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United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in National Register Bulletin, *How to Complete the National Register of Historic Places Registration Form.* If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. **Place additional certification comments, entries, and narrative items on continuation sheets if needed (NPS Form 10-900a).**

1. Name of Property

historic name Stone Arch Bridge

other names/site number

2. Location

street & number mm 89.41, over the Branch River ☐ not for publication

city or town Keene ☐ vicinity

state New Hampshire code NH county Cheshire code 005 zip code 03431

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended,

I hereby certify that this ✓ nomination ___ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60.

In my opinion, the property ✓ meets ___ does not meet the National Register Criteria. I recommend that this property be considered significant at the following level(s) of significance:

___ national ✓ statewide ___local

Richard A Boisvert DSHPO 6-7-12
Signature of certifying official/Title Date

State or Federal agency/bureau or Tribal Government

In my opinion, the property ___ meets ___ does not meet the National Register criteria.

Signature of commenting official Date

Title State or Federal agency/bureau or Tribal Government

Stone Arch Bridge
Name of Property

Cheshire, NH
County and State

4. National Park Service Certification

I hereby certify that this property is:

✓ entered in the National Register

___ determined eligible for the National Register

___ determined not eligible for the National Register

___ removed from the National Register

___ other (explain:) _____

Jon Edson N. Beall
Signature of the Keeper

8.14.12
Date of Action

5. Classification

Ownership of Property
(Check as many boxes as apply.)

- [ ] private
- [ ] public - Local
- [X] public - State
- [ ] public - Federal

Category of Property
(Check only **one** box.)

- [ ] building(s)
- [ ] district
- [ ] site
- [X] structure
- [ ] object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
		buildings
		sites
One		structures
		objects
One		**Total**

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing)

N/A

Number of contributing resources previously listed in the National Register

N/A

6. Function or Use

Historic Functions
(Enter categories from instructions.)

TRANSPORTATION—Rail-related

Current Functions
(Enter categories from instructions.)

TRANSPORTATION—Pedestrian-related

Stone Arch Bridge
Name of Property

Cheshire, NH
County and State

7. Description

Architectural Classification
(Enter categories from instructions.)

Other: Stone arch bridge

Materials
(Enter categories from instructions.)

foundation: Granite
walls: Granite
roof:
other:

Narrative Description

(Describe the historic and current physical appearance of the property. Explain contributing and noncontributing resources if necessary. Begin with **a summary paragraph** that briefly describes the general characteristics of the property, such as its location, setting, size, and significant features.)

Summary Paragraph

The Cheshire Railroad arched railroad is located at mm 89.41 over the Branch River in South Keene, New Hampshire.[1] It is a single-span stilted arch of split-faced granite, having a span of 68'-9" and carrying the former tracks of the Cheshire Railroad at an elevation of about 48 feet above the water below. On each side of the vault are massive, outward-curving wing walls that resist the horizontal thrust of the arched masonry and contribute to an appearance of immensity and permanence in the structure. The bridge was the largest of many arched stone bridges on the Cheshire Railroad and one of the largest single-span stone arch bridges in the United States at the time of its completion in 1847. The bridge is situated in an area of generally flat topography except near the channel of the river. The area immediately surrounding the bridge is presently wooded except for a small floodplain area at the northeast quadrant of the bridge, bounded by New Hampshire Route 101. The nearest buildings are residential, located about 500 feet from the bridge on the north side of Route 101. Historically, the bridge stood near two areas of concentrated industry. To the northeast, in the hamlet known as South Keene, were the shops of J. A. Fay and Company, pioneering manufacturers of powered woodworking machinery.[2] To the southwest, at Factory Village in the adjacent township of Swanzey, were a number of woodworking businesses, including saw and stave mills, a wooden pail factory, and a sash and blind shop.[3]

The arched bridge in South Keene retains integrity of location, setting, materials, workmanship, feeling, and association. The bridge retains substantial integrity of design. The original granite parapet wall was composed of two regular courses of ashlar and a second, upper coping course above the existing lower

[1]The Branch River is fed by Otter Brook and Minnewawa Brook, and lies wholly within Keene. The United States Geological Survey Geographic Names Information System provides the official name as "The Branch" (ID 87030). This stream is easily confused with the nearby "South Branch, Ashuelot River," United States Geological Survey Geographic Names Information System ID 870016, which lies in Swanzey, New Hampshire.
[2]James L. Garvin and Donna-Belle Garvin, *Instruments of Change: New Hampshire Hand Tools and Their Makers, 1800-1900* (Concord, N. H.: New Hampshire Historical Society, 1985), p. 15.
[3]L. Fagan, "Map of Cheshire County New Hampshire from Actual Survey." (Philadelphia: Smith & Marley,1858).

coping course. The two upper courses of the original parapet were removed in December 1903 and supplanted by an iron railing to permit the clearance between the two parallel tracks to be increased to modern specifications.[4] The iron railing has since been removed from the bridge.

Narrative Description

The Cheshire Railroad arched railroad bridge at South Keene is a single-span, stilted semicircular stone arch carrying the right-of-way of the former Cheshire Railroad across the Branch River. The bridge is built into a 700±-foot-long earthen causeway that is elevated some forty-eight feet above the banks of the river. The arch has a radius of 34'-0", giving the bridge a clear span at the springline of 68'-0". The width of the vault of the bridge, from face to face, has been measured at 27'-1."[5] The bridge is built of rough-faced granite ashlar, reportedly quarried on the Thompson Farm, located within a half mile of the bridge site in neighboring Roxbury.[6] Individual stones are hammered to precise beds that required only a minimum amount of mortar to achieve full bearing for each stone; in many cases, the stones were apparently laid dry. The exposed surfaces of each block are left with split faces, imparting a rusticated texture to the overall fabric. Many of these stones retain visible marks of the plug drills that were used to prepare them for splitting. The only features that are precisely finished are the arrises of the archivolt and its flanking piers, where the corners of the stones are chiseled to a true line.

The bridge has a single open vault with a measured span of 68'-0"± and with an arch intrados height above average water level of 39'-4"±.[7] The springline of the vault is elevated five courses of stone above the footings of the bridge, bringing the elevation of the rail bed at the top of the bridge to about forty-eight feet above the water at normal flow. The vault is composed of a single course of voussoirs, each having a soffit measuring about twenty inches, and a depth or height of about forty inches. The voussoirs vary in length in order to break joints, but probably average about 48 inches long. As noted above, the arris of the archivolt is chiseled to a sharp edge. The keystone is the only voussoir that projects beyond the chiseled curve of the archivolt.

Flanking each end of the vault are single heavy piers or buttresses that project about twenty inches from the plane of the arch. The corners of these piers are chiseled to a sharp arris. The buttress at the southwestern quadrant of the bridge has lost the sharp arrises at its corners through spalling of the granite. This limited area of the bridge appears to have been exposed to the heat of a fire, which typically causes spalling of this type on granite stones.

The spandrel walls between the vault ring and the piers are composed of coursed granite ashlar. The courses of the spandrels and the piers are aligned, and vary in depth from 24 inches at the bottom of the bridge to 18 to 20

[4] David Proper, "For decades, bridges stood over troubled water," *The Keene Sentinel*, March 28, 2006, paraphrasing Clifford C. Wilber, "Iron Railing on Stone Arch Bridge," "The Good Old Days" No. 486, *The Keene Sentinel*, December 10, 1936; Keene *Repertory* Almanac, p. 557.

[5] For detailed descriptions, measured drawings, and photographs of the bridge, see CHA [Clough, Harbour Associates], "Evaluation and Historic Recordation of the Cheshire Railroad Stone Arch Bridge over Branch River," CHA Project Number 19959 (November 2009).

[6] Keene History Committee, *"Upper Ashuelot," A History of Keene, New Hampshire* (Keene, N. H.: by the committee, 1968), pp. 89, 288, 395.

[7] Richard M. Casella, Historic Documentation Company, "Historic American Engineering Record/New Hampshire Historic Property Documentation, Cheshire Railroad Stone Arch Bridge," NH State No. 641 (2009).

inches at the top, beneath the wall coping, thereby enhancing a perception of the stability and height of the structure.

The granite wing walls beyond the piers curve outward on a quarter-circle radius, retaining massive volumes of earth behind their vertical faces and thereby resisting the spreading tendency of the vault. At the termination of their curved surfaces, the wing walls return to an alignment that parallels the axis of the bridge, and bury themselves in the hillsides on each side of the river. The river banks upstream and downstream from these walls have been armored with large pieces of packed granite rubble. The color of this armoring stone differs from that of the bridge ashlar, suggesting that the armoring of the embankments was carried out subsequent to the completion of the bridge.

