6.252
Average:			4.776

...no more than two trips w/o charging...

Whoa, whoa, whoa...
Not more than two? We've been instructed to schedule three.

PM PEAK!

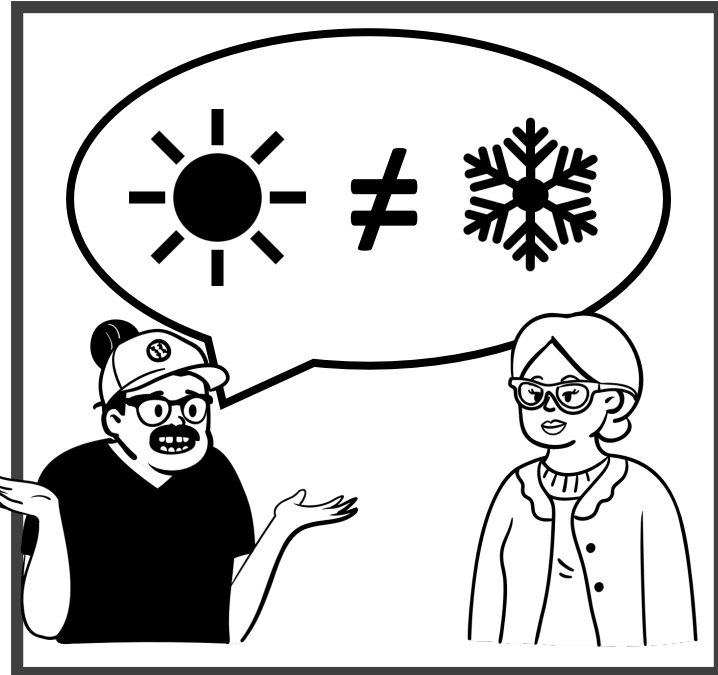
