

Deciphering Concord's Old Stone Walls and What They Indicate: *A Field Guide*

RICHARD T. T. FORMAN



Concord Land Conservation Trust
Special Publication
Concord, Massachusetts
2022



“So why would stone walls be constructed through woodlands?... they weren’t... ..called stone fences. Their purpose was to keep farm animals in, or out, of the open landscapes they enclosed.”

Tom Wessels, *Reading the Forested Landscape*, 1997

THE EVOLVING checkerboard. Stonewalls, like most everything else, appear, change, then disappear. Centuries ago, a conspicuous rectilinear network spread across Concord. Its enclosed spaces kept, and still keep, changing in both appearance and type. Woods are cut. Field crops alternate. Pastures expand, shrink, and disappear. Houses pop up. Economic goals, and related land uses, fluctuate. Some stone walls (stonewalls or simply walls) are cannibalized to use the stones elsewhere. The giant checkerboard appears both complex and unsteady.

Concord’s new residents at first squeezed together near the mill dam. Then, beginning in the 1654 “Second Division”, roads radiated outward to most parts of town. Farmers and farms did as well. Farm animals seemed essential for survival, and cows, oxen, horses need fencing. A bull requires high walls (Figure 1), as do sheep (never abundant in town). The farm animals need protection and food in cold months, whereas in warm months, crops and gardens need protection against the animals.

The first generation of these dispersed farmers cleared forest, and, knowing the English agrarian landscape of managed woven hedges, presumably mainly used stumps, branches, and brush as fencing for their animals. But wood rots. So, by about the second generation, farmers rolled and hauled the abundant glacier-rounded stones to build stonewalls (e.g., N. C. Wyeth 1930s painting in the book *Men of Concord*). This both improved fields and fenced enclosures. These walls were enormously valuable. The early checkerboard network proliferated across town from about 1675 to 1775, roughly coinciding with our Province of Massachusetts Bay Colony. Dispersed Concord farmers accomplished this stupendous feat.

Two people may build 10 feet of stonewall in a day. In 1871, NY/NE had 150,000 miles of stonewall (6 times around the equator). To estimate the total length of Concord’s stonewall network, I measured the walls recorded on late 1900s maps covering 8% of Concord’s 26 square miles. Too many uncertainties made the 440-mile result unreliable. A crude estimate of 150–200 miles of old stonewall in town seems better. Today many, perhaps most, of the original walls no longer exist (though a steel poker or

geophysical device might discover their buried basal stones). Other old walls highlighted below survive as valuable tangible human history.

The original colonial stonewalls

Two types, pasture (or single) stonewalls and cultivation (or double) stonewalls, characterize this most important group.

Pasture walls keep livestock in or out of valuable spaces. Normally these walls are composed of large glacially rounded stones, about two feet or a bit more in average diameter, visible along the bottom (Figure 2). Such stones are readily moved by one or two people. Medium-size stones usually predominate in the middle wall level and small rounded stones a foot or less in diameter sometimes still remain on top. A basal layer of large flattish and oblong stones often lies buried by the wall’s weight. Old stonewalls are normally built with few if any small exterior stone wedges or chinks (Figure 2), which readily fall out in the endless freeze-thaw cycles.

In cross section, the pasture stonewall forms a tall triangle, with the stones carefully fit together. Lichens commonly thrive on stonewalls, particularly on the upper stone layers remaining. No jumble of stones. The structure may last for centuries, barring a rare event such as the strong 1755 Cape Anne earthquake, which flattened nearby walls, or humans removing stones or later machines obliterating stonewalls.

In contrast, the original cultivation stonewall contains two rows of large and medium rounded stones, separated by a “V” trough filled with small rounded stones (Figure 3). This wall adjoins a crop field, or even a vegetable garden. A unique sequence explains the unusual wall form. The farmer plows the field and produces a crop. Fall and spring frosts penetrate the bare soil. Repeated daily freeze and thaw cycles in the top foot or so of soil gradually raise small stones upward (ice expands pushing soil and stones upward; then melting washes soil particles downward faster than stones). In spring, the farmer removes the new small stones on the surface and dumps them in the stonewall trough. After perhaps a decade of this farming and natural cycle, the top layer of soil is free of small stones. Thus cultivated fields produce two useful crops—stones and plants.

