

US ROUTE 4 CORRIDOR MANAGEMENT PLAN

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1.0 INTRODUCTION

The US Route 4 Corridor Management Plan was developed through a joint effort of the Town of Hartford, the Two Rivers-Ottawquechee Regional Commission (TRORC), the Vermont Agency of Transportation (VTrans), the project Steering Committee, local residents and business owners. This Corridor Management Plan was developed through a systematic review of existing transportation conditions, previously identified deficiencies, land use patterns, zoning and land use regulations, combined with input from local, regional, and state stakeholders. Future land use scenarios were developed for 2030 and 2050 using detailed parcel-specific projections which were thoroughly reviewed by all stakeholder parties. An examination of the 2030 and 2050 future scenarios led to the identification of future land use policy, transportation deficiencies and recommendations.



A number of studies of the US 4 corridor have been prepared over the past 30 years (*See Appendix A for a summary of previous studies*). Most of these studies have recommended new road alignments, village bypasses, or other costly infrastructure improvements to address identified capacity and safety concerns. In the end, each of these large-scale recommendations was ultimately passed over due to their significant costs.¹ Given this precedent for bypassing more costly recommendations and VTrans' current "Road to Affordability" initiative, the charge for this Corridor Management Plan was to develop a comprehensive land use and transportation plan that addressed capacity and safety deficiencies with transportation, land use policy, and regulatory alternatives that are less costly than traditional remedies.



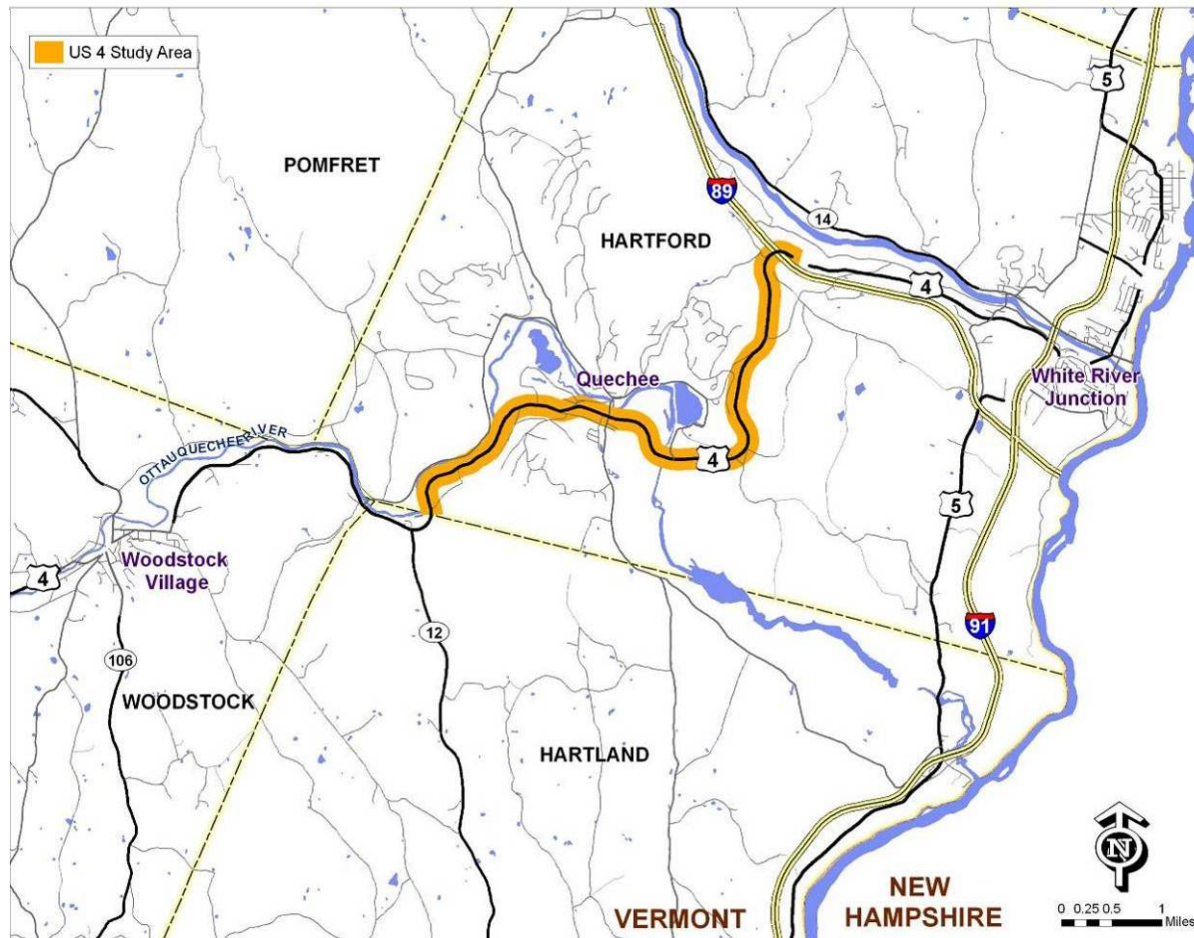
The study area for this Corridor Management Plan runs along US Route 4 between I-89 Exit 1 and the Hartland Town Line (Figure 1). From a statewide perspective, US Route 4 is one of only three high-level east-west routes across Vermont and carries the highest volumes of the three (VT Route 9 and US Route 2 are the others). The study area, which falls entirely within the Town of Hartford, includes a diverse mix of clustered retail, single-family residential, single-use retail, and undeveloped land uses. There are a number of important

¹ One report even noted that a potential new alignment would cost more than VTrans spends on all roads in the state in five years combined.



visitor and resident destinations along the study corridor, including the Quechee Gorge, the Gorge shops, the Gorge visitors' center, the Vermont Institute of Natural Science (VINS), and the village of Quechee. US Route 4 also serves as a primary route for visitors to Woodstock village and the Killington ski resort.

Figure 1: Project Study Area



Despite the regional importance of US Route 4 through Hartford, the road (also known locally as “Woodstock Road”) provides an important function for local commuting, shopping, and recreational trips. There is then a subtle conflict between the road’s functional class, the balance of mobility and accessibility it offers, and the role that it plays for local and regional trips into the future. Additionally, a significant portion of the parcels fronting US 4 are either undeveloped or underdeveloped, which poses the potential for a significant amount of new, locally-generated traffic to be added onto US Route 4 in the future.



These issues and the future form and function of land use and transportation improvements along the corridor were the main focus for the corridor Steering Committee (see member listing below) in the development of this Plan. In addition to receiving input from the Steering Committee, the Plan was presented to the public and to VTrans management staff two times each during the report's development. (See Appendix B for complete summary of public outreach)

This Corridor Management Plan moves through an assessment of existing and projected future transportation and land use conditions, including discussions on land use regulations, zoning, traffic congestion, access management, safety, and mobility. The Plan concludes with a set of transportation and land use recommendations that arose out of the analysis and through stakeholder input.

US ROUTE 4 CORRIDOR STUDY STEERING COMMITTEE MEMBERS

William Blaiklock
Randolph National Bank in Quechee; Hartford Area
Chamber of Commerce Member; Co-Director of Covered
Bridges Half Marathon

Michael Brands
Woodstock Town Planner and Zoning Administrator;
TRORC Transportation Advisory Committee

Susan Clark
VTrans, Regional Planning Coordinator

Gayle Ottman
Hartford Selectboard; Hartford Area Chamber of
Commerce Executive Director

Peter Esterquest
VINS Community Services Manager; Hartford Area
Chamber of Commerce Member

Gary Neil
Quechee Gorge Village

Jerry Frederickson
TRORC Commission / Executive Committee; Town of
Barnard representative

John Jalowiec
Hartford Planning Commission Chair; Quechee Resident

Peter Gregory
TRORC Executive Director; Hartford Area Chamber of
Commerce Member

Lori Hirshfield
Planning Director, Hartford Planning & Development
Services

Roger Shepard
Owner, Quality Inn and landowner

Project Staff:
Costa Pappis, VTrans
Matt Osborn, Hartford
Chuck Wise, TRORC

1.1 Corridor Vision & Goals

The US 4 corridor between Exit 1 and the Hartland Town Line in the Town of Hartford serves a critical role as "Woodstock Road" in serving local commuter, shopping, and visitor trips while also serving as "US 4," a critical east-west link in the statewide transportation system.

The vision for the US 4 corridor is one in which accessibility and mobility are maintained through comprehensive land use, transportation, and access management policies and through transportation infrastructure improvements.



For local residents, business owners, and visitors, “Woodstock Road” will provide a safe, accessible, and attractive travel corridor for automobiles, pedestrians, bicyclists, and transit buses with new sidewalks, bicycle facilities, carpool/transit facilities, intersection improvements, and development intensity focused in the Quechee Gorge and Quechee Village/Waterman Hill areas.

For long-distance through trips, “US 4” will provide safety and mobility for automobiles and trucks traveling through Hartford through improvements to roadway geometrics, access management, intersection enhancements, and demand management success through local land use decisions.

The following goals have been identified to help achieve the corridor vision:

- Provide an appropriate balance between through vehicle mobility and local access.
- Establish a strong and coherent connection between existing Town, Regional, and State development approval processes to ensure adequate and objective vetting of development proposals prior to the granting of approval.
- Acknowledging the lack of public funding for large-scale infrastructure improvements, identify innovative funding mechanisms, and utilize private developer contributions for off-site improvements to finance infrastructure improvements along the corridor.
- Preserve mobility along US 4 by maintaining the current end-to-end travel time and a minimum LOS D for all intersections and approaches and LOS C between such cross-points.
- Improve access to and circulation between existing and future development in the corridor through a joint local and state access management program.
- Provide a safe and efficient transportation corridor by addressing areas with known safety deficiencies.
- Improve travel options for pedestrians, cyclists, and transit users.
- Enhance the natural and scenic attributes of the corridor through donated and purchased scenic easements, consolidated growth patterns, access management, and landscaping along the corridor.
- Encourage development only in the defined growth areas along the corridor.



