VERMONT'S COVERED BRIDGES

COVERED BRIDGE STUDY

AT

WARREN BRIDGE

BRIDGE NO. 06
FAS HIGHWAY 188

TOWN OF WARREN
WASHINGTON COUNTY

MAY 1995

Prepared for:

THE STATE OF VERMONT
AGENCY OF TRANSPORTATION

Prepared by:

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BINGHAMTON, NEW YORK

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1.0 INTRODUCTION

1.1 Purpose and Objectives

The Vermont Agency of Transportation (VAOT) in a continuing effort to promote public safety and accommodate current and future traffic demands, is developing a long-range plan for the historic covered bridges located throughout the state.

The plan provides bridge specific traffic and structural data to local communities. The communities are then able to make better informed decisions involving repair, rehabilitation, or replacement of their covered bridges relative to both local transportation planning and the overall state transportation network system.

This plan has been prepared by a team effort, led by McFarland-Johnson, Inc. with support from several specialty support people/firms. Appendix E presents a listing of participants and involvement.

It is the objective of the VAOT and the Vermont Agency of Development and Community Affairs Division for Historic Preservation to preserve all covered bridges within Vermont. Many preservation actions are possible. It must be recognized, however, that most of the structures included in this study are currently carrying traffic and remain an important part of a community's transportation system. Therefore, practical options must be identified for consideration.

As a result of this Study, a course of action involving one of the following options will be recommended at each site:

A. Close the structure to vehicular traffic, with traffic diverted to the existing transportation network,

B. Continue use of bridge for light vehicular traffic, with heavier truck traffic diverted to other routes in the local network,

C. Close the structure to traffic and construct an adjacent bypass structure,

D. Rehabilitate the structure to safely support moderate traffic, or

E. Other options, such as moving the existing structure to a nearby preservation site with structure replacement on the existing site.

It must be recognized that this statewide study of a large number of covered bridges has been ongoing for an extended period of time. Accordingly, this report may not

address the latest developments at this particular bridge site, such as accidents, new structural failures, or findings of significance as a result of biennial VAOT bridge inspections.

Since this report deals with a covered bridge, which is a rather unique type of structure, a glossary of technical terms is presented in Appendix F to facilitate the review of this document. The appendix also contains a diagram of various types of truss configurations to further assist the reviewer.

1.2 Bridge Location and History

This study addresses the Warren Covered Bridge, which is located in Washington County in the central portion of the State (Figure 1). In the center of the Town of Warren, within the Village of Warren, the bridge extends across the Mad River on FAS Highway 188.