The wing wall at the northwestern corner of the bridge is pierced by a granite arch, filled with ashlar and partly buried in the embankment. The full dimensions and purpose of this arch are unknown, but investigators have assumed that the feature serves as a relieving arch, which would extend well inward from the vertical face of the wing wall. Relieving arches help to support the earthen fill behind a wing wall, resolving the effect of the fill into a vertical pressure on the arch instead of a horizontal pressure against the wing wall and thus permitting a high wing wall of relatively thin cross section to resist the pressure of a substantial height of fill. The investigators assume that all four wing walls of the bridge are provided with such arches near their bases, but only the arch at the northwestern quadrant remains partly exposed above grade level.[8]

Many of the joints between the stones of the vault, the spandrel walls, the piers, and the wing walls have no visible mortar. Many of the beds of the stones appear to have been hammered to a fineness that permitted the stones to be laid dry, yet to achieve good surface contact. But some joints in the bridge are filled with a soft, brownish mortar. Preliminary tests in 2006 suggested that this mortar might include some natural cement in addition to lime and sand.[9] The mortar appeared to have been employed only where irregularities in the beds of adjacent stones required a cushion to achieve even contact through the mass of masonry. In 2009, a more rigorous analysis of the mortar was carried out. The 2009 tests indicated the present of both the original brown bedding mortar and areas of later pointing or repair mortar. The brown mortar was determined to have the characteristics of "high calcium mortar cements that carbonate over time" and to have the approximate proportions of "1 part mortar to two parts sand by volume."[10]

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

[X] A Property is associated with events that have made a significant contribution to the broad patterns of our history.

[ ] B Property is associated with the lives of persons significant in our past.

[X] C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.

[8] CHA [Clough, Harbour Associates], "Evaluation and Historic Recordation of the Cheshire Railroad Stone Arch Bridge over Branch River," CHA Project Number 19959 (November 2009), p. 12, citing D. H. Mahan, *An Elementary Course of Civil Engineering for the Use of Cadets of the United States' Military Academy*, 6th ed. (New York: Wiley & Halsted, 1857, p. 145; and Ira Osborn Baker, *A Treatise on Masonry Construction*, 10th ed. (New York: John Wiley & Sons, 1909), p. 515, on the subject of relieving arches in retaining walls.

[9] James L. Garvin to Joyce McKay and Richard M. Casella (e-mail), December 18, 2009.

[10] David Gress, "Cheshire Railroad Stone Arch Mortar Evaluation," July 31, 2009, [p. 3].

Stone Arch Bridge
Name of Property

Cheshire, NH
County and State

☐ D Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)

Property is:

☐ A Owned by a religious institution or used for religious purposes.

☐ B removed from its original location.

☐ C a birthplace or grave.

☐ D a cemetery.

☐ E a reconstructed building, object, or structure.

☐ F a commemorative property.

☐ G less than 50 years old or achieving significance within the past 50 years.

Areas of Significance
(Enter categories from instructions.)

Criterion A: Transportation

Criterion C: Engineering

Period of Significance

Criterion A: 1847-1962

Criterion C: 1847

Significant Dates

1847

1903

Significant Person
(Complete only if Criterion B is marked above.)

Cultural Affiliation

Architect/Builder

Lucian Tilton (1812-1877)

William Scollay Whitwell (1809-1899)

Period of Significance (justification)

Criterion A: 1847 to 1962 (date of opening to arbitrary fifty-year National Register cutoff date)
Criterion C: 1847 (date of completion)

Criteria Considerations (explanation, if necessary)

Statement of Significance Summary Paragraph (Provide a summary paragraph that includes level of significance and applicable criteria.)

Completed in 1847, the great stone arched bridge at mm 89.41 at South Keene was one of the most impressive masonry arches to be constructed in the United States before 1850. The bridge is significant under National Register Criterion A for its role as a crucial link in a specific transportation system and for its demonstration of the capacity of the stone arch to span long distances while bearing the weight of railroad traffic. The bridge replicates a few predecessors of similar design on other important New England railroads, all of which represent the early use of massive stone vaults to span rivers that would otherwise have presented insurmountable barriers to the completion of rail systems linking several of the major cities of New England. The bridge is significant under Criterion C for its significance in engineering and as the work of a master. The bridge was designed by Lucian Tilton (1812-1877), with involvement by William Scollay Whitwell (1809-1899), both of whom attained eminence and national recognition in railroad engineering and, in the case of Whitwell, in water supply engineering and tunneling as well. Under Criterion C, the bridge is also significant for its aesthetics, utilizing carefully split granite ashlar to create a composition that juxtaposes the vertical arc of the bridge vault with the horizontal sweep of curved wing walls, thereby creating a design that surpasses most comparable spans of it era in visual impact.

Narrative Statement of Significance (Provide at least **one** paragraph for each area of significance.)

Criterion A: The arched railroad bridge in Keene, spanning the Branch River near the Keene-Marlborough town line, is significant under National Register Criterion A for its role as a crucial link in a specific transportation system and for its demonstration of the capacity of the stone arch to span long distances while bearing the weight of railroad traffic. The bridge is one of many impressive engineering structures on the line of the former Cheshire Railroad. Extending 42.81 miles from the Massachusetts border at Fitzwilliam to a point near the Vermont border at North Walpole, the Cheshire Railroad was chartered in 1844.[11] It completed its passage across Cheshire County to the Connecticut River and to its terminus at Bellows Falls, Vermont, in 1849.[12] The Cheshire Railroad was characterized as "one of the most thoroughly-constructed roads in the country. Its bridges, culverts and abutments, built of cut granite, are models of civil engineering."[13]

The Cheshire Railroad surpassed all other rail lines in New Hampshire in its mastery of masonry construction and in the bold use of the stone arch for its many stream crossings. Chief engineers for the line were Lucian Tilton and W. S. Whitwell. Under their supervision, contractors built twenty arched granite bridges and culverts, more than a hundred stone box culverts and cattle underpasses, and impressive cuts and fills along the 43-mile route.[14] Some of the line's culverts support over a hundred feet of overburden. Several of the stone

[11] *By-Laws and Act of Incorporation of the Cheshire Railroad Company and General Railroad Laws* (Keene, N. H.: Printed by H. A. Bill, 1845).

[12] *Thirty-Fifth Annual Report of the Railroad Commissioners of the State of New Hampshire, 1879* (Manchester, N. H.: John B. Clarke, 1979), pp. 107-110.

[13] D. Hamilton Hurd, ed., *History of Cheshire and Sullivan Counties, New Hampshire* (Philadelphia: J. W. Lewis & Company, 1886), p. 21.

[14] The Cheshire Railroad Area Form, written by Elizabeth J. Hostutler, states on page 2 that "the Cheshire Railroad is singular in the state for its high number of granite bridges and culverts, for their quality of construction, and for their survival. Seven stone arch bridges and thirteen large stone arch culverts are located along the 42.75 miles of track in New Hampshire, along with approximately 120 stone box culverts, four double box stone culverts, and four granite block cattle underpasses. Much of the credit for this stonework can be given to Lucian Tilton and W. S. Whitwell, chief engineers during construction, and the presence of local granite, sometimes within half a mile of the rail bed (Keene History 1968:288). Of particular note is the Tilton-design stone arch bridge over the South Branch of the Ashuelot River [*sic*] in Keene, built with granite from a quarry on the nearby Thompson Farm (Keene History 1968:288). Considered one of the finest examples in the country at its construction in 1849, the bridge is sixty feet high with a 90 foot span (Keene History 1968:395)."

arched bridges on the line are elliptical in outline; others are high, stilted semicircular arches. An arched highway underpass on Arch Street in the western part of Keene has in-curved portals, and the intersection of the semicircular vault and the portals represents complex geometry that required difficult stonecutting. The Arch Street underpass is accompanied by a long arched culvert that conducts nearby White Brook beneath the wide causeway of the railroad.

The Cheshire Railroad had its genesis in plans by Massachusetts investors to build a rail line from Boston to the western Massachusetts town of Fitchburg, about forty-one miles southeast of Keene, with further discussions of extending the line from Fitchburg to Brattleboro, Vermont. Seeing an opportunity to attract a line through Keene, local investors subscribed some $40,000 in December, 1843, to influence the engineers to choose a route that would pass through Keene en route from Fitchburg to Brattleboro.