2.0 LAND USE ASSESSMENT

The land use assessment's goal is to identify existing land uses for the parcels fronting US Route 4 and then project what the future land uses will be. The land use assessment also looks at the existing land use regulations. In sum, the land use assessment covers the four following subjects:

1. Environmental features along the study corridor
2. Existing land uses by parcel
3. Future land use projections
4. Existing corridor management policies and practices

2.1 Environmental Features Assessment

In addition to the Ottauquechee River and the Quechee Gorge, the following types of environmental features are shown in Figure 2 and Figure 3:

- Figure 2: Agricultural soils (prime and statewide), contours, and fluvial erosion hazard corridors
- Figure 3: Deer wintering areas, wetlands, public lands

A large portion of the land fronting US 4 in the study area is categorized as agricultural soils of statewide significance by the Natural Resources Conservation Service. Much of the corridor is categorized by steep slopes along both sides of the roadway. The study area also includes public lands, such as the Quechee Gorge State Park. Primarily in the area around the Quechee Gorge State Park, there are also areas with rare, threatened, or endangered animal and plant species. There are no wetlands immediately adjacent to US 4 in the study area. Any future development or roadway improvements should avoid encroachment into the identified fluvial erosion hazard corridors of the Ottauquechee River. The Fluvial Erosion Hazard Report is included as Appendix C.



Figure 2: Environmental Features – Agricultural Soils and Contours

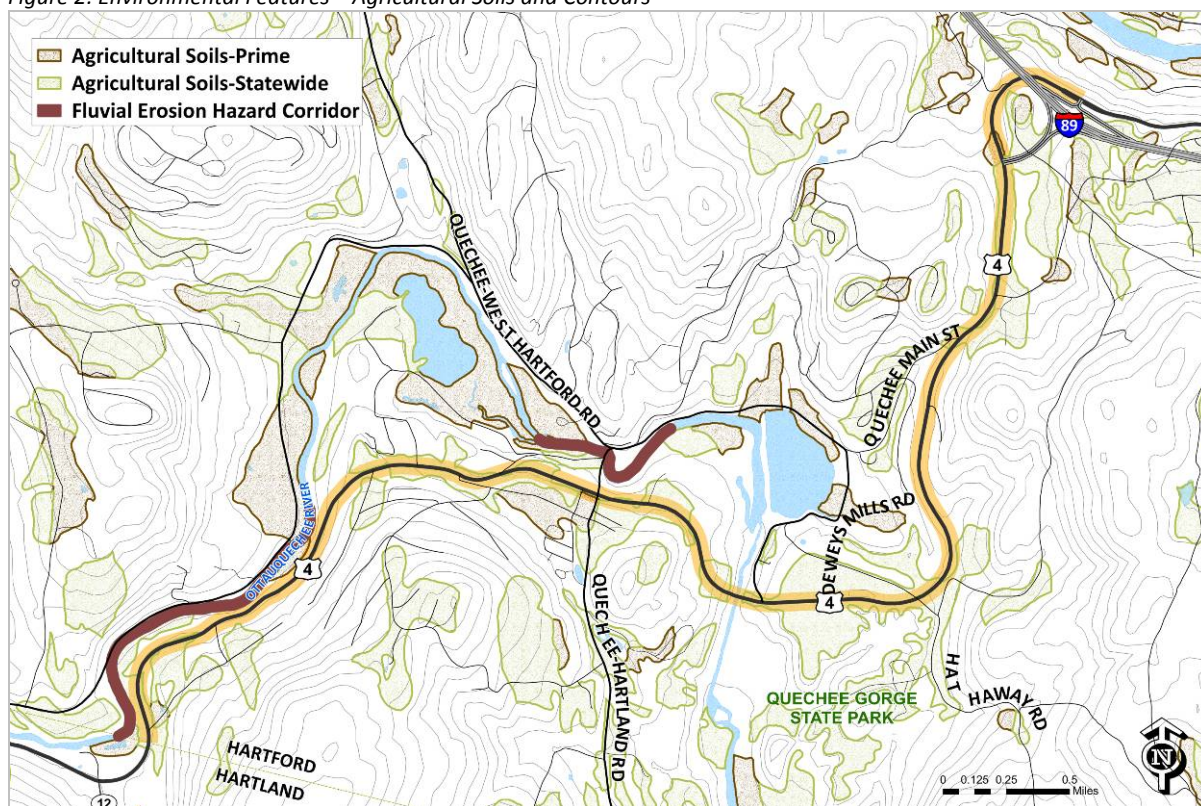
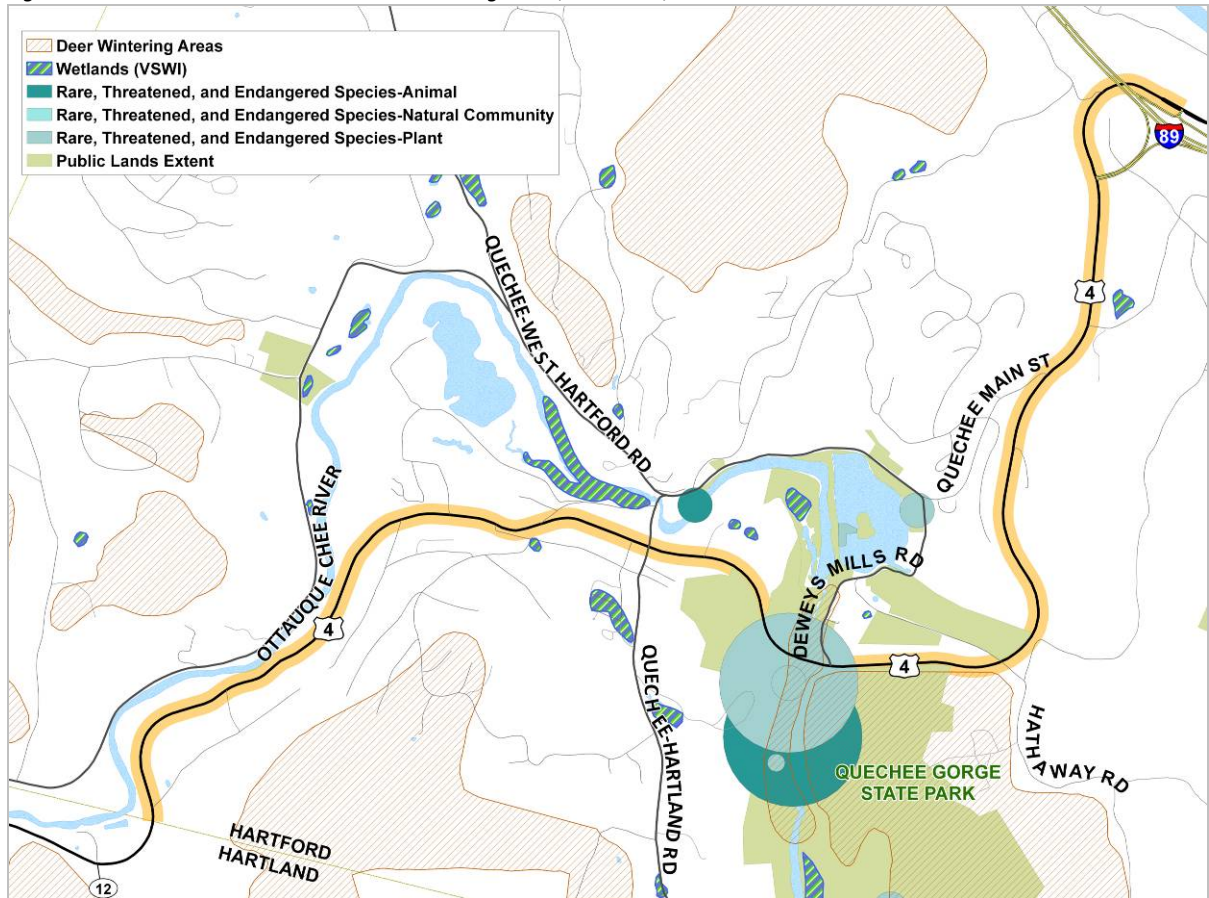


Figure 3: Environmental Features – Deer Wintering Areas, Wetlands, and Public Land

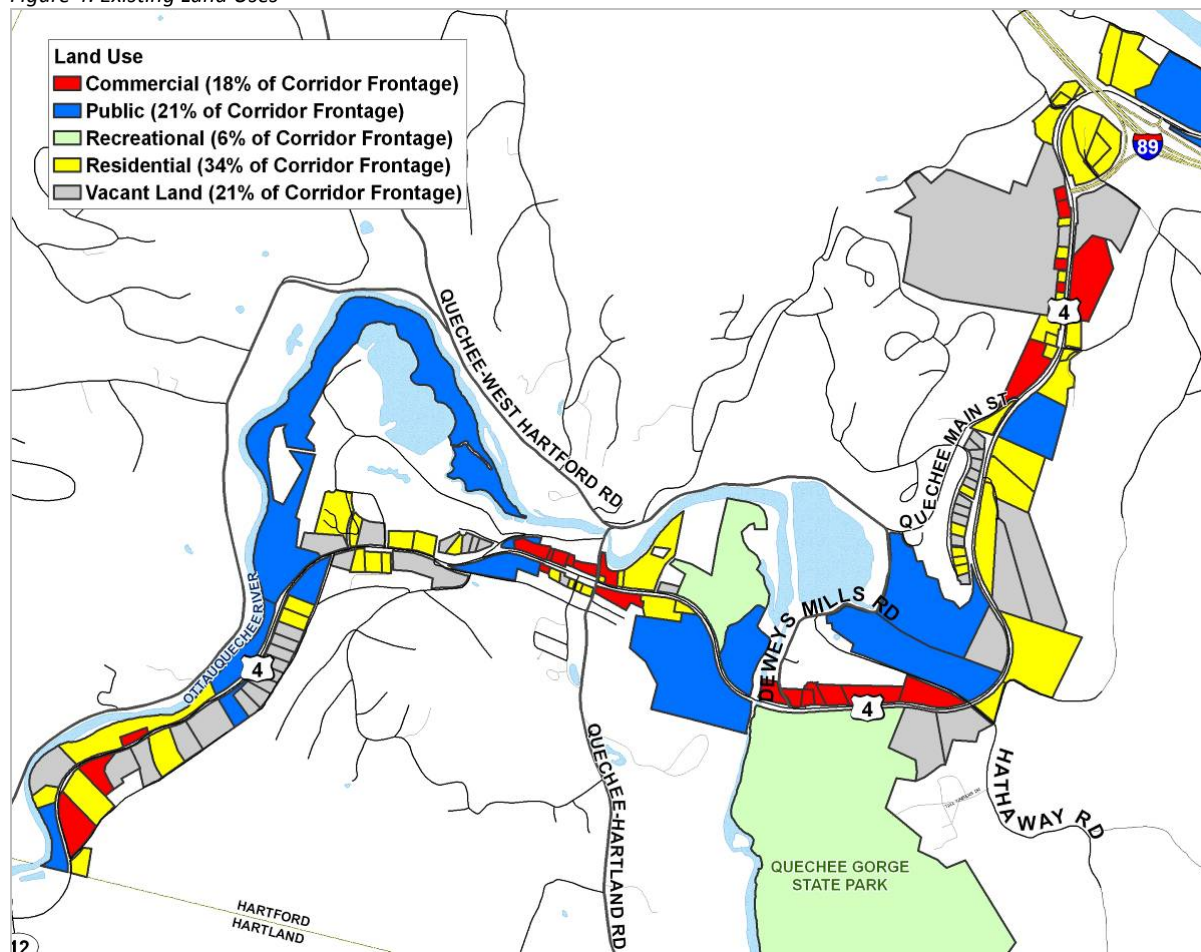


2.2 Existing Land Use Assessment

The existing land use assessment identifies the primary land uses (commercial, public, recreational, residential, vacant) of the 137 parcels that front US 4 in the study area (Figure 4). Of note is that 42 parcels out of 137 (31%) are currently undeveloped.



