THE STONE AGE, STILL WITH US

dry stone masonry in the united states

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The intrigue of re-discovery

From coast to coast across the country, newly recognized treasures reveal a dry stone heritage richer and more diverse than most people realize. Along the back roads, in areas less impacted by modern highways and new construction, it is thrilling to discover and begin to comprehend the vast use of stone - this most basic building material - in the development of American agriculture, transportation, and industry. Our perception that we are a "new" country is modified when we recognize two to three hundred-year old structures that are still part of our daily lives.

Long before European settlement, native Americans built dry stone and adobe dwellings, kivas, terraces, and aqueducts, that constantly entice study and understanding. Yet in the seventeenth century, colonists forged another American heritage from labor, ingenuity, and sheer necessity, using stone-building skills and techniques they brought from Europe

In large regions of the country, stone walls enclosed every field. Drystone mills and dams lined the streams. Stone dwellings, barns, and bridges were commonplace. Towns contained stone court houses, clerk's offices, banks, shops, inns, and churches. Dry stone structures that facilitated colonial transportation still support daily use: road-cut embankments, retaining walls, culverts, harbor walls, stone stream banks, bridge piers and abutments.

Dry laid granite, double-arched bridge in Hillsboro County, New Hampshire, spanning Beard Brook. Built around 1850 and still in use. Photograph by the Editor

In the colonies

Best known today are the thousands of miles of dry stone walls and fences that entirely altered American landscapes. A survey by the United States Department of Agriculture reported that in 1871 that there were 20,505 miles of stone fences in Connecticut, 14,030 miles in Rhode Island, 32,960 miles in Massachusetts, and 95,364 miles in New York State. Susan Allport extrapolated from these figures that it would have taken 1,000 men working 365 days per year, about 59 years to build the stone walls in Connecticut alone.

Yet, in spite of the labor require-

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ments, vast areas of the northeastern colonies became criss-crossed by networks of stone walls that surrounded fields, pastures, cropland, and farmsteads. To improve pasturage and allow cultivation, New England farmers had to clear the land of trees and then painstakingly gather the glacially-deposited stone of every size, "from baseballs to bushel baskets" that littered their land. Some farmers simply dumped these stone loads along their field borders and added to them year by year as freezing cycles and plowing yielded ever more stone. Some communities commissioned carefully-built walls meant to showcase prosperity and craftsmanship, but between these two extremes are the majority of servicible, ordinary, ubiquitous walls that continue to characterize New England (Gardner.)

In other parts of the country that were also originally forested, there is deep topsoil and no fieldstone. Here, to provide stock-proof enclosures for expensively-imported animals, to ensure bloodlines, and to conserve desirable woodlands, landowners obtained building material by digging quarries into creek banks and hillsides. Quarried stone produced durable, high-quality stone fences that covered the landscape in the richer areas of Virginia and Maryland, and the Bluegrass regions of Kentucky and Tennessee.

In regions settled primarily by English, Scots-Irish, and Germans, farms contained not only dry stone walls, dwellings and barns - but slave and servant quarters, stables, spring houses, ice houses, smoke houses, loom houses, root cellars, wells, and cisterns. Dry stone techniques may not be readily apparent in these structures because to weatherproof the walls, joints were usually sealed with lime mortar after construction, and now may be re-pointed with cement (a damaging practice.) Dry stone kilns in these regions burned limestone to make lime powder used for the mortar mix. The preferred wood for kilns was hickory because it made the hottest fires, and hickory trees quickly disappeared from the landscapes surrounding kilns.

Colonial industry developed as dry stone dams harnessed the energy of creeks and rivers to drive grist, paper, and saw mills, in places built as closely together along the waterways as local laws permitted. Specialized stone buildings also included distilleries, warehouses, and iron furnaces. With westward expansion, dry stone continued to be the building material of choice. Scots-Irish carried rock fence construction to Missouri and Arkansas, and Germans built carefully coursed dry stone walls, houses, and barns in the Texas hill country.

BY MID-CENTURY.

The engineering skills that fostered the industrial revolution utilized this fabulous, versatile, abundant material on an even greater scale, employing more manpower, specialized construction equipment, and large-scale buildings for manufacturing. Some dry stone structures from this period represent major engineering feats worthy of World Heritage status.

Massive iron furnaces, built of dry stone, fueled developing American industry. Don Fig of the National Forest Service compiled information on the gigantic Fitchburg Iron Furnace, a National Historic Site, in Estill County, Kentucky. The furnace cost over $360,000 in 1866, the year it was chartered to produce iron for post-Civil War railroad construction. This enormous dry stone furnace, sixty feet tall, was built by Italian masons over a two year period from local stone that was quarried a few miles from the site. A few years ago, a scoundrel who wanted to demolish the furnace and sell the stone, filled the structure with dynamite and set it off, but succeeded only in blowing out the side of a doorway (Fig).

