Proportions of Transit

The Eliot Deviation Index

Ben Chase

April 30, 2023

About Me

- Ben Chase (photo on right)
- 19 years old, Chicago, IL
- Born and raised in central Massachusetts

Experience

- Transit planning advocate
- Latest research on zoning near public transit
- Next research on college town transit

Resources and Contact

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- Twitter: @itsbenchase
- Email: ben.chase@benchase.info

Background

Created on May 3, 2022 - close to one year ago!

- Typical teenage fashion, at 1:00 in the morning

The ratio between distance and displacement

- Distance - total distance traveled on a path
- Displacement - straight-line distance between first and last points

No other measurements like this

This took my friend group by storm in popularity through 2022

This is a collaborative effort, mostly by me, but with the help of a few friends

What is this?

The Eliot Deviation Index (EDI) of a route, put very simply, is the following calculation:

$$\frac{\text{Distance traveled on a transit route}}{\text{Displacement of the transit route}}$$

Typically, a lower EDI means the routing is better - but context is needed.

This is the overly simplified version… there are, of course, some other criteria involved.

The Six Rules

Not every line is eligible for a calculation, and six main rules determine what counts:

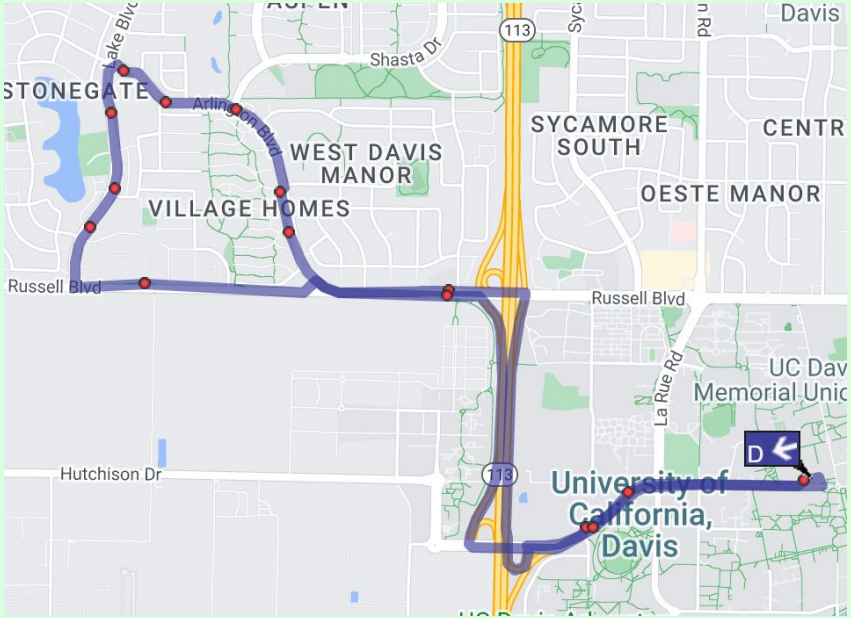
1. The line must begin and end at different stops. No loops allowed.
2. The line must have at least three stops.
3. The line must not end along the return journey to the beginning.
    3a. Lines that end with turning loops end at the midpoint of the loop.
    3b. Lines must travel with two distinguishable directions.
4. The line must look like a transit line and actually make sense.
5. The line must be a currently operating service pattern at the time of calculation.
6. The line must travel primarily by land.

Rule 3a (The Davis Rule)

Many bus routes (such as the D, pictured), have a looping section at one or both ends.

Still eligible, and in the database, the route ends at the stop closest to the midpoint of this loop.

Very commonly found in the wild.