Figure 4: Existing Land Uses



2.3 Future Land Use Projections

Future land uses along and adjacent to the corridor were estimated based on a number of factors, including development potential, zoning, and external growth rates. Future land use projections were developed separately for the following three categories of growth:

- Growth along the corridor: Accounts for development on parcels immediately adjacent to the study corridor.
- Growth in Quechee Lakes: Accounts for future growth within the Quechee Lakes development that does not immediately abut the study corridor.
- External growth: Accounts for general growth in the region affecting future traffic volumes on US 4 not included in the above two categories.



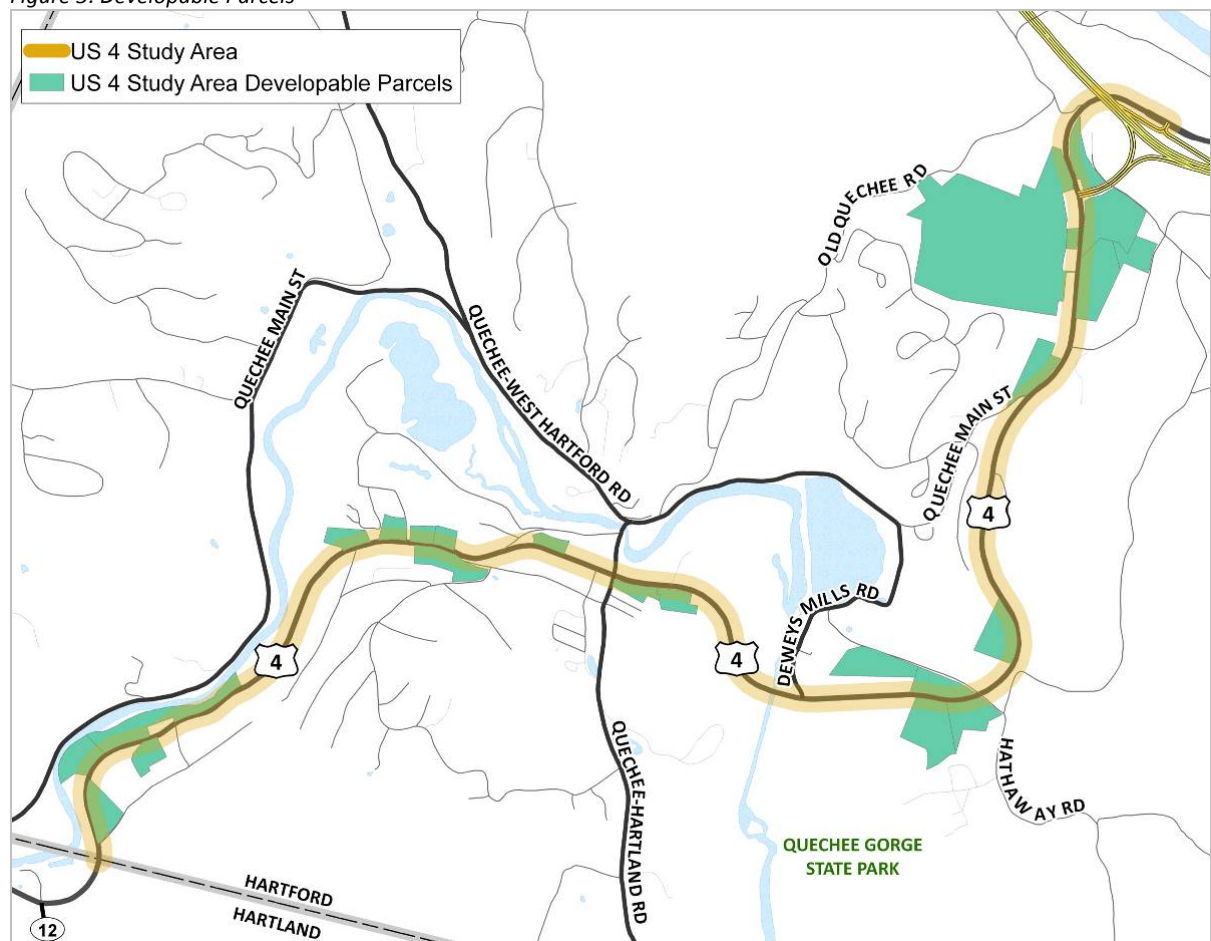
2.3.1 Identification of Developable Parcels

Immediately adjacent to the study corridor, 24 parcels were identified as potentially developable based on the parcel's frontage on US 4, buildable area, and development potential. Some of the existing undeveloped lots (42) did not have any buildable area and were considered to have no development potential. Potential development is considered new development or the redevelopment of a property:

- Example of new development: A wooded lot is subdivided, cleared, and two homes are built.
- Example of redevelopment: A gas station is renovated to include sandwich and donut shops, which intensifies the land use.

Figure 5 shows the locations of the 24 developable parcels.

Figure 5: Developable Parcels

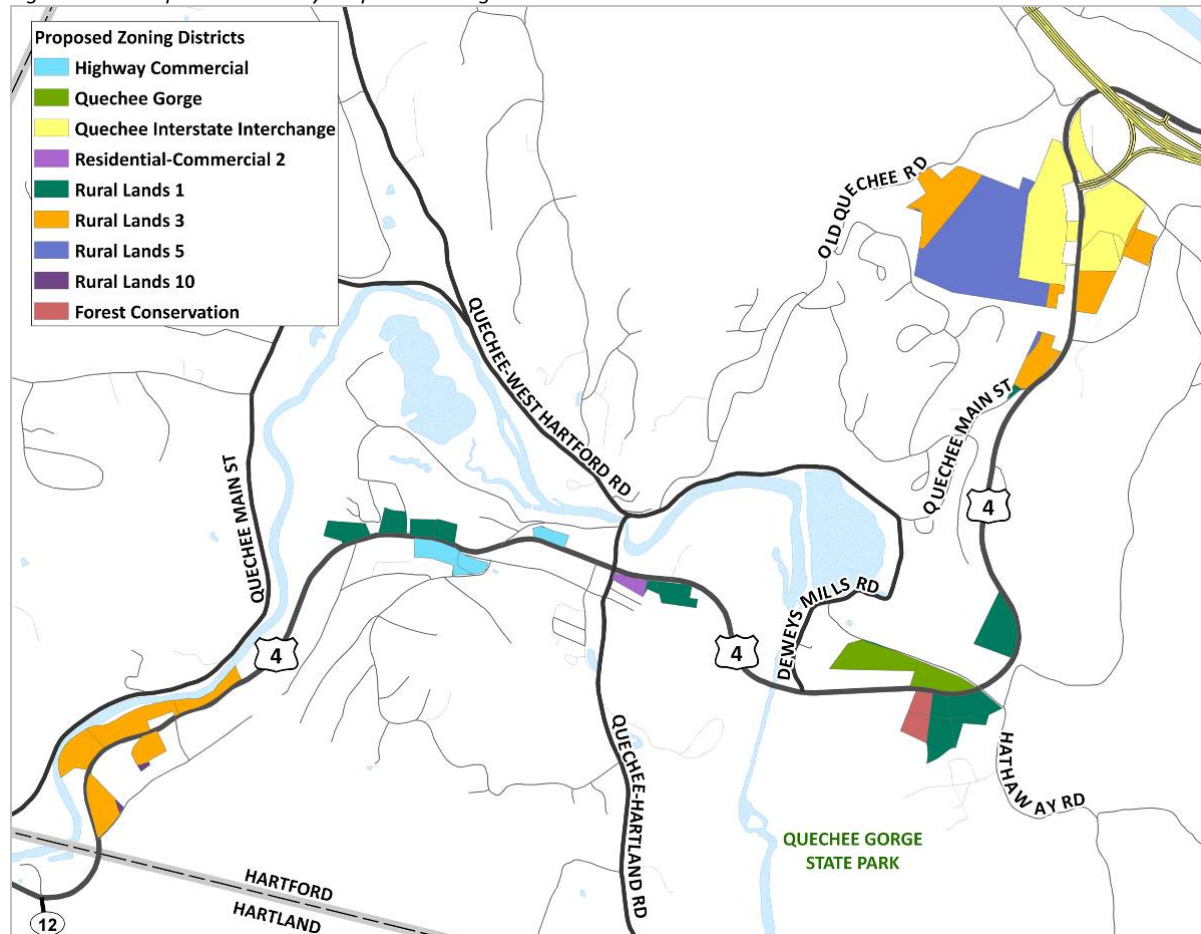


Residential and commercial growth projections along the corridor were based on the proposed zoning district boundaries and regulations being developed by the Town of Hartford concurrently with the



development of this Plan. Figure 6 shows the proposed zoning district that applies to each of the potentially developable parcels.

Figure 6: Developable Parcels by Proposed Zoning District



2.3.2 Designation of Residential and Commercial Development

Two broad land use categories were initially established for the developable parcels along the corridor: residential and commercial. The residential category includes single family and multi-family land uses. The commercial category includes a wide range of retail, office, and industrial uses.

The future development potential for each of the 24 identified parcels was designated as either commercial or residential based on the following factors:

- Development capacity of the parcel
- Prior development proposals for the parcel



- Physical location of the parcel and proximity to other similar uses
- Applicable zoning district
- Input from Regional and Town of Hartford planning staff
- Regional planner evaluation of development patterns along US 4 from Hartford to Bridgewater from 2000 to 2008.