The earliest remaining iron furnace was built two centuries earlier, in 1643 near Flynn, Massachusetts. Demand for iron continued to increase and has never stopped, although new production methods developed after the next two hundred and fifty years. In the meantime, between the late-eighteenth and mid-nineteenth centuries, the industry produced thou-

Kentucky rock fence, built of purpose-quarried coursed limestone

New England stone wall of glacially-rounded granite boulders

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sands of iron furnaces, built of stone blocks weighing many tons each, constructed mostly in the northeastern states where iron ore was mined. A good example is the restored Hopewell Furnace National Park in Pennsylvania, built in 1771.

Iron for rails coupled with dry stone for supporting structures greatly facilitated settlement in interior states and western territories. East of the Mississippi, crews of Irish immigrants, fleeing the potato famines at home, found ready employment as "turnpikers," and canal and railroad builders. In the U.S., they often communed together, moving around the country wherever their skills were needed. Stone work offered employment for many thousands from Ireland, where working with stone had been part of their lives for centuries.

The Louisville and Nashville Turnpike was one of many such projects. The turnpike was first chartered in 1829 by the Kentucky State Legislature with a capitol stock of one hundred thousand dollars. Entirely built with Irish labor, the pike was finally completed in 1859. Three stone bridges of the turnpike exist in an historic park that is now part of Ft. Knox Military Reservation. Unfortunately they have been damaged by concrete pointing that German prisoners of World War II were assigned to apply (Kenpf). Mary Pierce, Director of the Heritage Foundation in Franklin, Tennessee, directed us to three more bridges of the old turnpike that remain in good condition in Sumner, Davidson, and Robertson Counties, Tennessee - excellent examples of nineteenth-century dry stone work.

Dry stone canals, many hundreds of miles long, provided water connections between the agricultural West and the industrial East. Reaching its peak in the 1850s, the canal era produced some 4,000 miles of canals. The 363-mile-long Erie Canal, completed in 1825, linked the Hudson River with Lake Erie, thereby connecting the seaboard with the interior and transforming New York City into a world trade center.

Fitchburg Furnace, Estill County, Kentucky.

The Erie Canal so immediately and vastly altered shipping economics that by 1828 the states of Maryland, Virginia, and Pennsylvania chartered the Chesapeake and Ohio Canal Company to provide "a flatwater route to western wealth. . . . Penetrating 185 miles inland, the C&O Canal was one of the nations's most ambitious industrial experiments of the mid-1800's." The canal opened in 1850, having cost more than eleven million dollars. Masons built mortared and dry stone dams, culverts, embankments, abutments, weirs, spillways, tunnels, and eleven stone aqueducts that carry the canal over creeks and rivers. A series of huge dry stone locks overcame the 605-foot elevation change from the Chesapeake Bay to the Cumberland coalfields at the base of the Allegheny Mountains (National Park Service).

Sue Pridemore, of Delaware and Lehigh National Heritage Corridor, explained that the need to transport increasingly large quantities of coal to markets downriver led to intensive development of the upper Lehigh Valley in Pennsylvania. Between 1835 and 1838, Lehigh Coal and Navigation Company built 20 dams, 29 dry stone locks, and connecting dry stone canals between Mauch Chunk and White Haven. Laborers came from Germany, Ireland, Wales, and Scotland. Josiah White, the canal's builder, recorded in his journal that "I didn't know anything about blasting nor did they. But we were lucky; as I recollect we lost only two men." The builders constructed dry stone locks that lifted coal-laden barges as high as 30 feet.

Picturesque elements amid all this construction include the artfully-arched dry stone bridges spanning the waterways. Some of these remain in use today, supporting weights unimagined when they were built.

