NPS Form 10-900
(Rev. 8-86)

OMB No. 1024-0018

United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES
REGISTRATION FORM

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1. Name of Property

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historic name: N/A

other name/site number: **PINE CREEK PARK BRIDGE; Mill Hill Road Bridge**

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2. Location

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street & number: North of Old Dam Road, over Pine Creek

not for publication: N/A

city/town: Fairfield vicinity: N/A

state: CT county: Fairfield code: 001 zip code: 06430

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3. Classification

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Ownership of Property: public-local

Category of Property: structure

Number of Resources within Property:

Contributing	Noncontributing	
		buildings
		sites
1	0	structures
		objects
1	0	Total

Number of contributing resources previously listed in the National Register: 0

Name of related multiple property listing: N/A

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1986, as amended, I hereby certify that this X 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 X meets ____ does not meet the National Register Criteria. ____ See cont. sheet.

[signature] February 19, 1992

Signature of certifying official — Date

Director, Connecticut Historical Commission

State or Federal agency and bureau

In my opinion, the property ____ meets ____ does not meet the National Register criteria. ____ See continuation sheet.

Signature of commenting or other official — Date

State or Federal agency and bureau

5. National Park Service Certification

I, hereby certify that this property is:

✓ entered in the National Register ___ See continuation sheet.	[signature]	4/8/92
____ determined eligible for the National Register ___ See continuation sheet.		
____ determined not eligible for the National Register		
____ removed from the National Register		
____ other (explain): ____		

for Signature of Keeper — Date of Action

6. Function or Use

Historic:	TRANSPORTATION	Sub:	rail-related
	TRANSPORTATION		road-related
Current:	TRANSPORTATION	Sub:	pedestrian-related

7. Description

Architectural Classification:

other: Pratt pony truss

Other Description: Keystone column construction

Materials: foundation N/A roof N/A
walls N/A other METAL: Iron

Describe present and historic physical appearance. X See continuation sheet.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties: national.

Applicable National Register Criteria: A, C

Criteria Considerations (Exceptions) : B

Areas of Significance: ENGINEERING
TRANSPORTATION

Period(s) of Significance: 1870-95

Significant Dates: 1872, 1890

Significant Person(s): N/A

Cultural Affiliation: N/A

Architect/Builder: J.H. Linville, engineer
Keystone Bridge Company, fabricator

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.
X See continuation sheet.

Pine Creek Park Bridge (Photographs 1 and 2) is a small wrought-iron, pin-connected pony truss located on a causeway crossing Pine Creek in Fairfield, Connecticut. The bridge uses the Pratt-truss pattern, with its 54' length divided into nine panels of equal length (Photograph 3). Originally fabricated in the period 1870-1872, the bridge has as its vertical members and inclined end posts the Keystone Bridge Company's patented Keystone columns. Keystone columns are octagonal-section members made up of four pieces of rolled iron; on four sides, the pieces are flanged and riveted together, using spool-like spacers that create a gap. Because the spacers vary in length, the gap is widest at the midpoint of the column, thus creating a member that is thickest in section at its midpoint. The upper chord is a box girder built up of plates and angles, with the underside stiffened with widely spaced bars. The major diagonals are looped eyebars varying in width from 1 1/2" in the center panel to 1 7/8" at the ends. The bridge has a full set of counter diagonals, all tie rods with turnbuckles, that increase in thickness toward the center of the bridge. The lower chord consists of a double chain of 5"-wide forged eyebars. The truss measures 6 1/2' in depth.

The pins used to connect the members at the upper and lower chords are 3" and 3 1/2" in diameter, respectively. Because of the use of the Keystone columns, specialized cast-iron junction boxes are used at the portal joints, bearing ends, and lower panel points (Photograph 4). The columns join the upper chord's box girder by means of a connector consisting of series of riveted plates and angles (Photograph 5). The present floor system, a wood-plank deck carried on I-beam stringers and floor beams, dates from 1890. The present hanger bars that support the beams from the lower-chord castings (Photograph 6) probably represent remnants of the original arrangement. Sway bracing was added to the outside of the bridge running between outriggers riveted to the floor beams and four of the upper joints.