2.3.3 Residential Land Use Projections

Once the potential residential parcels were identified, the maximum residential unit projections for each parcel was calculated based on the proposed zoning regulations, which define the number of potential residential units based on frontage, lot depth, and minimum lot size. Residential projections were then split into single-family and multi-family units based on historic trends, zoning, and likely use for the parcel.

2.3.4 Commercial Land Use Projections

Further refinement of the projected commercial land uses were based on the following three inputs:

- Proposed zoning requirements
- Steering committee projections
- Input from Regional and Town of Hartford Planning Staff

At the 14 May 2008 Corridor Steering Committee meeting, a variety of land uses were presented and committee members were asked to rank which future land uses they thought were likely to be built along the corridor. Figure 7 summarizes the combined ranking of the steering committee members.



Figure 7: Steering Committee Future Commercial Development Projections

Land Use	Total Votes	%
Hotel	8	6%
Quality Restaurant	8	6%
Motel	7	5%
Fast-Food Restaurant with Drive-Through Window	7	5%
General Office Building	7	5%
Drive-In Bank	6	5%
Convenience Market with Gasoline Pumps	6	5%
Gasoline/Service Station with Convenience Market	6	5%
Medical-Dental Office Building	6	5%
Drinking Place	5	4%
High-Turnover (Sit-Down) Restaurant	5	4%
Nursery (Garden Center)	5	4%
Specialty Retail Center	5	4%
Supermarket	4	3%
Shopping Center	4	3%
Convenience Market (Open 15-16 Hours)	3	2%
Factory Outlet Center	3	2%
Free-Standing Discount Store	3	2%
Health/Fitness Club	3	2%
Single Tenant Office Building	3	2%
Video Rental Store	3	2%
Apparel Store	2	2%
Convenience Market (Open 24 Hours)	2	2%
General Light Industrial	2	2%
Hardware/Paint Store	2	2%
Pharmacy/Drugstore with Drive-Through Window	2	2%
Pharmacy/Drugstore Without Drive-Through Window	2	2%
Athletic Club	2	2%
Automobile Care Center	1	1%
Automobile Parts Sales	1	1%
Building Materials and Lumber Store	1	1%
Discount Supermarket	1	1%
Fast-Food Restaurant without Drive-Through Window	1	1%
Furniture Store	1	1%
Quick Lubrication Vehicle Shop	1	1%
Self-Service Car Wash	1	1%
Manufacturing	0	0%
New Car Sales	0	0%
Recreational Community Center	0	0%
Tire Store	0	0%

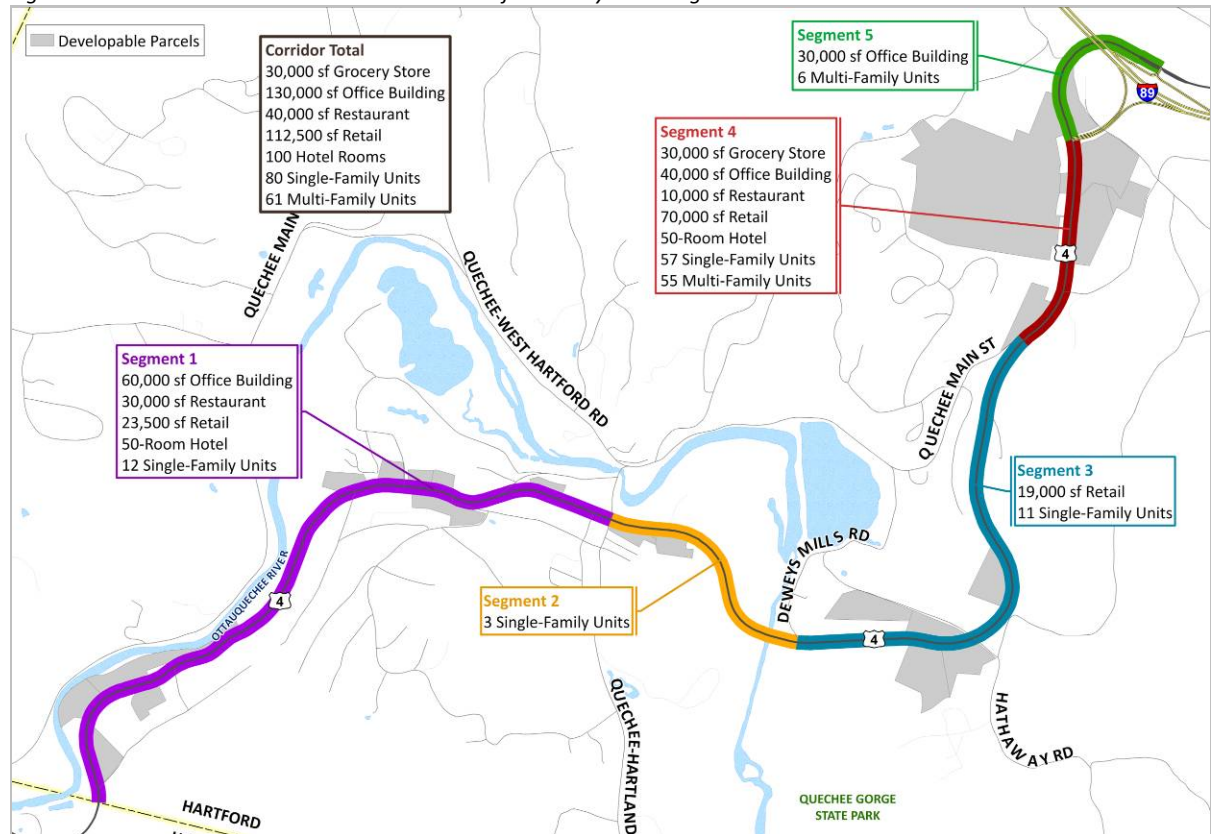
The Steering Committee projections, combined with applicable zoning regulations and local and regional planning staff input, were used to develop the future maximum commercial growth in the study area.



2.3.5 Maximum Residential and Commercial Growth Estimates

Figure 8 shows the maximum projected residential and commercial development along the study corridor by zone.¹ Based on engineering judgment, 60% of the calculated future growth is assumed to be complete by 2030 and 100% complete by 2050 (i.e. maximum buildout).²

Figure 8: Residential and Commercial Land Use Projections by Road Segment



2.3.6 Land Use Growth within Quechee Lakes

Although much of the Quechee Lakes development is not located immediately along the US 4 corridor, the future residential growth within Quechee Lakes was analyzed separately due to its significant growth potential. Future residential growth within Quechee Lakes was estimated based on the average number

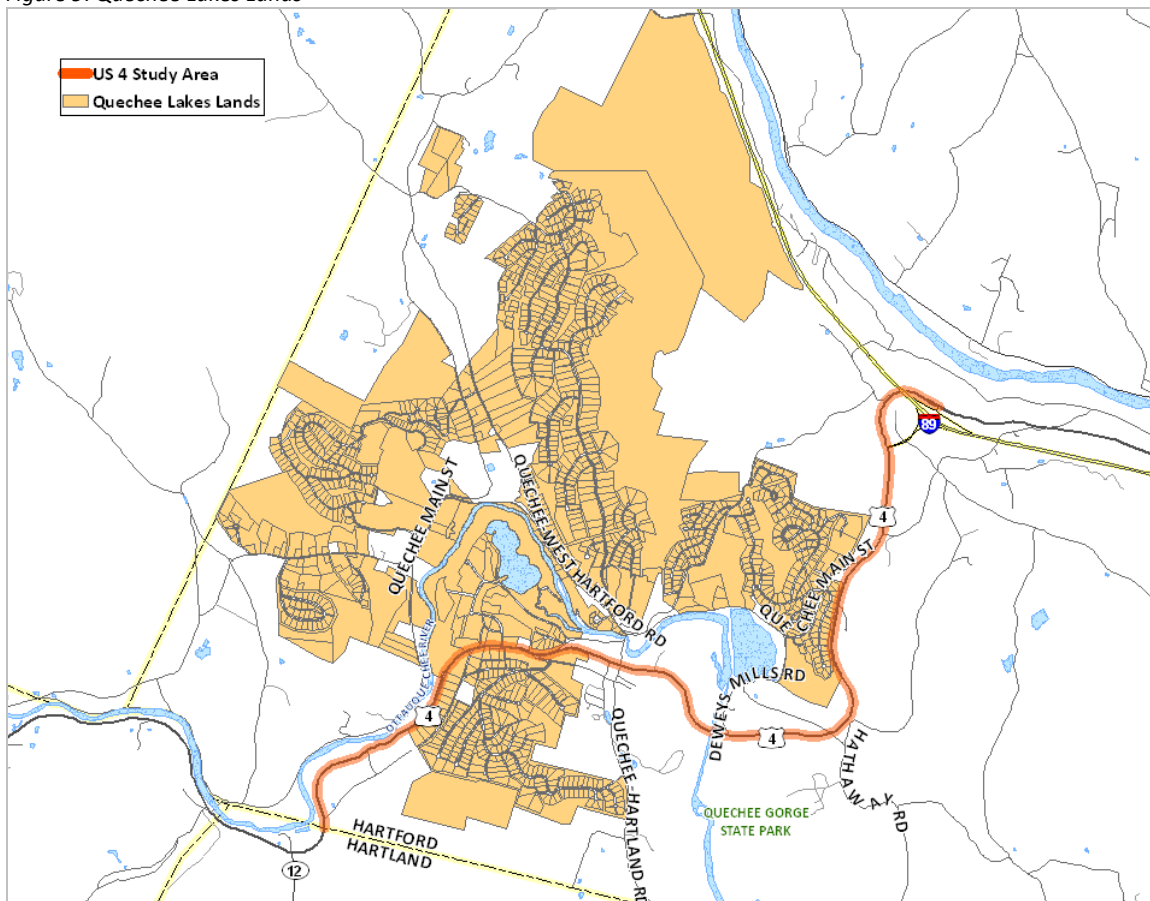
¹ Study area zones are defined as the road segments in between study intersections.