Figure 1
Stonewall for bull (or
sheep). Flattish basal
stones; vertically, large,
medium, and small
stones, partially stacked;
6+ feet high. East St.,
Carlisle.



Figure 2
Pasture ("Single")
stonewall. Large and
medium-size rounded
stones, indicating the
original farmer's land
clearing. CLCT (Concord
Land Conservation Trust),
Newbury Field.



Figure 3
Cultivation ("Double")
stonewall by flat area.
Foreground wall partially
cannibalized (stone
removal), background wall
intact. Harvard's Estabrook
Woods, Concord.



Figure 4
Livestock corral with
wood framework. Recent
reconstruction; many
granite stones. USNPS
(U.S. National Park
Service) next to 1700s
Hartwell Tavern, Lincoln.



Figure 5
Retaining wall for bridge,
downriver side. Many
slabs (flat stones) from
an outcrop quarry; river
foreground; flooded
floodplain background.
CLCT French's Meadow.



Figure 6
Cement-covered roof
and mortared stonewall.
Early 1900s boathouse;
lime-adapted spleenwort
fern and mosses. CLCT
October Farm Riverfront.



Different wall structures for different roles

After about 1775, farm wall building, as well as abundant glacially rounded stones, likely sputtered to a trickle. Good farmable land was all taken up. Farmers had too many sons for the available land, so some left town. But also, most large and medium-size glacial stones were already in walls and other structures, and hence scarce on the land. Concord was changing. By the early 1800s, the town's economy boasted numerous small manufacturing and commercial activities. The place became a magnet for small business.

Pasture stonewalls for livestock still predominated. Some were along property boundaries, but boundary lines often changed and were more easily marked in other ways. Cultivation walls remained near areas of good soil. Both wall types had basal stones, plus large, medium, and small stones above. Otherwise, their structures and functions differed markedly.

Cows seldom climb or jump. But tall hefty walls (Figure 1) are needed for a bull (see impressive Hunt-Hosmer farm wall in mid-1800s painting in the Concord Museum). High walls restrain sheep that climb. Also horses that jump. Horizontal poles or trunks atop the stones may have been common for bulls, sheep and horses, in addition to a good many town roadside walls. See the replica of an old corral periodically used by cattle on drives (Figure 4). Only once have I found horizontal poles topping an old stonewall in town. But they were recent. Barbed wire, sometimes remaining on today's old stonewalls, didn't become widely available until perhaps the 1880s. Of 27 photos I examined of Concord stonewalls in ca.1880 to 1920, only one 1920 photo showed wire fencing.

Retaining walls of stones that hold back soil play many roles. Bridge support (Figure 5). Big barn foundations. Small farmhouse foundations and cellar holes. A dam. The uphill cut-slope by a road. The road's downhill fill-slope. Groundwater and subsurface water readily flow through a stones-only retaining wall, so the wall doesn't fall, and soil doesn't slump.

A wall with two distinct types of stones, such as rounded and flat, rounded and sharp-edged, or different colors, probably indicates different sources of stones. Two-stone-type walls usually appear decorative, and primarily emerged in the 1800s-1900s.

Masonry walls (Figure 6), with stones held together by mortar or cement, were probably sparse here until the 1800s. Marble was locally mined for lime in the Estabrook Woods and farther south on land now in Lincoln.

Nevertheless, lime for plaster, fertilizer, cement, and mortar remained scarce.

Machine-made walls (Figure 7) using tractors and other motorized equipment likely spread in the early 1900s. With no clear structure, these walls include soil and huge stones.

Stone types, sizes, and shapes

In a ferocious time before dinosaurs, hot molten material from the Earth's interior flowed upward and cooled just below or on the land surface. Cooling of this hot stuff produced igneous rocks. Slow cooling beneath the surface often produced granite, with large easily seen minerals. Rapid cooling at the surface commonly produced basalt, a dark homogeneous appearing rock.