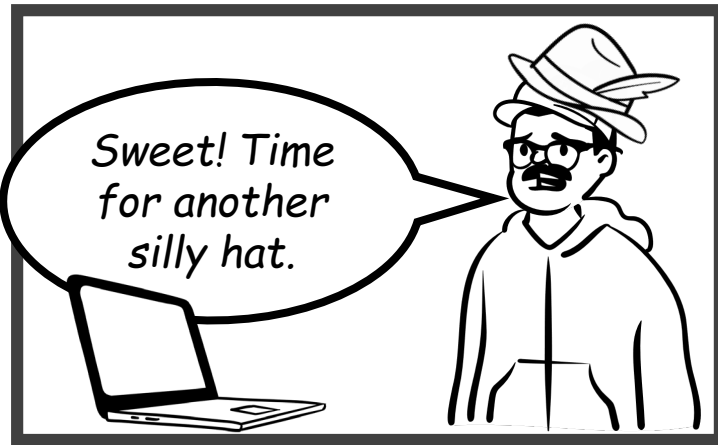
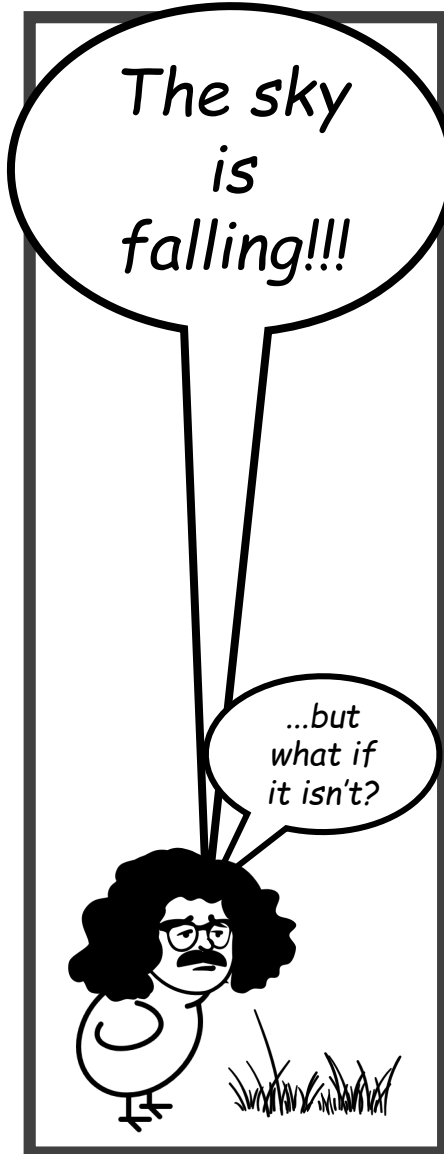
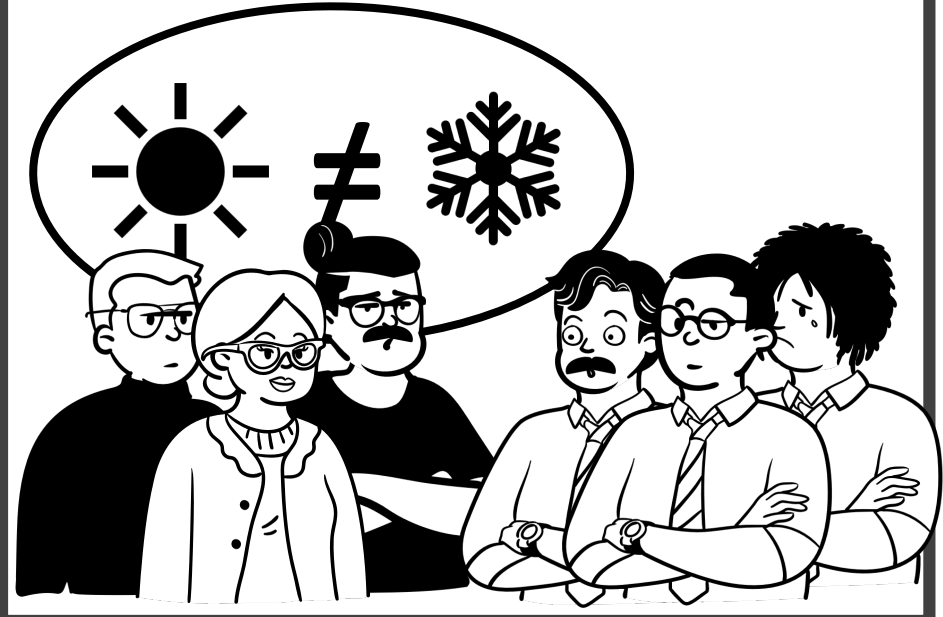
Cycle	68min
Span of Peak	180min
	2.65 ?