The bridge is located is an undeveloped conservation area in the marshy area where Pine Creek empties into Long Island Sound. The flow is currently carried through large culverts in the causeway, though water appears to flow under the bridge at times of flooding. The bridge's abutments are of poured concrete and were constructed in 1979 when the bridge was moved, in one piece, from its former location on Mill Hill Road in Fairfield, about 1 1/2 miles away, where it crossed the tracks of Metro North Commuter Railroad. Although it carried Mill Hill Road across the tracks for nearly 90 years, that was not its original location: prior to its re-erection for highway use in 1890, it had been an approach span to a railroad drawbridge across the Connecticut

River in Middletown.[1] Along with another identical 54' approach, the present span was replaced in 1888, making the trusses available for re-use. Although the width of the bridge was increased from 16' to 25', no alterations were made except for a new floor system. The bridge's mate was also re-erected for highway use on nearby Black Rock Turnpike;[2] it has since been demolished.

NOTES

1. Although the re-erection drawings of 1890 describe the truss as "old," they do not specifically cite its former location. However, a verbal description of the Middletown drawbridge's approach spans exactly matches this bridge in dimensions (54' long by 6 1/2' in depth) as well as components (Keystone column "struts," diagonal "ties," and lower-chord "links"). Given that the railroad removed both approach spans from the Middletown bridge in 1888 and erected two such spans at adjacent locations in Fairfield in 1890, no other explanation seems reasonable. See Connecticut Railroad Commissioners, Annual Report, 1872, p. 35, and Annual Report, 1888, p. 20.

2. For a description of the Black Rock Turnpike overpass, see Matthew Roth, Connecticut: An Inventory of Historic Engineering and Industrial Sites (Washington, 1981), 29; both bridges are given the railroad's date of 1890.

Summary

Pine Creek Park Bridge is significant in the history of engineering because it is an extremely rare specimen from the early days of metal-truss construction in America (Criterion C). The bridge is built with patented uprights and specialized cast-iron connectors that were unique to its fabricator, the Keystone Bridge Company of Pittsburgh, Pennsylvania. Such idiosyncratic elements, as well as the bridge's wrought and cast-iron materials and its use of pinned connections, are characteristic of the period, a time when bridge design was in its infancy. Keystone Bridge Company's president and chief engineer, Jacob Hays Linville, was one of the greatest bridge engineers of his day. He is credited with introducing the use of wide forged eye-bars, such as those that make up the lower chord of this bridge; designing the first long-span truss in America, the 320' Steubenville, Ohio, railroad bridge, completed in 1864; and designing the first truss over 500' in length. Although the Pine Creek Park Bridge is only a minor structure in comparison, it is one of only a half-dozen or fewer bridges by Linville that survive.[1] It was built in 1870-1872 as an approach span to a railroad drawbridge in Middletown, Connecticut, re-used in Fairfield as a highway overpass by the New Haven Railroad in 1890, and moved again in 1979 to its present location on a trail in a salt-marsh conservation area.

Engineering Significance

Pine Creek Park Bridge typifies the bridge building of the immediate post-Civil War period in several respects. Prior to this period, most of the few metal-truss bridges that had been built used cast-iron members for their compression members. Because of the material's brittleness, cast iron was subject to failure from unanticipated stresses, and engineers sought ways to substitute wrought iron, which had far greater tensile strength, for the cast-iron columns then in use. One important innovation in this direction was the Keystone column, first employed by J. H. Linville in a bridge he designed in 1863. Built up of rolled wrought-iron segments, the Keystone column resembled cast-iron columns of the period in that it was thicker in the middle, a possible advantage in resisting torsional forces. The keystone column's advocates also claimed an advantage in that interior corrosion could be detected during inspection, and the column simplified design in some bridges (not this one) because diagonal members could be routed through the gap, rather than using special midpoint connectors. Probably its greatest advantage was that it distinguished the products of the Keystone Bridge Company from those of

its competitors. In an age when fabricating companies were first emerging, most companies had some distinctive truss profile or special member which it could use in marketing its bridges. In addition to creating one of the first all-wrought-iron bridges (of necessity, cast-iron was retained as the only feasible way of connecting such odd-shaped members), the Keystone column is significant as a proprietary design that was typical of the early years of bridge engineering.