Also in early times, tectonic forces, colliding continents, and squeezed heated rock formed mountain ranges. The pressure and heat made minerals in existing rocks line up in layers, characteristic of many metamorphic rocks. Gneiss (pronounced nice) and schist (often with conspicuous mica layers) are two characteristic types, while a form of marble here results from the metamorphosis of limestone.

Much, much, much more recently, glaciers flowing and grinding their way southward broke the surface igneous and metamorphic rocks into stones. Ice moving over bedrock then rounded the huge stones, i.e., erratics. However, stonewall stones were mainly rounded by rubbing against each other in rushing streams and rivers within the glacier. Rounded glacial stones, from erratics to pebbles, were left by the melting ice widely scattered across the land. Sand and stones covered the place.

So, looking closely at stonewalls here commonly reveals a mix of igneous granite and basalt stones, plus metamorphic gneiss stones, usually all rounded in a glacier (Figure 8).

In scattered local spots, especially resistant bedrock, smoothed by the glacier, appears as rock outcrops projecting up through the covering of sandy (till) deposits. The southeastern end of a few large outcrops (roches montonees) here reveals an exposed cliff with numerous broken stones (Figure 9) from the bedrock. Mount Misery, in Concord for a century but now in neighboring Lincoln, is an impressive example.

For convenience, I'll call wall stones large (>2 ft. average diameter), medium (1 to 2 ft), and small (<1 ft diameter). These rounded wall stones were primarily transported from Quebec, New Hampshire, or simply northern Massachusetts by the last glacier, and left here when the ice melted. In general, large stones came the shortest distance.

Figure 7
Machine-made wall.
Imported huge and large
stones, rounded and
quarried; with piled-up soil;
on river floodplain with few
stones. Town of Concord's
Barrett's Mill Farm.



Figure 8
Diverse stone types
illustrated at T-intersection.
Gneiss, granite, one
brown quartzite, and
dark metasediment or
metabasalt stones. USNPS
Battle Rd., Lexington.



Figure 9
Wall of sharp-edged
flat-sided stones. Crudely
stacked wall structure;
from adjoining bedrock
outcrop. Fallen trees tend
to flatten a stonewall.
Mount Misery, Lincoln.



“This wall runs along just on the edge of the hill and following all its windings, to separate the more level and cultivatable summit from the slope, which is only fit for pasture or wood-lot, and that other wall below divides the pasture or wood-lot from the richer low grass ground or potato-field, etc. Even these crooked fields are not always ... lawless.”

Henry D. Thoreau, *The Journal of Henry D. Thoreau* (1862), July 12, 1852

The shapes of stones in Concord of course also vary. Glacially rounded stones seldom have a length-to-width ratio > 3. Large elongated stones are often set transversely, along with flattish stones, at the base of stonewalls (Figure 1).

Sharp-edged flat-sided stones appear in abundance in a few walls. These stonewalls are usually near a southeast rocky cliff (Figure 9), or where people have been breaking rock or stone. Rock-splitting before the late 1700s used ice, fire, or gunpowder. Afterward, hammered “pins” left rows of 2–5” holes in stones. From the 1870s, pneumatic drills made long holes. A quarry, such as Concord’s lime-quarry pits and copper-mine cliff, produces broken stones from bedrock. Erratics were sometimes sliced or broken, as at Mattison Field and other local spots. A road cut through bedrock, such as by Lowell Road close to the town center, or a dynamited Fairhaven Cliff site, produces lots of sharp-edged flat-sided stones.

Arrangement of walls

There’s nothing random about a stonewall, except perhaps the mixture of glacial stones. Walls are essentially arranged to fit soil and water (see Henry D. Thoreau quote). Cows: keep out of wetlands, so you don’t get mired or lost. Also out of brooks, rivers, and large ponds. Keep off good crop soils. Stay out of vegetable gardens. Avoid steep slopes and cliffs. Stonewalls protect valuable resources, including cows.

What can we interpret in the stonewall network? “T” intersections (Figure 8) usually mean the long wall is older, and the perpendicular wall younger. That’s the same for hedgerows in open country. But look closely to see whether the stones of the two walls are dovetailed together, suggesting the same age. A rectangular or square “pound”, for temporarily holding farm animals caught after disappearing (Figure 10), may or may not be connected to the large network.