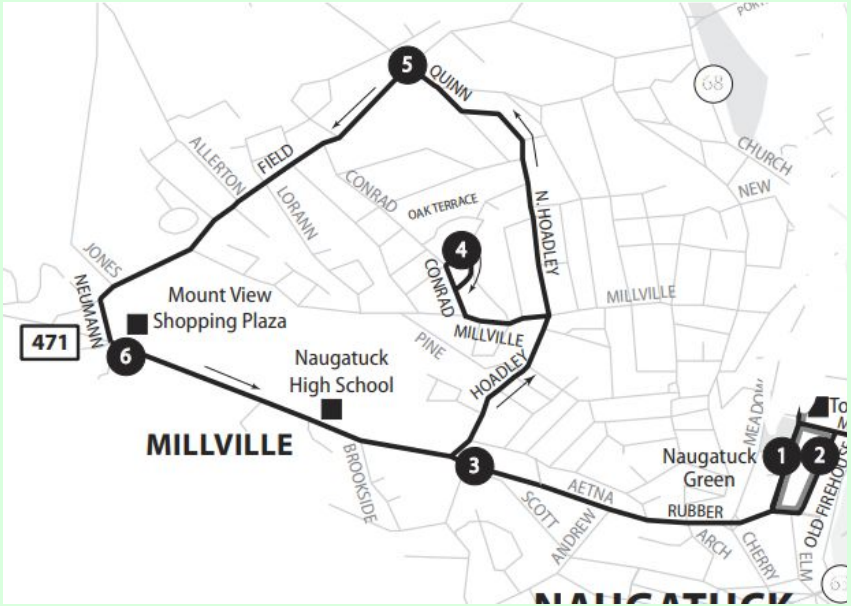


D (EDI: 1.33)
Davis, CA

Rule 3b (The Naugatuck Rule)

Similar to Rule 3a, the CTtransit 471 starts westbound trips at timepoint #1, and ends eastbound trips at timepoint #2 - due to one-way roads and interlining with other routes serving Naugatuck.

Route is split halfway around the looping portion as discussed with Rule 3a.

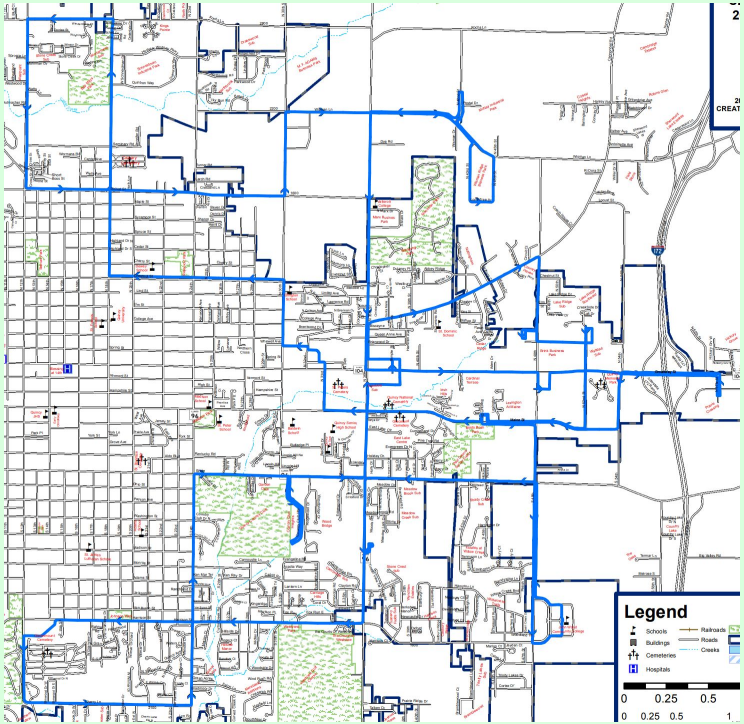


471 (EDI: 2.35)
Naugatuck, CT

Rule 4 (The Quincy Rule)

Where does it start? Where does it end? This is just spaghetti!

Commonly found in small cities with limited transit resources.



Blue Route
Quincy, IL

The Pittsburgh Adjustment

Why base the EDI off of distance between stops? Why not road or rail distance?

Topography. That's why.

Transit agencies do not have control of what the local landscape looks like, and it's unrealistic and costly to tunnel or bridge through everything.

Named after Pittsburgh, known for being a very hilly city with many topographical challenges.