² Growth in the Quechee Interstate Interchange area is predicted based on the assumption that water and sewer services will be available.



of dwelling units permitted between 1998 and 2007.¹ In those years, there was an average of 12 single-family homes and 7 multi-family units built per year. Based on these rates, 153 new single-family homes and 92 multi-family units were projected to be built by 2030 and 389 new single-family homes and 234 multi-family units by 2050.²

Figure 9: Quechee Lakes Lands



2.3.7 External Land Use Growth

While most of the future traffic increases along the study corridor will likely be driven by development along the corridor or within the Quechee Lakes development, there will certainly be future development outside of these two areas that will ultimately affect traffic on US 4. The future traffic volumes resulting

¹ Town of Hartford land use records

² Although the ultimate future residential development potential of Quechee Lakes (particularly in the 5C parcel) is still largely unknown, we felt that this projection methodology was reasonable and provided for conservative results for our use in estimating future traffic impacts along US 4.



from this “external” growth was accounted for by applying historic growth rates for US 4 into the future. More detail on this methodology is provided in the next section.

2.4 Existing Corridor Management Policies and Practices

An assessment of existing corridor management policies and practices includes the identification of management jurisdictions, a review of relevant plans, policies, and regulations, and follow-up interviews with staff to gain some insight into the current state of corridor management. This analysis for the US 4 corridor in Hartford was based in part on an assessment methodology recently developed by the Center for Urban Transportation Research, which includes the use of detailed checklists and matrices to evaluate the current status of inter-jurisdictional coordination, public policy, and regulatory standards that apply within the corridor.¹ The results of this assessment are summarized as follows.

Figure 10: Current Practice Matrix: Administrative Jurisdiction

Jurisdictions	Yes	Partial	No	Notes
Planning	<input checked="" type="checkbox"/>			Shared: VTrans, TRORC, Hartford
Development Regulation	<input checked="" type="checkbox"/>			Shared: State (Act 250), TRORC (Act 250/Substantial Regional Impacts), Hartford (local regulation, Act 250)
Access Approval	<input checked="" type="checkbox"/>			Shared: VTrans (US4), Hartford (Local Roads) – no Class I road segments
Coordination Requirements/Agreements/Protocols		<input checked="" type="checkbox"/>		No memoranda of agreement Informal process for internal application referrals at local level New (2007) statutory requirement to refer applications to VTrans for variance requests on state roads Hartford member of TRORC planning processes; TRORC supplies technical assistance, including data collection/analyses, studies, draft ordinances, development review.

2.4.1 Inter-Jurisdictional Coordination

It is very common for more than one governmental entity or agency to share responsibilities for corridor management – for the US 4 corridor, which extends beyond municipal, regional and state boundaries, this is especially true. The following entities have jurisdiction over various, interrelated, aspects of land and transportation planning and development along the US 4 corridor in the Town of Hartford:

- **Vermont Agency of Transportation** – for agency transportation planning, state highway access permits, and highway infrastructure maintenance and improvements. VTrans, through interagency review, may participate in Act 250 proceedings, and also may have standing as an “interested party” to participate in local development review hearings.

¹ Williams, K. M. and Hopes, C. 2007. *Guide for Analysis of Corridor Management Policies and Practices* Center for Urban Transportation Research, Tampa, FL (www.cutr.usf.edu).



- **District Environmental Commission** – for Act 250 development review, including consideration of a project’s potential transportation impacts and conformance with municipal and regional plans.
- **Two Rivers-Ottawaquechee Regional Commission** – for regional comprehensive and transportation planning programs, including the adoption of a regional plan that includes land use and transportation elements, and regional transportation development plans, studies and improvement programs. The regional commission also reviews and approves local plans, upon request provides a variety of technical assistance to its member municipalities and has standing in all Act 250 proceedings.
- **Town of Hartford** – for comprehensive municipal planning, land use regulation, and town highway ordinances and access permits, including the adoption of a municipal plan that includes land use and transportation elements and implementing bylaws, regulations and programs. Local regulatory authority is shared between the zoning administrator, planning commission, zoning board of adjustment, highway superintendent, and selectboard. The town is also a participating member of the regional commission and the commission’s Transportation Advisory Committee (TAC), and has standing in Act 250 proceedings through the select board and planning commission.

Each of these entities has different goals, objectives and responsibilities for corridor management. While the state retains immediate control within the highway right-of-way, it has little authority outside of Act 250 to plan for and regulate patterns and densities of development that may affect highway function, safety and efficiency.¹ This largely falls to the town, under its municipal plan and land use regulations, and local participation in Act 250 proceedings. The town, however, has no authority to approve access to state highways, including US Route 4 – as noted earlier, there currently are no Class 1 road segments that allow for shared jurisdiction – or to independently require improvements within state rights-of-way².

The regional commission serves largely in an advisory capacity to both its member towns and the state, and as a technical resource to the town. It does, however, have a regulatory role in Act 250 review – particularly for projects that may have “substantial regional impact” – defined in part by the regional commission to include projects that:

- Modify existing regional settlement patterns by (a) shifting activity from an existing regional development area to a major new area of regional development; (b) locating in an area which does not presently contain development of similar type or scale; or (c) resulting in activities currently served or planned for by development elsewhere in the region;

¹ Of note, under Act 250, a project cannot be denied, rather only conditioned, with respect to its potential impacts on traffic congestion and highway safety (under criterion 5). It can however, be denied for impacts to highway infrastructure (under criterion 9K).

² As noted by Peter Gregory of TRORC, because Hartford has adopted both zoning and subdivision regulations, for purposes of Act 250 jurisdiction it is classified as a “10-acre” (vs. 1-acre) town, reducing the number of projects subject to state review. As a result, Act 250 does not apply to projects involving less than 10 acres, or fewer than ten housing units.



- May significantly affect existing capacity of regional public facilities by: contributing to a reduction in the peak hour Level of Service (LOS) from D to E or from E to F; by contributing five percent or more to the peak hour Level of Service (LOS) D on a regionally significant local or state highway in or immediately adjacent to regional growth areas or LOS C on regionally significant local or state highways in rural areas; or by necessitating substantive capital improvements, such as widening or signalization of regionally significant local or state highways;
- Impair the continued function of significant regional facilities including, but not limited to, interstate highway systems.

Other thresholds also can apply to particular projects, depending on their type, scale, location, timing and potential impacts on one or more communities or regional facilities and resources. In cases where a project is determined to have substantial regional impact, the regional plan may override local plan policies and recommendations in Act 250.

Efficient and effective corridor management among multiple jurisdictions requires a level of coordination that often is lacking, to the detriment of highway capacity and safety and the communities and development it serves. Avenues exist for voluntary cooperation, including limited opportunities to participate in planning and project review at all levels, but currently there are few formal mechanisms in place that mandate inter-jurisdictional cooperation – particularly between VTrans and the municipality, who shoulder most regulatory responsibilities within the corridor.¹ Their respective authorities meet, and divide, along the right-of-way (or property) line. Current state statutes governing both require only that:

- As a condition of highway access approval by the state (or town for local roads), compliance with all local ordinances and regulations relating to highways and land use is required (19 VSA. §1111).
- In no case shall “reasonable” access to a property be denied, except as necessary to be consistent with state planning goals, and to be compatible with state agency, regional, or regionally approved municipal plans (19 VSA §1111).
- Applications to the state for a driveway or access permit must include a proposed highway access plan for the entire tract of land, and the agency can condition its approval accordingly, to include limits on accesses, the construction of frontage roads and lanes, traffic control improvements, etc.
- No deed for the subdivision of land abutting a state highway can be recorded by the town unless all subdivided lots meet state access requirements, including but not limited to the requirement to install a frontage road (19 VSA §1111)².

¹ VTrans has convened a “change of use” committee consisting of interested stakeholders to once again try to address this issue through proposed legislation, including possible statutory changes under 19 V.S.A. §1111 and 24 V.S.A. Chapter 117.

² Many municipal clerks, who are responsible for recording deed and subdivision plats, are not aware of or have difficulty administering this requirement – as a result it is often ignored, as noted in a July 9, 2007 letter from VTrans to municipal clerks.



- The town must provide notices of public hearing to VTrans for any requests for variances from setback requirements along state highways (24 V.S.A. §4464 as amended in 2007).¹

The need for better coordination between state and local government permitting processes that regulate development along state highways is a longstanding, statewide concern. The need is also evident locally from a recent example – cited by both town and regional commission staff – of a four-lot subdivision proposed along US 4 east of Quechee that the Hartford planning commission denied, based in part on traffic concerns, but VTrans approved, under an assumption that town approvals had been obtained.² The planning commission's decision is currently under appeal in Environmental Court.

Legislation has been proposed to improve notification and coordination requirements under both Title 19 (for highway access permits) and Title 24 (under local development review) but, until such legislation is enacted, better coordination will depend largely on voluntary local and state agency efforts.

There is also the need for coordination at the local level. Under the town's current land use and highway regulations, the zoning administrator, planning commission, board of adjustment, highway superintendent and selectboard all have separate, but sometimes overlapping, jurisdiction over development along and access to the highway corridor. The town's land use regulations now simply require that applicants obtain all necessary state and municipal permits, including highway access permits. Staff provides a critical coordinating function internally – applications are referred among staff for review on an informal basis, and between boards. There is still a chance however, that overlapping jurisdiction – e.g., for the review of development impacts on traffic and road conditions – may result in conflicting decisions or inconsistent conditions of approval.

2.4.2 Planning Policies and Recommendations

For purposes of this analysis, the Two-Rivers Ottauquechee Regional Plan (adopted in 2007) and the Hartford Town Plan (also adopted in 2007) were reviewed as the primary public policy documents affecting land use and transportation development along the corridor. The Hartford Town Plan has been approved by the regional commission, and is therefore considered to be consistent with state planning goals – including state land use transportation planning goals – and generally compatible with the regional plan and other approved municipal plans in the region.

Both plans have standing in Act 250 proceedings. The Hartford Town Plan also provides the statutory basis for the adoption of local regulations, including zoning and subdivision regulations, and for non-regulatory programs such as access management and interchange area plans, capital improvement programs, and land conservation initiatives that can affect both development and transportation infrastructure capacity. A summary of current planning policies is presented in Figure 11. A more detailed comparison of local and regional plan policies and recommendations is provided in Figure 12.

¹ A previous statutory requirement for municipalities to refer applications for development within 500 feet of an interchange ramp to the agency for review was repealed in 2004.

² VTrans has since revoked their permit because all local permits had not been obtained as represented by the applicant.