Fields typically increase in average size with greater distance from a farmhouse. A cluster of small stonewall enclosures suggests a farmhouse nearby, as in the eastern Estabrook Woods. Also, fields are larger farther from a town.

Parallel stonewalls appear dispersed yet

surprisingly common. Some function as a corridor for livestock movement to water (Figure 11). Others adjoin old wagon roads through woods and fields. Still others parallel the town’s main roads, such as the USNPS Battle Road. Two Rod Road, an old wagon road to the north, is 33 ft wide, i.e., two rods. Livestock corridors in Annursnac Woods and Upper Spencer Brook Valley are basically that same width. Henry Thoreau, the Concord surveyor, used a folding surveyors chain four rods long.

Retaining walls (Figure 5) are built where different surface levels immediately adjoin. Corral stonewalls are close to barns. A short cultivation stonewall suggests vegetable garden near a house (e.g., by an 1800s house foundation, Route 2A east of Merriam’s Corner). A small isolated pile of small rounded stones (Figure 12) also probably often indicates a vegetable garden close to home (e.g., near Borz Bog Meadow).

Stones, even small ones, are scarce in some areas. Barrett’s Mill Farm lies on a floodplain with river-deposited fine sand and silt. Glacial sands underlie the Walden Pond area, much of the Town Forest, the White Pond area, and even the large Wright Woods (stones of its scarce walls come from a broken-rock cliff). Ministerial Swamp is largely peaty swampland. Such areas have few if any stonewalls, which seem mainly built with stones brought in.

Cannibalized walls

Most rural New England stonewalls were apparently built after the Revolution, from about 1775 to 1850. But Concord was an early town. Its walls of rounded stone spread across the land a century earlier. Why does that matter for a field guide to today’s stonewalls?

For society, stones are resources. The mile-high last glacier spread large, medium, and small rounded stones across our future town. At first, farmers collected them and made walls for livestock. Yet roads kept proliferating. Houses with cellars and outbuildings appeared almost everywhere. Commercial, local industry, and public buildings spread. All required stones. Great. Farmers were piling the glacial stones in neat

Figure 10
Pound for stray farm
animals. Granite, gneiss,
and other stone types.
Near river and extensive
wet floodplain hazardous
to livestock. Town of
Concord's October Farm
Riverfront.



Figure 11
Parallel stonewalls forming
cow corridor or lane.
Connects seasonal cow
pond with farmstead and
pasture; granite and gneiss
stones. CLCT Upper
Spencer Brook Valley.



Figure 12
Pile of small rounded
stones from clearing a
small plot. Probably below
a vegetable garden by a
relatively recent (late1800s/
early 1900s) farmhouse.
CLCT Miller Farm.



rows across town. Stonewall cannibalization, the removal of stones for other uses, ensued in earnest (Figure 13).

Cannibalization of Concord's original wall network over such a long period leaves us with but a skeleton of its extensive grandeur. Old cultivation stonewalls, such as remain in Estabrook Woods (Figure 3) and Baptist Brook Woods, are hard to find. Strips of mainly small rounded stones remain after cannibalization of most medium and large stones from cultivation walls (Figure 13).

In most built areas, old pasture walls (Figure 2) almost disappeared. Still, impressive old pasture walls remain abundant in many natural areas.

Encountering a stonewall at Punkatasset that simply ended really puzzled me. What good was that wall for either farmer or cow? Finding a second dead-end stonewall hundreds of yards downslope deepened the mystery. No stones connected the walls though both dead-ends were near a trail. Looking more closely, neither wall completely stopped. Small stones remained in the leaves along with occasional larger stones, as if the walls had originally continued onward. Geologist and stonewall sage, Robert Thorson, didn't have to ponder, however—wagons on the old wagon-road trail carried away the "best stones"; i.e., the medium-sized stones easy to move and best for other building uses. Dead-end walls may have the best stones removed for their last 150 ft or so.