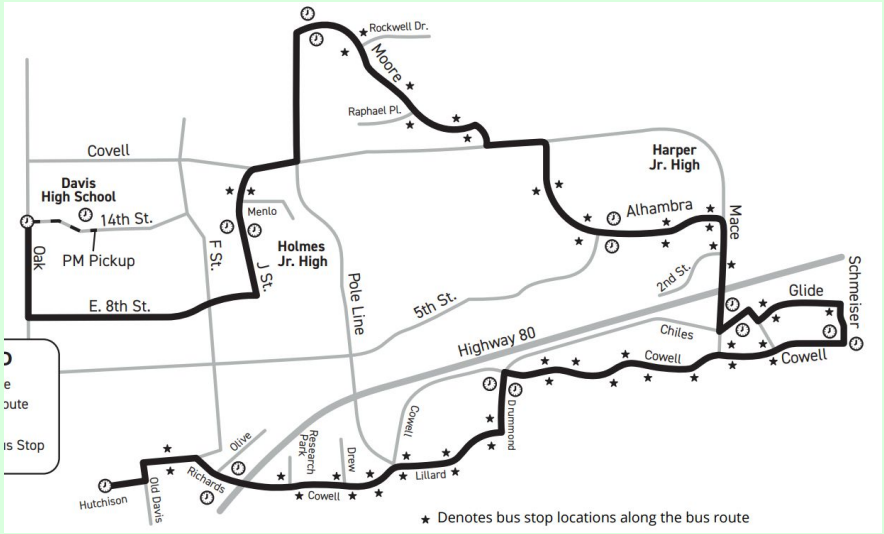
54 (EDI: 4.99 (C) / 3.2 (D))
Pittsburgh, PA

High EDIs aren’t always bad…

The EDI of a route needs to be looked at in conjunction with other factors.

Does it serve important places? What is the schedule like? Where do people want to go?

The Unitrans T, with an EDI of 7.8, is a twice-a-day school trip aligning with school hours to bring students to and from school with a one-seat bus ride.

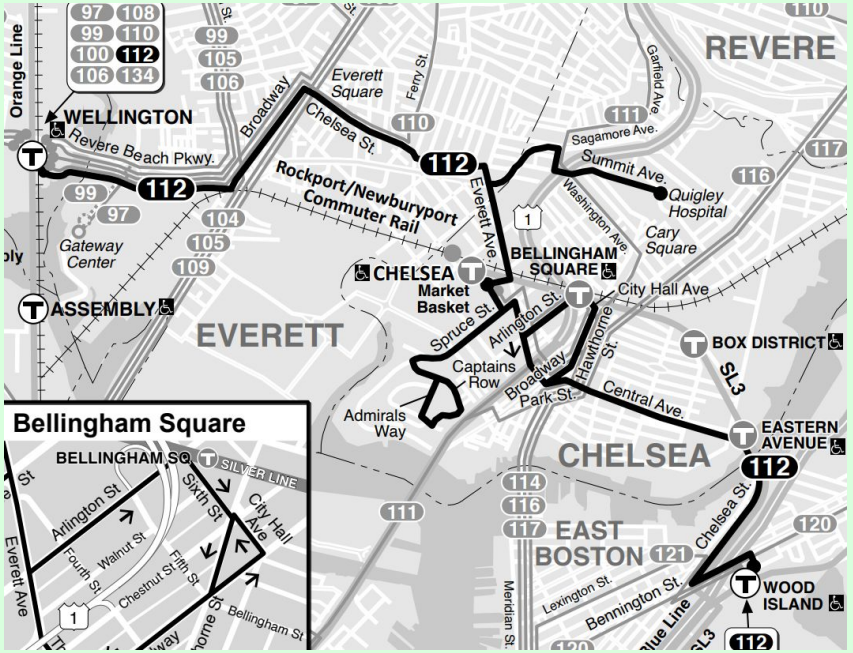


T (EDI: 7.8)
Davis, CA

… and low EDIs aren't always good…

Sometimes, bus routes are crowded with deviations that could easily be served by other routes.

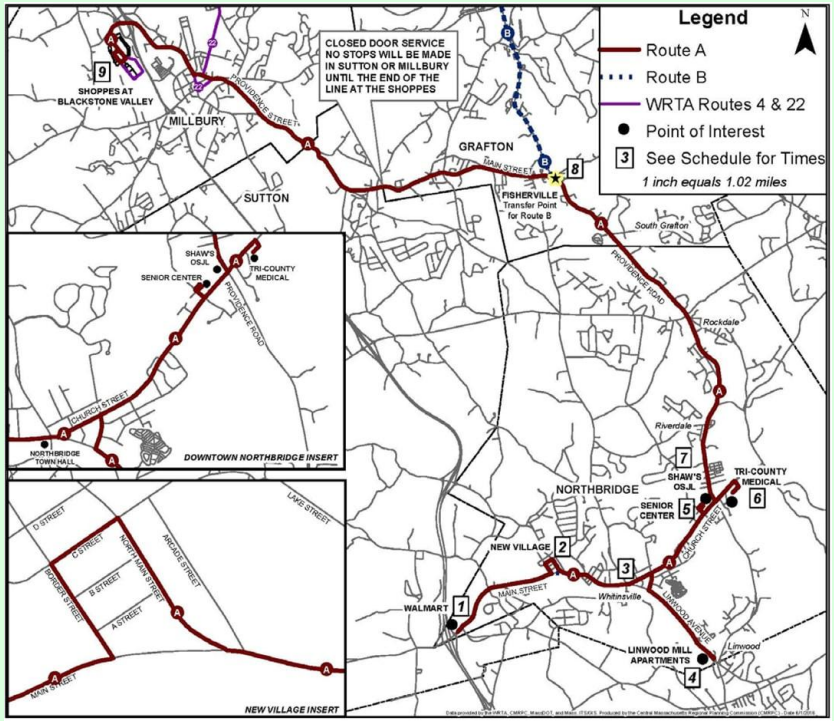
Many other bus routes serve Chelsea, and with the 2018 introduction of SL3 service, it might be easier to have a short deviation on other routes in the area, rather than having the main east-west connector deviating everywhere.



