



*Vermont Center for Geographic Information, Inc.  
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# **Vermont Statewide Bridge Data Development Project**

## **Project Work Plan**

*Collaborative Project*  
Vermont Center for Geographic Information, Inc.  
Vermont Agency of Transportation  
Vermont's Regional Planning Commissions

May, 2000



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**TABLE OF CONTENTS**

I. PROJECT OVERVIEW ..... 1  
    Overview ..... 1  
    Background ..... 1  
    Goal ..... 1

II. TECHNICAL PROPOSAL AND WORKPLAN ..... 3  
    Overview ..... 3  
    Inventory existing sources of bridge data ..... 3  
    Collect existing data ..... 3  
    Pre-process data ..... 3  
    Integrate data into statewide layer ..... 3  
    Post-process data ..... 4  
    Quality Control ..... 4  
    Document and release data ..... 5

APPENDICES

- ◆ A: Task List and Organizational Responsibilities
- ◆ B: Project Milestones
- ◆ C: GIS Data Specifications (bridge data layer)



## **I. PROJECT OVERVIEW**

### **Abstract:**

The Vermont Center for Geographic Information (VCGI) -- with the support of the Vermont Agency of Transportation (VAOT) and Vermont's 12 Regional Planning Commissions (RPCs) -- have agreed to work collaboratively toward the development of a statewide bridge data layer. Existing bridge data will be leveraged and integrated into a statewide layer. Quality control procedures will assure the overall integrity of the data. Feature level metadata will document how the bridge location was captured (and who captured it). Mechanisms will be established to assure long-term maintenance and improvements to this data layer.

### **Background:**

The Vermont Agency of Transportation (VAOT) has maintained inventories of Vermont's bridges for many years. VAOT's bridge inventory includes a wide range of information, such as bridge repair records, bridge sufficiency ratings, etc. Some of these databases even include Latitude and Longitude information, however, the accuracy of these coordinates are unknown (some preliminary analysis indicates that there are some significant positional inaccuracies).

The Vermont Center for Geographic Information, Inc. (VCGI) has provided VAOT with technical assistance in the area of GIS database development and management for several years. This technical assistance has included the development of a Linear Referencing GIS System, enabling mile-marker based information to be mapped. For example, VAOT maintains a wide variety of databases which contain mile-marker based information such as AADT (Average Annual Daily Traffic), HALS (High Accident Locations), pavement conditions, etc. The bridge inventories maintained by the agency also include mile-marker based information. VCGI has worked in cooperation with VAOT to "port" all long and short structure bridges on state/interstate highways to GIS format. Route and mile-marker information in the state long structure database was "standardized" and applied against VAOT's Linear Reference GIS System, creating a GIS point data layer (BRDG\LONGSTAT and BRDG\SHRTSTAT in the *VGIS Data Warehouse*). This data layer includes a unique bridge "structure ID", establishing a relational link to VAOT's master inventory database. The positional accuracy of this data layer has been improved through the use of bridge locations captured from 1:5000 orthophotos by Regional Planning Commissions (when available).



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Several Regional Planning Commissions (RPCs) have developed comprehensive bridge data layers for their region; capturing all bridges inventoried by VAOT (State/Town long and short structures). However, others have been hampered by resource limitations or other priorities.

**Goal:**

To develop a statewide GIS bridge layer which includes all bridges listed in VAOT's bridge inventory system. Specifically, this project will:

- A. Inventory existing bridge data and evaluate quality.
- B. Integrate existing data into a statewide data layer.
- C. Perform quality control checks to assure overall integrity of the data.
- D. Establish long-term procedures to assure maintenance and improvements to this data layer through multi-agency collaboration.



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## II. TECHNICAL PROPOSAL AND WORKPLAN

### **Overview:**

VCGI's inventory of bridge data resources available from RPCs and VAOT has determined that a significant amount of geo-spatial data already exists. The challenge is to integrate these various data resources into a single statewide data layer; one that retains information as to how the location was derived and by whom. The following section highlights each step in the data development process.

