

ILGISA 2026 · MONDAY 10:30 · RIVER H

Polygons from First Principles

How **x**GRIDs extend the UN's 2025 settlement methodology to neighborhood-scale geographies.

Harry Brisson · Data Lead & Co-Founder, Ward Wise · Mic Check



miccheck.media/what-is-chicago



github.com/HarryBrisson/chiGRIDs

FIVE QUESTIONS

What we will answer in thirty minutes

- 1 Who draws the lines?
- 2 What do the lines cost us?
- 3 Is there a rule instead?
- 4 What does the rule say about Chicago, Peoria and the rest of Illinois?
- 5 Can a rule work at neighborhood scale?

Chicago first, then Peoria and Illinois. The last slide answers all five in one line each.

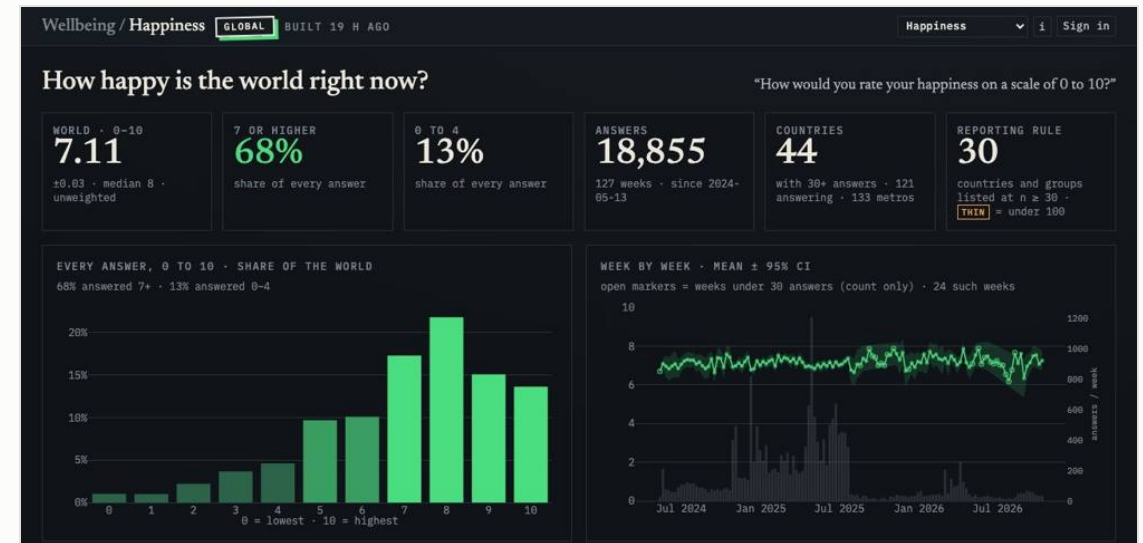
WHY I CARE

I measure wellbeing in cities, everywhere

Every week, Mic Check asks people how their lives are going: 18,855 answers from 121 countries and 133 metros since May 2024.

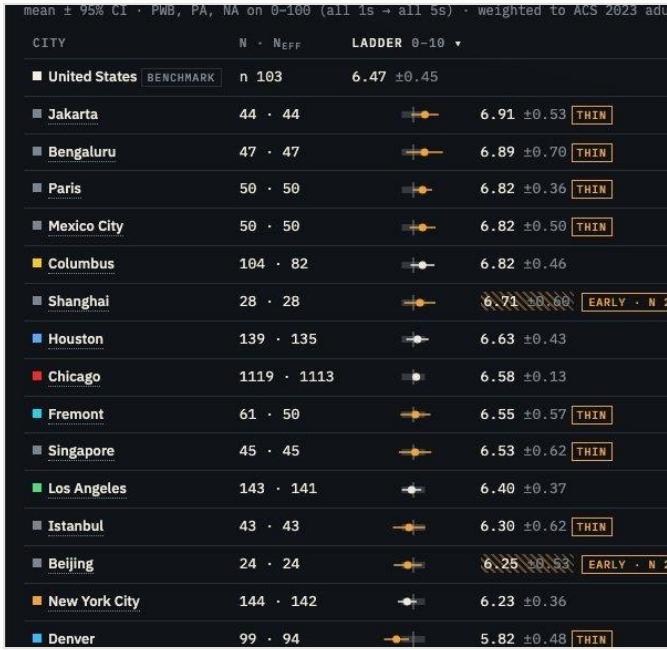
- Nielsen, measurement
2011-2021 · what counts as a view, a listen, an exposure
- Mic Check, a survey engine
2021 - present · the same questions, answered city by city, weighted by geography
- Ward Wise / Penlight
2024 - present · Chicago measured by ward, neighborhood and square mile

To compare cities, I first have to decide what a city is. That question is personal, and it is why this work exists.

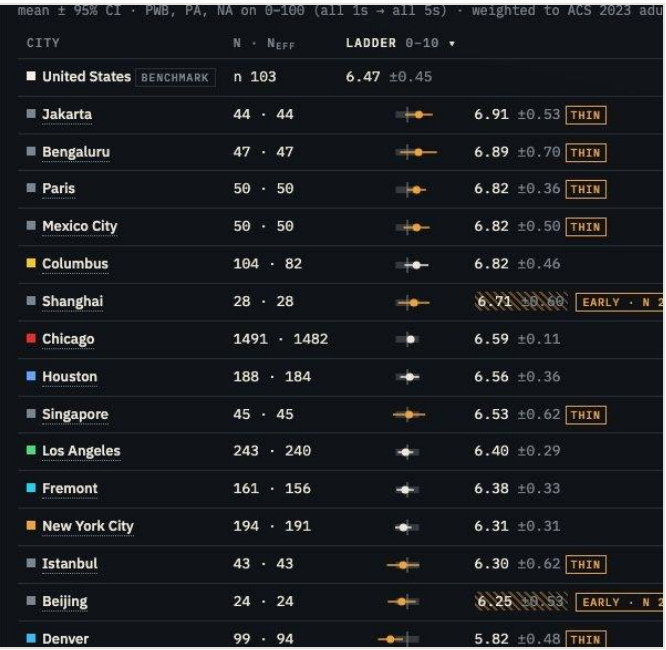


WHY I CARE

My own board has to choose a Chicago



city-defined · each city's own ZIP frame



UN-defined · plus a sample from the dense ring

LIFE EVALUATION, 0-10	CITY	UN
Houston n 139 → 188	#1 · 6.62 ± 0.43	#2 · 6.56 ± 0.36
Chicago n 1,119 → 1,491	#2 · 6.58 ± 0.13	#1 · 6.59 ± 0.11
Fremont n 61 → 161	#3 · 6.55 ± 0.57	#4 · 6.38 ± 0.33
Los Angeles n 143 → 243	#4 · 6.40 ± 0.37	#3 · 6.40 ± 0.29
New York City n 144 → 194	#5 · 6.23 ± 0.36	#5 · 6.31 ± 0.31