The bridge's use of pins to connect its components is another distinguishing characteristic of the period's bridges. Although the alternative, riveted connections, provided greater rigidity, American engineers favored pinned connections through the early 1890s. Pinned bridges were much easier to erect, at least until field riveting became more commonly available, and it was claimed that pinned connections transmitted forces better than the more rigid riveted joints. By 1900 pinned connections had disappeared for all but the largest trusses. At the same time, steel had totally superseded wrought iron in bridge construction.

J. H. Linville and the Keystone Bridge Company

Jacob Hays Linville (1825-1906) had no formal training in engineering, though his education at Union College (Class of 1848) may have included studies in mathematics and science. Instead, as was typical for the period, he learned engineering on the job, working first as a surveyor for the Army Engineers (predecessor to the Corps of Engineers) and then as an assistant to William H. Wilson in supervising the construction of the Philadelphia, Media and Westchester Railroad. Linville continued as Wilson's assistant when the older man became a resident division engineer for the Pennsylvania Railroad. In 1863, the railroad made Linville its Engineer of Bridges and Buildings.

As the Pennsylvania Railroad's chief bridge engineer, Linville faced the challenge of constructing several large bridges over wide rivers, such as the Ohio and Monongahela, as well as numerous iron replacements for the railroad's older wooden spans. With only his own experience and Haupt's General Theory of Bridge Construction (1851) to help him, Linville designed numerous bridges for the railroad, several of which were among the largest trusses in the country at the time. As part of this work, he had the railroad construct the first machine for testing the strength of full-sized bridge members, which previously had been estimated only through experience or extrapolation from laboratory tests.

In 1864-1865, Linville, along with three other employees of the Pennsylvania Railroad (including Andrew Carnegie), formed the Keystone Bridge Company to manufacture bridges. Linville provided the engineering expertise, Carnegie contributed financial savvy, and the other partners handled marketing and shop supervision. The company also acquired the railroad's testing machine. Since Linville retained his position with the Pennsylvania Railroad, the new company had a ready-made customer, though they quickly expanded by providing large trusses for many other railroads as well. Within ten years' time, the Keystone Bridge Company had built more than twelve linear miles of iron bridges. With its patented columns as a marketing device and its proven record of providing some of the largest railroad bridges in the country (including the 1876 Cincinnati bridge over the Ohio River, the first truss to exceed 500' in length), the Keystone Bridge Company was one of the country's largest fabricators of the 1870s. Eventually, standardization in engineering, as well as an unsuccessful patent dispute with the Phoenix Bridge Works over Phoenix's similar bridge column, caused the company to give up the use of the Keystone column. The company remained an important bridge fabricator, however, and at 50,000 tons annual capacity, its plant was one of the three largest in the country in 1898. Two years later the firm was purchased by the American Bridge Company to form the core of an emerging bridge-fabricating monopoly then being undertaken by J. P. Morgan.

Although he continued to work as a consulting engineer, designing bridges and steel-framed buildings, Linville disassociated himself from the firm in the late 1870s. In the 1880s, he was involved in a series of unsuccessful business ventures which, along with the death of his only child in 1899 and his own failing health, left him rather embittered in his old age. Despite his withdrawal from bridge engineering, Linville's place in history was assured by his pioneering designs for large iron trusses and by his association with one of the country's most important fabricating firms, Keystone Bridge Company.

Historical Background

The Middletown drawbridge, for which this bridge originally served as an approach span, was built by the New Haven, Middletown, and Willimantic Railroad as part of the "Air Line" between Boston and New York. Along with two other large structures, the Lyman and Rapallo viaducts, the bridge reflected the large-scale engineering undertaken by the line; it had a 300' swing span, four 200' spans, and two 54' approaches. In an age when most railroad bridges were still wooden, the Air Line's managers boasted that all of their bridges were either

masonry or iron. However, the line had grossly overspent on construction and declared bankruptcy almost as soon as it opened. Eventually, the line became part of the New Haven Railroad.

The drawbridge's approach spans were replaced in 1888. Along with parts from other old bridges, the railroad re-used the trusses as part its massive upgrading of its New York to New Haven main line. With curve realignment, expansion to four tracks, and elimination of almost all grade crossings, the project required scores of new highway bridges. Today, this bridge is one of two surviving examples of the railroad's re-use of 1870s trusses.