Key findings include the following:

- Regional and town plans both emphasize the importance of US 4 as the major east-west highway serving the region, and the fact that it supports a variety of sometimes conflicting functions, particularly within village areas. Both plans also identify the need for better corridor and access management.
- Both plans call for concentrating development and highway access within designated, compact growth areas, and restricting development and highway access outside of these areas, to preserve existing settlement patterns, avoid inefficient strip development and sprawl, and to protect rural, cultural and scenic resources.
- Both plans identify downtown White River Junction and Quechee Village as designated growth areas. They differ however with regard to designations around the Quechee Interchange. The Hartford plan identifies this as a growth center, targeted for high density, mixed use development, and recommends zoning changes to that effect. The regional plan, which includes specific policies for interchange development, recommends only limited transportation and travel-related development at this interchange because of its location away from regional growth areas. The regional plan does not support development at interchanges that would adversely affect existing downtowns and villages, or diminish the function of the highway network. The regional plan includes recommendations for the preparation of an interchange area plan, developed in association with the local community.
- Both plans call for better access management – at the regional level to preserve highway capacity and function, and at the local level to maximize available development capacity. Both recommend incorporating applicable state highway design and access management standards under local regulations. The regional plan includes specific access management recommendations for US 4, and directs the regional commission to provide needed technical assistance (e.g., model ordinance language) to its municipalities. It also notes that some segments (e.g., in villages, downtown) could be re-designated as Class 1 to allow for joint state-town access management authority. The town plan recommends increased frontage distances along US 4.
- Both plans identify the same needed transportation infrastructure and maintenance improvements along the corridor – including completion of already scheduled infrastructure improvement projects (e.g., turning lanes, Waterman Hill and Quechee Main Street intersections), and bicycle and pedestrian enhancements (e.g., widened road shoulders and the extension of village sidewalks).



Figure 11: Current Practice Matrix: Planning Policies & Recommendations

Planning Policies	Yes	Partial	No	Notes
Plans	<input checked="" type="checkbox"/>			<ul style="list-style-type: none"> ▪ VTrans (agency plans), TRORC (regional, transportation plans), Hartford (town plan) ▪ Town plan provides policy basis for adoption of regulations, other plans; municipal plan approved by TRORC
Data/Trends Analyses		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ Town, regional plans include demographic, development trends information ▪ Town plan includes regional build-out analysis of existing, proposed zoning ▪ Town, regional plans acknowledge need for better traffic, road capacity, sufficiency data, traffic impact studies for use in development review ▪ Regional plan identifies US 4 as the most studied route in region
Development/Growth Center Policies	<input checked="" type="checkbox"/>			<ul style="list-style-type: none"> ▪ Municipal, regional plans promote concentrated development, access within designated growth areas, limited development/access outside these areas ▪ TRORC Growth Areas: Regional Center (WRJ), Village Settlements (Quechee) ▪ Hartford Growth Areas: White River Junction, Quechee, Quechee Interstate Interchange ▪ Conflicts between local, regional growth area designations related to interchange area, US 4 corridor immediately west of Quechee Village
Interchange Area Plan/Policies		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ No supporting interchange area plan (as allowed under 24 VSA Section 4432) ▪ TRORC plan includes specific policies for interchanges; limit development outside growth areas, develop interchange plans. ▪ Hartford plan targets Quechee interchange area for development -- local/regional conflict
Corridor Management Plan/Policies			<input checked="" type="checkbox"/>	<ul style="list-style-type: none"> ▪ No existing plan; corridor management plan currently under development
US 4 Corridor	<input checked="" type="checkbox"/>			<ul style="list-style-type: none"> ▪ VTrans (Category 3), TRORC (major arterial), Hartford (major arterial) ▪ All recognize US4 as major east-west highway with multiple, often conflicting, functions ▪ TRORC plan includes policies/recommendations specific to US 4 ▪ Town plan recommends that lot frontage be increased along US 4 ▪ Town, regional plans identify similar needed infrastructure improvements
Access Management (AM) Plan/Policies		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ VTrans (2007 AM Program Guidelines), TRORC (plan policies), Hartford (plan policies) ▪ VTrans access management program guidelines referenced in regional, but not local plan ▪ TRORC plan includes both general access management policies; and policies specific to US4 to maintain its primary function for mobility ▪ Hartford plan--general AM policies to "maximize development capacity;" US 4 top priority for access management ▪ No supporting access management plan for US4 (as authorized under 24 VSA Section 4432)



Figure 12: Regional and Local Plan Policies

Policy Area	TRORC Regional Plan	Hartford Town Plan
US 4 Corridor	<ul style="list-style-type: none"> Maintain/upgrade to improve safety, enhance capacity; small scale improvements to reduce seasonal peak traffic congestion Strengthen access management – concentrate access within existing nodes, restrict access in higher speed areas, and require shared access in these areas. Work with developers to secure access easements. Upgrade Waterman Hill, Quechee Main Street intersections prior to approval of new, major development. Pursue walking, bicycling, traffic calming enhancements in villages. 	<ul style="list-style-type: none"> US 4 top priority for access management. Increase minimum lot frontage standards. Improve intersections with Waterman Hill, Quechee Main Street. Improve for bicycle use (widen shoulders, sensors at signals). Extend sidewalks in Quechee, Quechee Gorge. Preserve scenic areas along RT4 from Lakeland Drive southwest to Hartland Town line.
Land Use/ Development Patterns	<ul style="list-style-type: none"> Provide for intensive development only in regional growth areas served by infrastructure Rural areas – low density development that minimizes resource impacts and use conflicts, maintains rural character; PUDs/ clustering encouraged. Avoid sprawling development, strip development in rural areas; minimize impacts of strip development on scenic resources. Encourage compact, densely developed projects that use land efficiently. Layout project sites to allow for coordinated use of entire parcel 	<ul style="list-style-type: none"> Preserve traditional development pattern of compact villages surrounded by rural countryside. Concentrate development in proposed growth centers – mixed use, higher densities, reduced lot sizes and widths. New zoning district for I-C properties along US 4 in Quechee. New zoning district for Quechee Interstate Interchange area. PUD overlay district for rural areas, for all major subdivisions.
Growth Areas	<ul style="list-style-type: none"> White River Junction (Regional Center) Quechee Village (Village Settlement) 	<ul style="list-style-type: none"> Quechee Quechee Interstate Interchange
Interchange Area	<ul style="list-style-type: none"> Interchange development should not be detrimental to regional growth areas, public investments. Quechee Interchange not appropriate location for a growth center (outside of designated regional growth center). Limit to travel/transportation related uses, not high traffic commercial or institutional uses. Support development of interchange master plans to include access management, scenic/open space preservation, design controls, etc. 	<ul style="list-style-type: none"> Quechee Interstate Interchange area designated growth area New zoning proposed for interchange area, based in part on build-out analysis.
Transportation Infrastructure	<ul style="list-style-type: none"> Promote coordinated land use-transportation planning Development must not materially decrease mobility, functional use or safety of highways Act 250– require interconnected road networks 	<ul style="list-style-type: none"> Collect LOS data (arterials, intersections) Development applications – request LOS data for roads, intersections, traffic studies Transportation impact fees for large scale commercial, residential development
Access Management	<ul style="list-style-type: none"> Guide development toward existing nodes Minimize access/curb cuts on public roads (a variety of techniques noted) Implement through Act 250, local plans, regulations – model ordinance For state highways, coordinate with VTrans; encourage reclassification of some to Class 1. Avoid direct access onto state or national highways, particularly on truck network Cooperate with VTrans to implement state access management program, clarify permitting process 	<ul style="list-style-type: none"> Critical on national, state highways to maximize development capacity Reference/incorporate state design standards Review access for changes in use Implement local access management through updated regulations, highway ordinance – e.g., to encourage shared driveways, use of existing nodes, subdivision connections, access landscaping and enhancements, etc.



2.4.3 Development Regulation

The regulation of development along the US 4 corridor is largely the responsibility of the Town of Hartford under its land use regulations and highway ordinance. As noted, VTrans retains jurisdiction over access to the highway right-of-way, which extends to the subdivision of adjacent parcels; and both the town and regional commission have standing in Act 250 for the review of larger development projects along the corridor.

Hartford has comprehensive land use regulations, including both zoning regulations (as amended through 2007) that control the type, location, scale, and density of development; and subdivision regulations (as amended through 1987) that regulate the pattern of land subdivision and development, and related infrastructure improvements. These regulations are intended, and now required by statute, to implement the Hartford Town Plan. They are currently being updated to incorporate 2007 plan recommendations. For this analysis both existing and available draft regulations were reviewed. The town also has a highway ordinance that controls connections (accesses, intersections) to town roads, and includes driveway and road standards. This ordinance is also in the process of being updated, with the assistance of the regional planning commission.

These longstanding regulations have been updated frequently over the years to respond to changing circumstances and community objectives – as such they contain provisions for the review of subdivisions, site plans, conditional uses, and planned developments and, in the downtown, design considerations. The current bylaws offer a well-established framework for regulating development within the US 4 corridor. They do not, however, include a corridor overlay district, or standards specific to the US 4 corridor. There are also general references pertaining to access management, intersection and road design, but specific standards, for the most part, are lacking.

A summary of identified local regulatory practices that are relevant to corridor management is presented in Figure 13. Key findings include the following:

- As noted previously, there are no application referral requirements under the local regulations that specify review by the town's highway superintendent under the local road ordinance, or by VTrans for development along federal and state highways. The subdivision regulations do include general references to the highway ordinance. The planning commission and board of adjustment both have the ability to require the submission of traffic data or studies as needed under subdivision, site plan or conditional use review.
- There are currently seven zoning districts that regulate the type, scale, and density of land use along the corridor. Districts generally correspond to plan objectives to concentrate development in designated growth centers within and adjacent to existing settlements (Quechee Gorge, Residential-Commercial, Residential), and the interchange area (Quechee Interchange, Industrial Commercial), and to be more restrictive of development outside these areas (Rural Lands Districts).
- Several districts are defined in part in relation to highway access – the Industrial-Commercial, Quechee Interstate Interchange, Residential-Commercial, and Rural Lands 1 Districts. One



district – the Quechee Interchange District – specifically calls for the application of access management principles in project design, but includes no district specific access management standards.

