



Some Useful Measures of Length and Area for Urban Land

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Article citation:

[Gaffney, Mason]. "Some Useful Measures of Length and Area for Urban Land." N.d. Study guide.

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SOME USEFUL MEASURES OF LENGTH AND AREA FOR URBAN LAND

1. Measures of length

Chain and rod units are included here. You may think them archaic, but they are basic to U.S. land measurements. George Washington, Tom Jefferson, Mason and Dixon, Anthony Wayne, and other famous surveyors knew them well. Few things are as permanent as the way land is originally divided, because there is massive inertia against unpacking and repacking land parcels. That is a complex social process, involving many more than the direct actors. Therefore, these chain and rod units are still with us, even if you never heard of them. Chain and rod units are highlighted in this type.

$$3' = 1y$$

$$3.28' = 39.37'' = 1 \text{ meter}$$

✓ 4.5' = 1.5y = width of tennis court alley. (Note how sporting areas are measured on the English system, even in countries that have long been on metric. Tradition!!)

$$5' = \text{width of ping-pong table}$$

$$9' = \text{length of ping-pong table}$$

$$13.5' = \text{width of tennis service court}$$

✓ — 16.5' = 5.5y = **1 rod**

21' = base of square for footprint of one citrus tree, old standard

$$21' = \text{length of tennis service court}$$

$$27' = 9y = \text{width of tennis court, singles}$$

$$36' = 12y = \text{width of tennis court, doubles}$$

$$50' = \text{width of basketball court}$$

$$60.5' = \text{baseball pitch, mound to plate}$$

$$64' = (\text{appr.}) \text{ pitcher's throw to 1st base}$$

$$66' = 22y = \mathbf{4 \text{ rods} = 1 \text{ chain}} = \text{standard width of R.R. r.o.w.}$$

$$66.78' = \text{pitcher's throw to 2nd base}$$

$$78' = 26y = \text{length of tennis court, baseline to baseline}$$

$$85' = \text{width of hockey rink}$$

$$90' = \text{side of baseball diamond, base to base}$$

$$94' = \text{length of basketball court, college and pro}$$

✓ — 99' = 33y = **1.5 chains** = depth of small lot. Because it is close to 100', it is sometimes "fudged" as 100, to go from **chain system** to decimal (but not metric) system. See "standard block." Making lots 99' deep lets you get exactly one block from each 2 acres.

✓ 127.28' = baseball catcher's throw, home to 2nd base

— 160' = 1/33 mile = width of football field

$$195' = \text{width of Canadian football field}$$

✓ 200' = length of hockey rink

— 272.25' = 90.75y = length of football sideline for one acre

$$440' = 1/12 \text{ mi} = \text{"standard" city block, old style, long}$$

✓ side, incl. 40' street. This allows for eight 50' lots.

✓ 660' = 220y = **40 rods = 10 chains** = 1/8 mi = 1 furlong

$$900' = 300y = \text{typical golf hole, length}$$

✓ 1320' = (440y) = 80 rods = 20 chains = .25 mi = standard oval
running track

3281' = 1 kilometer = .621 miles

2640' = 880y = 160 rods = 40 chains = .5 mi

5280' = 1760y = 320 rods = 80 chains = 1 mi = 12 "standard"
blocks

2. Measures of area

1 acre is 10 square chains ($66^2 \times 10$ equals 43,560).
Alternatively, call that one furlong of r.r. r.o.w. ($66' \times 660'$),
or 1/8 mile of r.r. r.o.w. 1 acre is equal to each of the
following:

- 43,560 s.f.
- 4,840 s.y.
- 4,047 sq. meters
- 2,420 graves @18 s.f. ($6' \times 3'$, traditional)
- 968 ping-pong tables @45 s.f. ($9' \times 5'$)
- 435.6 placer mining claims, 49er standard ($10' \times 10'$).
- 160 sq. rods ("perches")** @272.25 s.f. or 30.25 s.y.
- 153.6 tennis service courts ($21' \times 13.5'$)
- 130 mature citrus trees, new standard, e.g. in Ventura County
- 100 mature citrus trees, old standard, as found in Riverside (because citrus started here, with cheap land & water)
- 87 parking spaces with access lanes @500 s.f.
- 33.5 tract houses @1300 s.f. (yard & garage excluded)
- 15.5 tennis doubles courts @2,808 s.f., ($78' \times 36'$)
- 10 sq. chains** @4356 s.f. ($66'^2$) or 484 s.y. (22^2)
- 8 50' lots, 99' deep, plus 40' street 99' long.
- Living space for about 28 people @3.5 per household. That comes to 17,920 per square mile. At that density, 240 million people can be housed in 13,393 s.m. That is the area of a circle with radius of 65.3 miles; or a square with base of 116 miles; or two circles with radii of 46.2 miles.
- 5.38 baseball infields @8,100 s.f. ($90' \times 90'$)
- 2.56 hockey rinks @17,000 s.f. ($200' \times 85'$). (Hockey rinks, compared to other sporting arenas, do not require total land space in proportion to their size, because the players use no space at all outside the sidelines and endlines. There is also a very minor space saving from the rounded corners.)
- .9075 football gridirons (without counting endzones) @48,000 s.f. ($300' \times 160'$)
- .6769 Canadian football fields ($@330' \times 195'$)
- .5 old standard city blocks ($@440' \times 198'$)
- .405 hectare (ha.). 1 ha. = 10,000 sq. meters.
- .125 mile ($1/8$ mile, 660') lineal r.r. R.O.W., one chain wide
- (Basketball courts and soccer fields are variable)

3. Forms making one acre

An acre is:

A square with side of 208.71'

Circle with radius of 117.75'

Rectangle 99' x 440' (probable basis of standard block)

Rectangle 132' x 330' (possible basis of deeper block)

10 square chains

4. Land uses requiring one acre

- 1.0 a. per 100 mature citrus trees, old Riverside standard
- 1.0 a. per 130 mature citrus trees, new standard

5. Acreage requirements

Mnemonic

It takes so many acres for each of the following:

- 1.1 a. per football field @48,000 s.f. (omitting end zones)
- 1.48 a. per Canadian football field @64,350 s.f.
- 2.0 a. per standard city block
- 2.47 a. per ha.
- 4.85 a. per mile of city street, 40' wide
- 8.0 a. per mile of r.r. R.O.W., 66' wide
- 9.3 a. per typical hole of golf (@300y x 150y)
- 12.2 a. per mile of 100' R.O.W.
- 40 a. per "one-mule" farm, historical
- 140 a., Anaheim Stadium
- 160 a. per standard "homestead" farm = 1 quarter-section
- 180 a. per typical 18-hole golf course (not counting land for clubhouse and grounds, parking, rounding off, etc.)
- 210 a. Disneyland
- 247.1 a. per sq. km.
- 300 a. Dodger Stadium
- 320 a. Sta. Anita
- 380 a. Hollywood Park
- 529 a. total site, Calif. Speedway, Ontario
- 640 a. per section = 1 sq. mi.

Whew, that's too much to remember! What, then, should you remember? Whatever turns you on! These are memory aides for you. Remember a few of them, as "anchors" for your memory.

6. Acres, square miles, and the survey system

36 sections in a square 6mi x 6mi make one "township." These are oriented to true meridians. The north-south columns are called ranges, and numbered east and west from principal meridians such as San Geronimo down here, and Mt. Diablo "up there" (S.F. Bay Area). The east-west rows are called township rows, and numbered north and south from the same two basing points. The system, advanced by Thomas Jefferson, all got started at the line between Pennsylvania and Ohio (Northwest Ordinance, 1787).

There are many basing points, throughout the U.S.A. west of Pennsylvania, each on a principle meridian. The main N-S drag of Indianapolis, "Meridian Avenue," is on a basing point meridian. "Base Line Road," in San Bernardino and Los Angeles Counties, runs due west from the principle basing point on San Geronimo. The street grid in western San Bernardino County is based on "section-line" roads, the roads traditionally built by counties on the lines bordering sections. Most midwestern cities are laid out that way.

East of Ohio, an older packing method is used, called "metes and bounds," ("run a line southwesterly from the Gibbs well and spring house to the old red oak tree, thence another line east-north-easterly to a cairn of native stones about three feet high, with a white pine stake bearing the mark of Ethelbert Washburn, Surveyor, 1853, ...") This method is picturesque and customized, but fraught with error and costly to survey. Old Spanish grants in the southwest are also surveyed by metes and bounds. My own parcel has over 30 separate straight lines. A neighbor landowner of mine wants to build, but must first go to law with another neighbor contesting the survey lines. Fun! This has held him up for four years now, and he's a lawyer himself.