112 (EDI: 2.28)
Everett / Chelsea, MA

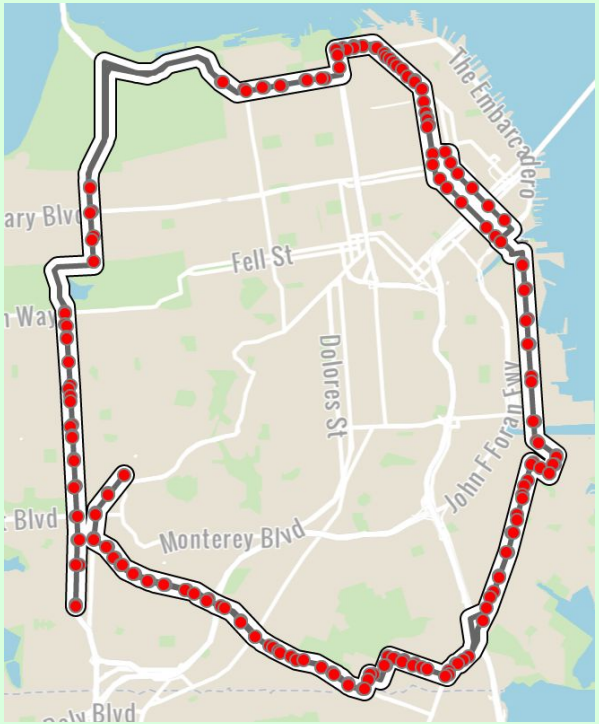
… as other context is usually needed.

Population density and the location of points of interest matter as well. The WRTA A connects all the major points of interest - the town center, grocery stores, urgent care facility - with some walkable residences and a major shopping center and connection point to the rest of the network. All while traveling twice the distance between the two endpoints.