"Of some thirty nineteenth-century [dry] stone bridges remaining in New Hampshire, the Gilsum span is preeminent for the dramatic height of its

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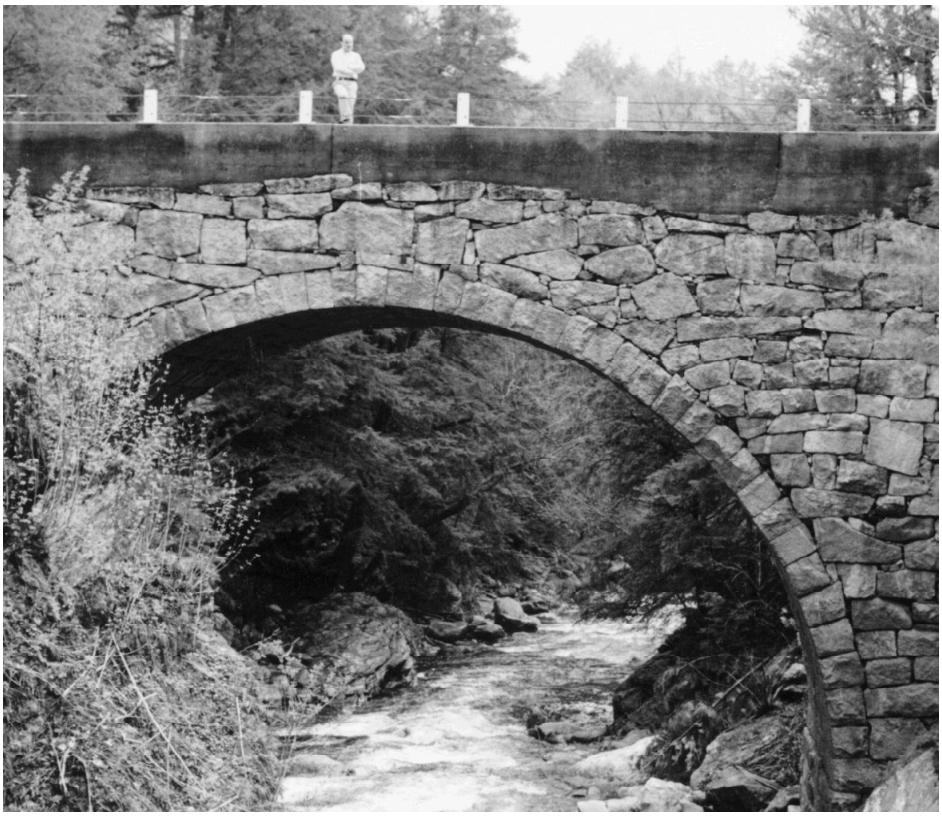

Gilsum Bridge. Cheshire County, NH. For scale, notice the person on the bridge.

arch and for the rugged picturesqueness of its setting." Built in 1862-1863 to replace five earlier washed-out or rotten timber bridges spanning the Ashuelot River, the bridge arch has a clear span of 47 feet, 8 inches and rises 43 and 1/2 feet above the stream bed (Commoss and Garvin).

The Westfield River dry stone bridges in Massachusetts, built in the 1830's, allowed steam locomotives to negotiate the steep, eight-mile-long narrow gorge. Ten bridges were built of dry stone by Irish and Scottish craftsmen, from square blocks of granite quarried from the surrounding cliffs. Each 50-foot-wide bridge rose higher than the last until the highest arch soars more than 70 feet above the stream below. "Amtrak trains still rumble over three of the bridges, including a graceful double arch in Middlefield (Rolando)."

The intriguing story of the Dolloff Dam in New Hampshire reveals another marvelous engineering feat of the nineteenth century. The gigantic dam, built in 1842, impounded the 800-acre Pawtuckaway "Pond" to provide water power 21 miles downstream by way of the Lamprey River meanders to the Newmarket Cotton Mills. Because there are no quarries nearby; the dam was probably built from the huge glacially-deposited granite boulders that surround the area; tool marks on nearby waste stones indicate that the blocks were split where they lay. The stone was hauled to the dam by wagons or sleds and lifted into tall courses by block and tackle from wooden derricks with masts and booms - all entirely powered by men and oxen. The impoundment continues to supply the Newmarket hydroelectric plant which produces electricity that is sold to power companies throughout New England (Garvin). This wondrous 1842 structure, built entirely of dry stone, is phenomenal on any international scale.

To the coast

The railroads opened a floodgate of settlement and construction west of the Mississippi. The Central Pacific and Union Pacific joined their tracks in 1869 at what is now Golden Spike National Historic Site at Promontory Summit, Utah, heralding the "world's first transcontinental railroad." The railroad grade and its associated features, designated a National Civil Engineering Landmark, include campsites that housed hundreds of workers who built seventeen original drystone culverts and seven trestles with stepped abutments of dry-laid stone retaining walls. The site efficiently illustrates the expanding railroads' dependence on dry stone infrastructures (Anderson and Wilson) .

On the Pacific coast, skills of immigrant Chinese and Italians were put to use building highway and railroad embankments, bridges, and tunnels through mountainous areas; dry stone terraces for the vineyards of California; and miles of aqueducts bringing water from the mountains to the coastal regions.