We're gonna need a bigger boat.



Cold Weather Findings

- On very cold days, buses can consume twice as much energy as during warm days
- Charge time during 80m cycle (9a-3p) is not enough to build energy between peaks on such days
- Peaks are too long
- PM Peak failures could become commonplace on cold days
- Winter *AVERAGE* consumption is 67% higher than the expected consumption.



2013-2014

2021

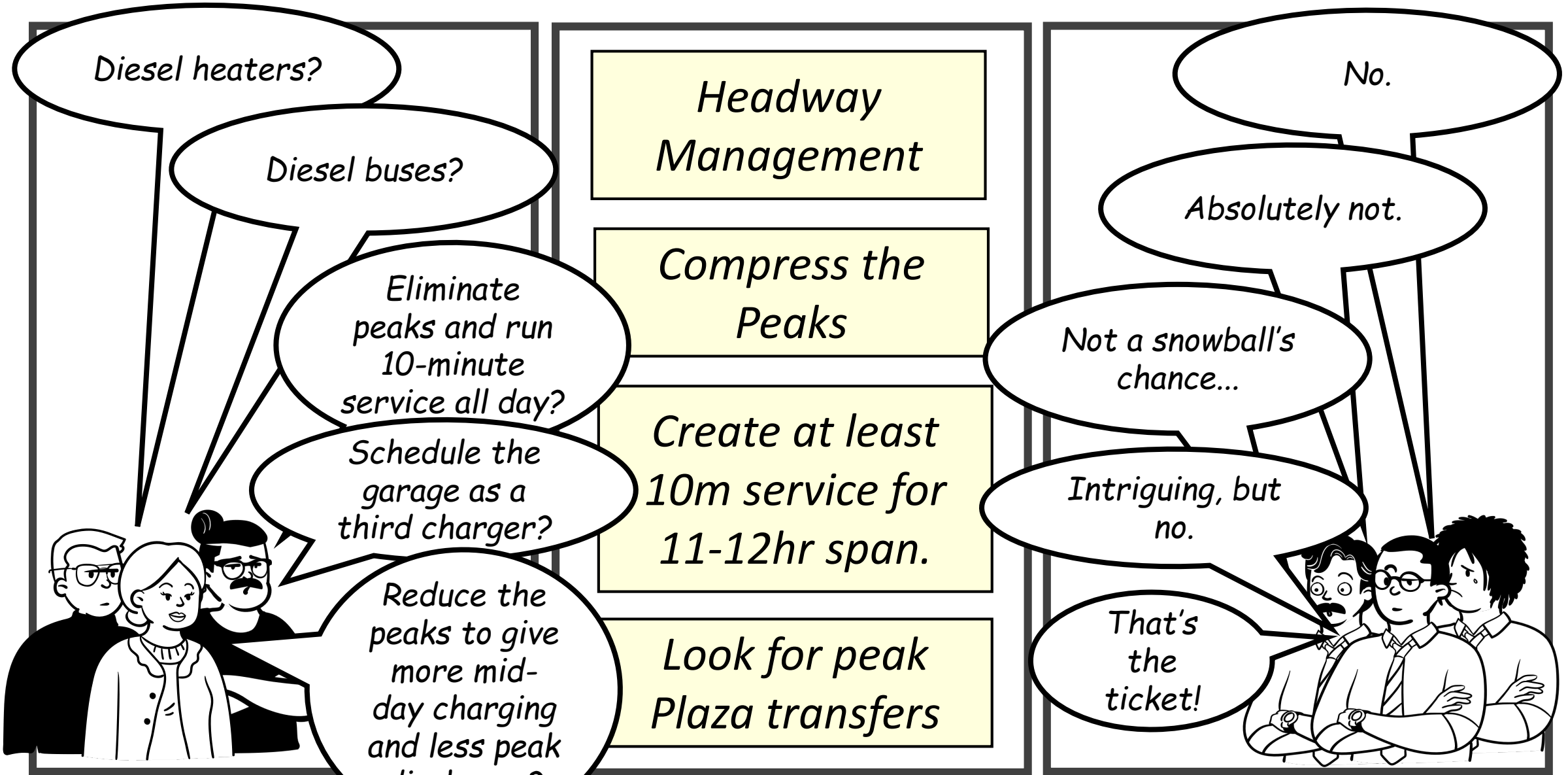
2022

2023

July 2023

Today





2013-2014

2021

2022

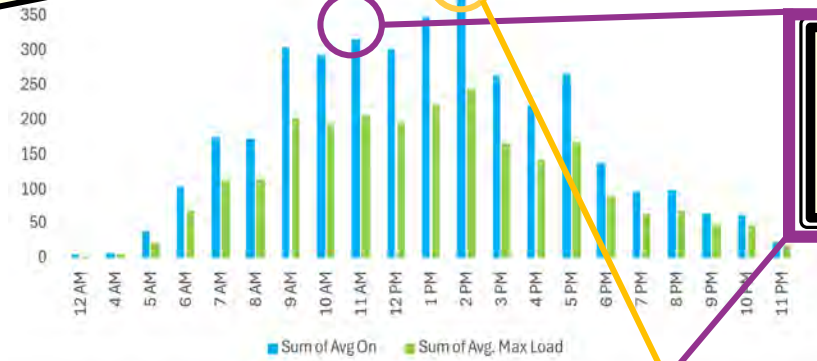
2023

July 2023

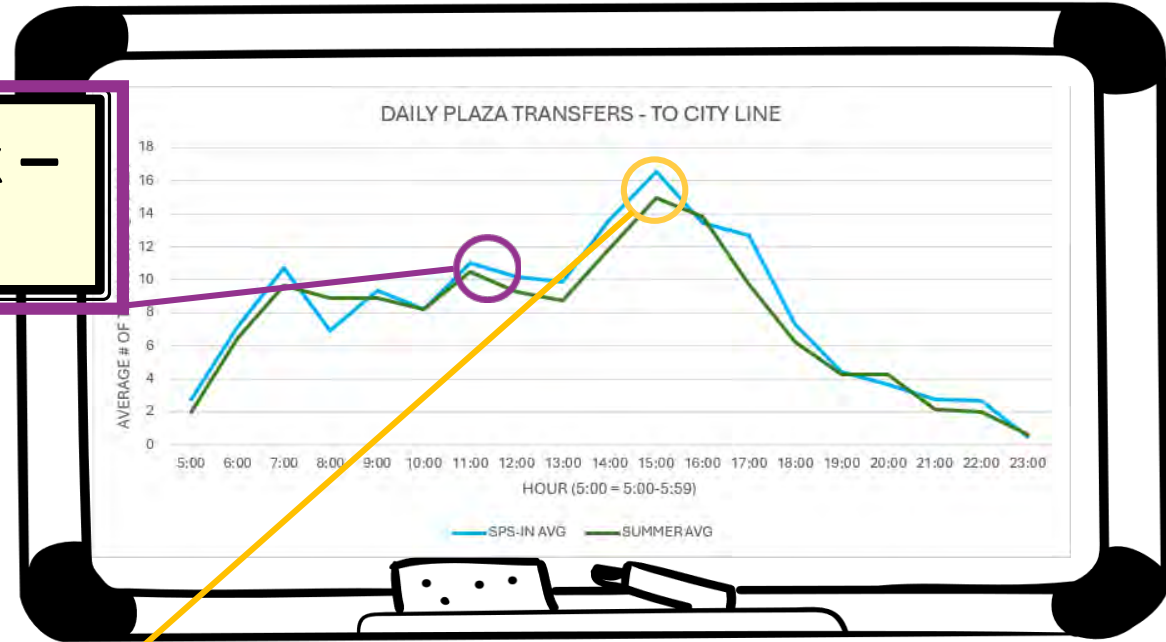
Today



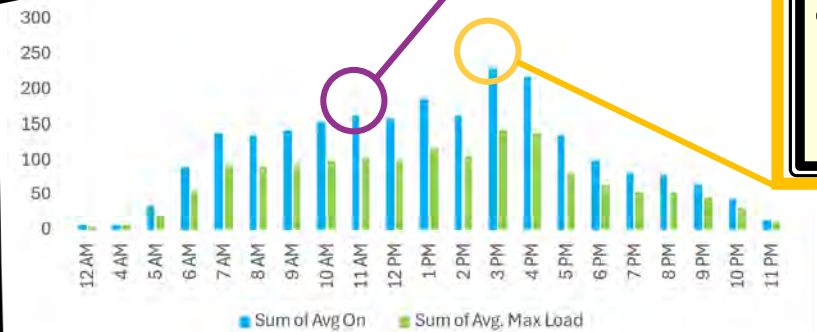
School Year



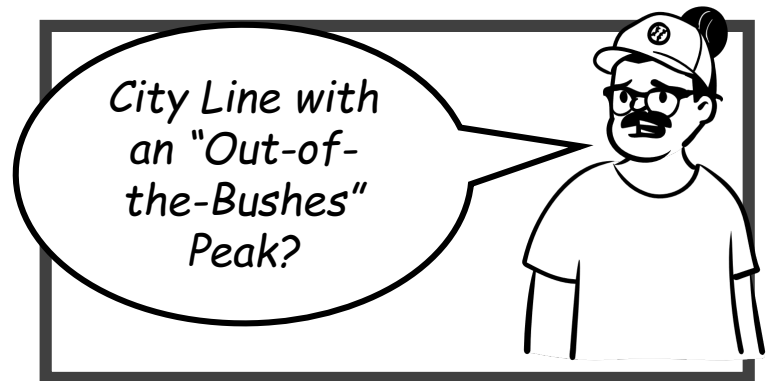
True AM Peak – 11am hour.