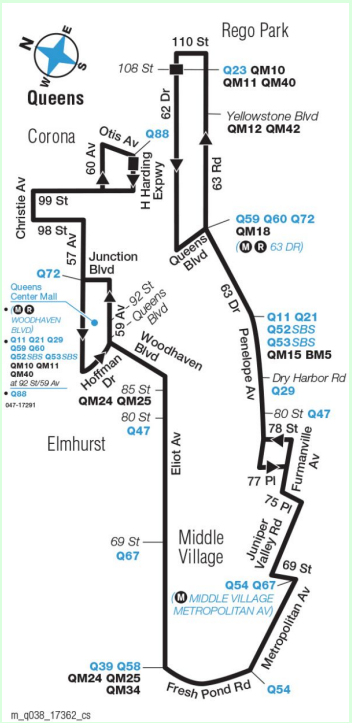
A (EDI: 2.08)
Northbridge / Grafton, MA

Just a few fun ones…



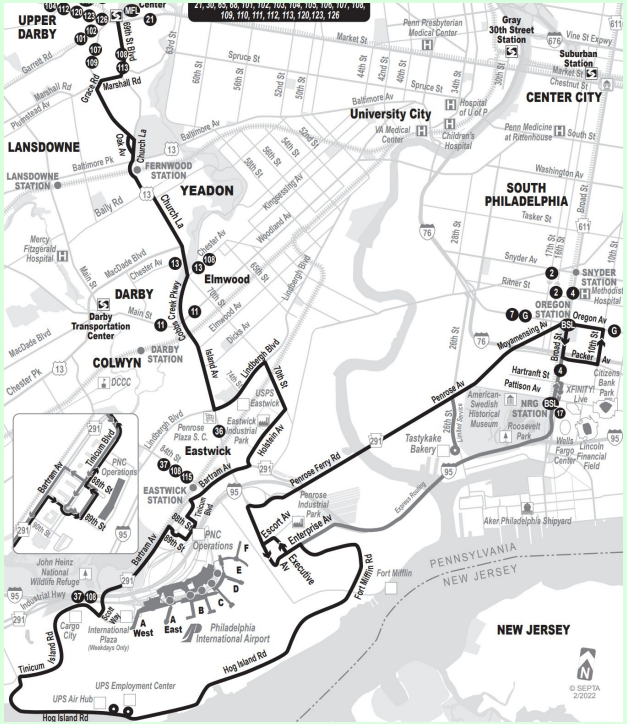
91 (EDI: 14.58)
San Francisco, CA

89 (EDI: 5.89)
Pittsburgh, PA

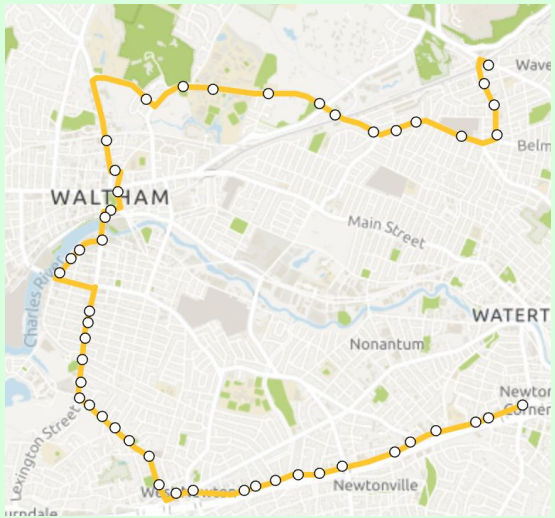


Q38 (EDI: 24.34)
Queens, NY

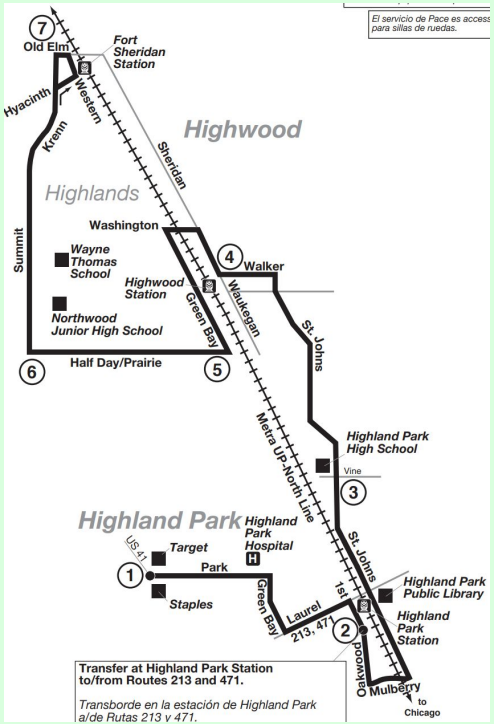
Some more fun ones…



68 (EDI: 3.73)
Philadelphia, PA

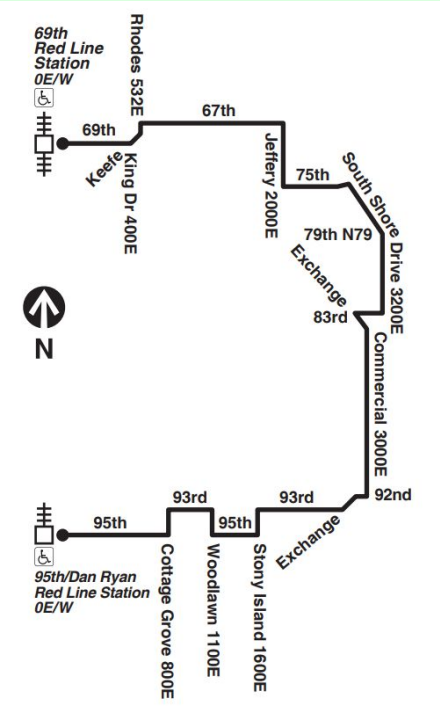


554 (EDI: 3.8)
Waltham / Newton, MA

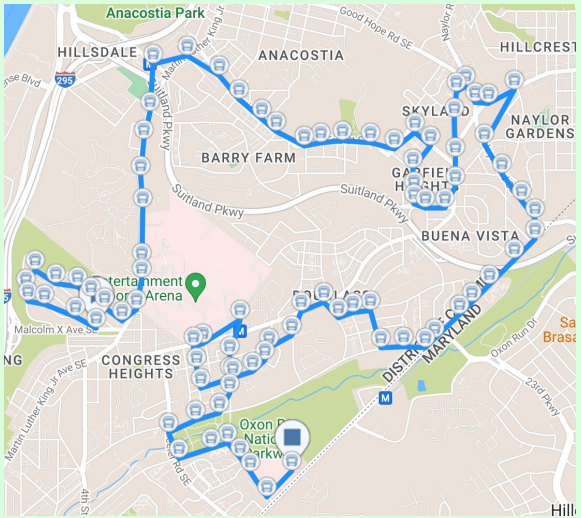


472 (EDI: 3.36)
Highland Park / Highwood, IL

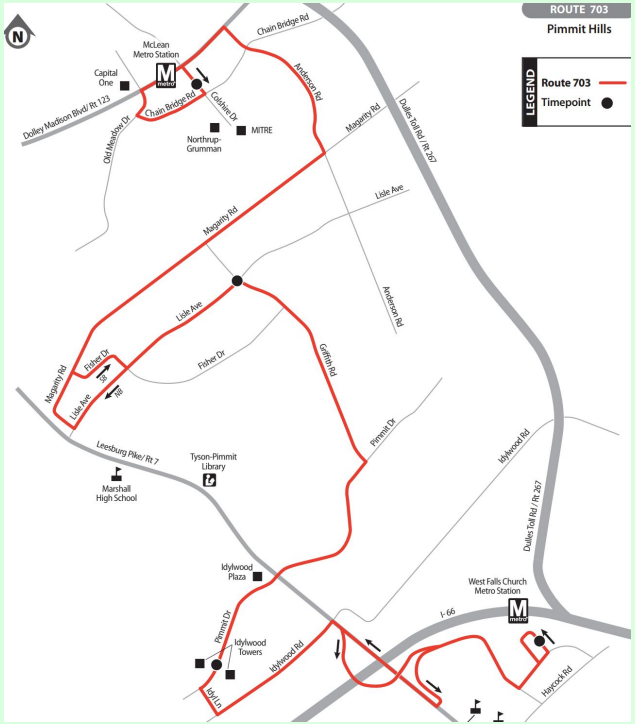
There’s over 1500 more…



N5 (EDI: 3.6)
Chicago, IL



W3 (EDI: 8.82)
Washington, DC



703 (EDI: 2.63)
Falls Church / Tysons, VA

A Detailed Database

The database is located online at edi.benchase.info, and currently consists of:

1,575 calculated EDIs

290,128 stops located in 20 states, 3 provinces, and the District of Columbia

KML data is available for mapping in GIS-related programs

Additional stats…

Mean EDI: 1.66

Median EDI: 1.37

Mean Length: 9.77 miles

Median Length: 7.55 miles

As of 4/29/23 9:20 pm CT

Online Calculator

There is an online calculator with a number of more detailed features…