Cannibalization eliminated and transformed stonewalls for a long time in this old town.

Roadside walls and later walls

Roads complicate the story of old pasture stonewalls. Farmers' wagon roads (farm roads, woods roads, cart paths) have essentially the same walls as those between pastures. Such roads are narrow and little used, mainly by rural neighbors.

On the other hand, town roads are wider, busier, and used by both locals and through traffic of diverse sorts. Town roads pass many properties with walls constructed well, and not so well. Also, farmers' maintenance of walls along the road varies from meticulous to occasional to non-existent. Adding to the problem, town road uses often include horses, sheep, and herds of cows, all of which may bump into or break through a roadside wall of rounded stones.

The Concord-to-Lexington USNPS Battle Road seems like a promising example. However, to help visitors visualize the open 1775 landscape, in recent decades stonewalls there were extensively repaired, upgraded, or

constructed anew. Many walls with few lichens, including some low ones and only-small-stones walls, were built in the 1990s. Unaltered town roadside stonewalls from colonial time may have disappeared in Concord.

Four prominent processes transform stonewalls: (1) neglect; (2) cannibalization; (3) addition of stones on top; and (4) obliteration by machinery. These processes molded most of today's Concord walls.

Town roadside stonewalls seem quite different and highly diverse, compared with the old-wagon-road or pasture walls.

To understand the types of town walls, and their evolution, I made notes on: (1) 31 stonewalls on 1.9 mi of roads built in the mid-1700s (Strawberry Hill Rd., Balls Hill Rd.); (2) 27 stonewalls along 1.7 mi of early 1800s roads (Sudbury Rd., Garfield Rd.); and (3) 12 Concord stonewall photos by Alfred Hosmer in ca. 1880-1903; and 15 similar Herbert Gleason 1900-1920 photos.

To sense the evolution of stonewalls after the original colonial walls, I recognize three broad time stages: Early; Mid-stage; and Recent.

Early stonewalls (appeared mid-1700s to early 1800s, overlapping the original stonewall period)

(1) Early pasture walls; (2) rough-top walls; (3) rather smooth, somewhat rounded-top walls; (4) corrals and pounds; (5) walls for bulls; (6) early cultivation walls; and (7) town road walls that gradually become more diverse.

Mid-stage stonewalls (appeared early-to-late 1800s)

(1) Thin vertical-sided walls (Figure 14); (2) walls with large, medium and small stones at all levels (Figure 14); (3) low walls (Figure 15); (4) many quarried cut rocks in wall, a few with drill marks. (Figure 16); (5) neglected walls, now a much-widened strip of stones (Figure 3); and (6) cannibalized walls, now a strip of mainly small rounded stones (Figure 13); (7) high walls for sheep; (8) narrow short cultivation walls for vegetable gardens; and (9) small isolated mounds of small rounded stones (Figure 12) often from vegetable gardens.

Recent stonewalls (appeared late 1800s to present)

(1) Flat top walls (Figure 17); (2) walls with flat top-stones; (3) walls with many tiny exterior wedges (chinks); (4) a strip of jumbled stones with little or no structure; (5) masonry walls with mortar/cement; (6) machine-made walls; and (7) handsome, elegant walls in part for show (Figure 18).

Figure 13
Cannibalized cultivation wall. Most large and medium stones removed, leaving central row of smaller stones; adjoins former tillable area. South of Bateman's Pond.



Figure 14
Later pasture wall. Single layer thick; spaces give a filagee look; small, medium, and large stones (some cut) at all levels; mostly granite and gneiss stones. CLCT Thornton Woods.



Figure 15
Low wall with small granite stones and no visible lichens. Accumulated leaves microhabitat. Wall built in 1990s, along Route 2A constructed here in 1806. USNPS, Lexington.



Figure 16
Broken-rocks wall with medium-size stones added. Several rocks (e.g., large central one) with 6-7" pneumatic-drill marks. Leaf accumulations. By The Trustees' Old Manse.



Figure 17
Flat-top wall with top layer of quarried flat stones. Heterogeneous mix of stones beneath from varied sources; includes many tiny exterior wedge stones. USNPS, Liberty St..