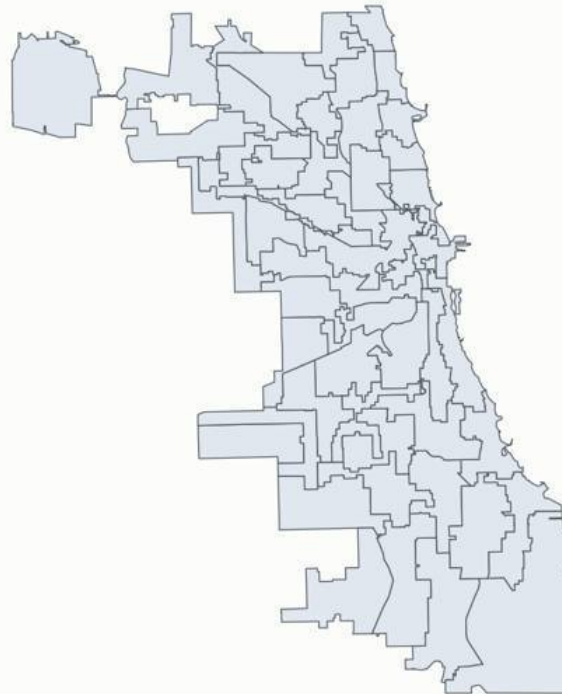
Flip one switch and the order changes. The intervals overlap, so neither order is a finding. The finding is that the ranking depends on the boundary, and a reader cannot tell which one they are seeing unless the number says so. This UN-defined view is live today on Mic Check's board; offering it in Ward Wise's Penlight is the next step.

Chicago: 77 frozen areas, 50 moving wards

Community areas (1920s, frozen)
77 areas



Wards (redrawn every decade)
50 wards



- **1920s:** the University of Chicago's Social Science Research Committee, led by Ernest Burgess, cut the city into **75 community areas** for publishing the 1930 census.
- The boundaries were **frozen on purpose**, so that each decade's numbers could be compared with the last.
- **1956:** O'Hare became area 76 after the airport was annexed.
- **1980:** Edgewater split from Uptown, area 77. No change since.
- The **50 wards** are redrawn after every census, so a ward number never means the same place twice.

Every official line has an author

- **City limits** are the sum of every annexation ordinance since 1837, each petitioned by landowners or approved by voters.
- **ZIP codes** are mail routes. They exist to move letters, and the Postal Service changes them when the routes change.
- **Metro areas** are lists of whole counties, joined when a quarter of a county's workers commute into the core.

"Nobody can recompute this line. Anyone can download it."

What Is Chicago?, on the city limits

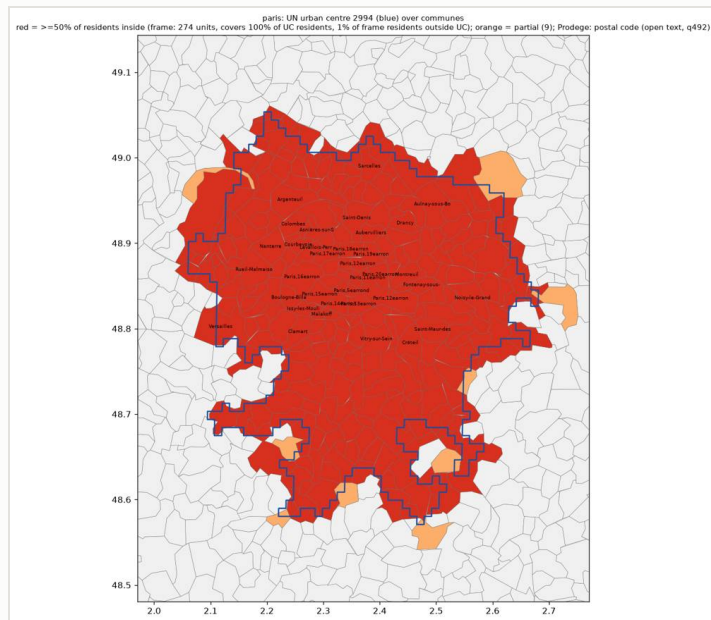
Five Chicagos, five authors, one decade

DEFINITION	AUTHOR	PEOPLE (2020)	KM ²	ZIPs
☐ City of Chicago	City Council, by ordinance	2,744,500	599	56
☒ UN urban centre (2025)	UN DESA, from the JRC grid	3,683,951	932	98
☒ Older GHSL rule (2023)	Joint Research Centre	5,533,687	2,231	174
☐ Census urban area	Census Bureau, from blocks	8,669,050	6,148	301
☒ Metro area (CBSA)	OMB, from commuting flows	9,447,373	18,186	362

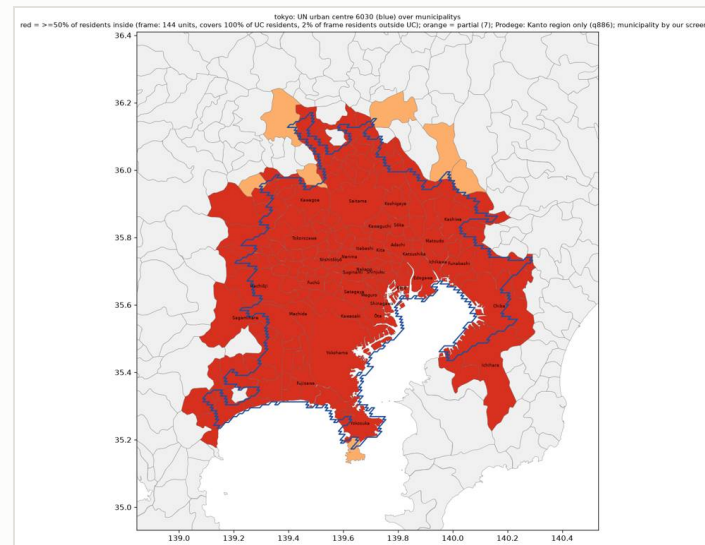
2020 residents inside each boundary, from the Census PL 94-171 block counts; a ZIP counts when at least half its residents live inside. Source: the explainer's data bundle (built 2026-09-08). Mic Check samples Chicago by ZIP: the city-defined board draws from the first row's 56 ZIPs, and a ring sample over 48 more extends it to the UN centre.