When such a route was ultimately not selected, local rail proponents secured a charter for the Cheshire Railroad on December 17, 1844. The charter authorized the corporation to construct a line "from any point on the south [boundary] line of the State [of New Hampshire], in Fitzwilliam or Rindge, and passing thence through the village of Keene, to the western boundary of the State, in Walpole or Charlestown," and further authorized the corporation to build a bridge across the Connecticut River to connect with Rockingham, Vermont.[15] A second New Hampshire law, passed on December 27, 1844, authorized the Cheshire Railroad to "unite with the Winchendon [Massachusetts] railroad corporation . . . and when said corporations shall have united . . . under the name of the Cheshire railroad company . . . all the franchises, property, powers and privileges granted and acquired under the authority of the states of New Hampshire and Massachusetts respectively, shall be held and enjoyed by all the said stockholders, in proportion to the amount of property or interest held by them respectively, in either or both of said companies or corporations."[16]

By this means, the Cheshire Railroad secured authority to connect Winchendon, Massachusetts, and Rockingham, Vermont, by rail. Further action by the Massachusetts legislature authorized construction of six miles of track connecting Winchendon and Fitchburg, Massachusetts, thereby making legal a complete rail route passing through Keene from Boston to the Connecticut River at Walpole, New Hampshire, and Rockingham, Vermont.[17] By May, 1848, when the line had become active between Boston and Keene, the directors of the Cheshire Railroad reported to the stockholders that great prospects were to be expected in the near future by completion of an integrated transportation system covering northwestern New England and linking that region with Boston:

> The time has past, if it ever existed, when the final completion of the road could be regarded by any one as questionable. It is now only a question of a few weeks, in point of time,—earlier or later. But still, in this point of view, important to us,—important that we shall be realizing at the earliest day, the advantages which we shall derive from the use of our entire line,—important to us, that we shall be ready as soon as the other roads constructing above us shall be completed, to receive their business and to pass it along to its destination; with the Rutland, the Sullivan, the Central, the Passumpsic, the Vermont and Canada, and the Ogdensburg roads,—all passing on to completion, and in the business of all of which our road must participate, in a greater or less degree,—we can

[15] *By-Laws and Act of Incorporation of the Cheshire Railroad Company and General Railroad Laws* (Keene, N. H.: Printed by H. A. Bill, 1845).
[16] Ibid.
[17] *First Annual Report of the Directors of the Cheshire Railroad Company, to the Corporation* (Keene, N. H.: J. & J. W. Prentiss, 1846).

> want no incentive to urge us on our work, and can entertain no distrust, that when the road shall be completed, the amount of business which shall be done on it will exceed any expectations which have been entertained by its most sanguine friends.[18]

The arch over the Branch River surmounted the final major obstacle preventing a railroad connection to Keene from the south. Following completion of the bridge in 1847, the Cheshire Railroad completed its route to the heart of Keene and opened the road to regular traffic on May 16, 1848 with the arrival of a special excursion train from Boston.[19]

The bridge is by far the single most impressive structure along the right-of-way of the Cheshire Railroad. The arch is immense in scale and finished in workmanship. Its large voussoirs (the stones that form the barrel of the vault) and the stones that form its spandrel walls and wing walls are all hand-hammered to create smooth joints, yet are deliberately left with rough faces to enhance the sense of massive ruggedness in the huge structure. This bridge was an engineering triumph in its day, and remains a monument in American transportation history.

The Cheshire Railroad was officially abandoned along most of its length in 1972.[20] In the early 1990s, the New Hampshire Department of Transportation purchased approximately forty linear miles of the railroad in the towns and cities of Fitzwilliam, Troy, Marlborough, Swanzey, Keene, Surry, Westmoreland, and Walpole. In keeping with standard practice, this linear corridor was placed under the administrative care of the Bureau of Rail and Transit of the New Hampshire Department of Transportation. The Bureau of Rail and Transit, in turn, has permitted the use of much of the line as a recreational trail under the Trails Bureau of the Department of Resources and Economic Development (DRED).

Criterion C: The bridge is significant under National Register Criterion C as an impressive feat of civil engineering and as the work of a master. The bridge is one of the most impressive masonry arches ever built in New Hampshire. S. G. Griffin's *A History of the Town of Keene* states of the bridge and its designer,

> Mr. Lucian Tilton was chief engineer and the first superintendent [of the Cheshire Railroad], and the road was pronounced to be of superior character. The massive and graceful arch over the Branch at South Keene—a single span ninety feet broad and sixty feet high, designed by Mr. Tilton and built under his direction—is one of the finest of the kind in the country and worth traveling a long distance to see.[21]

By actual measurement, the bridge carries the rail bed approximately 48 feet above the water level of the Branch at normal flow.[22] The bridge was considered one of the finest and most daring arched spans in the United States when it was completed in 1847. Its progress was reported in a local Keene newspaper in December 1846:

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[18] *Third Annual Report of the Directors of the Cheshire Railroad Company, to the Corporation* (Keene, N. H.: J. & J. W. Prentiss, 1848).

[19] Clifford C. Wilber, *Centenary of the Opening of the Cheshire Railroad to Keene, N. H., May 16, 1848* (Keene, N. H.: Keene National Bank [1948]).

[20] Robert M. Lindsell, *The Rail Lines of Northern New England* (Pepperell, Mass.: Branch Line Press, 2000), pp. 60-63.

[21] S. G. Griffin, *A History of the Town of Keene* (Keene, N. H.: Sentinel Printing Company, 1904; facsimile edition, Bowie, Maryland: Heritage Books, 1980), p. 446.

[22] The Boston & Maine Railroad's Main Track Structures list states that the bridge has a clear span of 68'3" and a total height of 51'6" (B&M 1953).

> The key stones of the great bridge (a magnificent structure) over the East Branch, in this town, were put in place last week, and the filling [over the arch] is now going on vigorously, as is the work on the whole line.[23]

The engineering design for the Cheshire Railroad, including the arched bridge, was provided by Lucian Tilton and W. S. Whitwell.[24] The actual design of this and other bridges on the Cheshire Railroad is attributed to Tilton. A native of Hampton Falls, New Hampshire, Tilton (1812-1877) is credited with surveying the route of the Cheshire Railroad. He served as superintendent of the railroad upon its completion.[25] Tilton married Lucretia Jane Wood of Keene on April 1, 1850.[26]

Tilton later served as consulting engineer for the Ashuelot Railroad, which connected Keene and East Northfield, Massachusetts, and was employed as superintendent of the Fitchburg Railroad in Massachusetts from 1850 to 1853.[27] He subsequently served as superintendent of the Toledo and Wabash Railroad and as president of the Great Western Railroad; in the latter position, he and his family rented the home of the Abraham Lincoln family in Springfield, Illinois, when the Lincolns left for Washington, D. C., in January 1861. Tilton moved to Chicago in 1869, and his house there was destroyed two years later in the great Chicago fire of October 8, 1871.[28] He was interested in history and served on the executive committee of the Chicago Historical Society from 1871 to 1875. In 1873, Tilton served as a director of the New York, West Shore, and Chicago Railway Company.

Tilton died in Chicago on March 19, 1877 and left a "fortune of fully a quarter of a million dollars, mainly in cash and bonds, and it is stated a portion consists of $60,000 in gold, but recently purchased."[29] After Tilton's death, his widow, Lucretia Jane Tilton, gave $3,000 to the Chicago Historical Society in his name. He was considered one of the most eminent railroad engineers in the United States.[30]

At her own death in 1906, Lucretia Jane Tilton bequeathed practically her entire estate of $225,000 to charitable institutions, including two in her home town of Keene: the Elliot City Hospital, which received $6,000, and the Invalids' Home, which received $5,000.[31]

William Scollay Whitwell also attained eminence as an engineer, but unlike Tilton did not remain in the employment of railroads during his full career. Whitwell was born in Augusta, Maine, in 1809. The Engineering Record noted his death in 1899 with the statement that Whitwell "was educated in Boston schools and at the Lawrence Scientific School, finishing with a course in practical work in several machine shops.

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[23] *New-Hampshire Sentinel* (Keene, New Hampshire), December 9, 1846. In an article in *The Keene Sentinel*, March 28, 2006, David Proper quotes an earlier article of 1936 by Clifford Wilber to the effect that a powerful storm damaged many properties in New England on October 13, 1846: "In Keene little rain fell, but during the high winds which prevailed, the 'great framework' that had been built to support the erection of the stonework, fell, a complete ruin, with a loss to the contractor of several hundred dollars in addition to that caused by the delay." Clifford C. Wilber, "Stone Arch Railroad Bridge," "The Good Old Days" No. 472, *The Keene Sentinel*, November 23, 1936.

[24] *First Annual Report of the Directors of the Cheshire Railroad Company, to the Corporation* (Keene, N. H.: J. & J. W. Prentiss, 1846).

[25] Tilton's place and date of birth are supplied in an article by David Proper, "Lincoln never did stay here, but Keene man rented his home," *The Keene Sentinel*, February 11, 2003. The United States Census of 1850 listed Tilton as a resident of Keene, "age forty." His death date of March 19, 1877, in Chicago, is given in the *Chicago Daily Tribune*, March 22, 1877, and the *Cheshire Republican* (Keene, N. H.), March 31, 1877.

[26] New Hampshire Bureau of Vital Records and Health Statistics, "Marriage Records."

[27] David Proper, "Lincoln never did stay here, but Keene man rented his home," *The Keene Sentinel*, February 11, 2003.