### **Inventory Existing Sources of Bridge Data:**

This project will be tapping into existing sources of bridge data. This includes data from RPCs, VAOT, and VCGI. A complete inventory of existing data sources is a vital prerequisite to determining how the data will be integrated into a statewide layer.

VCGI has already compiled an inventory of existing data sources (as of May, 1999). The report entitled "*Development of a Statewide Bridge Data Layer*" documents the status of existing data sources. All twelve RPCs were interviewed, providing a clear view of "what is out there". This project is an outgrowth of the recommendations articulated in the report.

### **Collect Existing Data:**

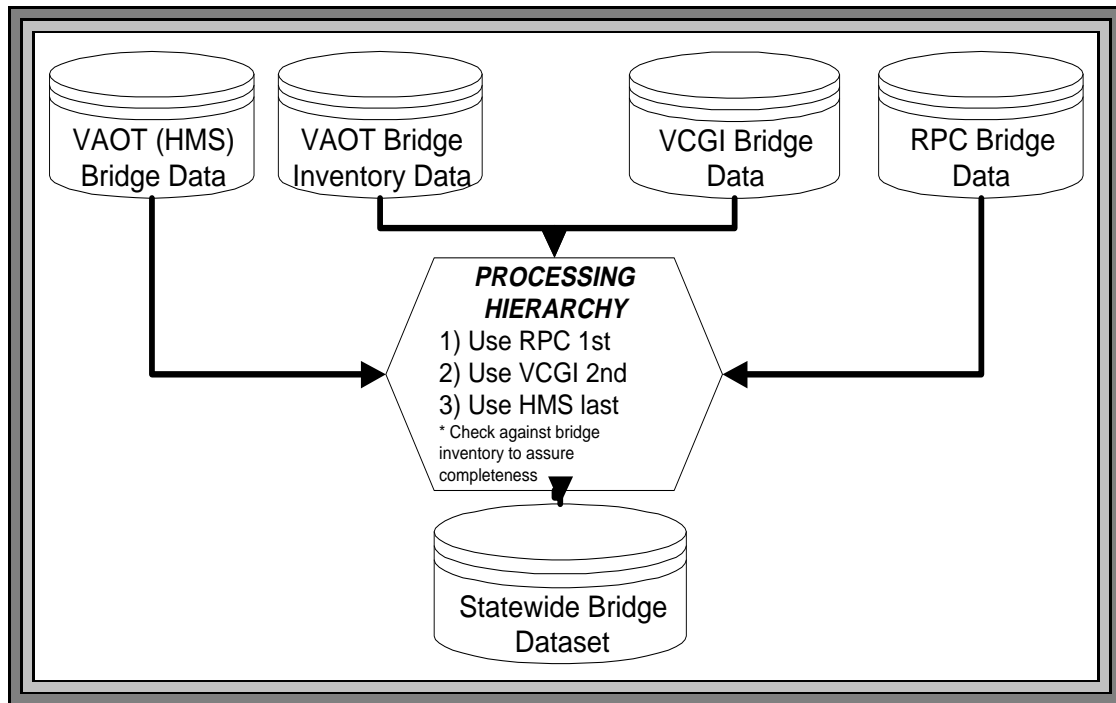
VCGI will ask participants (VAOT and RPCs) to submit existing data for possible inclusion into statewide bridge data layer. The data will be loaded onto VCGI's GIS server.

### **Pre-process Data:**

Existing data layers (or databases) will need to be "pre-processed" prior to integration. The data will be put into a similar format in order to facilitate integration. Some RPC bridge locations lack VAOT's unique structure number (STRUCT\_NUM). These will need to be tagged (unless an alternative source can be identified). Bridge locations in VAOT's Highway Mapping System (HMS) will need to be converted into points locations will fall on the road centerline. Latitude/Longitude coordinates in VAOT's bridge inventory will need to be converted into an ARC/INFO coverage.