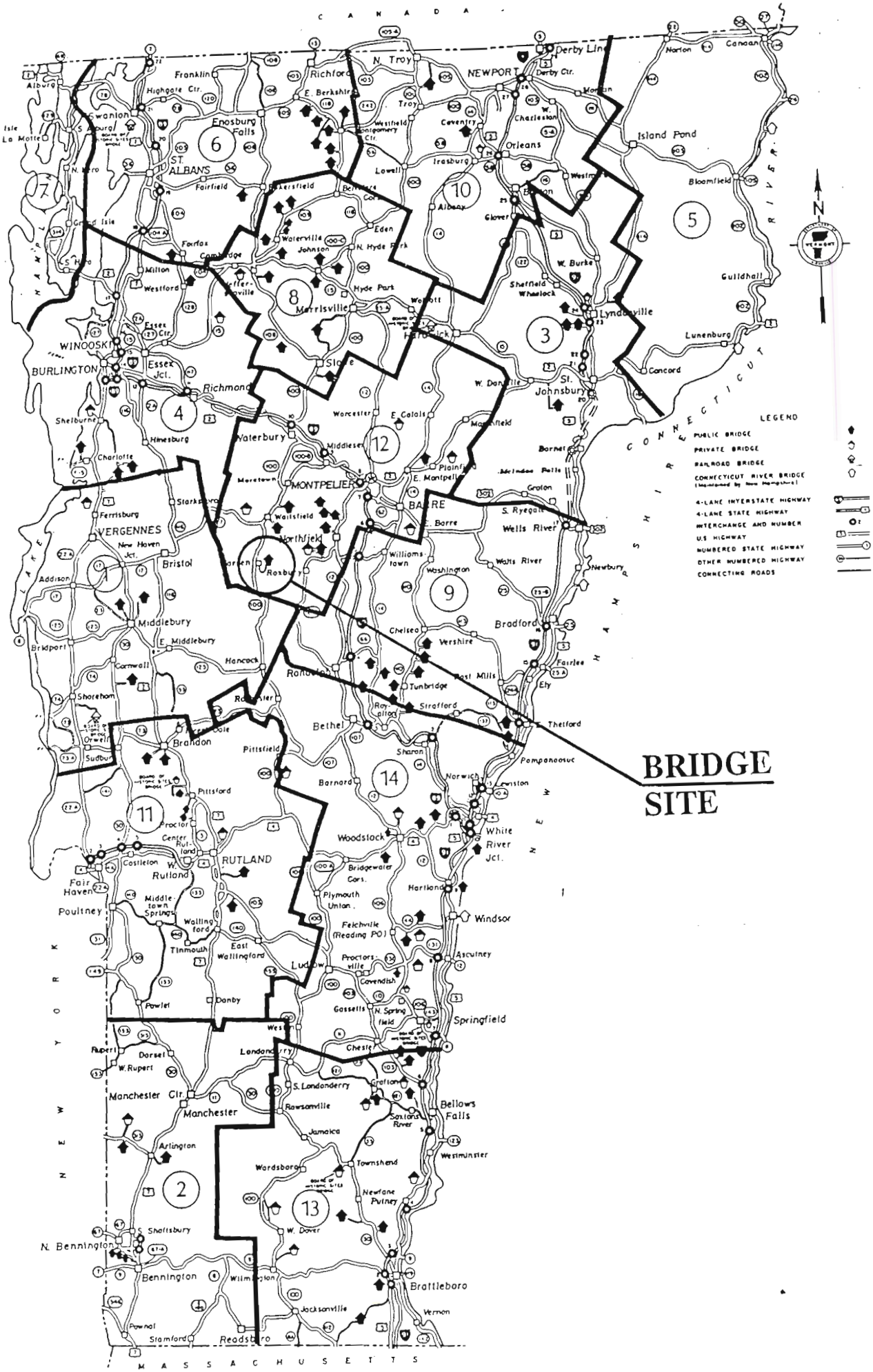
The Warren Covered Bridge was built in 1879-80 by Walter Bagley and is the only covered wooden bridge in the Town of Warren.

The Warren Covered Bridge is currently listed on the National Register of Historic Places. The National Register is a federal program, administered by the National Park Service, which identifies historic resources of national significance. A detailed account of the structure is contained in the "National Register of Historic Places Inventory -Nomination Form" presented in Appendix A.

A summary of the bridge's physical characteristics is provided below.

BRIDGE CHARACTERISTICS

Timber Truss Configuration	Queenpost
Number of Spans	1
Measured Length (End to End)	54.9'
Gable Overhang (Each End)	4'-5"
Measured Horizontal Clearance	13.33'
Measured Vertical Clearance at Truss	10.17'
Measured Vertical Clearance at Center of Bridge	12.75'
Sidewalk Provided	None
Approach Roadway Surface	Asphalt
Load Posting	Missing



VERMONT
COVERED BRIDGES

FIGURE 1

2.0 STUDY METHODOLOGY

2.1 Introduction

The two primary topics involved with this Study are structural needs/capacity and traffic needs/capacity. To obtain the necessary data several techniques were employed. The techniques included site visits, questionnaire surveys, and review of state and federal documents.

For the collection of general data, bridge sites were visited by representatives from the VAOT, McFarland-Johnson, and the Town.

As a service to local communities, the VAOT regularly inspects all publicly owned covered bridges located throughout the State and documents pertinent traffic and structural information. A copy of the July 1992 Bridge Inspection Report, Bridge Inventory, and Estimated Traffic Volumes are presented in Appendix B.