Comparability: the UN changed its ruler

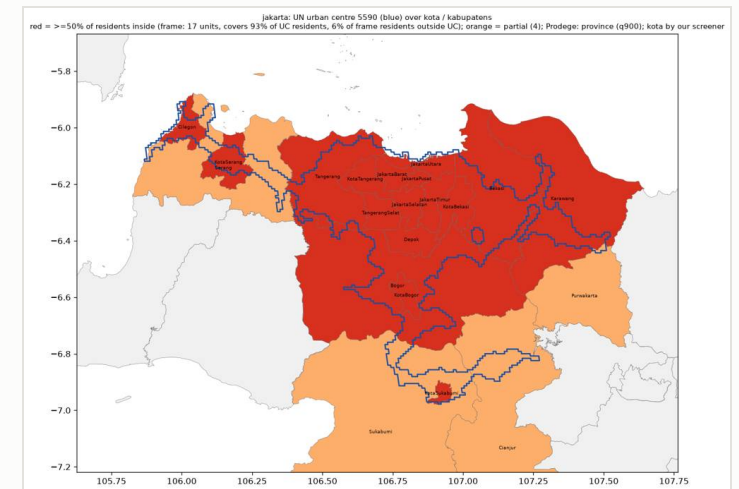
The 2018 edition carried the Census urbanized area forward to about **8.9 million**. The 2025 edition applies one rule to the whole planet: Chicago is **3,683,385**, ranked **125**. Same city, same decade; only the definition moved. The same rule drawn over local units elsewhere:



Paris • communes · 274 units cover 100% of the centre's 9.4M; 1% of their residents sit outside it



Tokyo • municipalities · 144 units cover 100% of the centre's 33.2M; 2% of their residents sit outside it



Jakarta • kota / kabupaten · 17 units cover 93% of the centre's 41.9M; 6% of their residents sit outside it

| Four first principles

1 **Start from a lattice, not from borders.**

Equal cells over the whole surface; city limits, counties and ZIPs play no part.

3 **Regenerable by anyone.**

Public data and a published recipe in, the same polygons out, cell for cell.

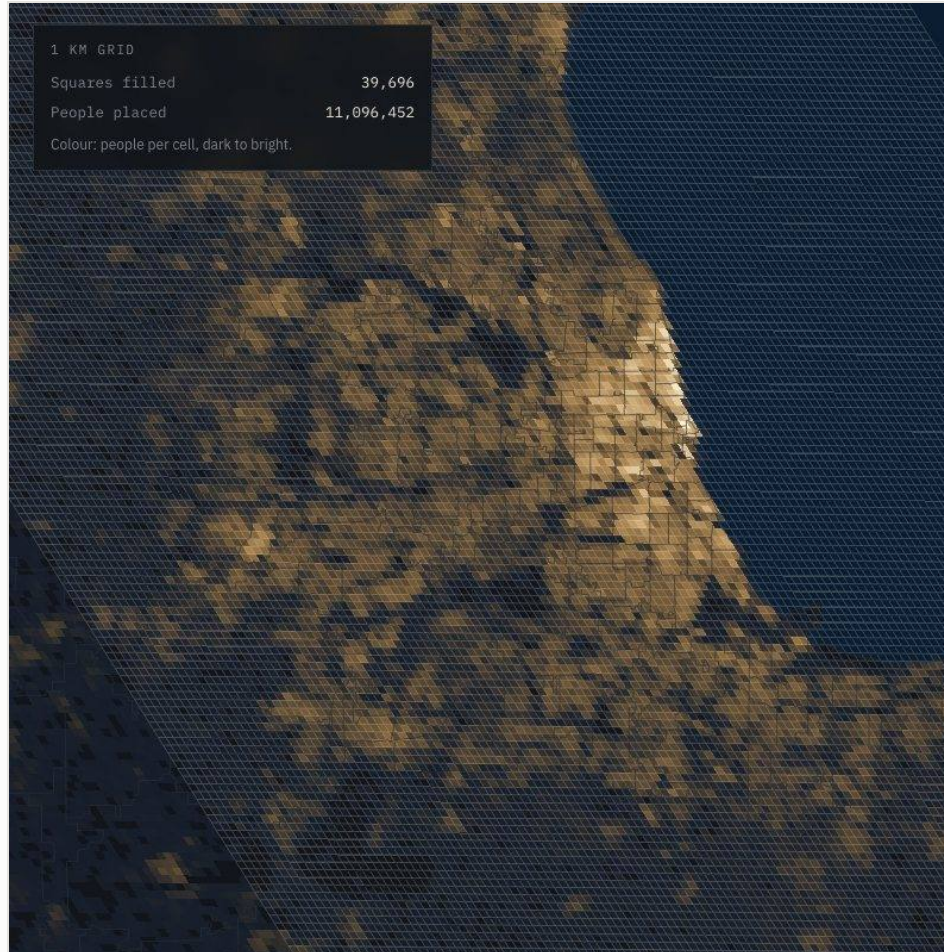
2 **One public rule.**

Thresholds anyone can read: a density, a size, a neighbourhood vote.

4 **Versioned.**

When the rule changes, the old polygons stay citable and the change is one clause you can name.

Step one: ignore every border.

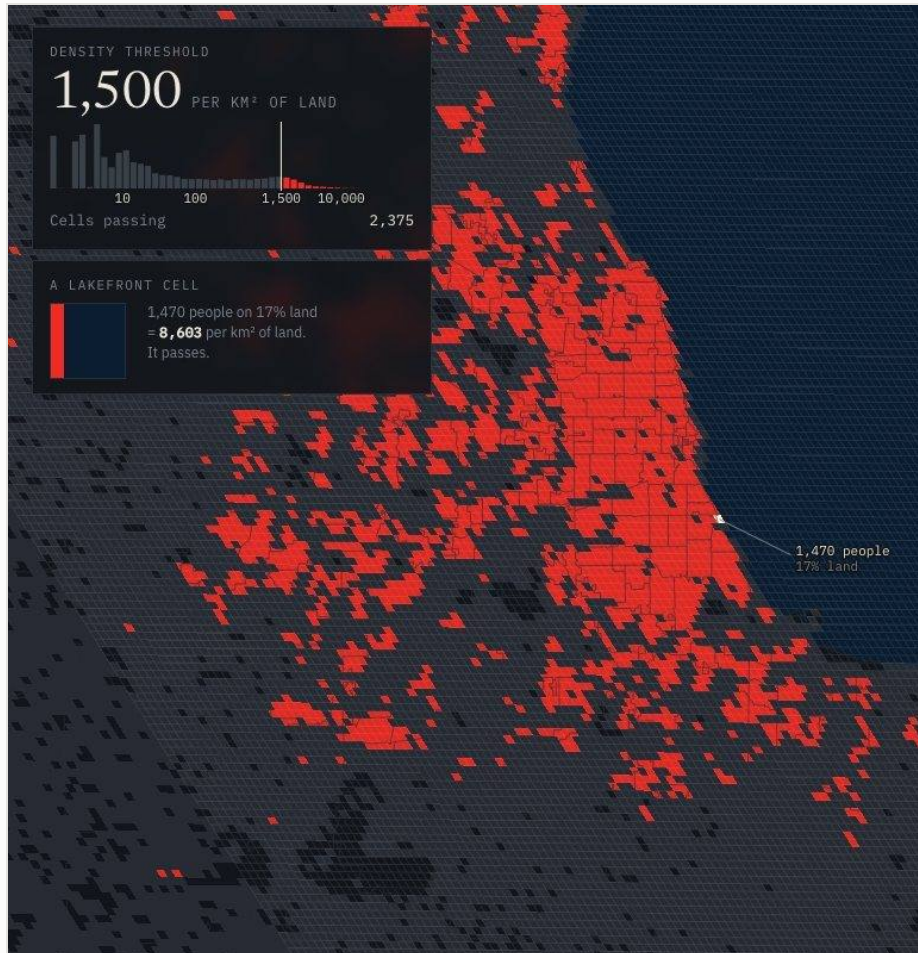


The rule starts from a grid of one-kilometre squares laid over the whole planet, with an estimate of how many people live in each square. City limits, county lines and zip codes play no part.