Integrity

The bridge retains its historic significance despite relocation from its original site. The significance of the bridge lies primarily in its intrinsic technology and its value as a rare surviving structure associated with J. H. Linville (Criteria Consideration B). Since the bridge has had few alterations and was moved intact in 1979, it retains all of its historic dimensions and material except for the floor system and width, both of which were changed a hundred years ago when it was re-erected for highway use over the railroad.

NOTES

1. Conversation with Eric DeLony, Chief, Historic American Engineering Record, June, 1991. Connecticut's only other truss from the 1870s is the 1871 Riverside Avenue Bridge. It was built by Keystone Bridge Company but designed by an outside engineer; it uses cast-iron columns for its compression members.

9. Major Bibliographical References

_X_ See continuation sheet.

Previous documentation on file (NPS):

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

Primary Location of Additional Data:

_ State historic preservation office
X Other state agency — Connecticut Dept. of Transportation
_ Federal agency — 24 Wolcott Hill Road
_ Local government — Wethersfield, CT 06109
_ University
_ Other -- Specify Repository: _____

10. Geographical Data

Acreage of Property: less than one

UTM References:	Zone	Easting	Northing		Zone	Easting	Northing
A	18	645780	4553920	B	__	_____	_____
C	__	_____	_____	D	__	_____	_____

___ See continuation sheet.

Verbal Boundary Description: ___ See continuation sheet.
The nominated property includes the bridge and abutments.

Boundary Justification: ___ See continuation sheet.
The boundary includes only the components of the bridge itself.

11. Form Prepared By John Herzan, National Register Coordinator

Name/Title: Bruce Clouette and Matthew Roth

Organization: Historic Resource Consultants Date: June 11, 1991

Street & Number: 55 Van Dyke Avenue Telephone: 203-547-0268

City or Town: Hartford State: CT ZIP: 06106

Bridge drawings, 1890. File 49.42, Engineering Department, Metro North Commuter Railroad, 347 Madison Avenue, New York, New York.

Clouette, Bruce, and Matthew Roth. Connecticut's Historic Highway Bridges. Wethersfield: Connecticut Department of Transportation, 1991.

Connecticut Railroad Commissioners. Annual Report, 1870-1895.

Middletown, Connecticut, 1877. Boston: O. H. Bailey, 1877 [bird's-eye view].

Katte, Walter. "Memoir of Jacob Hays Linville." Transactions of the American Society of Civil Engineers, 59 (December 1907): 549-55.

Roth, Matthew. Connecticut: An Inventory of Historic Engineering and Industrial Sites. Washington, D.C.: Society for Industrial Archeology, 1981.

Tyrrell, Henry G. "Whether to Strengthen the Old Bridge or Renew It?" Railroad Gazette, 30 (August 2, 1901), 542.

_____. History of Bridge Engineering. Chicago: G. B. Williams Co., 1911.

NPS Form 10-900-a
(8-86)

OMB Approval No. 1024-0018

United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES
CONTINUATION SHEET

Photograph captions — Pine Creek Park Bridge, Fairfield, Fairfield County, CT — Photos-1

All photographs:

1. Pine Creek Park Bridge
2. Fairfield, Fairfield County, CT
3. Photo Credit: HRC, Hartford, CT
4. April, 1991
5. Negative filed with Connecticut Historical Commission
   Hartford, CT

Captions:

South end, camera facing north
Photograph 1 of 6

West elevation, camera facing northeast
Photograph 2 of 6

Roadway elevation of east truss, camera facing northeast
Photograph 3 of 6

Detail of portal connection, east truss, camera facing northeast
Photograph 4 of 6

Detail of upper joint, east truss, camera facing northeast
Photograph 5 of 6

Detail of lower joint, showing cast-iron connector, 1890 floor beam, and outrigger for sway bracing, east truss, camera facing northwest
Photograph 6 of 6