Bridge and traffic survey questionnaires were sent by McFarland-Johnson to community representatives. The bridge survey addressed the physical characteristics of the bridge as well as local financial resources committed to bridge maintenance and repair. The traffic survey addressed existing and proposed land use relative to traffic volume and circulation patterns. Both survey questionnaires are presented in Appendices C and D.

2.2 Structural Evaluation Methodology

A structural evaluation has been performed for the bridge with the goal of determining the suitability of the current bridge load posting. The scope of work for this study does not provide for a thorough structural analysis, due to the complex nature of these types of structures. Accordingly, the investigation focused on the major components of the structure, including floor members and trusses. Also, to further restrict the truss evaluation to the intent of this study, a "plate-girder analogy" type analysis was performed to predict stress conditions for comparison with allowables.

References consulted for this effort included: "Timber Bridges: Design, Construction, Inspection, and Maintenance Specifications", 1990; "Standard Specifications for Highway Bridges (AASHTO)", 1992 edition; and the "National Design Specifications for Wood Construction", 1991 edition. A difficulty arises, however, in attempting to apply contemporary specifications to structural timber milled and graded at the time of the construction of this bridge. Original timber is usually of much better quality than material available today. Therefore, selection of "allowable" stresses are critical to the results of the analytical evaluation.

Contrary to standard practice for more routine evaluations of steel or concrete structural components, no "ratings" of the timber components have been produced. Since Vermont State Statutes limit the load posting of bridges with timber floor components to a maximum of 16,000 pounds for Class 3 highways and 20,000 pounds for Class 2 highways, the

structural evaluation performed for this bridge has been performed for the appropriate weight vehicle. If the structure is currently posted for a lower limit, then the lower limit is also considered in the investigation.

The results of the analysis lead to a comparison of predicted actual stresses with allowable stresses. The conclusion of the analysis is a determination of the suitability of the load posting. If repairs are appropriate that could increase the posted capacity of the structure, then they are included in the recommendations portion of this report.

It should be noted that the analysis has not been altered to account for structural deficiencies due to timber rot or fractures. For purposes of the analysis of this study, it has been assumed that all structural components are in good condition and that necessary structural repairs will be performed by the bridge owner to maintain an acceptable level of service.

2.3 Traffic Evaluation Methodology

The traffic evaluation considered a variety of issues. These issues included site specific characteristics such as existing and projected traffic volumes, type of vehicle, land use, environmental constraints, and local policies toward development. The evaluation process entailed the following:

- Undertake a field review at the bridge site, and make a determination whether detailed traffic counts were required (either 24-hour or intersection peak hour movements). This determination was based on volume of traffic observed, classification of the road approaching the bridge site, and observation of the surrounding land use and potential traffic generators.

- Review survey responses relative to existing and future land use, traffic generators, and bridge specific construction activity. Determine how anticipated land use, within the study area, will impact the existing covered bridge.

- Obtain from the VAOT estimated existing and future traffic volumes, the bridge inspection report, and the bridge inventory list. If the volume of traffic warrants a traffic analysis, define the roadway's quality of traffic operational conditions using the "Highway Capacity Manual Special Report 209" guidelines.

- Draw conclusions from appropriate data and make recommendations.

3.0 STUDY AREA CONSIDERATIONS

3.1 Study Area of Influence

The area of influence for this study was defined as the approximate area encompassed by a one-half mile radius around each bridge.

Figures 2 and 3 depict the location of the Warren Bridge in the central portion of the Town of Warren. Figures 4 and 5 present general photographs of the structure and both approaches.

3.2 Study Area Land Use

3.2.1 Existing Land Use

Two areas in Warren have historically been the sites of intensive land use activity. The Village of Warren is the Town's government and business center and more recently Sugarbush Village which is associated with the Sugarbush Ski Area. The resort has approximately 8,000 commercial lodging beds which, in part, allows for seasonal populations of over 13,000 people.