[28] National Park Service, website for "Lincoln Home National Historic Site: The Lincolns in Springfield, 1849-1861."

When he entered active engineering practice, railways were beginning to attract general attention, and his work on many lines gained for him a wide circle of acquaintances."[32]

Whitwell participated in the survey of the route of the Western and Atlantic Railroad from Atlanta, Georgia, to Chattanooga, Tennessee, in 1837 under the direction of that railroad's chief engineer, Stephen Harriman Long, a native of New Hampshire who achieved eminence as an Army topographical engineer and as a railroad and bridge designer.[33]

In June, 1846, Whitwell appears to have left employment on the Cheshire Railroad to accept appointment as chief engineer of the Eastern Division of the newly formed Boston Water Commission, created to build reservoirs and a water supply system for Boston. Whitwell was responsible for the design and construction of the city's first large-scale public water system, the Cochituate Water Works.[34] Whitwell long remained prominent in the field of water supply engineering.

Whitwell was a founding director of the Boston Society of Civil Engineers, established in 1848.[35] His work on Boston's water supply earned Whitwell national recognition, and in 1850 he was appointed the first chief engineer of the Jersey City Water Works, designing a complex water supply system that included three reservoirs.[36]

In 1863, in the capacity of supervising state engineer for Massachusetts, Whitwell directed the sinking of the central shaft of the Hoosac Tunnel, a monumental undertaking of railroad engineering. This daring project placed workers in a deep vertical shaft that was sunk at the proposed center of the long tunnel, excavating outward in opposite directions to meet the tunnels being driven in from each end. This effort required extraordinarily precise surveying methods; but by placing crews at the center of the proposed conduit, the project effectively doubled the tunneling rate and cut the remaining completion time for the tunnel in half. The error of alignment when the separate shafts at last met in 1872 and 1874 was a mere fraction of an inch.[37]

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[29] Obituary, Col. Lucian Tilton, *Chicago Daily Tribune*, March 22, 1877, quoted in Richard M. Casella, Historic Documentation Company, "Historic American Engineering Record/New Hampshire Historic Property Documentation, Cheshire Railroad Stone Arch Bridge," NH State No. 641 (2009).

[30] *The Repertory* (Keene, N. H., 1924-25), p. 189.

[31] Obituary, Lucretia J. Tilton, *Chicago Daily Tribune*, November 5, 1906; "Large Sums for Charity," *Chicago Daily Tribune*, November 16, 1906, quoted in Richard M. Casella, Historic Documentation Company, "Historic American Engineering Record/New Hampshire Historic Property Documentation, Cheshire Railroad Stone Arch Bridge," NH State No. 641 (2009).

[32] *The Engineering Record*, November 11, 1899, quoted in Richard M. Casella, Historic Documentation Company, "Historic American Engineering Record/New Hampshire Historic Property Documentation, Cheshire Railroad Stone Arch Bridge," NH State No. 641 (2009).

[33] For a full biography of Long, see Richard G. Wood, *Stephen Harriman Long, 1784-1864: Army Engineer, Explorer, Inventor* (Glendale, Cal.: Arthur H. Clark Co., 1966).

[34] Nathaniel J. Bindlee, *History of the Introduction of Pure Water into the City of Boston* (Boston: A. Mudge & Son, 1868), pp. 95-6, quoted in Richard M. Casella, Historic Documentation Company, "Historic American Engineering Record/New Hampshire Historic Property Documentation, Cheshire Railroad Stone Arch Bridge," NH State No. 641 (2009).

[35] *Journal of the Association of Engineering Societies*, I:1 (November 1881), p. 7, quoted in Richard M. Casella, Historic Documentation Company, "Historic American Engineering Record/New Hampshire Historic Property Documentation, Cheshire Railroad Stone Arch Bridge," NH State No. 641 (2009).

[36] Charles Winfield, *History of the County of Hudson, New Jersey* (New York: Kennard and Hay Printing Company, 1874), p. 292, quoted in Richard M. Casella, Historic Documentation Company, "Historic American Engineering Record/New Hampshire Historic Property Documentation, Cheshire Railroad Stone Arch Bridge," NH State No. 641 (2009).

[37] David Jacobs and Anthony E. Neville, *Bridges, Canals, and Tunnels: The Engineering Conquest of America* (New York: American Heritage Publishing Company, 1968), pp. 40-51.

Historic context: The predecessors of early railroad stone arched bridges were similar but smaller and less highly finished highway bridges, which began to appear in New Hampshire in the 1830s. A summary of the early history of arched highway bridges is given below under "Developmental history/additional historic context information."

After 1840, railroad corporations quickly surpassed highway builders in the size and workmanship of arched stone bridges. The Cheshire Railroad surpassed all others in New Hampshire, and probably in northern New England, in the quality of its granite construction. The course of the railroad throughout Cheshire County affords many other examples of arched granite bridges and culverts that may be juxtaposed with the great arch over the Branch River. Among the most impressive of these structures are the elliptical and semicircular vaults to be seen along the line. Also unusual are the enormously long granite arched culverts that conduct local streams through the causeways of the rail bed at points where the elevation of the rails was far above that of the streams below and the causeways are proportionately wide at their bases.

Among the most notable of the arched granite structures along the line are the following: 1. The stone arch highway underpass (94.57 mm) at Arch Street, Keene. The inward-curving portals of this bridge meet the stilted semicircular vault of the underpass in an intersection of complex geometry; 2. The stone arch highway underpass (85.45 mm) at Thatcher Hill Road in Marlborough. This high, stilted semicircular arch has straight portals but sharply outwardly-curved wing walls; 3. The semi-elliptical stone arch (83.24 mm) over the Ashuelot River at Troy; 4. The three-centered stone arch bridge (73.32 ± mm) over Scott Brook in Fitzwilliam; and 5. The double elliptical stone-arched bridge (71.08 ± mm) over an unnamed brook in Fitzwilliam.

Other New Hampshire railroad lines also retain notable stone arches. One of the earliest stone railroad arches constructed in the state was built in 1840 to span Salmon Brook in Nashua (37.87 mm). The Bridge Street tunnel in Bellows Falls, Westminster, Vermont (83.80) was constructed in 1851 to allow passage of trains beneath the streets and buildings of that growing railroad center.

The 1910 Railroad Commissioners' Report indicates that there were then forty-three stone bridges on the Boston & Maine Railroad system in New Hampshire, which by then had absorbed the Cheshire Railroad.[38] The current New Hampshire Department of Transportation Railroad Database includes a total of twenty-eight, although additional smaller bridges could be recorded as culverts due to inconsistencies in data entry.[39]

Although New Hampshire retains many arched stone railroad structures, no other arched bridge, on the Cheshire Railroad or elsewhere, equaled the bridge at South Keene for sheer height, span, and massiveness of construction until the approach of the twentieth century. Many of the attributes of the South Keene bridge, however, were echoed on other, smaller spans of the Cheshire Railroad. Among these characteristics are the use of rough-faced ashlar masonry with precisely cut beds and arrises, the employment of curved granite wing walls to buttress the arches, the definition of the tops of the bridges by projecting coping courses, and a general sophistication of geometrical layout and proportioning. Together, these attributes offer a convincing visual impression of unstinting investment of thought, aesthetic sensitivity, and capital in the design and construction of the entire Cheshire Railroad line.

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[38] *Sixty-Sixth Annual Report of the Railroad Commissioners of the State of New Hampshire, 1910* (Manchester, N. H.: John B. Clarke Co., 1910), p. 114.

[39] R. Stuart Wallace and Lisa Mausolf, "New Hampshire Railroads: Historic Context Statement" (Concord, N. H.: New Hampshire Department of Transportation, 2001), p. 113.

The only arched stone railroad bridge in the immediate region to equal the daring of the South Keene span was the double arched bridge across the Connecticut River at Bellows Falls, built in 1899 by the Fitchburg Railroad, which had assumed control of the Cheshire Railroad, to replace an earlier bridge across the river. The Bellows Falls bridge represents a limited resurgence of masonry arches for railroad spans at the end of the nineteenth century after a half-century of eclipse by truss bridges. Each of its spans measures 140 feet but has a rise of only twenty feet, giving this bridge two of the longest masonry arches, with the least rise, in the United States. The South Keene and Bellows Falls bridges, built half a century apart, each contributed to the reputation of the Cheshire or Fitchburg line for engineering sophistication.

National context: Completed in 1847, the stone arch bridge in Keene took its place among a small number of arched stone structures that had then been built in the eastern United States to meet the new challenge of carrying railroad traffic across geographical barriers. A few of these structures were viaducts that used a series of masonry arches to create elevated roadways for rail traffic. Others, more directly comparable to the Keene bridge, were single-span stone vaults that carried tracks above individual features, usually streams that flowed in channels well below the elevation of the tracks that needed to cross them.