### **Integrate Data into a Statewide Layer:**

The pre-processed data layer will then be integrated into a statewide coverage, going from "best" to "worst". The following hierarchy will be used:



Data Processing Hierarchy

**Post-process Data:**

A subset of the points (locations captured from sources other than GPS or orthophotos) will be “snapped” to the intersection of VAOT’s road centerline data layer and 1:5,000 surface waters (when available). This will generally be limited to data captured from HMS, but some RPC data may be snapped as well. The ANGLE attributes in the bridge layers Point Attribute Table (PAT) will be automatically calculated based on the alignment of the road.

**Quality Control:**

VCGI will verify that all bridges listed in VAOT’s Bridge Inventory are represented in the statewide bridge data layer. All attributes will be checked to assure that they are fully populated. Bridge locations captured from HMS (and other low accuracy sources) will be checked against digital orthos (where available) or 1:5000 roads and surface waters.



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**Document and Release Data:**

VCGI will develop FGDC compliant metadata. The new layer will be loaded into the VGIS Data Warehouse for distribution to the public.



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## ***APPENDICES***

- , *A - Task List and Organizational Responsibilities*
- , *B - Project Milestones*
- , *C - GIS Data Specifications*



**APPENDIX A**  
**Task List and Organizational Responsibilities**

This section provides a brief description of major task groups and associate sub-tasks.

<b>TASK GROUP</b>	<b>TASK#</b>	<b>DESCRIPTION</b>	<b>ORG<sup>1</sup></b>
Data Inventory	1.1	Interview RPCs and VAOT to determine what they have.	VCGI
Data Inventory	1.2	Draft a report documenting status of existing data.	VCGI
Collect Data	2.1	Collect existing data.	ALL
Pre-Process Data	3.1	Determine pre-processing requirements for RPC and VAOT data. Develop pre-processing routines as needed.	VCGI
Pre-Process Data	3.2	Pre-process RPC data.	VCGI
Pre-Process Data	3.3	Pre-process VAOT data.	VCGI
Integrate Data	4.1	Develop procedures used to integrate data.	VCGI
Integrate Data	4.2	Implement integration procedures.	VCGI
Post-Process Data	5.1	Develop post-processing routines.	VCGI
Post-Process Data	5.2	Snap “bad points” to road centerline and surface water data.	VCGI
Post-Process Data	5.3	Calculate ANGLE attribute.	VCGI
Quality Control	6.1	Develop QA/QC routines.	ALL

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<sup>1</sup> Defines who is responsible for completion of this task. ALL is used to define all of those who are participating (VCGI, VAOT, RPCs).