Summer



True PM Peak— 2 or 3 PM hour



2013-2014

2021

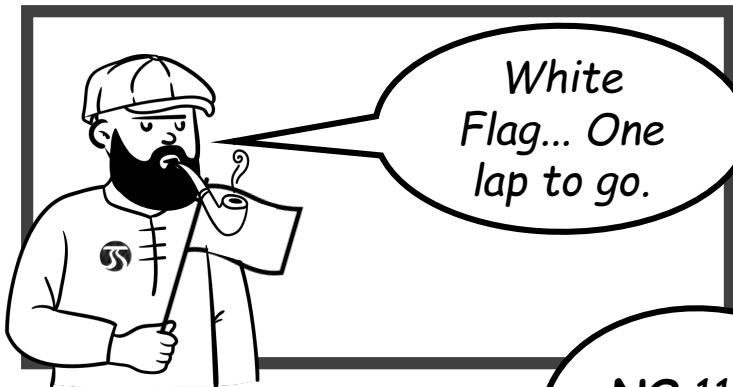
2022

2023

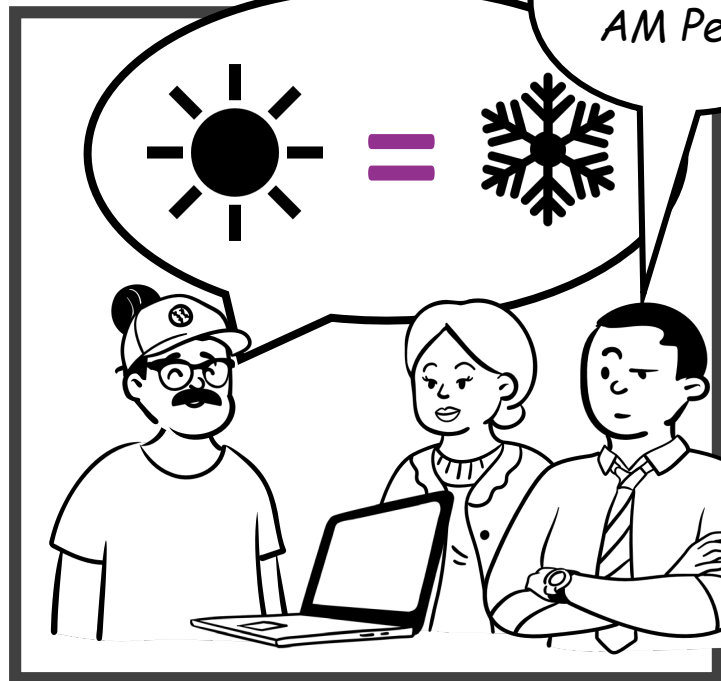
July 2023