Each agency has an agency code, listed on the website, next to each agency's name in the stop and route listings (CTA: il-cta)

Sample route used is the CTA 55A

Detailed Route View

Lists out all stops along a route

Displays EDI and route length at the end

Enter agency: il-cta
Enter line: 55A
- Midway Orange Line Station (14121) (1, 0.0, 1.0)
- 55th Street & Cicero (4542) (2, 0.49, 1.0)
- 55th Street & Laramie (17110) (3, 1.01, 1.22)
- 55th Street & Lockwood (4544) (4, 1.12, 1.22)
- 55th Street & Long (4545) (5, 1.25, 1.21)
- 55th Street & Linder (17111) (6, 1.39, 1.2)
- 55th Street & Central (17112) (7, 1.53, 1.18)
- 55th Street & Menard (4548) (8, 1.76, 1.17)
- 55th Street & Mayfield (4549) (9, 1.89, 1.16)
- Austin & 55th Street (4556) (10, 2.02, 1.15)
- Austin & 56th Street (4557) (11, 2.13, 1.23)
- Austin & 58th Street (4559) (12, 2.38, 1.41)
- Austin & 59th Street (4560) (13, 2.51, 1.48)
- 5920 S Austin (4561) (14, 2.58, 1.53)
- Austin & 60th Street (4562) (15, 2.63, 1.55)
- Austin & 62nd Street (4564) (16, 2.89, 1.66)
- Austin & 63rd Street (4565) (17, 3.01, 1.7)
- Meade & 63rd Street (4566) (18, 3.14, 1.65)
- Meade & 64th Place (18382) (19, 3.31, 1.69)
- Austin & 65th Street (4568) (20, 3.45, 1.86)