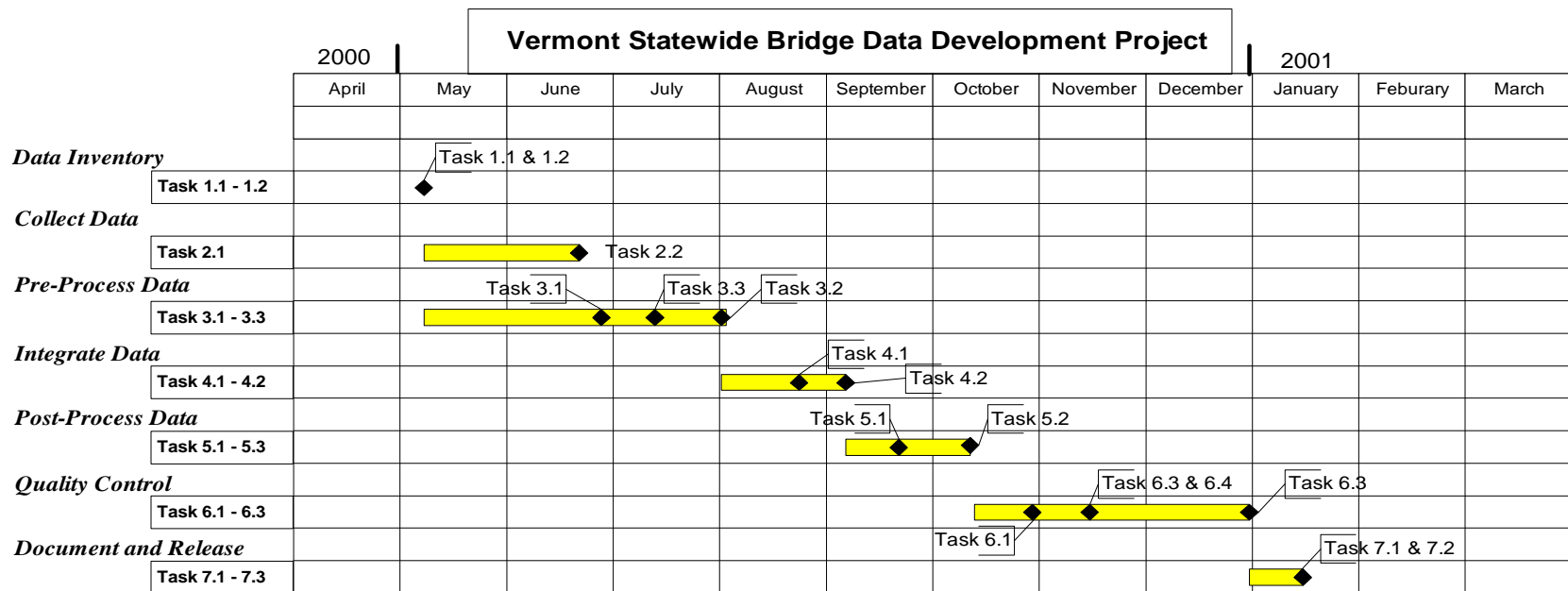


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Quality Control	6.2	Check HMS locations (and other questionable locations) against orthos or 1:5000 data sources.	VCGI
Quality Control	6.3	Verify that all bridge are represented.	VCGI
Quality Control	6.4	Check attributes.	VCGI
Document and Release	7.1	Develop FGDC metadata.	VCGI
Document and Release	7.2	Load into VGIS Data Warehouse for distribution.	VCGI



**APPENDIX B**  
**Project Milestones**





# GIS Data Specifications

## Statewide Bridge Data Layer

### Appendix C

#### Statewide Bridge Data Model

This section documents how a bridge feature will be represented in the statewide database, and the attributes tagged to each feature. Specific bridge ratings and associated characteristics will be stored in an extract of the VAOT Bridge Data Inventory and bundled with the coverage (BRIDGE.INVENTORY).

#### Bridge Feature Representation

The center point of each bridge will be represented by a point. Figure 1 and 2 represents the relationship between the real world features (bridge) to how it will be represented in the statewide bridge data layer.