Today

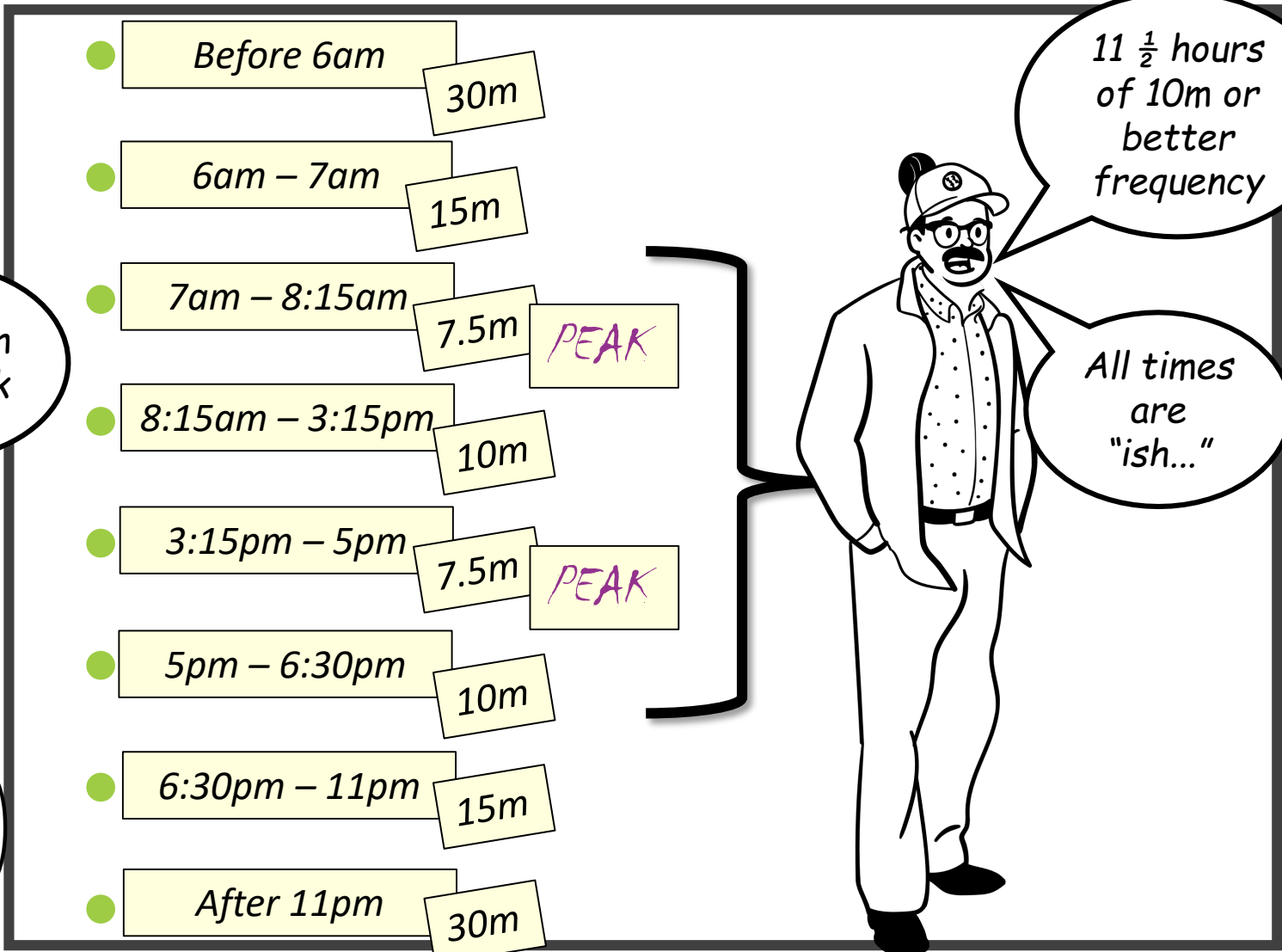




White Flag... One lap to go.



NO 11am AM Peak



11 1/2 hours of 10m or better frequency

All times are "ish..."