Distance: 3.45 miles
Eliot Deviation Index: 1.86
Average Stop Spacing: 0.18 miles

Online Calculator

Cumulative Distance / EDI Tracker

Austin & 65th Street (4568) (20, 3.45, 1.86)

4568 - Stop ID for Austin & 65th Street

20 - Stops on the line up to this point

3.45 - Distance in miles on the line to this point

1.86 - EDI of the line if it ended at this point

Enter agency: il-cta
Enter line: 55A
- Midway Orange Line Station (14121) (1, 0.0, 1.0)
- 55th Street & Cicero (4542) (2, 0.49, 1.0)
- 55th Street & Laramie (17110) (3, 1.01, 1.22)
- 55th Street & Lockwood (4544) (4, 1.12, 1.22)
- 55th Street & Long (4545) (5, 1.25, 1.21)
- 55th Street & Linder (17111) (6, 1.39, 1.2)
- 55th Street & Central (17112) (7, 1.53, 1.18)
- 55th Street & Menard (4548) (8, 1.76, 1.17)
- 55th Street & Mayfield (4549) (9, 1.89, 1.16)
- Austin & 55th Street (4556) (10, 2.02, 1.15)
- Austin & 56th Street (4557) (11, 2.13, 1.23)
- Austin & 58th Street (4559) (12, 2.38, 1.41)
- Austin & 59th Street (4560) (13, 2.51, 1.48)
- 5920 S Austin (4561) (14, 2.58, 1.53)
- Austin & 60th Street (4562) (15, 2.63, 1.55)
- Austin & 62nd Street (4564) (16, 2.89, 1.66)
- Austin & 63rd Street (4565) (17, 3.01, 1.7)
- Meade & 63rd Street (4566) (18, 3.14, 1.65)
- Meade & 64th Place (18382) (19, 3.31, 1.69)
- Austin & 65th Street (4568) (20, 3.45, 1.86)

Distance: 3.45 miles
Eliot Deviation Index: 1.86
Average Stop Spacing: 0.18 miles

Online Calculator

This can also be viewed in reverse…

just enter reverse as the line name

Enter line: reverse
Enter line: 55A
- Austin & 65th Street (4568) (1, 0.0, 1.0)
- Meade & 64th Place (18382) (2, 0.15, 1.0)
- Meade & 63rd Street (4566) (3, 0.31, 1.2)
- Austin & 63rd Street (4565) (4, 0.44, 1.8)
- Austin & 62nd Street (4564) (5, 0.57, 1.52)
- Austin & 60th Street (4562) (6, 0.82, 1.31)
- 5920 S Austin (4561) (7, 0.87, 1.29)
- Austin & 59th Street (4560) (8, 0.95, 1.26)
- Austin & 58th Street (4559) (9, 1.07, 1.22)
- Austin & 56th Street (4557) (10, 1.33, 1.17)
- Austin & 55th Street (4556) (11, 1.44, 1.16)
- 55th Street & Mayfield (4549) (12, 1.57, 1.24)
- 55th Street & Menard (4548) (13, 1.7, 1.32)
- 55th Street & Central (17112) (14, 1.92, 1.43)
- 55th Street & Linder (17111) (15, 2.06, 1.47)
- 55th Street & Long (4545) (16, 2.21, 1.5)
- 55th Street & Lockwood (4544) (17, 2.33, 1.52)
- 55th Street & Laramie (17110) (18, 2.44, 1.52)
- 55th Street & Cicero (4542) (19, 2.96, 1.51)
- Midway Orange Line Station (14121) (20, 3.45, 1.86)
Distance: 3.45 miles
Eliot Deviation Index: 1.86
Average Stop Spacing: 0.18 miles

Online Calculator

Segments

Can also calculate for a portion of a line… in this case, only the portion of the 55A traveling along 55th Street.

Enter segment as the line name, and the calculator will prompt for the first and last stops of each segment, counting consecutively from the first stop on the line.