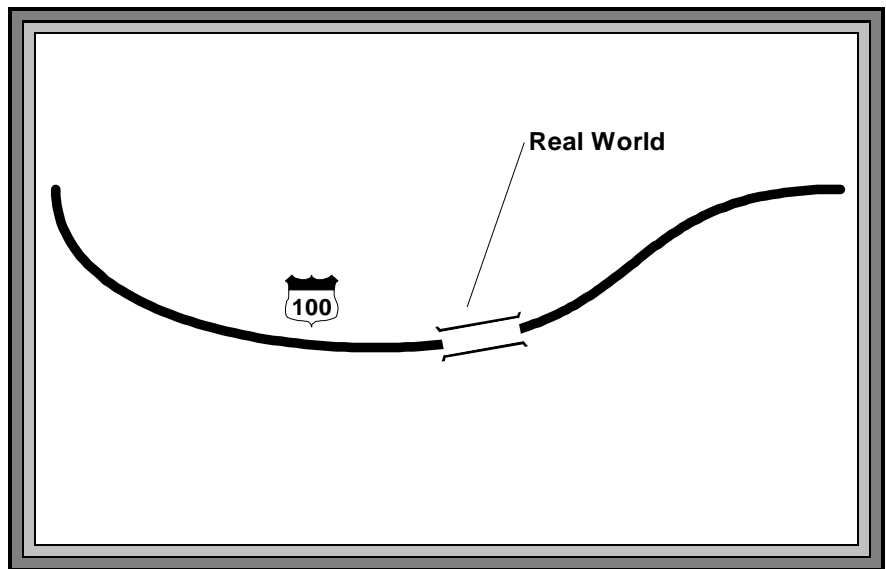


Figure 1 - Real World

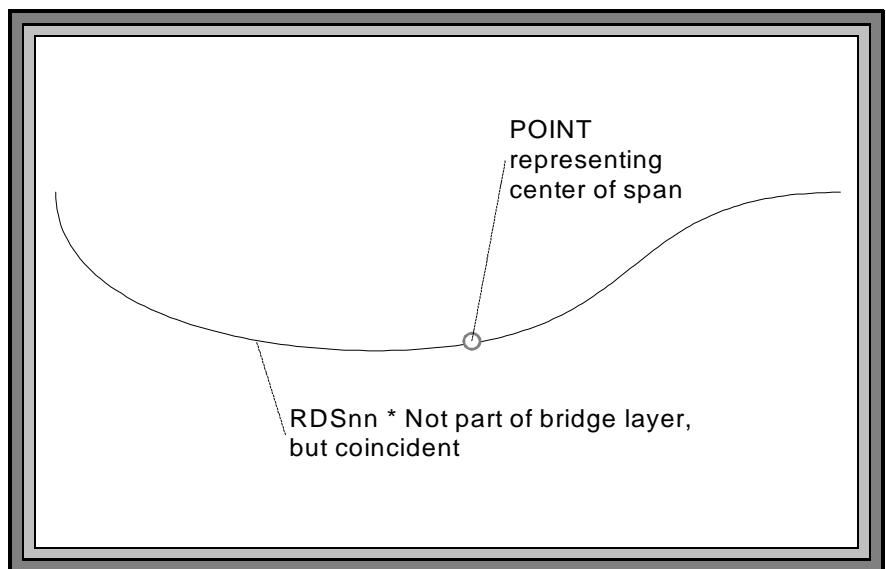


Figure 2 - Representation in Data Layer



**Bridge Feature Attributes**  
*Point Attribute Table*

The following attributes will be tagged to each line and point feature in the statewide bridge data layer.

<b>TABLE NAME: BRIDGE.PAT</b> (Point Attribute Table)					
<u>Field Name</u>	<u>WDTH</u>	<u>OPUT</u>	<u>TYP</u>	<u>N.DEC</u>	<u>ALTERNATE NAME</u>
AREA	4	12	F	3	
PERIMETER	4	12	F	3	
BRIDGES#	4	5	B	-	
BRIDGES-ID	4	5	B	-	
STRUCT_NUM	15	15	C	-	
STRUCT_TYPE	2	2	C	-	
BRIDGE_LBL	5	5	C	-	
FIPS6	5	5	I	-	
CT_CODE	4	4	C	-	
LOCMETH	2	2	I	-	
SRCORG	2	2	I	-	
RPC	2	2	C	-	
ANGLE	3	3	I	-	
UPDACT	1	1	C	-	

**Point Attribute Table**  
*Field Definitions*

**Field Name:** STRUCT\_NUM      Type: C    Width: 15    Decimals: 0  
**Attribute:** VAOT bridge structure ID  
**Source:** VAOT bridge inventory  
**Content:** Contains “primary” bridge number stored in VAOT’s bridge inventory databases. This is a unique identifier for every bridge in the state.  
*NOTE: Secondary structure records in the VAOT Bridge Inventory (ex: roads that may go under the bridge) will be stored in a related table (BRIDGE.SECONDRY).*

**Field Name:** STRUCT\_TYPE      Type: C    Width: 2    Decimals: 0  
**Attribute:** Type of structure  
**Source:**  
**Content:** Type of structure  
 SL = State Long Structure (> 20 feet)  
 SS = State Short Structure (< 20 feet)  
 TL = Town Long Structure (> 20 feet)  
 TS = Town Short Structure (< 20 feet)

**Field Name:** BRIDGE\_LBL      Type: C    Width: 5    Decimals: 0  
**Attribute:** VAOT Route Log bridge numbers  
**Source:**  
**Content:** Contains bridge numbers shown on VAOT Route Logs.