Among the arched stone structures that preceded construction of the Keene bridge were two great spans on the Baltimore and Ohio Railroad, America's first major rail line and a pioneering American enterprise that was destined to provide many prototypes for the eastern railroads that followed it.[40] The first was the Carrollton Viaduct (1829) over Gwynn's Falls, Maryland, with an eighty-foot arch over the river and a secondary twenty-foot arch over a wagon road. The second was the Thomas Viaduct (1835) in Elkridge, Maryland, over the Patapsco River on the Washington Branch of the Baltimore and Ohio Railroad. A classic viaduct rather than a single major arch, the Thomas Viaduct is an arcade of eight open masonry arches, built on a four-degree lateral curve, for a total length of 612 feet.[41] Closer to Keene was the impressive Canton Viaduct (1835) on the Boston and Providence Railroad. Designed by engineer William Gibbs McNeill, this multi-span structure carried its rails seventy feet above the slow-flowing East Branch of the Neponset River in Canton, Massachusetts. Like other structures designed by McNeill, a West Point graduate and former employee of the Baltimore and Ohio Railroad, the Canton Viaduct was built by Scottish stonemasons who inscribed the faces of many of its stones with their personal hallmarks, ostensibly to document their labor and claim their wages.[42] Unlike the contemporary Thomas Viaduct, the Canton structure has granite infill beneath its high, stilted arches, presenting the appearance of a solid wall buttressed by a blind arcade rather than of a structure of connected open arches.

The direct predecessors of the Keene arch were a series of stone railroad arches built in western Massachusetts during the late 1830s and early 1840s. These bridges were designed by George Washington Whistler (1800-1849), McNeill's brother-in-law and, like McNeill, a graduate of the United States Military Academy at West Point. These bridges stood on the Western Railroad, an extension of the Boston and Worcester Railroad; the Western Railroad was built through the immensely difficult terrain of the Berkshires to connect the two state capitals of Boston and Albany, New York.

Whistler and McNeill worked together to design the Boston and Worcester and the Western Railroad, but Whistler is credited with most of the design of the Western line, including a series of ten masonry arch bridges, several of which provided clear prototypes for the Keene bridge. These are large, single-span stone vaults, some spanning about sixty feet and rising to heights of 67 feet. Some have spandrel walls of local shale, somewhat

[40] Brian Solomon, *North American Railroad Bridges* (Saint Paul, Minn.: Voyageur Press, 2008), pp. 16-22.
[41] Eric DeLony, *Landmark American Bridges* (New York: American Society of Civil Engineers, 1993), pp. 10-11.
[42] DeLony, *Landmark American Bridges*, p. 12; Edward T. Galvin, *History of Canton Junction* (N.p.: by the author, 1987).

irregularly coursed, and others have spandrels of split granite comparable to the masonry of the Keene bridge and other structures on the line of the Cheshire Railroad.[43]

A comparison of the Whistler bridges and the Keene arch reveals differences as well as similarities. All the single-span Whistler bridges utilize segmental or semicircular stilted arches supported on vertical sidewalls of varying heights. As might be expected of structures built in rugged terrain, the somewhat earlier Whistler bridges are less symmetrical than the Keene bridge, never displaying the same detail on all four quadrants. Whistler Bridges 3, 4, and 5 are all built with vaults of split granite voussoirs, but have spandrel walls composed of roughly coursed local shale. Among the single-span Whistler bridges, only Bancroft Bridge in Middlefield, Massachusetts (spanning a highway and an adjoining stream) has coursed granite spandrels.

In comparison with the Whistler bridges, the Keene bridge is completely symmetrical in the shapes of its wing walls, and its masonry has a greater degree of finish. The Keene span displays excellent workmanship, an attribute that may result from its proximity to the quarry that supplied the granite. Its large voussoirs (the stones that form the barrel of the vault) and the stones that form its spandrel walls and wing walls are all hand-hammered to create smooth joints, yet are deliberately left with rough faces to enhance the sense of massive ruggedness in the huge structure. The spandrel walls between the vault ring and the piers are composed of coursed granite ashlar. The courses of the spandrels and the piers are aligned, and vary in depth from 24 inches at the bottom of the bridge to 18 to 20 inches at the top, beneath the wall coping, thereby enhancing a perception of stability and height of the structure. In all respects, the Keene bridge is more symmetrical and more highly finished and architectonic than its Massachusetts predecessors. It represents a major accomplishment in railway arches at a period when such arches were soon destined to be eclipsed by wood, and later metal, truss bridges, which would retain their dominance for much of the last half of the nineteenth century.

The early date of the Keene bridge, its design by an eminent early railroad engineer, and its aesthetic refinement and perfection of workmanship all identify the Keene stone arch bridge as significant at the local, statewide, and national levels of significance.

Developmental history/additional historic context information (if appropriate)

Stone arch bridges of any type were rare in New Hampshire before the 1830s, and were not common even during that decade. As shown below, the origin of stone arch highway bridges in New Hampshire, and presumably elsewhere in New England, can often be traced to the knowledge and experience of civil engineers who were employed during the 1830s in the textile manufacturing centers of New England. In such places, engineers had been challenged to construct canals, headraces, tailraces, and other structures of stone, which often took the form of stone arches and vaults extending beneath brick factory buildings. Preceding the advent of railroad construction, these substantial works connected with waterpower engineering provided the earliest opportunities in New England for the construction of arches and vaults of a substantial nature, paving the way

[43] For documentation of the Whistler bridges on the Western Railroad (later part of the Boston and Albany system), see "Middlefield-Becket Stone Arch Railroad Bridge District," Hampden County, Massachusetts; National Register of Historic Places #80000502; and the following Historic American Engineering Record [HAER] files: HAER MA-154 (Whistler Bridge No. 3, Becket, Berkshire County, MA); HAER MA-155 (Whistler Bridge No. 4, Becket, Berkshire County, MA); HAER MA-156 (Whistler Bridge No. 5, Becket, Berkshire County, MA); HAER MA-158 (Double Arch Bridge, Chester, Hampden County, MA); and HAER MA-161 (Bancroft Bridge, Middlefield, Hampshire County, MA). For a contemporary description of some of these bridges, see William Guild, *A Chart and Description of the Boston and Worcester and Western Railroads . . .* (Boston: Bradbury and Guild, 1847). For a popular modern account of the Whistler bridges, see Brian Solomon, *North American Railroad Bridges* (St. Paul, Minn.: Voyageur Press, 2008), pp. 16-22.

for highway bridges of similar construction and, soon thereafter, for railroad bridges of an even more substantial scale.

The stone arch structures that preceded the advent of railroad construction in New Hampshire, circa 1840, were municipal highway bridges that were constructed in scattered sections of the state, but concentrated in the Contoocook River Valley and the vicinity of Keene. Once railroad corporations adopted the granite arch as a permanent method of bridge and culvert construction, they typically invested much more capital in these structures than had New Hampshire towns when building arched highway bridges. The result was stone construction of a more massive and finished character, and often of more complex geometry, than the simpler semicircular or segmental highway bridges that had preceded the arrival of railroad construction.
The first of the arched stone bridges in the Contoocook River Valley was a twin-arched span built in Henniker in 1835 at the site of a wooden bridge that already had stone abutments and a stone central pier. This was reputed to be the first double-arched stone bridge built in New Hampshire. An earlier arched bridge, or rather an arched opening through a high stone causeway, had been built at High Bridge in New Ipswich in 1819. A smaller, single arched span was built at Troy, New Hampshire, in 1835, simultaneously with the Henniker bridge. The Henniker bridge was damaged by floods in 1936 and destroyed by the hurricane of 1938.

The new consideration of split granite for bridge construction in the 1830s was probably due to the introduction about 1830 of the plug drill and the plug-and-feathers method of splitting stone. This technique involved the drilling of cylindrical holes in granite, and the insertion of a wedge and two tapered, half-round shims in each hole. The new practice brought more force to bear upon the stone than had an older splitting method. The earlier method had entailed chiseling a line of shallow slots in the granite and inserting iron wedges in the slots, between sheet metal shims. Introduction of the plug drill permitted larger blocks of granite to be split with greater control than did the older method. The new technique also permitted increased quarrying of granite from ledges of uniform stone, as distinct from the prevalent older practice of splitting erratic boulders of varying geological origins.[44]

Leander W. Cogswell tells of the building of the Henniker bridge in his *History of the Town of Henniker*, published in 1880, forty-five years after the feat was accomplished.[45] According to Cogswell, at a town meeting on November 5, 1832, the selectmen were instructed to investigate the feasibility of building a stone arch over the Contoocook River. "This was the first move made for building a stone bridge with two arches, there having been as yet no such structure, it is said, in the state. . . . After discussing the propriety of building a stone bridge, the town authorized the selectmen to employ an experienced engineer to examine and estimate the probable expense of building a stone bridge, and report to the town in the September following. James Haywood, of Lowell, Mass., was employed, who examined the matter thoroughly, and made a report to the town at the time designated, which report was accepted." At a town meeting on October 27, 1834, the selectmen recommended that the town build such a bridge, and the town responded with an affirmative vote. After a false start when the first chosen contractor was compelled to withdraw his proposal, the bridge contract was awarded to William Smith, who procured the services of Isaac C. Flanders, of Lowell, Mass., as engineer. Cogswell continued:

[44] For a discussion of the two methods of granite splitting, and the rapid replacement of the earlier method around 1830, see James L. Garvin, *A Building History of Northern New England* (Hanover, N. H.: University Press of New England, 2001), pp. 44-47.
[45] Leander W. Cogswell, *History of the Town of Henniker, Merrimack County, New Hampshire*, reprint of the 1880 edition (Somersworth, N. H.: New Hampshire Publishing Company, 1973), pp. 248-253.