Agriculture is a significant land use within the Town. Consistent with statewide trends, however, the economic viability of agriculture within the town has declined over the past twenty years. Regardless of this trend, the long term preservation of farmland soils remains a priority for the Town of Warren. Agricultural land preservation techniques include utilization of land trusts, rural residential zoning districts, and tax stabilization contracts.

3.2.2 Existing Zoning

The Town of Warren has zoning regulations (as amended March 1994) and subdivision regulations (as amended March 1991). In December of 1989, the Town's Board of Selectmen adopted a Town Plan.

The Warren Bridge is located within the Historic Residential District R-3. The purpose of the District is to preserve the historic character of Warren Village while providing compatible higher density housing.

3.2.3 Anticipated Future Development

The Warren Town Plan identifies the Villages of Warren and Sugarbush as "growth areas." It is Town policy to encourage growth around these two areas in order to utilize future Town resources efficiently, to prevent sprawl, and to take advantage of the existing infrastructure.

According to Town officials, there are no land subdivisions or building permit applications pending that may impact traffic volumes at the covered bridge.

F.A.S. 188

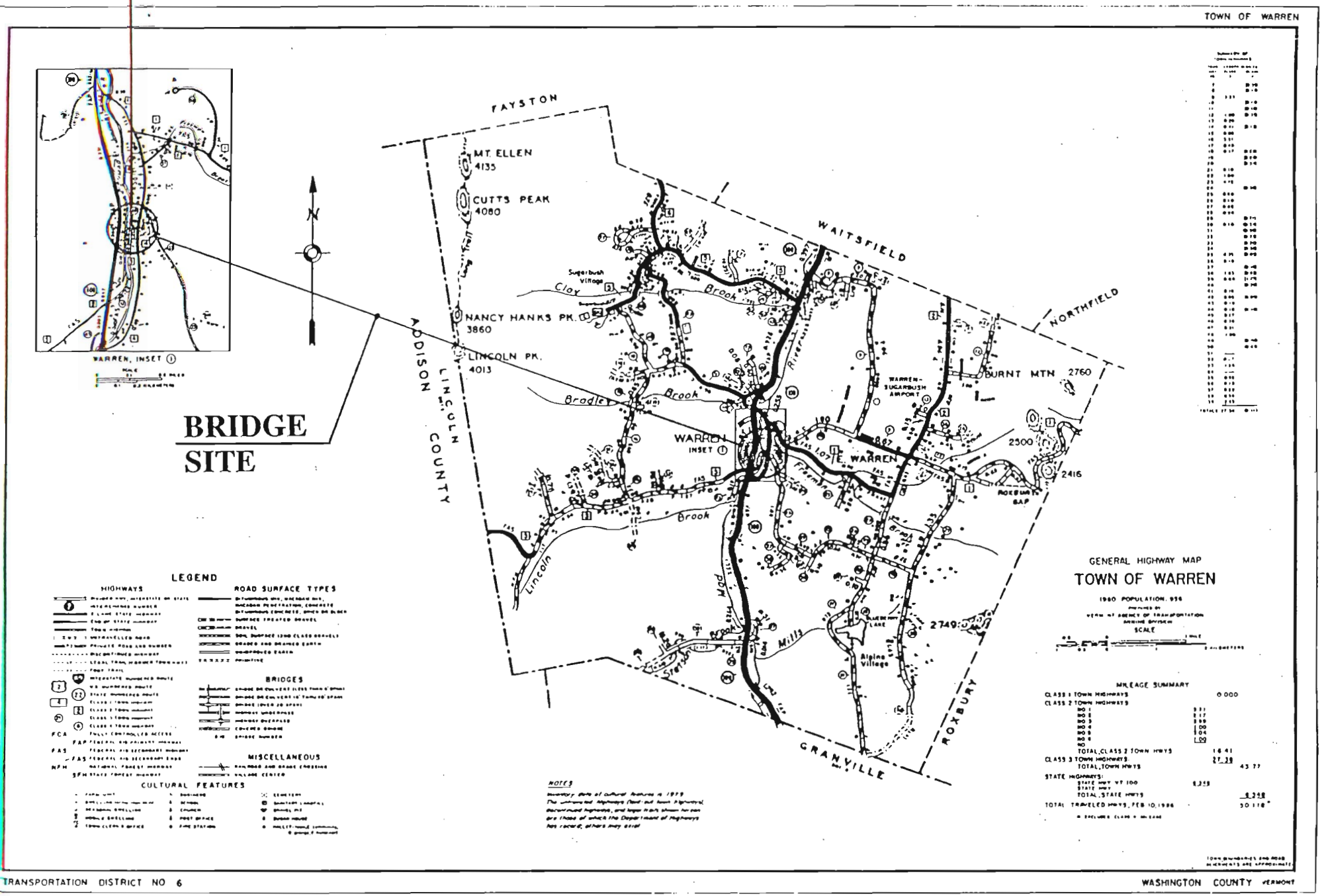
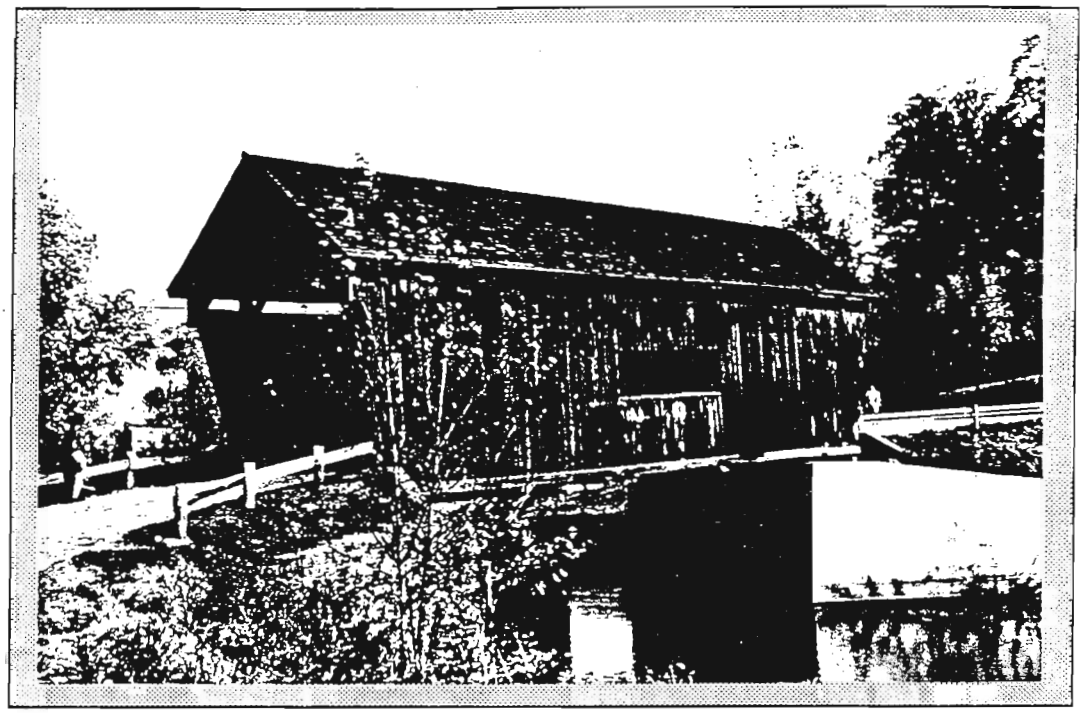
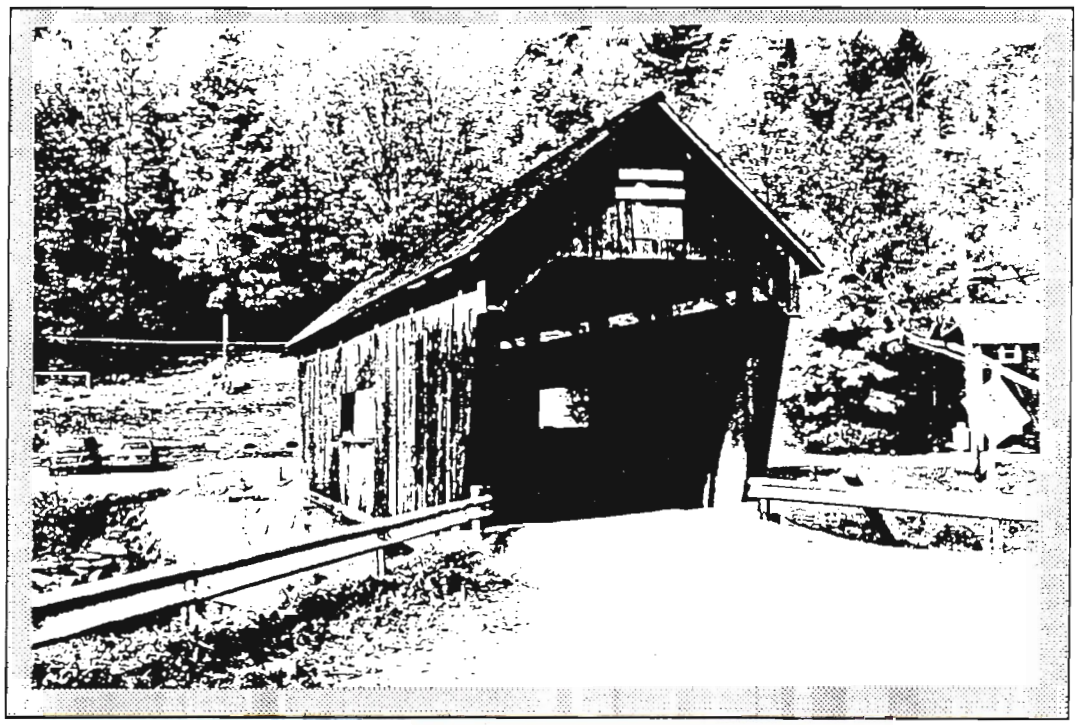