**Field Name:** FIPS6      Type: I    Width: 5    Decimals: 0  
**Attribute:** Municipality (town, city, gore, grant) code  
**Source:**  
**Content:** Standard FIPS code (Refer to VGIS Geocodes Standard)

**Field Name:** CTCODE                      Type:C    Width: 4    Decimals: 0  
**Attribute:** VAOT County-Town code  
**Source:**  
**Content:** The county-town code identifies the municipality in which each bridge falls.

**Field Name:** LOCMETH                      Type: I    Width: 2    Decimals: 0  
**Attribute:** Method used to locate/digitize the feature  
**Source:** Refer to SRCORG  
**Content:**  
 1 = Digitized from 1:5000 orthophoto  
 2 = Captured using mileage info and dynamic segmentation  
 3 = Intersection of 1:5000 roads and 1:100,000 surface waters  
 4 = Intersection of 1:5000 roads and 1:24,000 surface waters  
 5 = Intersection of 1:5000 roads and 1:5,000 surface waters  
 6 = Latitude/Longitude derived from 1:24,000 USGS paper maps  
 7 = Collected in the field using GPS

**Field Name:** SRCORG                      Type: I    Width: 2    Decimals: 0  
**Attribute:** Organization/project which created/updated the feature  
**Source:** Assigned when point is digitized or moved.  
**Content:** This attribute identifies the organization or project which digitized the feature. When a feature is digitized, moved or reshaped, the SRCORG code should be updated. The SRCORG codes will serve as a record of "who did it".

- 1 VCGI
- 2 VAOT
- 10 Addison County RPC
- 11 Bennington County RC
- 12 Central VT RPC
- 13 Chittenden County RPC
- 14 Northwest RPC
- 15 Lamoille County PC
- 16 Northeast VT Development Assoc.
- 17 Rutland RPC
- 18 Southern Windsor RPC
- 19 Two Rivers-Ottawquechee RPDC
- 20 Upper Valley-Lake Sunapee RPC
- 21 Windham RPC

**Field Name:** RPC                              Type: C    Width: 2    Decimals: 0  
**Attribute:** Regional Planning Commission code  
**Source:** *VGIS Handbook: Geographic Area Codes Standard.*  
**Content:** The RPC code will be used to identify which RPC region the bridge point resides in. This will facility "check-in/check-out" to RPCs for update and integration back into the master bridge data layer.

AC	Addison County RPC	NV	Northeastern VT Development Assoc.
BC	Bennington County RC	RR	Rutland RPC
CC	Chittenden County RPC	SW	Southern Windsor County RPDC
CV	Central Vermont RPC	TR	Two Rivers-Ottawquechee RC
NW	Northwest RPC	UV	Upper Valley-Lake Sunapee Council
LC	Lamoille County PC	WR	Windham Regional Commission



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**Field Name:** ANGLE                      Type: I    Width: 3    Decimals: 0

**Attribute:** Angle of bridge span

**Source:** Generated by program

**Content:** This item specifies the angle of the span in degrees from north, allowing the user to place bridge marker symbols at the correct angle.

**Field Name:** UPDACT                      Type: C    Width: 1    Decimals: 0

**Attribute:** Used for flagging the type of update made to a point

**Source:** Assigned by organization performing updates

**Content:** Updated data sets received by VCGI are compared against the original data set provided to the data developer, and a record of changes made to the data will be generated. To enable this process, data developers must record any changes made to the point topology in the UPDACT field with the following code:

<u>UPDACT</u>	<u>Action</u>
A	Added point (i.e., a new point)
M	Moved point