In this example, 55th & Cicero is 2, and Austin & 55th is 10, for a nine stop segment.

```
Enter line: segment
Enter line: 55A
Starting stop: 2
Ending stop: 10
- 55th Street & Cicero (4542) (1, 0.0, 1.0)
- 55th Street & Laramie (17110) (2, 0.52, 1.0)
- 55th Street & Lockwood (4544) (3, 0.63, 1.0)
- 55th Street & Long (4545) (4, 0.75, 1.0)
- 55th Street & Linder (17111) (5, 0.9, 1.0)
- 55th Street & Central (17112) (6, 1.04, 1.0)
- 55th Street & Menard (4548) (7, 1.26, 1.0)
- 55th Street & Mayfield (4549) (8, 1.39, 1.0)
- Austin & 55th Street (4556) (9, 1.52, 1.0)
Distance: 1.52 miles
Eliot Deviation Index: 1.0
Average Stop Spacing: 0.19 miles
```

Online Calculator

Adding Routes

Is there a route that isn't calculated yet? What about this fictional routing?

Anything can be put through the calculator by inputting custom as the route, and by entering the stop IDs in consecutive order along the line.

There's also some extra codes in there:

-1 - Add a stop at a custom location

-2 - Remove the previously added stop

-3 - Add a stop from another agency

-0 - End the line

```
Enter line: custom
Line Name: calc test
Stop ID: 4539
Added: Archer & New England (1, 0.0, 1.0)
Stop ID: 4540
Added: Archer & Sayre (2, 0.13, 1.0)
Stop ID: -2
Archer & Sayre (4540) removed.
(1, 0.0, 1.0)
Stop ID: -1
New Stop Name: Archer & Neva
New Stop ID: whatever
New Stop Latitude: 41.792059
New Stop Longitude: -87.800193
(2, 0.33, 1.0)
Stop ID: -3
Enter agency: il-pace
Stop ID: 10294
Added: Archer / 73rd Ave. (3, 0.52, 1.0)
Stop ID: -0
- Archer & New England (4539) (1, 0.0, 1.0)
- Archer & Neva (whatever) (2, 0.33, 1.0)
- Archer / 73rd Ave. (il-pace | 10294) (3, 0.52, 1.0)
Distance: 0.52 miles
Eliot Deviation Index: 1.0
Average Stop Spacing: 0.26 miles
```

Online Calculator

Stop Search

Need to find a stop in the large database?

This tool can search either one agency or the entire database for all stops with a specified string within it.

For example… 20 stops in the database have “Index” within their names.

The agency and stop ID of the stop is included.

Enter search: Index
- Balboa / Index (ca-lacmta | 332)
- Balboa / Index (ca-lacmta | 8916)
- Haskell / Index (ca-lacmta | 20026)
- Haskell / Index (ca-lacmta | 20043)
- NE 10th St & Index Ave NE (wa-king | 45170)
- NE 10th St & Index Ave NE (wa-king | 46570)
- North Queen St at Index Rd (on-ttc | 10624)
- North Queen St at Index Rd (on-ttc | 10629)
- Old Georgetown Rd & Poindexter Ln (md-mont | 24704)
- Poindexter & B (va-hrt | 1830)
- Poindexter & Jackson (va-hrt | 1875)
- Poindexter & Rodgers (va-hrt | 1832)
- Poindexter & Stewart (va-hrt | 1833)
- Poindexter & Stewart (va-hrt | 1874)
- Poindexter & Wade (va-hrt | 5343)
- Poindexter & Wade (va-hrt | 5345)
- Post & Index (WB) (wi-metro | 4910)
- Union at Poindexter (Maaco) (wa-kitsap | 360)
- Woodley / Index (ca-lacmta | 16814)
- Woodley / Index (ca-lacmta | 8505)

Results: 20

Contributing

The EDI and associated database would not be possible if it wasn't for the collaborative effort from me and a small group of friends who have found a number of these bus routes shown throughout this presentation.

Want to join us?

There is a new Discord server for anything related to the Eliot Deviation Index!

Join it now (or later) - discord.gg/Gn628Vr2PG

Discuss, request, and submit routes for inclusion within the EDI database.

Discord is the easiest, but you can also submit an export file (prompted after ending a custom line) via email.

Thanks!

How to get in touch with me and for more information:

tc23.benchase.info

edi.benchase.info

Twitter: @itsbenchase

ben.chase@benchase.info

I’ll be responding throughout the day, so reach out!