Dana Supernowicz of the Eldorado National Forest describes California as a melting pot of dry stone techniques because of three major stone-building ethnic groups - Chinese, Italians, and descendants from the British Isles - and numerous minor groups. Their skills made possible the many major dry-stone road-retaining walls constructed from 1860 to 1906, and thousands of miles of dry-stone field walls, built mostly in the sheep grazing areas.

A variety of examples: In the northern part of the state, up to 10,000 Chinese were employed to work on the Central Pacific Railroad. With completion of the railroad, their skills were quickly put to use on other stone work: flumes, irrigation ditches, banks, and dry stone dams using granite blocks 2 x 3 feet in size. The Welsh performed much of the stone quarrying. Swiss-Italians and Italians who settled near Placerville built the entire town of stone - some structures totally dry, some stone and earth, and some

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Eldorado National Forest, California, roadway culvert built by Chinese masons. Note the oriental character of the lintel.

with limestone pointing and stucco. In the 1930's, a blending of these skills inspired Bernard Maybeck to design a "Wrightian-style" fireproof resort in the mountains, all of stone with dry stone walls.

Into the twentieth century

Atop the Rocky Mountains, Glacier National Park engineer Goodwin proposed a roadway to cross the continental divide in the early 1900s. Surveying and engineering plans were complicated, and after a series of disagreements Goodwin resigned from the project. Following revisions by Thomas Vint, in 1924 the park awarded the Going-to-the-Sun Road contract to the firm of Williams and Douglas, who it turn subcontracted work to a series of builders from various countries, including Russia. A monstrous 54-foot-tall dry-stone retaining wall supports a major "loop," making climbing the grade over the mountain possible in one loop instead of 15 switchbacks. The road was pivotal to transmountain travel before the advent of federal Works projects in the 1930s and 40s, and is listed in the Historic American Engineering Record. (Gordon).

Practical dry stone construction projects continued in the twentieth century even during the Great Depression, when a variety of public works relief agencies offered employment. The Public Works Administration (PWA), Works Progress Administration (WPA), and the Civilian Conservation Corps (CCC) provided work for huge numbers of jobless laborers, many of whom already had, or quickly acquired, basic dry stone skills. These government initiatives included the still-in-use dry stone trails, dams, erosion controls, retaining walls, and roadways of the national parks, from the Channel Islands in the Pacific to Acadia in Maine.

Dry stone work supporting Rim Rock Drive in Colorado National Monument is being carefully maintained by John Tordoff, Facilities Manager. Massive stone retaining walls that hold fill along the cliff face and support the Rim Rock Road shoulders are a combined legacy of the WPA and the CCC. Both dry and mortared stone work of Rim Rock incorporate the naturalistic or rustic styles preferred in national park construction. The WPA employed local Italian stone masons to direct the original construction and training for 2,500 CCC workers. The masons quarried construction material from the cliff face, using air drills to split off the rock. Crews built the walls entirely by hand, using picks, shovels, wheelbarrows, and for lifting the larger stones, block and tackle. Observers of the day described the road as "one of the most impressive legacies of the CCC in western Colorado." Tordoff also organized instruction for national parks maintenance personnel to repair Serpent's Trail, which climbs the north side of No Thoroughfare Canyon, and has 27 switchbacks supported by retaining walls of coursed, dry-laid rubble.

Now

Dry stone work, built without mortar, is remarkably durable, relying on the skill of the craftsmen and the forces of gravity and frictional resistance. It withstands fire, water, decay, and insects. The mason needs only a few basic tools; the structures are easily repaired; the material is readily available and recyclable; and the work does not deplete resources. Little wonder, then, that building in dry stone is an eternal practice.

When correctly built, dry stone walls are even earthquake resistant. Scottish masons recently completed a dry stone wall near Seattle, Washington. Local observers kept asking what kept the wall together. They could not understand strength without cement. These questions were resoundingly answered in March of this year with the devastating 7.0 Seattle earthquake when the wall survived totally intact, merely settled more firmly into place (Aitken and Rippingale).

There are impelling reasons to continue and preserve this ancient craft today - to protect historic structures, provide worthwhile rural employment, promote tourism, and preserve beautiful landscapes. Most importantly, dry stone masonry is STILL a viable building technique as hundreds of thousands of architects, landscape architects, engineers, developers, landowners, and gardeners are excitedly re-discovering. Local stories, hidden structures, secret "finds," and family traditions enthusiastically come to life with re-embraced skills that use, protect, and build on this shared heritage.

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