Figure 18
Decorative vertical-erratics stonewall. Two tiers, with basal stones arranged to create a constant height wall; built in the 1890s. CLCT Nashawtuc Hill, Shaw Land.



Town roadside stonewalls have clearly evolved. Although a similar number of wall types mainly appeared in each stage, most early and mid-stage walls continued to be built into the recent stage. Thus, over 300 years stonewalls diversified enormously along Concord's roads. The original large glacially rounded stones were little used in mid-stage and recent walls. Most stonewalls appearing since 1800 were no longer primarily for livestock. Recent wall-building highlights aesthetics.

Altering stonewalls by neglect and cannibalization probably predominates from early to mid-stage. Adding stones on top and obliterating walls may be mainly recent processes.

Stonewall species

Lichens predominate. Thin flat "crustose lichens" that penetrate the rock surface often appear as rounded splotches of old lighter-or-darker gray paint. Rounded "foliose lichens" with air between lichen and rock appear thicker, and are usually either yellowish (due to usnic acid) or light gray. A close look reveals lots of lichen species on different sides of diverse stone types.

Micro-environmental conditions along a stonewall, especially on the moist side, favor many vascular plants, mosses, and invertebrates. Accumulated leaves help form soil. The cement or mortar of masonry walls supports locally uncommon lime-adapted lichens and mosses, even spleenwort ferns (Figure 6). In pastures, biodiverse hedgerows form along stonewalls.

Chipmunks often run along stonewalls, which

provide lots of entrances for a burrow beneath. Squirrels and other animals also move along walls. House cats, bobcats, and other predators seem to relish elevated straight stonewall tops for foraging. Nuts from squirrels and chipmunks give rise to wall-damaging trees. Tree falls flatten walls.

To conclude

Field guide means getting out, reading the clues, and suggesting past, present, or future consequences. "Ecodetectives" focus on the unusual, as well as the repeated patterns. What's an observation imply or indicate? Reading stonewalls provides insight into their origins, their ages, their uses, and their locations.

Many conclusions here include words such as "apparently", emphasizing some observer uncertainty, as well as humility. Hopefully historians and ecological observers ahead will discover evidence to evaluate the hypotheses and conclusions gained from stonewalls here.

On almost every walk in the woods, I notice something unusual or novel. That inevitably leads to pondering, and new insight. With stone walls and nature, mysteries abound—always beckoning.

Acknowledgements

All figures are Richard Forman photos. I warmly thank Robert Thorson, Lawrence Buell and Barbara Forman for wonderful manuscript reviews; also, Anke Vos, David Foster, Joan Ferguson, Ron McAdow, Henry Moss, and Barbara Forman for valuable contributions.

Helpful references: Susan Alport, *Sermons in Stone* (2021); David Foster, *Thoreau's Country* (1999); Robert Thorson, *Exploring Stone Walls* (2005).

RICHARD T. T. FORMAN, Professor Emeritus at Harvard University, received a Haverford College B.S., University of Pennsylvania Ph.D., two honorary doctoral degrees, awards/honors in eight countries, and served as President or Vice-President of three professional societies. He taught at the Escuela Agrícola Panamericana, University of Wisconsin, Rutgers University, and the Harvard Graduate School of Design and Harvard College, receiving the Lindback Foundation Award for Excellence in Teaching. Forman pioneered several ecological fields with numerous articles and books, including: *Landscape Ecology*, *Land Mosaics*, *Road Ecology*, *Mosaico territorial para la region metropolitana de Barcelona*, *Urban Regions*, *Urban Ecology*, and *Towns, Ecology, and the Land*. In Concord, he led or helped lead (1992–2004) two town *Open Space Plans*, *Historic Resources Masterplan*, *Concord's Mill Brook*, and (in 2021) coauthored *Ecology along Concord Trails*.

The Board of Trustees and Directors wish to thank Richard Forman for generously offering to research and write this wonderful guide on stonewalls as a special publication for the Concord Land Conservation Trust. We are enriched intellectually and collectively by Richard's scholarly work, and are grateful for his willingness to openly share his fascinating discoveries.