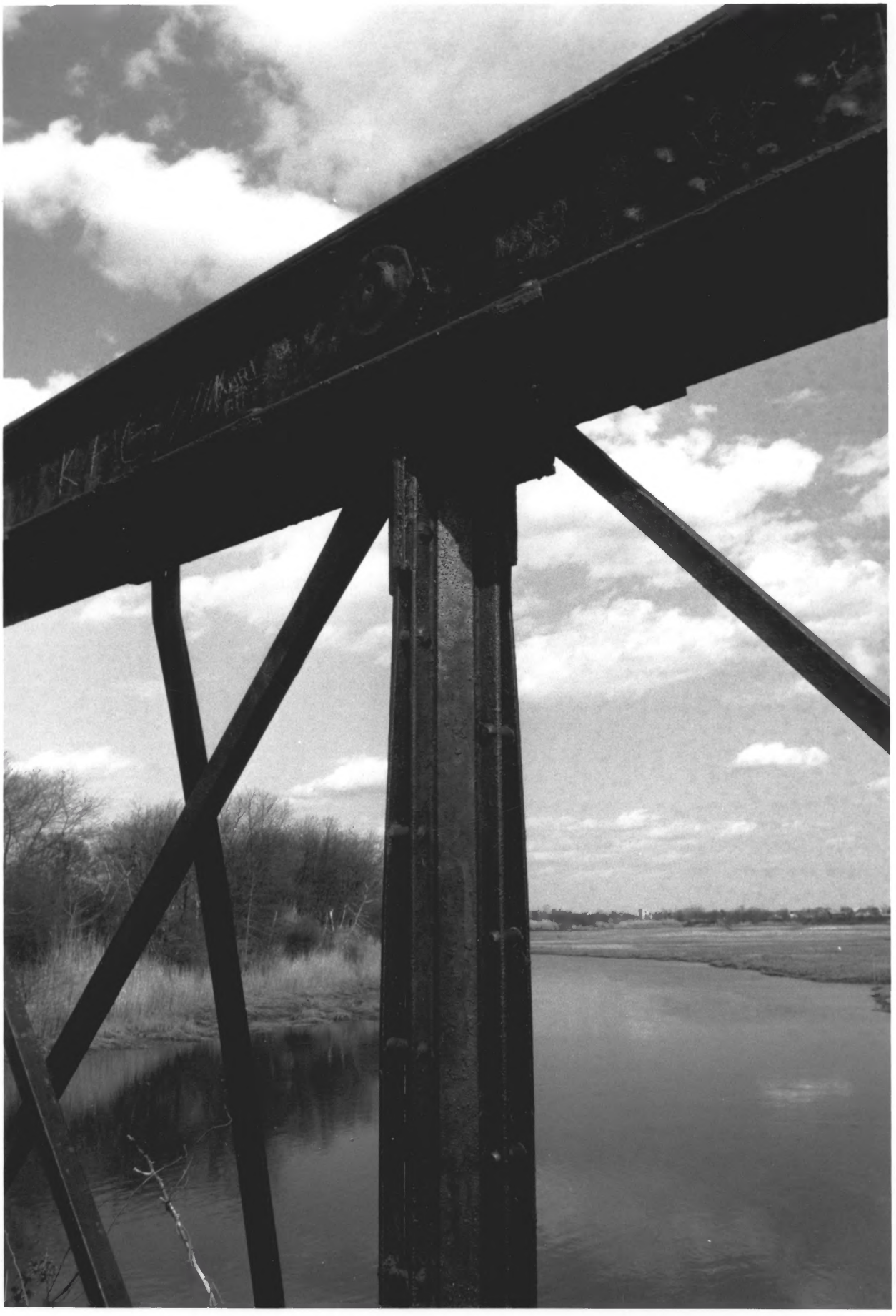
Pine Creek Park Bridge, Fairfield,
Fairfield County, CT

Photo 1 of 6

Pine Creek Park Bridge, FAIRFIED,
Fairfield County, CT
Photo 2 of 6

Pine Creek Park Bridge, Fairfield,
Fair Field County, CT
Photo 3 of 6

Pine Creek Park Bridge, Fairfield,
Fairfield County CT
Photo 4 of 6



Pine Creek Park Bridge, Fairfield,
Fairfield County, CT
Photo 5 of 6

Pine Creek Park Bridge, Fairfield,
Fairfield County CT
Photo 6 of 6