2013-2014

2021

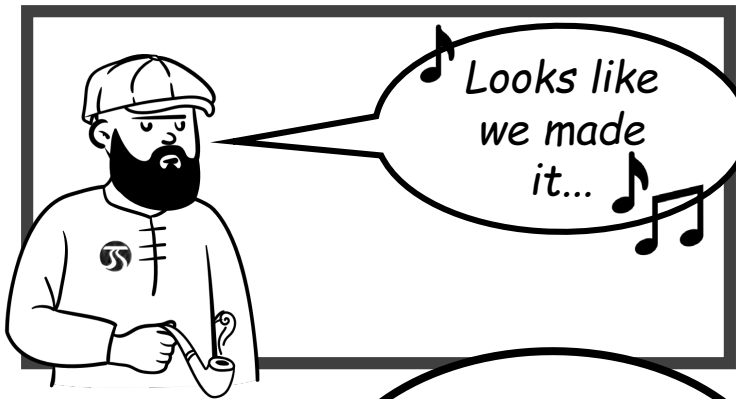
2022

2023

July 2023

Today





October

Average
60 / 37

Records
85 / 11

November

Average
44 / 30

Records
68 / -7

December

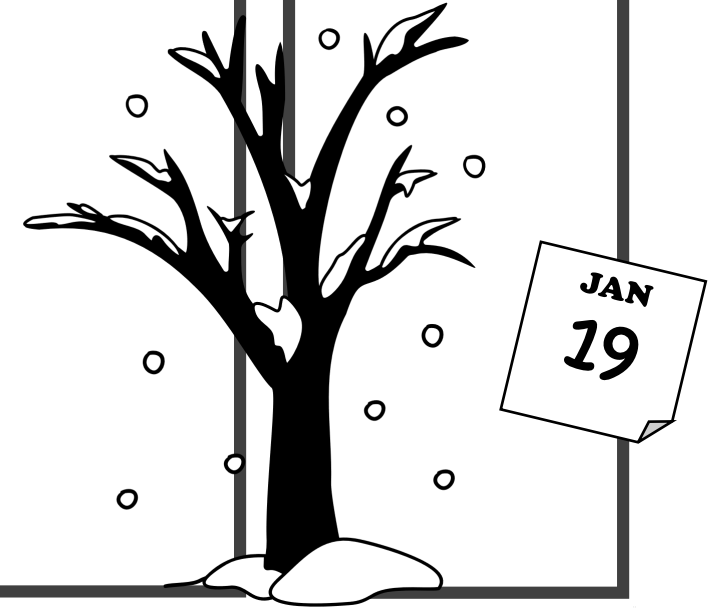
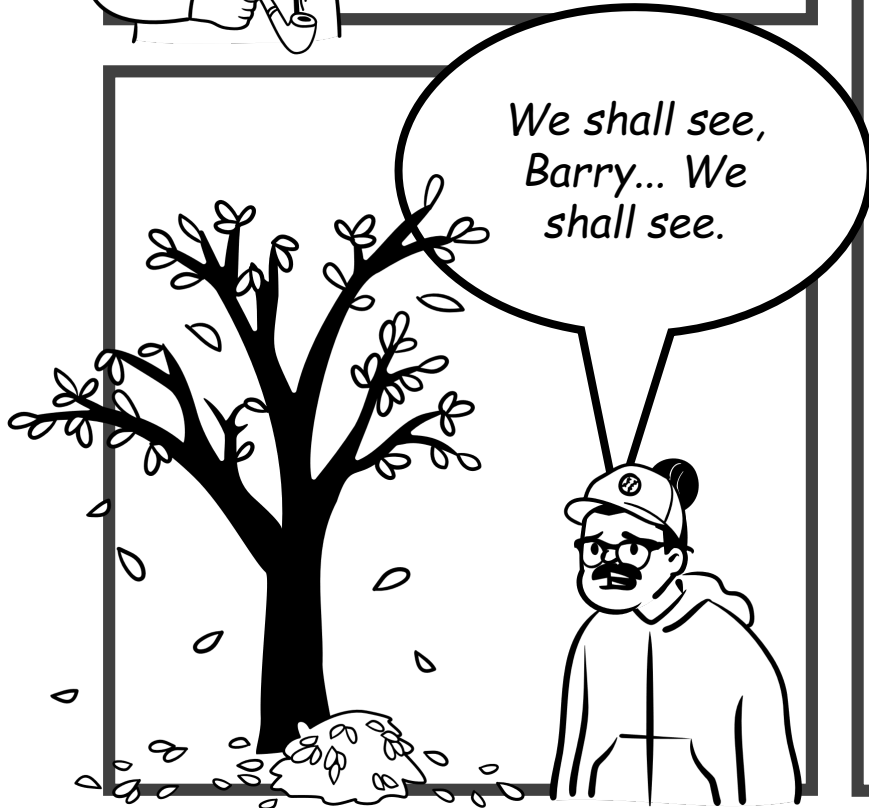
Average
35 / 24