> A great deal of curiosity was manifested by the people of this and neighboring towns as the work progressed; and numerous were the prophesies, that when the wooden arches were removed, the whole structure would fall with them. The bridge was completed, and the day set for driving out the key pins, which would let the wooden arches fall. Several hundred people assembled to witness this ceremony, some with anxious faces, but by far the larger part with a perfect confidence. At a given signal from Mr. Flanders, the two pins were driven out, and down came the wooden arches;—but the *bridge did not follow*. Its success was an assured fact, amidst the cheers of the assembled multitude. The "heater" [ice breaker] of the bridge was repaired and made higher in a few years. No material damage was done to the bridge until the severe freshet in the early spring of 1852, when the water forced its way around the north end of it, doing some damage to the stonework, and at one time threatening to sweep away the blacksmith shop at the end of the bridge . . .

From the above, it is clear that New Hampshire community leaders were becoming aware of the potential to construct arched stone bridges at least as early as 1832, when the first inquiries were made in Henniker about such a bridge. It is perhaps significant that, also in 1832, a town committee in Gilsum, near Keene, made a recommendation "in favour of building a stone arch bridge" in that town, though their recommendation was not fulfilled until the 1860s.[46]

Research has thus far not disclosed the professional qualifications or the accomplishments of engineer James Haywood of Lowell, Massachusetts, who provided the first analysis of the feasibility of constructing the bridge at Henniker. The identity of Isaac C. Flanders, who served as master builder or superintendent for the actual construction of the bridge in 1835, is more certain. Isaac Colby Flanders was born in Warner, New Hampshire, on February 26, 1805.[47] He was living in Lowell, Massachusetts, in 1834.[48] Although Flanders was still described as "of Lowell" in 1835, when he was employed to supervise construction of the Henniker stone bridge, he was living in Manchester, New Hampshire, a year later, when his first child was born on March 7, 1836.[49] The 1844 Manchester Town Directory lists Flanders as a stone mason, living on Hanover Street. By 1852, the directory lists Flanders as a railroad contractor, living on Chestnut Street. Flanders died in Warner, his birthplace, on August 7, 1882, at the age of seventy-seven. His obituary in the *Concord Daily Monitor* noted that "Mr. Flanders was a native of Warner, but went to Manchester quite early in life, and continued to reside there until within about 12 years." He was buried in Manchester.[50]

The new Henniker bridge soon received favorable notice in the press. The first volume of Isaac Hill's *The Farmer's Monthly Visitor*, published in Concord, New Hampshire, in 1839, included the following description. This account was reprinted in the *New-Hampshire Sentinel* of Keene on November 13, 1839.

Granite Roads and Bridges

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[46] Sylvanus Hayward, *History of the Town of Gilsum, New Hampshire, from 1752 to 1879* (Manchester, N. H.: John B. Clarke for the author, 1881), p. 59.

[47] Microfilm town records, Warner, New Hampshire, New Hampshire State Library, Vol. I, p. 368; Edith Flanders Dunbar, *The Flanders Family From Europe to America* (Rutland, Vt.: Tuttle Publishing Company, Inc., 1935), pp. 339-40, 414.

[48] Dunbar, *The Flanders Family*, p. 414; *Vital Records of Lowell, Massachusetts to the End of the Year 1849* (Salem, Mass.: The Essex Institute, 1930), Vol. II—Marriages, p. 308.

[49] Dunbar, *The Flanders Family*, pp. 414-15.

[50] *Concord Daily Monitor*, August 8, 1882.

> . . . That most valuable of all kinds of rock, the Granite, which is the foundation and superstructure of the majestic mountain Monadnock, and which is as easily rived as a log of oak or maple, is now extensively used in the construction of bridges and causeways. Arches over the Contoocook and other considerable streams are constructed of pure split granite, which fixed on a foundation of the same material will stand forever. The splendid bridge erected two or three years ago by the town of Henniker which cost about $3300, and is actually worth much beyond that sum, has been already noticed in the [Farmer's Monthly] Visitor. Another granite arched bridge over a branch of the Contoocook running from the north, was erecting when we passed, the expense of which paid in cash by the town was from seven to eight hundred dollars. We are glad that our fellow citizens of Henniker are abundantly able to build and support these noble structures: such a generous public sprit as they evince richly merits and is generally acc[o]mpanied by such prosperity as attends them. The town of Hillsborough, in imitation of its sister on the river below, is also completing the structure of a beautiful arched granite bridge over the main river at the village denominated Hillsborough Bridge.[51]

The earlier reference to the Henniker bridge had appeared in *The Farmer's Monthly Visitor* in April, 1839:

> Another improvement evincing the generous enterprise of an interior town of New Hampshire, is the beautiful granite bridge thrown over the Contoocook in two arches at Henniker village: this bridge which in some situations would have cost ten times as much, was constructed by the town of Henniker about three years ago at an expense of 3,300 dollars. Like the stones of the temple of Solomon, the stones of this bridge were all measured and numbered at the quarries from which they were taken, and every one suited to its place. . . . The granite bridge was proof against the late violent freshet, although it had to encounter an immense weight of ice and water, proving that undermining only can destroy it . . ."[52]

As noted in *The Farmer's Monthly Visitor*, Hillsborough was preparing its first stone bridge in 1839. Charles James Smith's *Annals of the Town of Hillsborough* (1841) describes the evolution of this bridge:

> The first bridge over the Contoocook River built in Hillsborough, was erected of wood in 1779, on the site of the present stone bridge, and was reconstructed in 1796. Daniel McNeil was employed by the town, as architect to rebuild the same in 1809. The town deeming it advisable to have a bridge of more substantial material; constructed in 1824 a bridge of split stone, excepting forty feet in the middle which was built of wood. Mr. Squires F. Clement,

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[51] *The Farmer's Monthly Visitor*, p. 157.

[52] *The Farmer's Monthly Visitor*, April 15, 1839, p. 56. The same issue of *The Farmer's Monthly Visitor* describes the granite fence posts that are still seen along the old Franklin Pierce Highway east of Henniker village: "An economical mode of constructing fences, worthy [of] the attention of all farmers in the vicinity of granite quarries, is pursued by the enterprising citizens of Henniker. The Henniker granite, although not as perfect as that drawn from the bosom of our own Rattlesnake [Hill], near the banks of the Merrimack, being mixed with siennite, is rived even more easily than the pure granite. Posts from the rock are split with scarcely less facility than from logs of wood. These are readily drilled for the reception of a wooden plug, into which ordinary boards are nailed. These boards or slabs from ten to twelve inches in width fastened transversely to uprights of granite will make the best of fence. The stone posts, once procured, will always remain and fence thus constructed after continuing good for many years can be easily renewed at a trifling expense. So quick is the growth of the sapling pine that a new wood will grow up while wood of the old fence is consuming." (*Farmer's Monthly Visitor*, April 15, 1839, p. 56)

supervised this work. In 1839, this bridge was elevated five feet, with a new stone railing, and the present elegant granite arch substituted in lieu of the wood work of the former bridge. Messrs. Reed and Thompson of Keene were the contractors.[53]

Since "Reed and Thompson" of Keene are credited with building the first arched bridge in Hillsborough, it is worth noting that by 1839, Keene, too, was investing in substantial arched stone highway bridges. Keene voted in March, 1839, to use $3,300 of its federal surplus revenues, distributed to New Hampshire towns in 1837, to pay for the construction of arched stone bridges.[54] A four-arched stone bridge on South Main Street opened on November 2, 1839, costing the town about $2,100.[55] This bridge has been replaced. A two-arched bridge was built on Court Street in 1840, and remains in place, though bypassed.[56]

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[53] On May 5, 1893, the east retaining wall of the original arched bridge failed due to a combination of frost action and high water. Engineers condemned the original vault of 1839 and the town voted to replace the bridge with a second arched stone span at a special town meeting of June 3, 1893. The firm of Ward and Douglass of Barre, Vermont, were low bidders. Upon disassembling the old bridge, the contractors discovered that the canal under the southern causeway, supplying Contoocook Mills, was unsound. The canal and adjacent ledge were removed and reconstructed, with part of the cost shared by the mills. The entire arch and causeway south of the arch were rebuilt at a total project cost of $24,320.14. In the spring of 1902, part of the northern causeway leading to the rebuilt arch also failed. It was rebuilt by the same contractors, Ward and Douglass, at a contract price of $16,513.33, paid in two fiscal years. See *Annual Reports of the Town of Hillsborough* for the fiscal years ending February 15, 1894, February 15, 1903, and February 15, 1904.