FIGURE 2

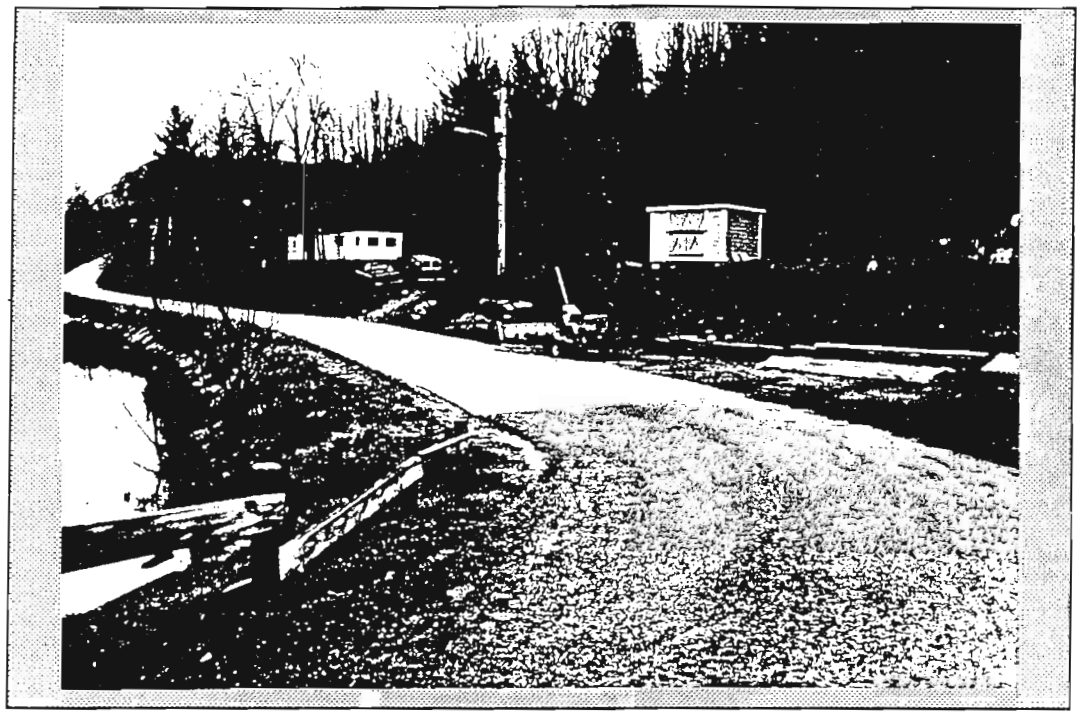


ELEVATION VIEW

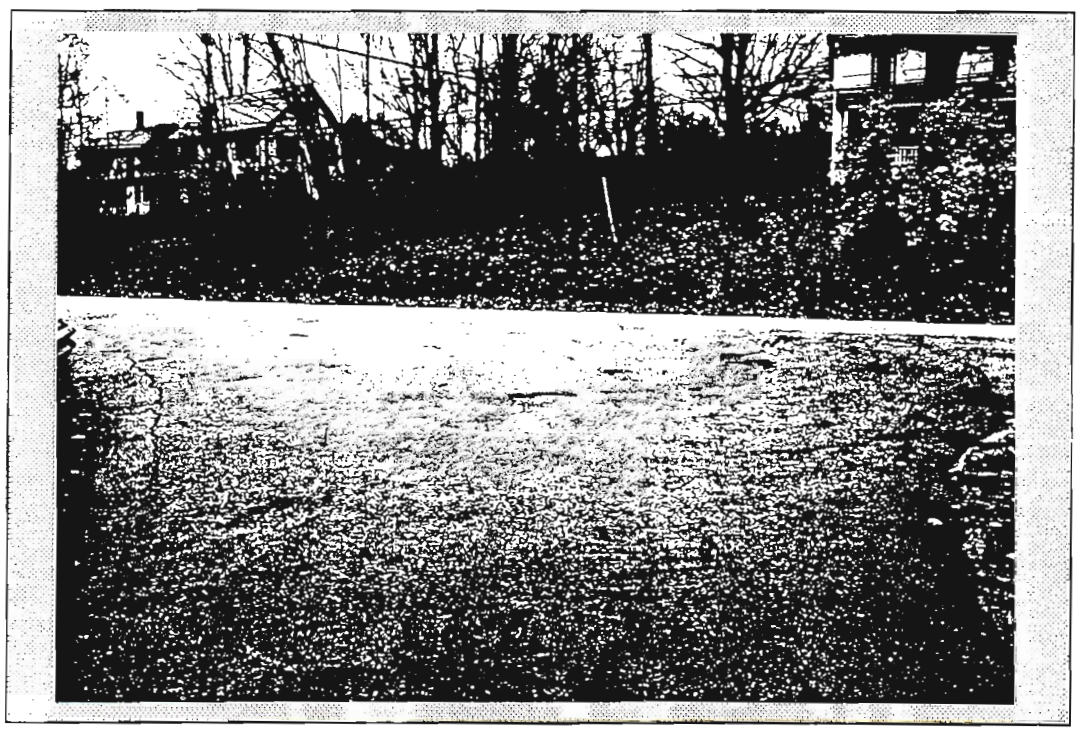


END VIEW

FIGURE 4



VIEW LOOKING WEST



VIEW LOOKING EAST

FIGURE 5

4.0 SITE ACCESSIBILITY

4.1 Existing Roadway System

As shown on Figure 2, the current Town highway network is approximately 44 miles of Town roads and 6 miles of State roads. There are no Class 1 roads in the Town, approximately 17 miles of Class 2 roads, and 27 miles of Class 3 roads. The Warren Bridge serves FAS Highway 188, a Federal Aid Secondary Highway.

The covered bridge is currently not posted for a legal load limit. However, the bridge is posted as closed to trucks and buses and is not used by snow plows.

Regional highways within the Town are limited to the north-south highway State Route 100.

4.2 Future Roadway System

A goal of the Town is to maintain and plan for a network of roadways within the Town that will provide safe and adequate transportation balanced with the desire to retain the scenic beauty and natural areas of the Town.