Records
61 / -9

January

Average
36 / 25

Records
58 / -14



2013-2014

2021

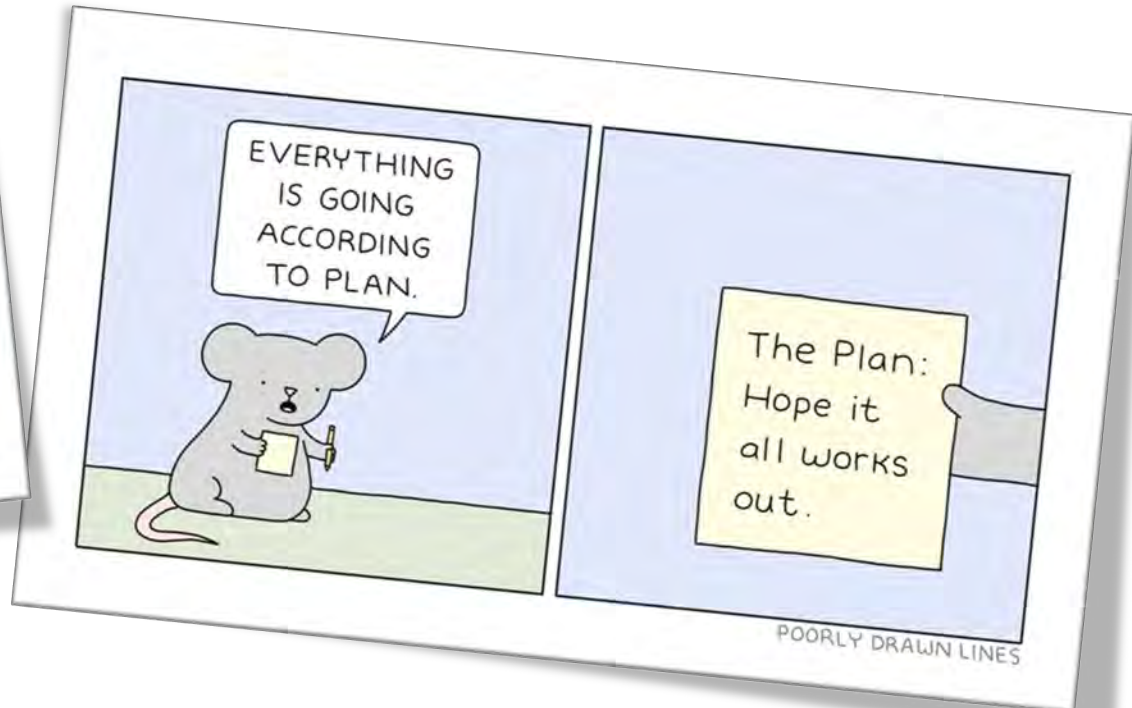
2022

2023

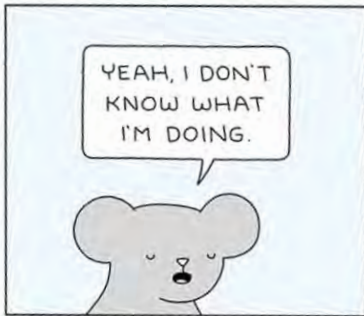
July 2023

Today





POORLY DRAWN LINES



POORLY DRAWN LINES