The grid is drawn in an equal-area world projection, which is why it sits at a slight tilt over Chicago. Hover a square to read its population.

Live: miccheck.media/what-is-chicago#beat=grid

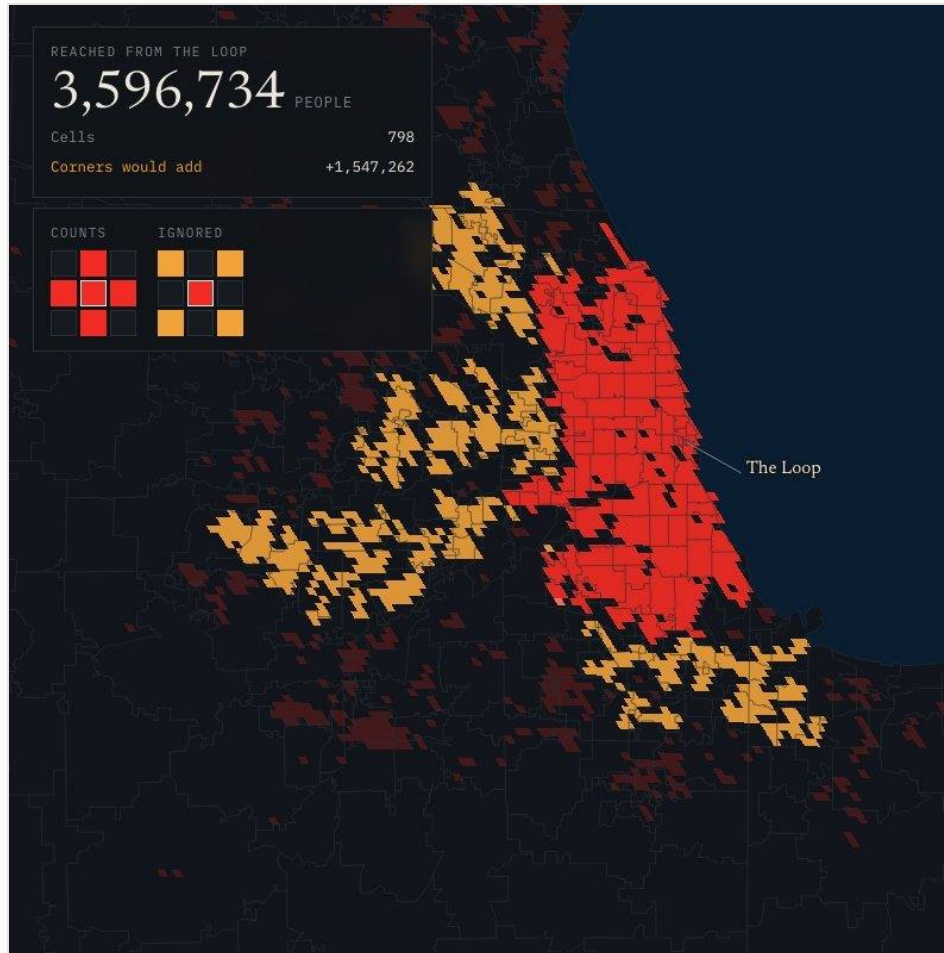
Step two: keep only the dense squares.



A square counts as dense if it holds at least 1,500 people per square kilometre of land. Water does not count toward the area, so a lakefront square with a sliver of shore can pass on a few hundred residents. Everything else goes dark.

Live: miccheck.media/what-is-chicago#beat=dense

Step three: dense squares must touch side to side.

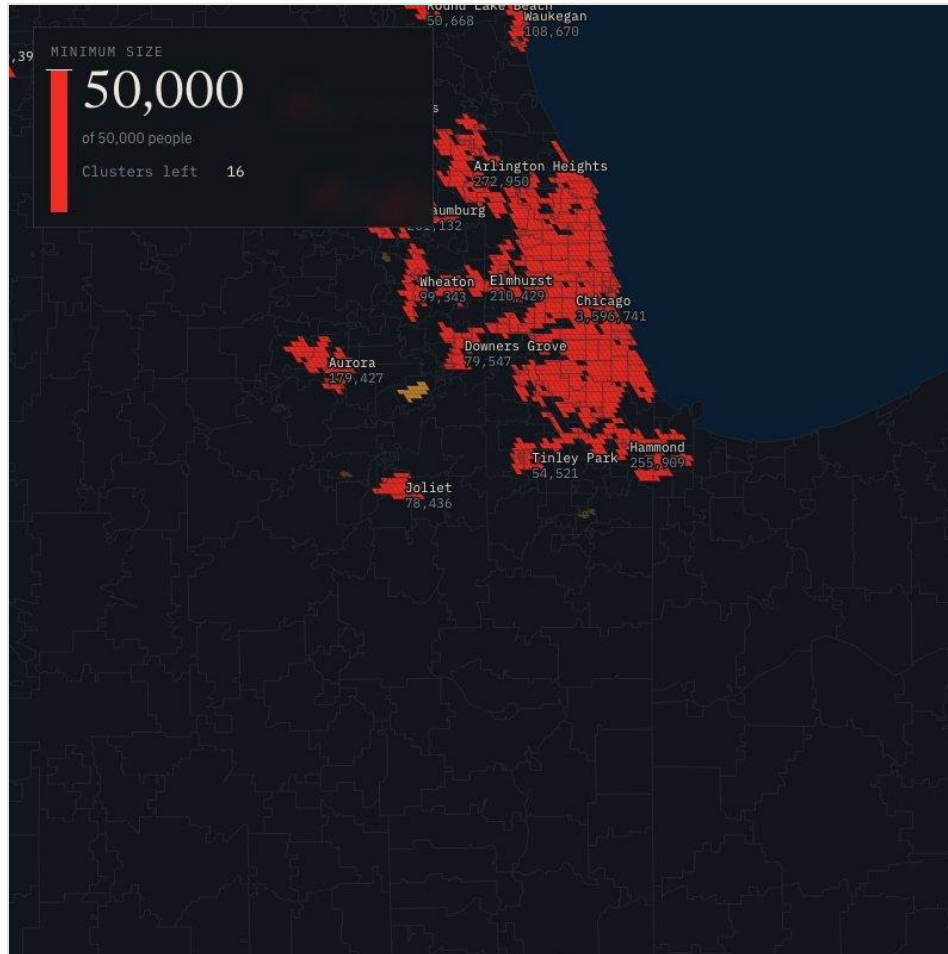


Dense squares that share an edge belong to the same cluster. Squares that only meet at a corner do not. Watch the connection spread from the Loop and stop wherever the chain breaks.