The Town is encouraging the widespread support and participation in providing an area-wide shuttle bus service to and from inns and the ski areas, in particular the Sugarbush Ski Resort. The Warren Planning Commission is currently working on improving traffic and pedestrian circulation and parking within the Warren Village.

Currently, other than routine maintenance, Town officials have indicated that there is no roadway or bridge construction planned for the bridge site.

4.3 Alternative Route Evaluation

Part of the evaluation of preservation options identified in subsection 1.1 is the consideration of available alternative routes. A transit of the local transportation network led to the following observations:

- The shortest detour (bridge-to-bridge circuit) on established roads (minimum of Class 2 T.H.) is approximately 0.8 miles (identified on Figure 3).

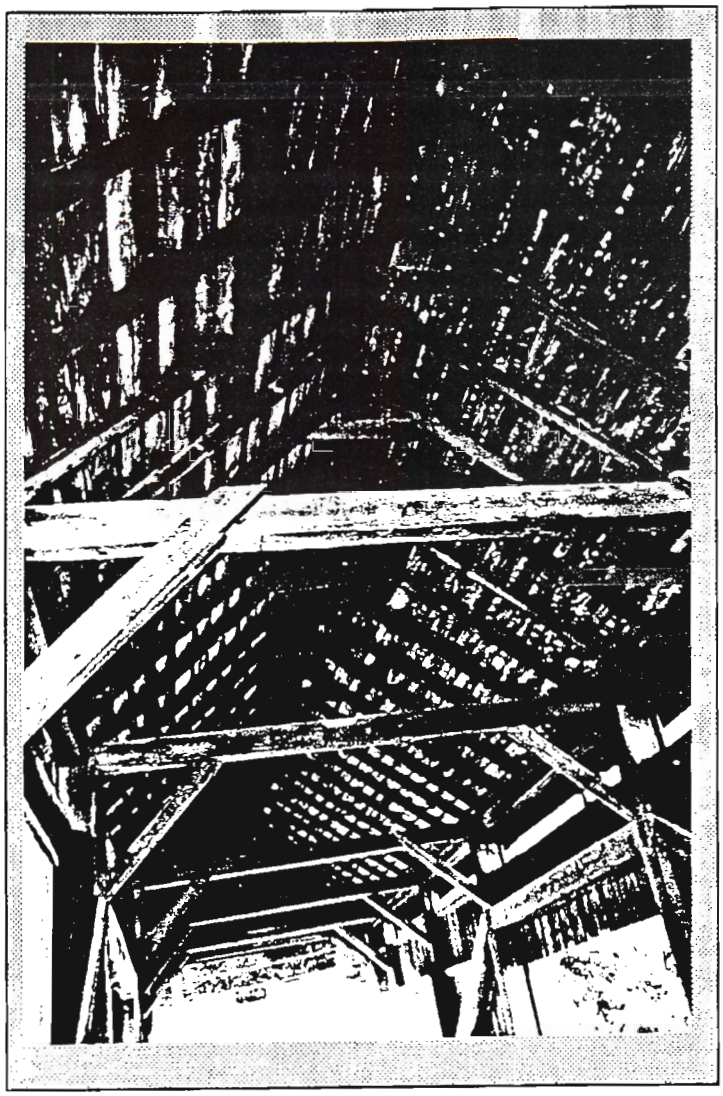
- No load restrictions were posted at any bridge on the detour route at the time of our transit. Further, VAOT information indicates that the posting capacity for the one bridge on the detour is 31 tons (which provides sufficient capacity for this detour to be acceptable).

6.0 STRUCTURAL EVALUATION

- No vertical clearance restrictions exist at any of the bridges on the detour route.

- A local site bypass may be possible, if necessary, on the upstream side of the covered bridge; however, this issue was not studied in-depth.

The two primary topics involved with this Study are structural needs/capacity and traffic needs/capacity. To obtain the



ROOF FRAMING

QUEENPOST TRUSS

FIGURE 7