In California, old Spanish grants are intermingled with other lands that passed through the public domain, and are surveyed on the rectangular (or "gridiron") Jeffersonian system. This gets confusing, but was provided for in the Treaty of Guadalupe-Hidalgo, 1848: treaties take priority over other civil laws, by the U.S. Constitution (Article VI, Section 2). A map attached hereto shows Spanish grants mingled with Townships and Ranges near Beverly Blvd. in L.A.

To see a typical gridiron pattern in California, view a road map of Tulare County, or other county with land on the floor of the east side of the San Joaquin Valley. In Tulare County, the valley floor area is divided in perfect squares one mile on each side. Each such square mile is called a "section." Tulare County followed the usual practise of building a county road (or "pike") along the section lines. This gave road access to every small farmer.

In a city like Visalia, the main streets are the old county pikes. This pattern is found throughout the midwest.

The west side of the valley is different. It had no water until 1967 or so, when the California Aqueduct was extended that far south. By that time the land was in gigantic holdings, many of them oil corporations. It has never been divided even into small farms, let along city lots.

The measuring units often override other factors to determine the parcel size and shape. For example, a square with base of 20 chains makes 400 square chains, or 40 acres. The Riverside Greenbelt is divided into such 40-acre squares by streets that are just 20 chains (1320') apart, four per mile. The minimum lot size allowed by its zoning is 5 acres, a number chosen because it is an integral divisor of 40.

7. Benchmark areas to remember

It is useful to memorize a few benchmark areas, as bases for comparison. Here are a few that I find useful to remember.

<u>Name</u>	<u>Sq. Miles</u>	<u>Acres</u>	<u>% of lower 48</u>
MD	10,577	6.77m	.35
DE	2,057	1.32m	.07
IL	56,400	36.1m	1.88
CA	158,693	101.6m	5.30
Lower 48	3,000,000.+/-	1,932.0m	100.00
KS	82,264	52.6m	2.73

All those numbers are a bit round. A lot depends on how they treat water surfaces, especially in smaller states with bays and estuaries. Round them off, and Calif. is 100m acres, easy to remember; KS is half of CA; IL is 1/3 of CA; DE is 1.3% of CA; etc.

8. Some foreign land measures

arpent, France Varies from 1 - 1.5 English acres; translates as "acre."

caballeria, Cuba. A very large unit, used for vast sugar plantations. 33.162 acres. Source: The New Leaf 2(2): summer 92, Stan Sapiro, citing WSJ 6/24/59; Insights, Jan/Feb 1998 p3, citing same WSJ piece, but with dec. point moved 3 places to left. Value of a cab is est at \$4,000, or \$121/acre - that seems very low!

manzana, Guatemala.

cuerda cuadrado, Guatemala

1 cuerda = 25 barras

1 barra = 33"

It would follow, 1 cuerda = 825" = 68.75'

Also, a cc = 4726.6 s.f. = .109 acre

1 yarda = 1 barra + unas pulgas - Santo first said +8, but maybe it is really +3, to make an English yard. Dictionary says yarda means yard.

Santo's home is on about 15 cuerdas cuadrados (cc). That's about 1.6 acres. Not clear if that is the curtilage or the whole farm; I suspect it is the whole farm.

(Cuerda's basic meaning is a cord; barra's basic meaning is a rod or bar.)

Santo says 1 cc vale k quetzals. 1 quetzal = \$.20, so 1 cc vale \$200. At 9 cc/acre, that comes to \$1800/acre. Much more in cities: that is a remote farm area (but it does rain a lot, no need to buy water).

A few rich people bought up most of the tierras long ago, baratas, now might sell at current high price, says Santo.

morgen, S. Africa and Dutch, 2.116 acres

Morgen, Gy., translates as "acre." Acker means field, etc.

mu, China, 1/15 ha. (source: Aziz Khan)

verst, Russ., .6629 mi

desiatina, Russ

9. Expansion of a circle

Let $\pi = \text{pi}$

$$A = \pi r^2$$

$$A' = 2\pi r$$

$$A'/A = 2/r$$

$$r' = 1$$

$A'/A = 2r'/r$ The elasticity of production of A by r is 2.
Here is the meaning of "The area increases with the square of r."