- Existing district dimensional requirements – evaluated in more detail in related build-out analyses – allow for relatively moderate to high densities of development along the corridor. Minimum lot areas range from 8,000 square feet in village and interchange districts, in areas served by water and sewer, to three acres in rural lands districts. Lowest density districts are located off the highway corridor, suggesting that the availability of road access is, at least in part, a factor in defining district development capacity.
- Minimum lot widths, measured along the front setback line, do not necessarily equate with lot “frontage” along the road right-of-way, but generally (with side setbacks) regulate the linear spacing of development along the highway corridor. Lot widths range from a minimum of 50 feet in the Quechee Interstate Interchange District to 250 feet in the Rural Lands 3 District, and vary by lot size, but not road function. Lot widths, especially in village areas, are intended in part to preserve existing character. They may also affect, but are not specifically tied to, access separation distances. Access separation distances recommended by VTrans (which vary based on traffic volumes and speeds) typically exceed minimum lot width requirements.
- The regulations incorporate statutory protections for pre-existing, nonconforming lots along the highway. Such lots must have frontage along public roads or waters or, with the approval of the Planning Commission, a 50-foot (right-of-way) access to public roads or waters (which, for smaller subdivisions may be reduced to 20 feet). Existing small lots may be developed if they have a width of at least 40 feet, subject to conditional use review, which includes an evaluation of traffic and road impacts. There is no local lot merger requirement, as allowed (but no longer required) by statute.
- Minimum front setback distances are also defined, which in turn define the corridor (or streetscape) “width” extending beyond the right-of-way to the building line. Front setback distances, measured from the edge of the right-of-way, range from 20 to 40 feet, in some cases varying by lot size, but not highway function. Front setbacks, especially in village areas, are defined largely to preserve village character, and also have the effect of minimizing required driveway lengths. Along some segments, setback requirements may make it difficult to accommodate future road improvements or realignments. In lower density residential and rural districts, the setback distance ranges from 20 to 35 feet.
- The number of potentially permissible uses ranges from 10 in the most restrictive residential and rural lands districts, to 36 in the Industrial-Commercial District. Most uses are subject to site plan and conditional use review. All districts but one (the Industrial-Commercial District) currently allow for residential development, including single family dwellings. Commercial development, for the most part, is limited to districts that access, but don’t extend along the



highway – as a result the potential for extensive commercial strip development along US 4 is limited.

- There is no access management section under zoning that applies to all types of development (e.g., in the general regulations), however there are specific standards for minimum access distance from road intersections (100 feet), corner clearance, and access/parking aisle widths. “Internal roads” are required for parking areas with more than 100 spaces.
- Site plan review by the planning commission focuses mainly on site layout, circulation and design, and is required for all but single and two-family dwellings, farming and forestry. A change in an existing access or circulation pattern also triggers site plan review. Site plan review provisions include access (e.g., number, location, radii), traffic and pedestrian circulation considerations but few specific standards. Connecting roads to adjoining parcels may be required. Shared or mixed use parking also may be allowed subject to site plan review.
- Conditional use review by the board of adjustment applies to most uses allowed in the vicinity of the corridor. Review criteria include an evaluation of the impacts of proposed development on traffic and roads in the vicinity, but again there are few specific standards. The board may limit the number and location of accesses, and require road improvements if the level of service (LOS) drops below “C.”
- The subdivision regulations, administered by the planning commission, control the pattern of development, and related infrastructure such as new or extended roads. The regulations define major and minor subdivisions in relation to the number of lots created, and whether or not road extensions are proposed. Minor subdivisions must have frontage on or an existing access to a public road. There are no related lot or access management standards – e.g., for flag lots, lot splits or re-subdivisions. The regulations define levels of service for roads that are not applied in the regulations. The regulations do, however, include a street continuation-connectivity requirement, and also note that highway superintendent approval is required for access, road and intersection design, under the town’s highway ordinance.

Planned developments, reviewed by the planning commission in association with review as major subdivisions, are allowed (but not required) in all districts. Dimensional waivers and density bonuses are allowed, to encourage more efficient patterns of development, clustering and the preservation of open space. There are no specific standards related to access management, circulation or road design.



Figure 13: Current Practice Matrix: Development Regulations

	Yes	Partial	No	Notes
Application Requirements		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ VTrans/Act 250 : site plans, traffic data/ study, notice typically required ▪ Hartford: site/subdivision plans; traffic data/study may be required under site plan or conditional use review; not specified for subdivision review ▪ No application referral requirements under local regulations
Zoning Districts		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ US 4 Zoning Districts: Industrial-Commercial, Quechee Interchange, Quechee Gorge, Residential-Commercial, Residential 3, Rural Lands 1,3 ▪ Town plan recommends new expanded interchange area district (QII) and extended highway commercial district along US4 west of Quechee ▪ No corridor management overlay district; corridor-specific standards
District Standards		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ Minimum district lot size and density requirements promote generally moderate to high densities of development along corridor – highest densities within/adjacent to villages served by water and sewer, interchange area ▪ Minimum lot width, (not frontage standards) specified – widths measured along front set back, not tied to access separation distances. ▪ QII district references access management objective, but does not include related management standards
Frontage/Access Standards		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ VTrans standards apply on state highway (vary by traffic volume, speed) ▪ Zoning, highway ordinance standards apply to connecting roads ▪ No local regulatory standards specific to frontage, access along US 4 ▪ Minimum lot widths (not frontage) specified; widths not tied to recommended access separation distances ▪ Lot must have frontage on or, with PC approval, access to public road or waters (statutory); 50 ft. minimum but PC may reduce to 20ft for < 5 lots ▪ Pre-existing lots without required frontage may be developed if 40+ ft wide or deep (statutory), subject to conditional use review; no merger required ▪ No specific limits on number of accesses per lot or frontage distance ▪ Curb cuts (excluding SFD/TFD) must be 100+ ft from road intersections ▪ Minimum corner clearance, access widths specified in zoning. ▪ “Internal road” required for parking areas with 100+ spaces
Site Plan Review		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ Applies to all but single, two family dwellings, farming, forestry uses ▪ Includes access considerations, but no specific standards; shared access not required ▪ Review of site circulation; may require road connections to adjoining parcels ▪ Shared, mixed use parking allowed subject to site plan review ▪ Change in curb cuts, internal or external circulation triggers site plan review
Conditional Use Review		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ Applies to conditional uses (most uses listed) ▪ Reviews project impacts on traffic conditions, road capacity ▪ Board may control number, location of vehicle access points ▪ Infrastructure improvements may be required if road LOS drops below C
Subdivision Standards		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ Minor subdivisions (<5 lots) must have frontage on or access to public road ▪ No access restrictions for subsequent lot splits, re-subdivisions ▪ Subdivided lots must meet zoning requirements, but no specific prohibitions on flag lots, or access to other irregularly shaped lots ▪ Street connectivity/continuation requirement, but dead ends also allowed. ▪ References town highway ordinance for road, intersection standards
Improvements		<input checked="" type="checkbox"/>		<ul style="list-style-type: none"> ▪ Bonding or other surety may be required for required improvements ▪ Installation may be required prior to lot sale, issuance of zoning permits



2.4.4 *Hartford Land Use Regulation Revisions Currently Ongoing*

Hartford is now working on updates of its zoning and subdivision regulations and, with regional commission assistance, a comprehensive update of its highway ordinance. The proposed zoning district boundaries are shown in Figure 14. Specific objectives of this work are to implement the 2007 town plan recommendations, and to establish greater consistency between the zoning regulations, subdivision regulations and highway ordinance. Proposed zoning regulations, reviewed to date, may have the effect of increasing development capacity and densities along the corridor by:

- Expanding the Quechee Interstate Interchange District to incorporate the adjoining Industrial-Commercial District, and increasing the number of allowed uses in this district (see Figure 15 and Figure 16).
- Creating a new Highway-Commercial District, extending along US4 west of Quechee Village, that would significantly increase the number of allowed uses in this area, and potentially lead to commercial strip development extending beyond existing commercial uses.
- Reducing minimum lot size, frontage and setback requirements in many of the districts.
- Down-zoning land outside of the corridor (e.g., through the creation of Rural Land-10 districts).

The US 4 corridor and related corridor or access management policies – e.g., to increase lot widths along the corridor and to incorporate state access management standards under local regulations – have not yet been addressed. The town has been working with the regional commission to better define general access management requirements in its updated highway ordinance, which could be referenced and applied under the other regulations as appropriate.



Figure 14: Proposed Zoning District Boundaries

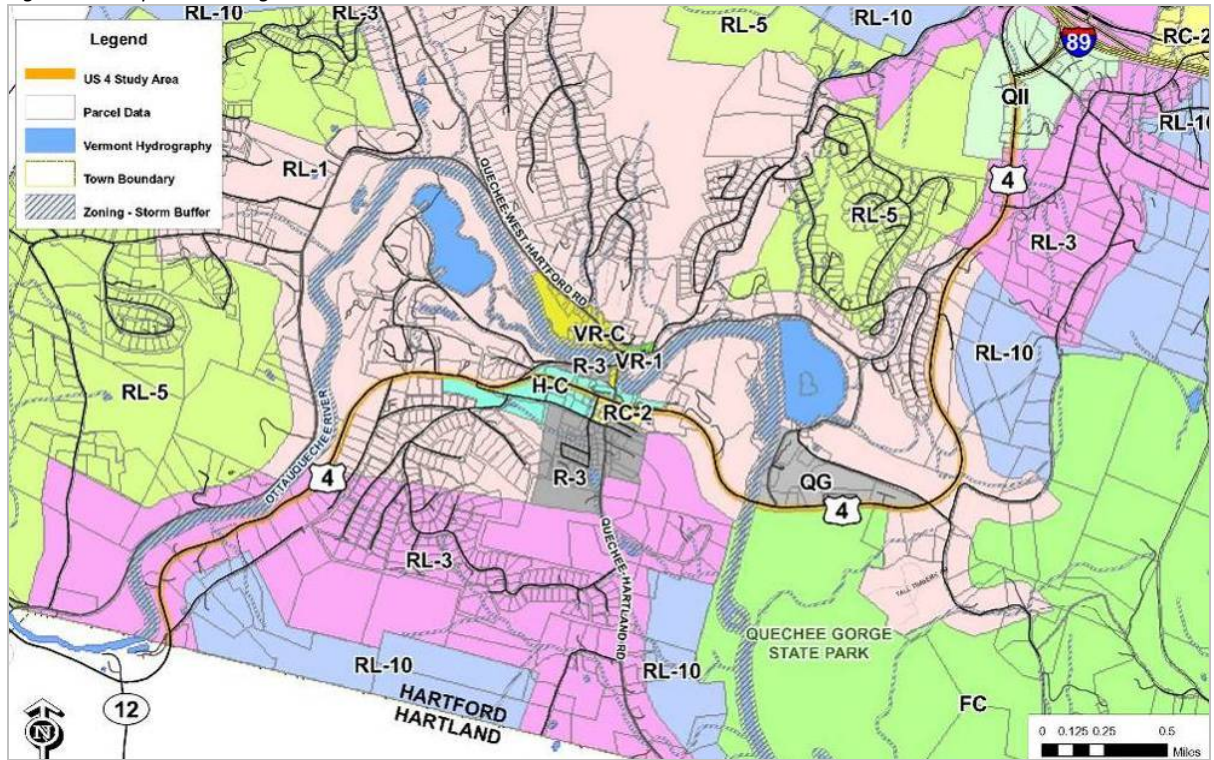


Figure 15: Existing and Proposed Quechee Interstate Interchange Zone per Hartford Zoning Revision