If corners counted, the Loop's cluster would pick up another 1.5 million people.

Live: miccheck.media/what-is-chicago#beat=connect

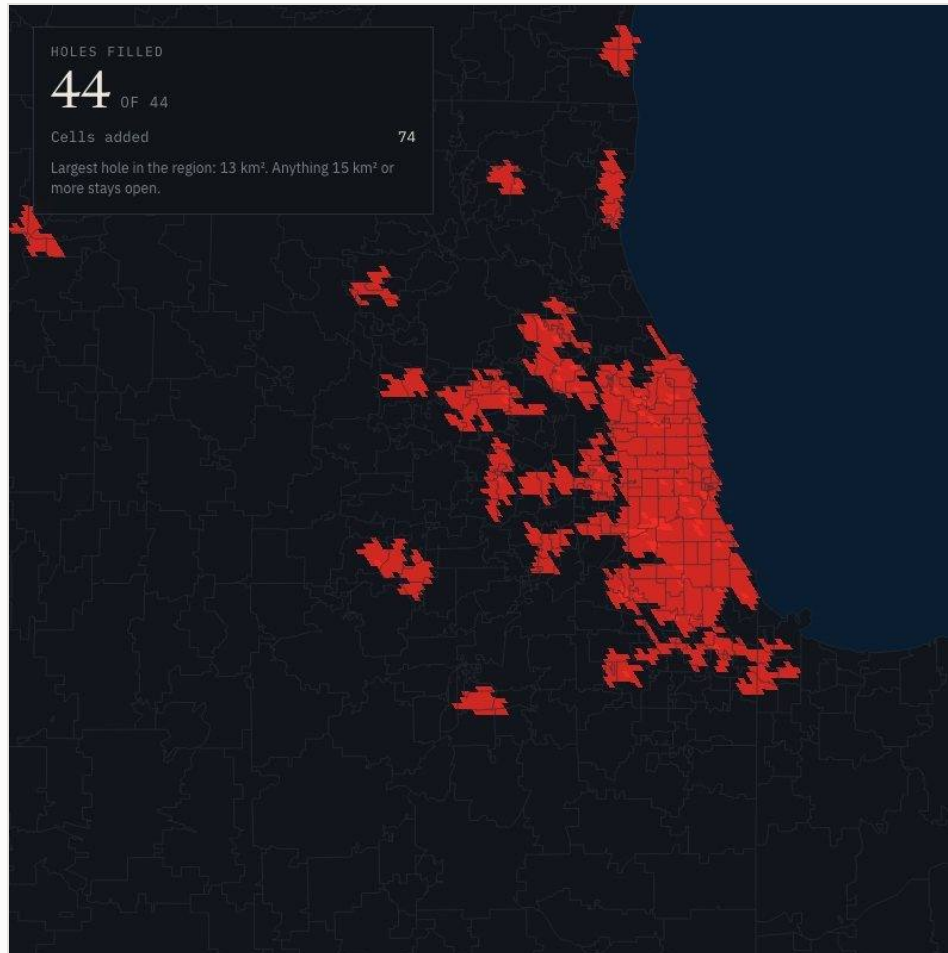
Step four: a cluster needs 50,000 people.



There are 301 dense clusters in the region. Most are a few squares around a town centre. The bar rises to 50,000 and everything under it drops out. 16 clusters survive. They are the seeds of the urban centres.

Live: miccheck.media/what-is-chicago#beat=size

Step five: fill the small holes.

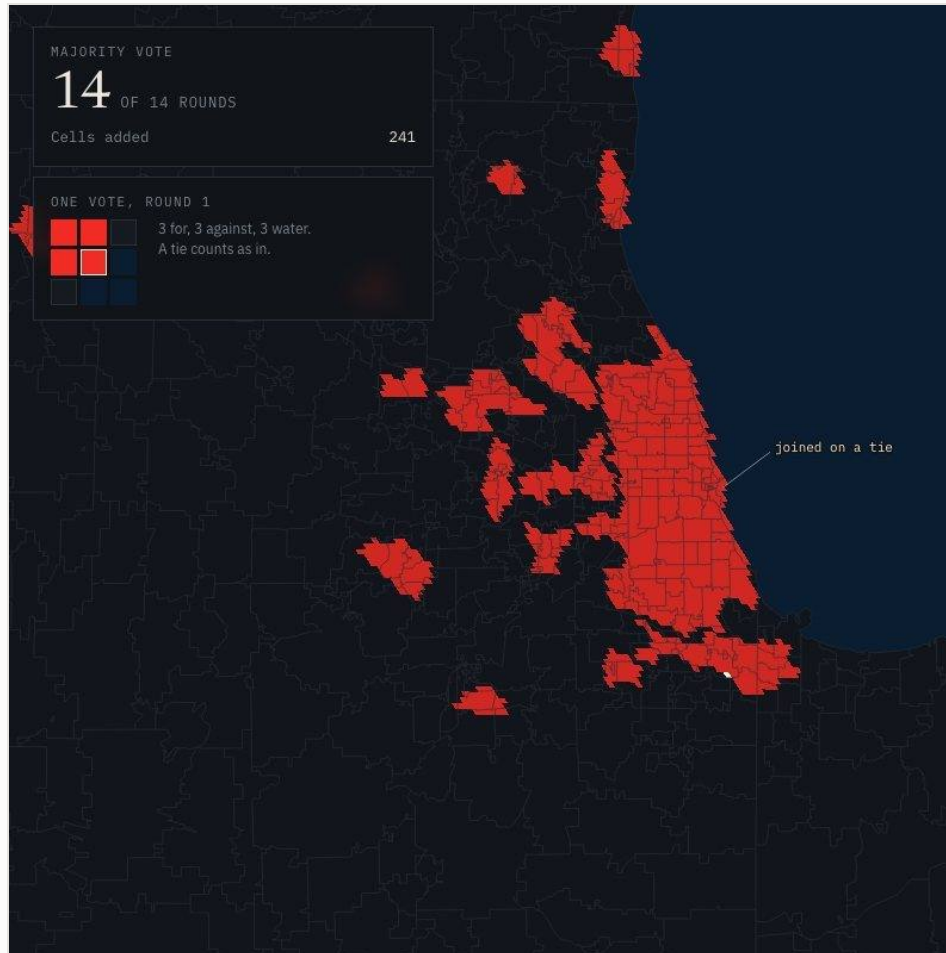


Parks, rail yards, cemeteries and factory land leave gaps inside a cluster. Any enclosed gap smaller than 15 square kilometres is filled in. Nothing larger is.