[54] *New-Hampshire Sentinel*, October 23, 1839. The town of Pelham, New Hampshire, likewise voted in 1837 to use its federal surplus revenues to construct arched stone bridges, building three such spans between 1837 and 1840.

[55] *New-Hampshire Sentinel*, October 23, 1839; *The Repertory* (Keene, N.H.: Repertory Publishing Company), Vol. I, No. 12 (November 1925), p. 587.

[56] *The Repertory* (Keene, N.H.: Repertory Publishing Company), Vol. II, No. 3 (June 1927), p. 125. In an article on stone arched bridges, historian David Proper of Keene stated that "the name of George Benjamin Hall has been associated with construction of this bridge. Born in Keene in 1822, Hall was a resident of New Hampshire and also of western Massachusetts towns, including Orange, Athol, Wendell and Irving, where he died at the age of 80. Family tradition links him to stone masonry and bridge building. His body was returned to Keene for burial in November 1902." David Proper, "For decades, bridges stood over troubled water," *The Keene Sentinel*, March 28, 2006.

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-----. "Lincoln never did stay here, but Keene man rented his home" [Lucian Tilton]. *The Keene Sentinel*, February 11, 2003.

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-----. "Iron Railing on Stone Arch Bridge," "The Good Old Days" No. 486, *The Keene Sentinel*, December 10, 1936.

Newspapers:

Stone Arch Bridge — Cheshire, NH
Name of Property — County and State

Cheshire Republican, Keene, N. H.

New-Hampshire Sentinel, Keene, N. H.

The Keene Sentinel, Keene, N. H.

Previous documentation on file (NPS):

___ preliminary determination of individual listing (36 CFR 67 has been requested)
___ previously listed in the National Register
___ previously determined eligible by the National Register
___ designated a National Historic Landmark
___ recorded by Historic American Buildings Survey #_____
___ recorded by Historic American Engineering Record #_____
___ recorded by Historic American Landscape Survey #_____

Primary location of additional data:

X State Historic Preservation Office
X Other State agency
___ Federal agency
X Local government
___ University
___ Other
Name of repository: _____

Historic Resources Survey Number (if assigned): KEE0182

10. Geographical Data

Acreage of Property Less than one acre
(Do not include previously listed resource acreage.)

UTM References
(Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing		Zone	Easting	Northing
1	18	724194	4754712	3			
2				4			

Verbal Boundary Description (Describe the boundaries of the property.)

Please see sketch map.

Boundary Justification (Explain why the boundaries were selected.) The selected boundaries incorporate the stone structure of the bridge, including the wing walls buried in the fill of the causeway to the north and south, because this nomination pertains to the stone structure only.

11. Form Prepared By

name/title James L. Garvin
organization _____ date March 27, 2012
street & number 30 South Main Street, Bldg. 1, Suite 201 telephone 603-856-4871
city or town Concord state NH zip code 03301

Stone Arch Bridge — Cheshire, NH
Name of Property — County and State

e-mail james@jamesgarvin.net

Additional Documentation

Submit the following items with the completed form:

- **Maps:** A **USGS map** (7.5 or 15 minute series) indicating the property's location.

  A **Sketch map** for historic districts and properties having large acreage or numerous resources. Key all photographs to this map.

- **Continuation Sheets**

- **Additional items:** (Check with the SHPO or FPO for any additional items.)

Photographs:

Submit clear and descriptive photographs. The size of each image must be 1600x1200 pixels at 300 ppi (pixels per inch) or larger. Key all photographs to the sketch map.

Name of Property: Stone Arch Railroad Bridge

City or Vicinity: South Keene

County: Cheshire State: New Hampshire

Photographer: Peter Michaud

Date Photographed: April 1, 2012

Description of Photograph(s) and number:

1 of 4. Keene Stone Railroad Arch Bridge, view from the northeast, near New Hampshire Route 101, showing a broadside view of the eastern side of the bridge.

2 of 4. Keene Stone Railroad Arch Bridge, view from the northwest, taken from the northern bank of the Branch River, showing the soffit of the vault, the nine-foot-wide buttresses, and the curved wing walls of the bridge.

3 of 4. Keene Stone Railroad Arch Bridge, view from the south beneath the vault of the bridge, showing the voussoirs of the vault, the curved wing walls of the bridge, and the granite stream bank armoring placed upstream (right) and downstream of the wing walls.

4 of 4. Keene Stone Railroad Arch Bridge, view from the south, facing north-northeast, showing the curved wing wall of the northwest quadrant of the bridge, the granite stream bank armoring placed downstream of the wing wall, and (behind the armoring) the voussoirs of a relieving arch built into the face of the straight rear portion of the wing wall.

Property Owner:

(Complete this item at the request of the SHPO or FPO.)

name Bureau of Rail and Transit, New Hampshire Department of Transportation

Stone Arch Bridge
Name of Property

Cheshire, NH
County and State

street & number 7 Hazen Drive telephone 603-271-2468

city or town Concord state NH zip code 03301

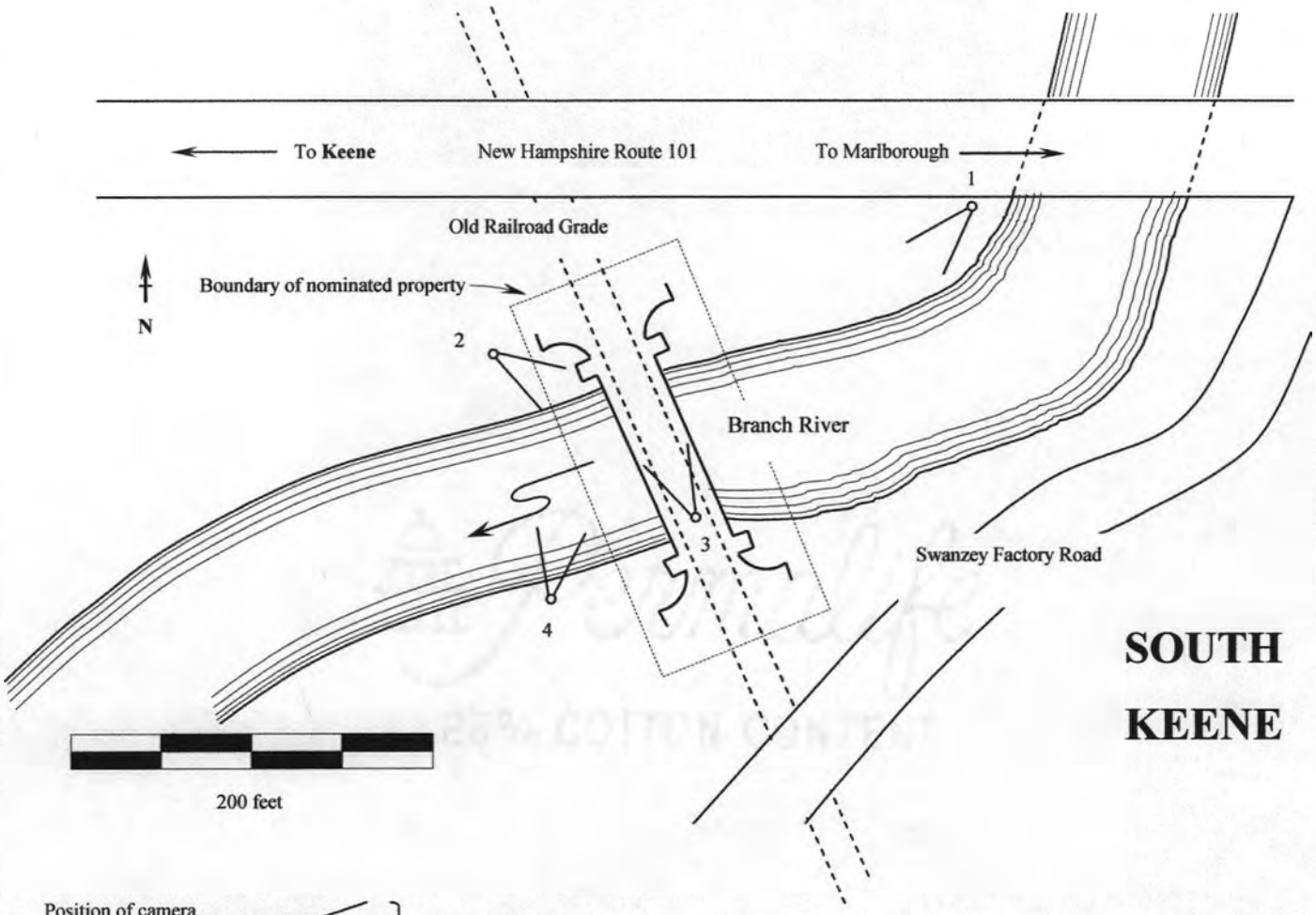
Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C.460 et seq.).
Estimated Burden Statement: Public reporting burden for this form is estimated to average 18 hours per response including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Office of Planning and Performance Management. U.S. Dept. of the Interior, 1849 C. Street, NW, Washington, DC.