44 holes in the region, 74 squares in all.

Live: miccheck.media/what-is-chicago#beat=holes

Step six: smooth the edges by majority vote.



Each square just outside a centre looks at its 3-by-3 neighbourhood. Water squares abstain. If at least half of the voters are inside, the square joins. The vote repeats until nothing changes: 14 rounds for the Chicago region.

Live: miccheck.media/what-is-chicago#beat=smooth

The result: 932 km², 3,683,385 people



Every break in the chain of dense squares became a border. Replaying the rule on the public grid reproduces the UN's boundary exactly: 932 of 932 cells match. The neighbours, each its own city to the UN:

Hammond	301,148	Downers Grove	84,702
Arlington Heights	298,081	Elgin	80,255
Elmhurst	223,924	Joliet	79,086
Schaumburg	218,625	Tinley Park	58,362
Aurora	190,074	Lake in the Hills	58,273
Waukegan	112,414	Round Lake Beach	52,986
Wheaton	108,584		

13 neighbouring centres, 1,866,514 people between them. 2025 grid populations.

To the UN, Peoria is a town

144,315

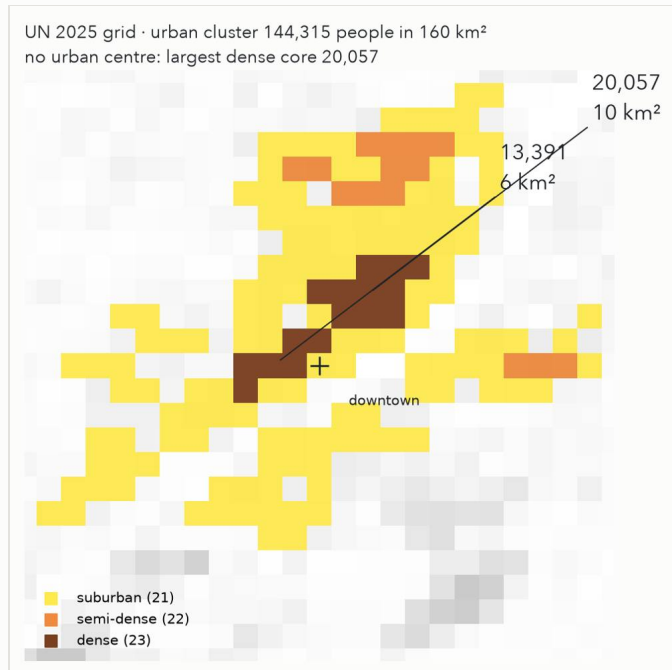
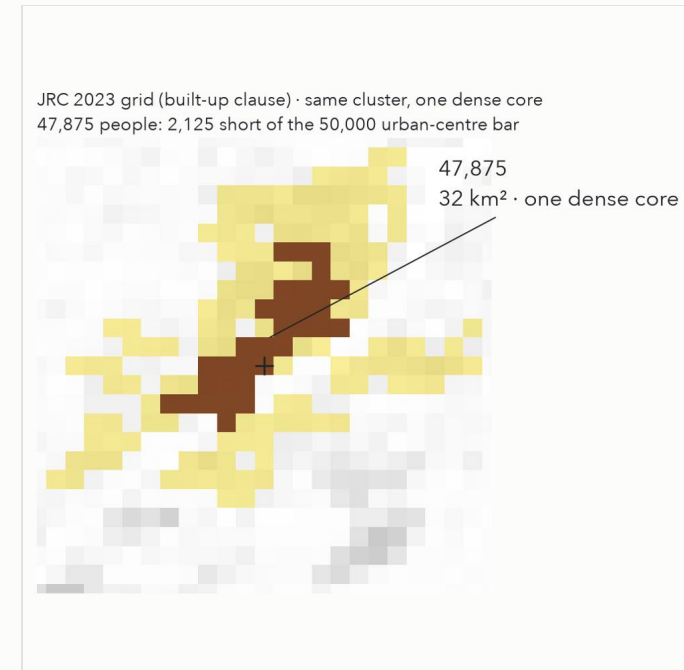
people in Peoria's urban cluster on the 2025 grid
(160 km²); 144,549 on the 2023 grid

47,875

in its one dense core under the 2023 rule: 2,125
short of the 50,000 an urban centre needs

20,057 + 13,391

the same core under the 2025 rule, split in two with
the built-up clause gone. No urban centre; the UN's
city table skips Peoria



Illinois under the rule: cities and towns

CITY	UN 2025 URBAN CENTRE	JRC 2023 URBAN CENTRE	CITY LIMITS 2020	METRO AREA 2020
Peoria	none largest dense core 20,057	none largest dense core 47,875	113,150 124 km ²	368,789 Peoria, IL
Springfield	none largest dense core 13,878	none largest dense core 44,311	114,394 158 km ²	208,636 Springfield, IL
Rockford	86,647	150,998	148,655 167 km ²	338,788 Rockford, IL
Champaign	79,407	87,759	88,302 59 km ²	236,075 Champaign-Urbana, IL
Bloomington	58,461	78,345	78,680 70 km ²	170,956 Bloomington, IL

Urban centres: contiguous 1 km cells of class 30 on each published grid, replayed from the rasters (tools/peoria_stills.py). City limits: Census 2020 PL 94-171 geoheader, summary level 160, Illinois. Metro: U.S. Census Bureau, Population Estimates Program, Vintage 2023 CBSA table, April 1 2020 estimates base, 2023 OMB delineations.

Peoria's peers: three honest lists that do not agree

By city-proper population

Peoria city, Illinois · 113,174

1	Broken Arrow, Oklahoma	113,553
2	Lansing, Michigan	112,661
3	Lakeland, Florida	112,629
4	High Point, North Carolina	114,161
5	Gresham, Oregon	114,249

By metro area

Peoria, IL · 368,789

1	Atlantic City-Hammonton, NJ	369,798
2	Ann Arbor, MI	372,258
3	Hickory-Lenoir-Morganton, NC	365,270
4	Naples-Marco Island, FL	375,760
5	Ocala, FL	375,904

By UN settlement, US

Peoria, Illinois · 144,315 · tier: town

1	Deltona, Florida	156,006
2	Tuscaloosa, Alabama	125,962
3	Harlingen, Texas	119,381
4	Winter Haven, Florida	146,841
5	Waco, Texas	166,057

Across all 97 Illinois settlements, the city-limits and metro lists share 12 names with the settlement list. Every settlement's lists: miccheck.media/parallel-peorias.

One clause, and fourteen centres become one



The grid is built by the European Commission's Joint Research Centre, and its own 2023 release used the same six steps with one extra clause: a square also counts as urban if at least half of its land is built up, even when few people live there. That clause admits airports, rail yards, factories, malls and freight terminals, and those squares sit exactly in the gaps between Chicago and its neighbours.

Chicago's peers under one rule, 2025 urban centres (UN MTUC table)

CENTRE	PEOPLE	KM ²
Chicago	3.68M	932
Barcelona	3.98M	454
Berlin	3.56M	686
Sydney	4.15M	1,317
Melbourne	3.64M	1,357
Athína (Athens)	3.10M	404
Busan	3.26M	361
Washington, D.C.	3.27M	1,186
San Francisco	3.16M	915
Houston	3.96M	1,583

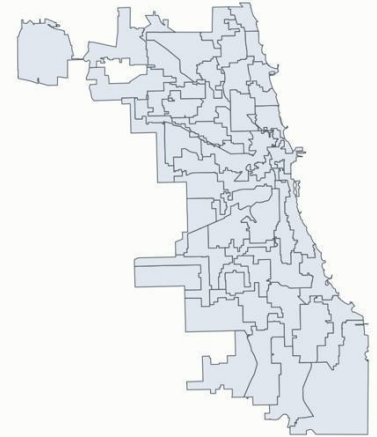
The gap: there is no rule below the city

- The UN rule stops at the urban centre. Inside it, everything is still somebody's record: 77 areas from the 1920s, 50 wards from the last map, ZIPs from the mail.
- None of them is uniform, none is regenerable, and only one is versioned, by accident, when it is redrawn.
- What would the four principles give you one mile down?

Community areas (1920s, frozen)
77 areas



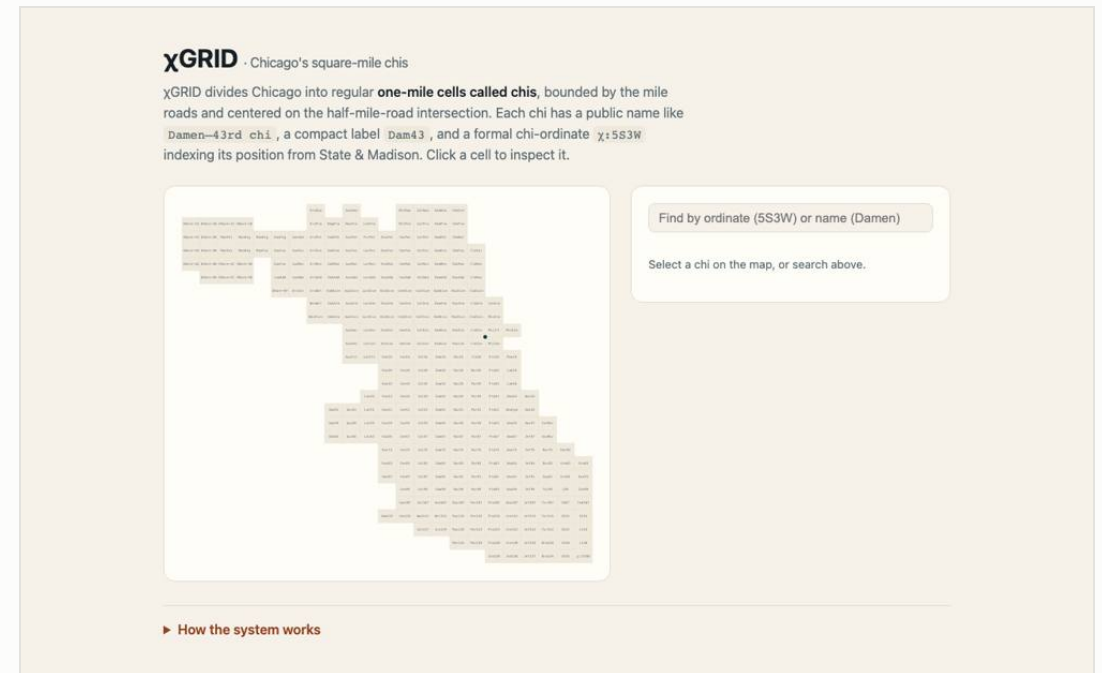
Wards (redrawn every decade)
50 wards



xGRID: a square-mile geography for Chicago

- Chicago Geographically Reductive Indexed
Districts: the city tiled into roughly one-mile cells, "chis", anchored to the address-grid origin at State & Madison.
- **Limits are mile roads.** Midpoints are the half-mile roads, on both axes.
- A layer *beneath* neighborhoods and community areas, not a replacement: where a neighborhood name is fuzzy, a chi is exact, uniform and addressable.
- On GitHub, MIT. Street-aligned cells follow street centerlines: Chicago publishes them; OpenStreetMap has them everywhere.

χ :5S3W = Damen–43rd chi = "Dam43"



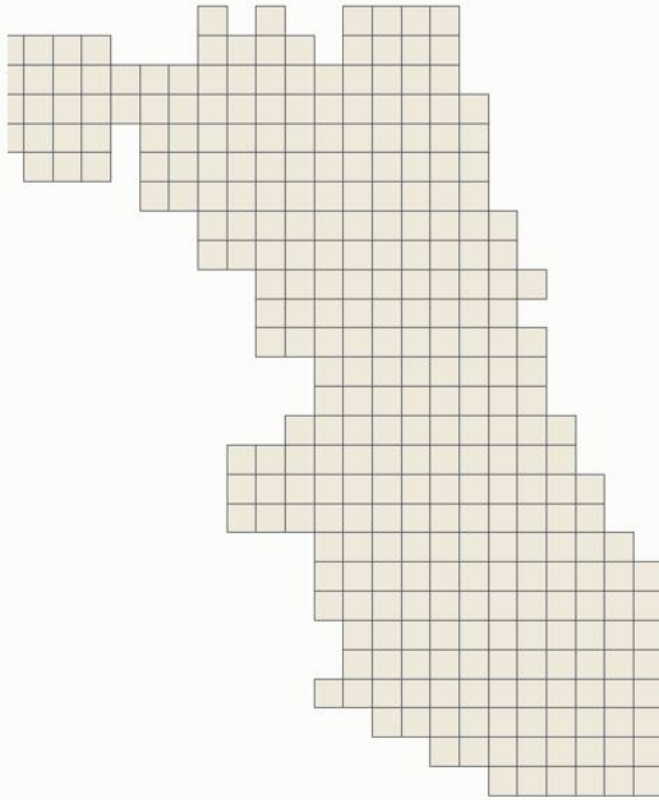
Naming: three forms, four rules

ORDINATE	χ:5S3W	5th mile-band south, 3rd west of State & Madison: formal, sortable
NAME	Damen-43rd chi	the avenue first, then the street: human-readable
LABEL	Dam43	compact, for maps and tables