Stone Arch Bridge
Name of Property

Cheshire, NH
County and State

United States Department of the Interior
National Park Service

Sketch Map with Photograph Key



Position of camera and photo number → Range of view

KEY TO PHOTOGRAPHS

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES
EVALUATION/RETURN SHEET

REQUESTED ACTION: NOMINATION

PROPERTY NAME: Stone Arch Bridge

MULTIPLE NAME:

STATE & COUNTY: NEW HAMPSHIRE, Cheshire

DATE RECEIVED: 6/29/12 DATE OF PENDING LIST: 7/27/12
DATE OF 16TH DAY: 8/10/12 DATE OF 45TH DAY: 8/15/12
DATE OF WEEKLY LIST:

REFERENCE NUMBER: 12000504

REASONS FOR REVIEW:

APPEAL:	N	DATA PROBLEM:	N	LANDSCAPE:	N	LESS THAN 50 YEARS:	N
OTHER:	N	PDIL:	N	PERIOD:	N	PROGRAM UNAPPROVED:	N
REQUEST:	N	SAMPLE:	N	SLR DRAFT:	N	NATIONAL:	N

COMMENT WAIVER: N

√ ACCEPT ___ RETURN ___ REJECT 9.14.12 DATE

ABSTRACT/SUMMARY COMMENTS:

Entered in
The National Register
of
Historic Places

RECOM./CRITERIA_____

REVIEWER_____ DISCIPLINE_____

TELEPHONE_____ DATE_____

DOCUMENTATION see attached comments Y/N see attached SLR Y/N

If a nomination is returned to the nominating authority, the nomination is no longer under consideration by the NPS.

Stone Arch Bridge
Cheshire County - NH
1 of 4

Stone Arch Bridge
Cheshire County, NH
2 OF 4

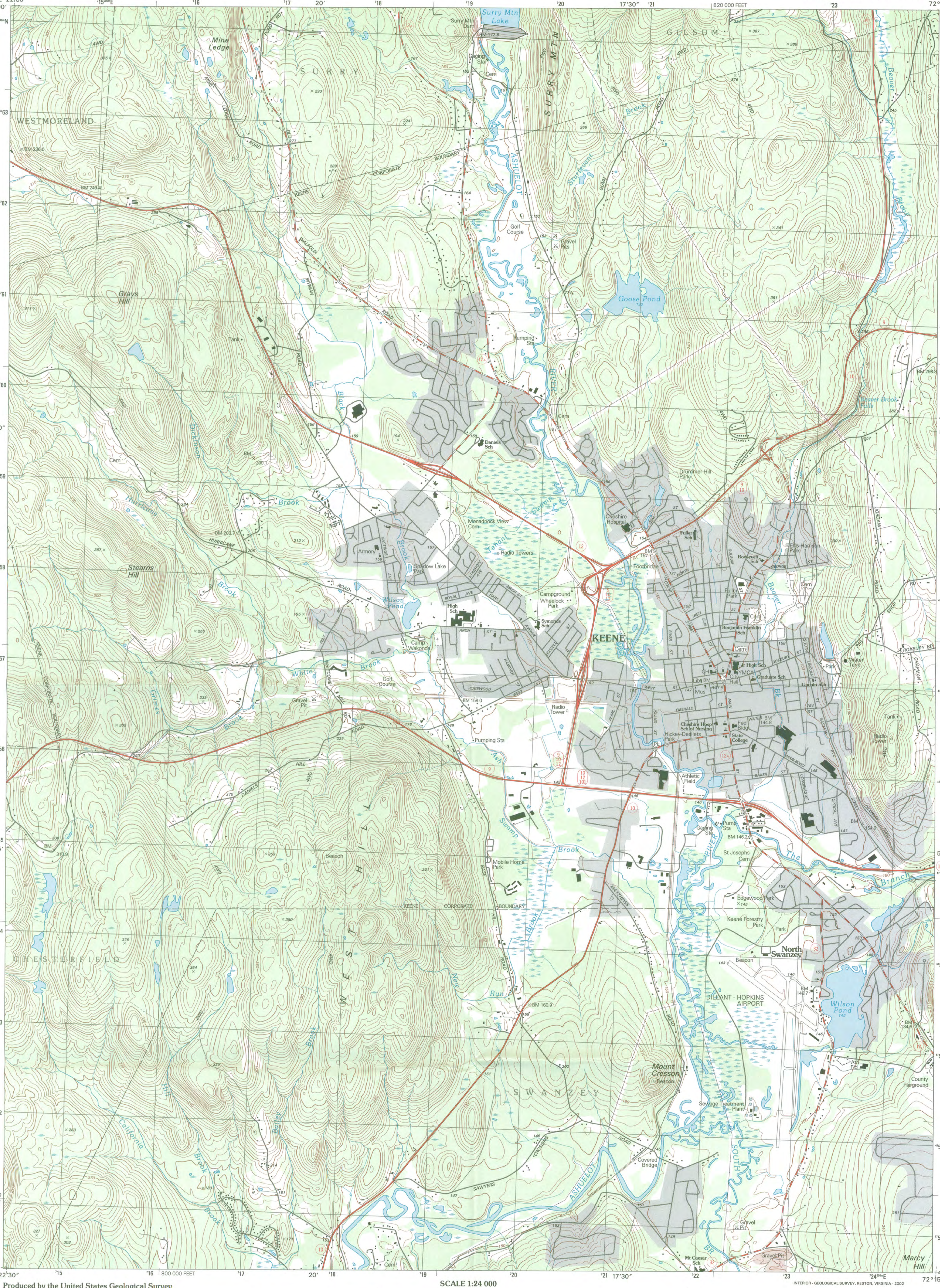
Stone Arch Bridge
Cheshire County, NH
3 of 4

Stone Arch Bridge
Cheshire County, NH
4 OF 4

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

KEENE QUADRANGLE
NEW HAMPSHIRE-CHESHIRE CO.
7.5-MINUTE SERIES (TOPOGRAPHIC)



INTERIOR - GEOLOGICAL SURVEY, RESTON, VIRGINIA - 2002

Stone Arch Bridge
mm 89.41 over
Branch River,
Keene, N.H. 03431
UTM Zone: 18
E: 724194
N: 4754712

Produced by the United States Geological Survey

Topography compiled 1998. Planimetry derived from imagery taken 1998 and other sources. Survey control current as of 1980
Boundaries current as of 2001

North American Datum of 1983 (NAD 83). Projection and 1 000-meter grid: Universal Transverse Mercator, zone 18
10 000-foot ticks: New Hampshire Coordinate System of 1983

North American Datum of 1927 (NAD 27) is shown by dashed corner ticks. The values of the shift between NAD 83 and NAD 27 for 7.5-minute intersections are obtainable from National Geodetic Survey NADCON software

There may be private inholdings within the boundaries of the National or State reservations shown on this map

Houses of worship, schools, and other labeled buildings verified 1980

MN GN
15½° 276 MILS
1° 50' 33 MILS

UTM GRID AND 2001 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

20% TOTAL RECOVERED FIBER

SCALE 1:24 000

KILOMETERS 1 0.5 0 1 2
METERS 1000 0 1000 2000
MILES 1 0.5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 6 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
(TO CONVERT ELEVATIONS TO THE NORTH AMERICAN VERTICAL DATUM OF 1988, SUBTRACT 1 FOOT)
TO CONVERT FROM METERS TO FEET, MULTIPLY BY 3.2808

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, P.O. BOX 25286, DENVER, COLORADO 80225
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

NH
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Walpole
2 Gilsum
3 Marlow
4 Spofford
5 Marlborough
6 Hinsdale
7 West Swanzey
8 Troy

ADJOINING 7.5' QUADRANGLES

ROAD CLASSIFICATION

Primary highway hard surface ....
Secondary highway hard surface ....
Light-duty road, hard or improved surface ......
Unimproved road ......

Interstate Route   U.S. Route   State Route

KEENE, NH
1998
NIMA 6569 IV NE-SERIES V812

ISBN 0-607-96732-3