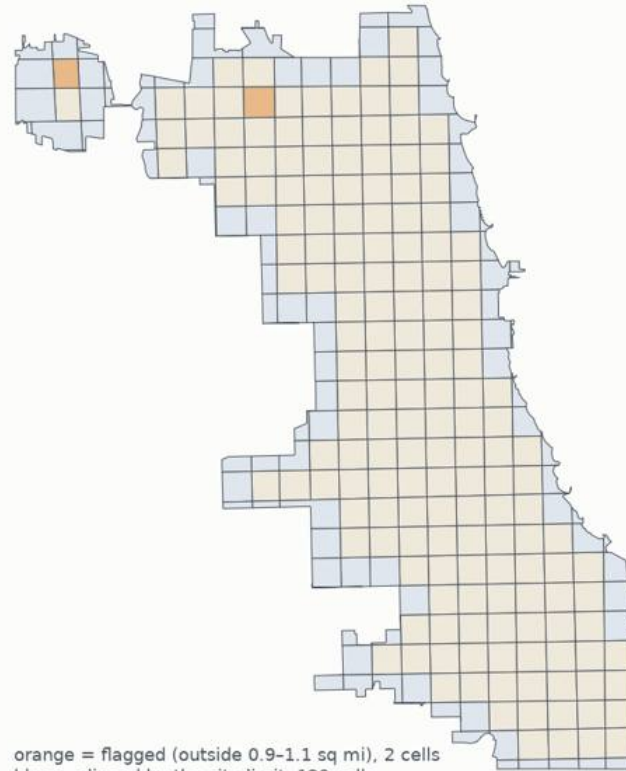
- **Number first, 1-indexed.** The four cells at the origin are 1S1W, 1S1E, 1N1W, 1N1E; no "0" band, so an index never reads as a false zero distance.
- **Avenue before street.** The north-south road names first.
- **Half-mile roads are centers, never limits.** Damen and 43rd name the cell; Ashland, Western, Pershing and 47th bound it.
- **v2 carries two names.** A local one from the real arterials (**Mus99** , Muskegon-99th, in the Calumet pocket) and a canonical one from the idealized grid (**Bur99** , Burnham-99th; **RivCon** for the origin cell where the river crosses Congress).

v1 vs v2: 302 ideal squares or 288 real sets of blocks

v1 · mile-squares on the address grid
302 cells



v2 · bounded by real mile-road centerlines
288 cells

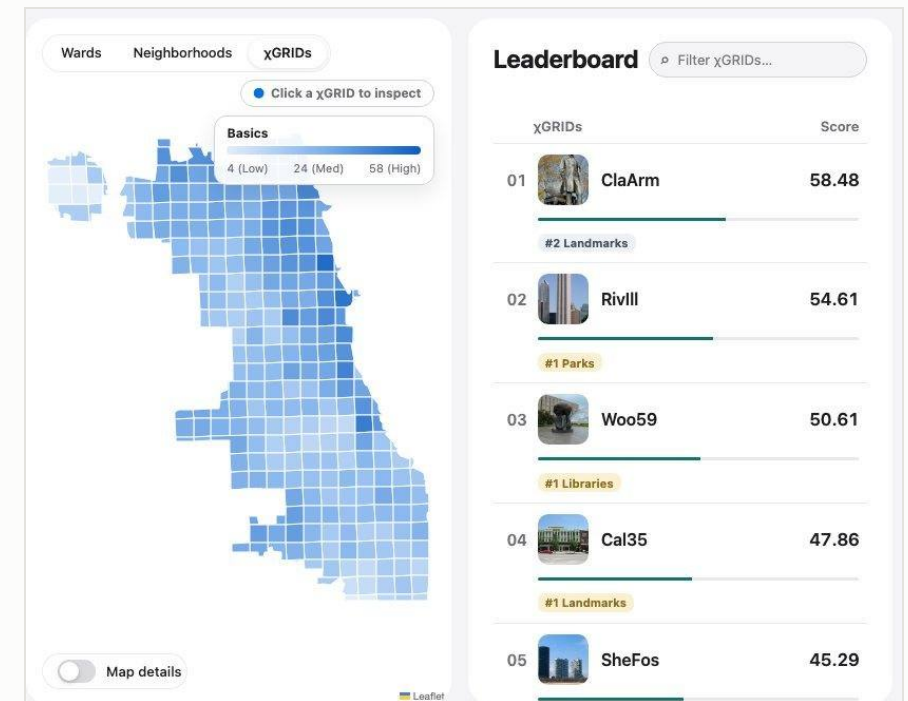


orange = flagged (outside 0.9-1.1 sq mi), 2 cells
blue = clipped by the city limit, 120 cells

- v1: perfect one-mile squares on the address grid. Every cell is exactly one square mile.
- v2: cells bounded by the real mile-road centerlines, clipped to the city limit.
- Built by rule: **substitute** the nearest aligned road where a mile road is missing; **impute** a straight line where no road exists; **flag** interior cells outside 0.9-1.1 sq mi; mark **edge** cells clipped by the limit.
- The same trade-off as 2025 vs 2023: a cleaner rule or a truer map, and the version tells you which you chose.

In use, and how to do it where you are

- **Penlight** rolls every measure to wards, neighborhoods and chis: 605,283 chi-level observations in the current civic-data snapshot.
- **byop/v1**, bring your own polygons: a measure repo publishes points, a raster or polygon values with an aggregation spec, and the pipeline rolls it up. Four measures so far (sunscore, parkability, rentrate, microhappiness).
- **Your city**: today's generators are Chicago's (v1 hard-codes State & Madison, v2 its mile roads). The recipe needs three inputs: an address-grid origin, a mile spacing, and your mile roads from OpenStreetMap or your own centerlines.
- **When a 1 km lattice beats a mile grid**: comparing across cities or countries, use the UN's global lattice. Talking to the people who live there, use the grid they already navigate by.



FIVE ANSWERS

Conclusions

- Every boundary has an author.
Who draws the lines?
- A number must say which geography it is about.
What do the lines cost us?
- A rule beats a record when you need to compare.
Is there a rule instead?
- To the UN, Peoria is a town, and a rule away from being a city.
What does the rule say about Illinois?
- A square mile is a neighborhood anyone can regenerate.
Can a rule work at neighborhood scale?

THANK YOU

Links, slides, and a question for you

miccheck.media/ilgisa

the slides, the six-step recipe for ArcGIS and QGIS, and a two-question form

miccheck.media/presentations/ilgisa-2026

this deck, in your browser

miccheck.media/what-is-chicago

the UN rule, replayed on Chicago

miccheck.media/parallel-peorias

every Illinois settlement and its twins

github.com/HarryBrisson/chiGRIDs

polygons, generators, MIT

penlight.wardwise.org

measures by ward, neighborhood and chi

Does your organization report by ZIP, tract or municipality?

The form asks only that, and whether a twenty-minute call would help.



miccheck.media/ilgisa