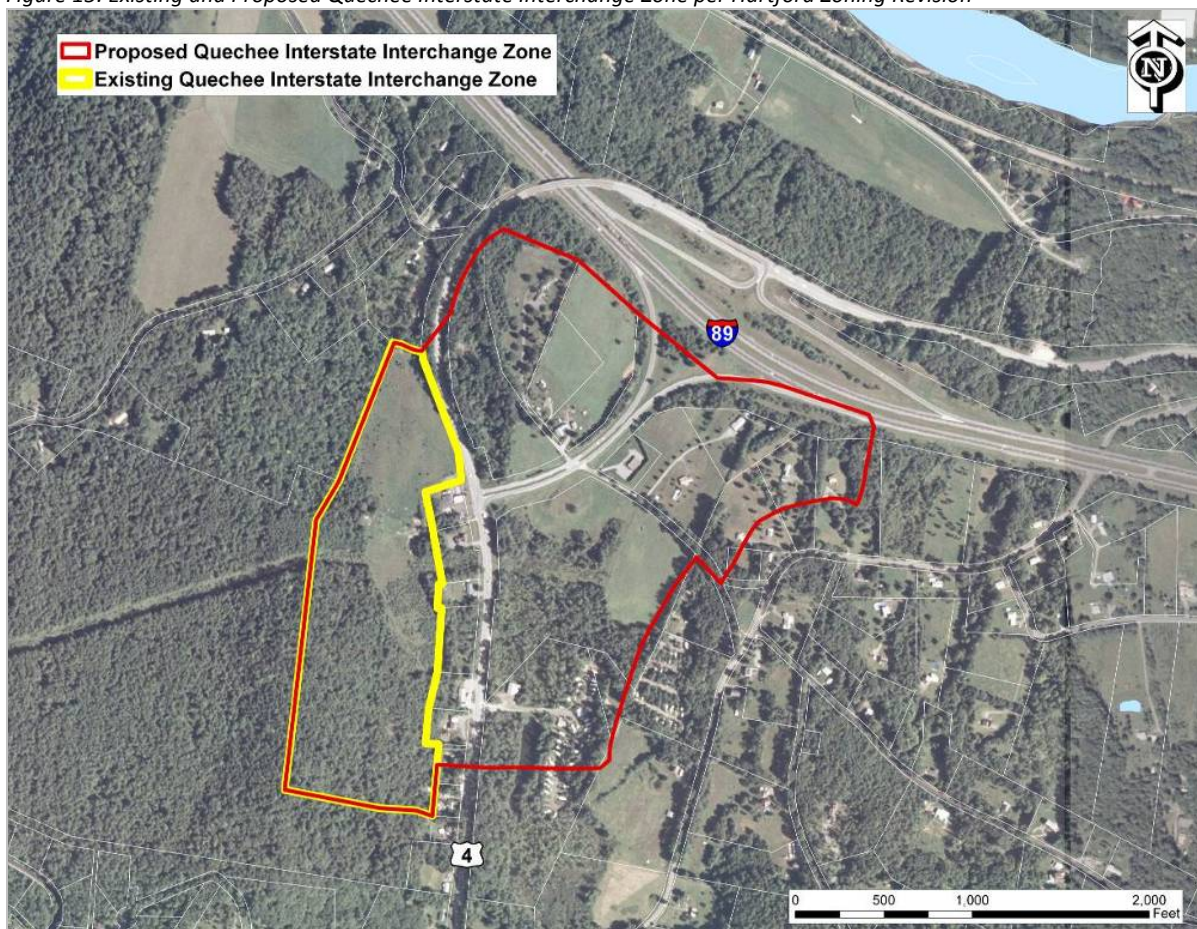


Figure 16: Comparison of Allowed Uses in Proposed QII District

Permitted Uses	Existing Zoning		Proposed Zoning	
	RL-3	RC-2	QII	QII
Agriculture				
Bakery				
Bed & Breakfast				
Single-Family Dwelling (Dwelling Unit, Single)				
Two-Family Dwelling (Dwelling Unit, Two)				
Multi-Family Dwelling (Dwelling, Multi-Unit)				
Retail <2,500 Sq. Ft.				
Office < 2,500 Sq. Ft.				
Office 2,500 - 10,000 Sq. Ft.				
Public Assembly				
Conditional Uses				
Banking, Financial Institution				
Bed & Breakfast				
Campground				
Cemetery				
Contractor's Shop				
Daycare Facility				
Farmstand				
Food Assembly/Catering				
Funeral Home				
Garden Center				
Home Business				
Hospital/Med. Ctr.				
Hospital/Nursing Home				
Hotel, Motel, Inn				
Kennel				
Light Manufacturing/Industry				
Light Manufacturing/Retail Sales				
Lodging House				
Lt. Mfg/Retail Sales				
Medical Clinic				
Mixed Use Building				
Mobile Home Park				
Motor Vehicle Service Station				
Museum (= 10,000 sq. ft.)				
Museum ? 10,000 Sq. Ft.				
Neighborhood Commercial Facility				
Nursing Care Facility				
Office > 10,000 Sq. Ft.				
Office Building (= 10,000 sq. ft.)				
Open Air Market				
Parking Facility				
Passenger Terminal				
Performing Arts Facility				
Personal Services				
Place of Worship				
Private Club				
Private School				
School				
Public Assembly				
Public Assembly Facility < 2,500 Sq. Ft.				
Public Assembly Facility 2,500 Sq. ft.+				
Public Facility				
Public Information Facility				
Recreational Facility				
Research, Testing Lab				
Restaurant				
Restaurant (no drive-thru)				
Restaurant, Bar				
Bar				
Retail 2,500-10,000 Sq. Ft.				
Retail Store (= 10,000 sq. ft.)				
Two-Family Dwelling				
Veterinary Clinic				

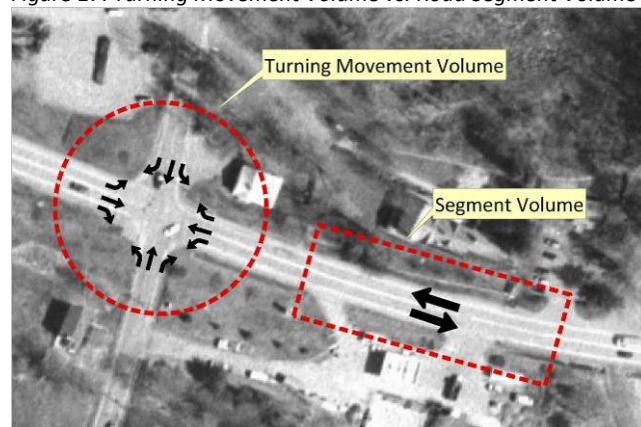


3.0 TRAFFIC VOLUME ASSESSMENT

Both road segment traffic volumes and intersection turning movement volumes are analyzed in the traffic volume assessment (Figure 17). The traffic volume assessment consists of the following topics:

1. Historic Traffic Volume Trends
2. Local vs. Through Traffic on US 4
3. Traffic and Business Volume Fluctuations
4. Average Volumes on Secondary Roads
5. Traffic Growth Projections
6. PM Peak Hour Intersection Volumes

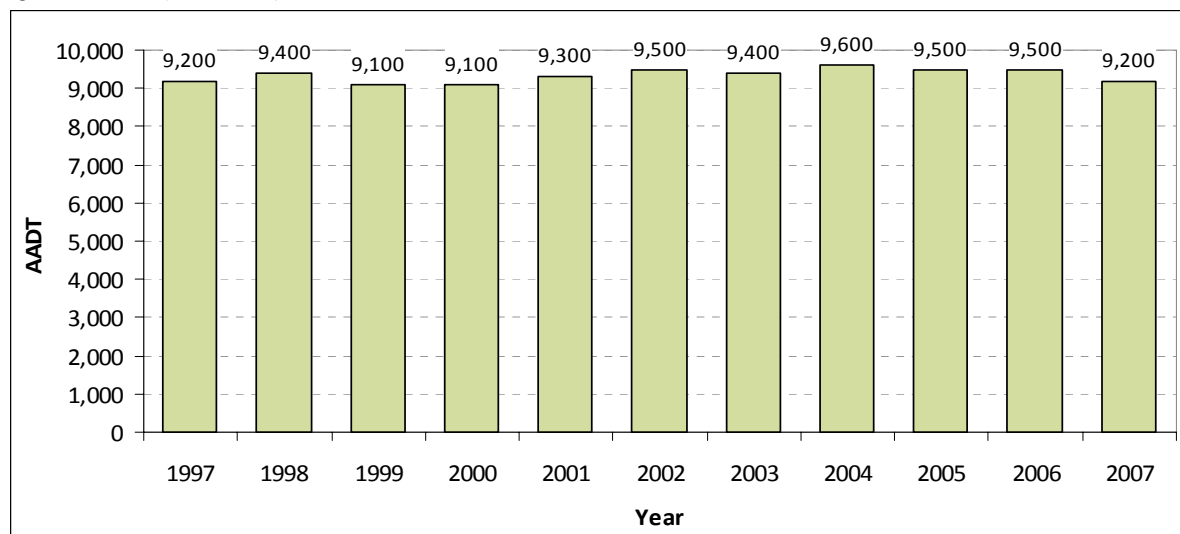
Figure 17: Turning Movement Volume vs. Road Segment Volume



3.1 Historic Traffic Volume Trends

Since 1997, Average Annual Daily Traffic (AADT) on US 4 at the Quechee Gorge has grown on average by a modest 0.4% annually based on a linear regression calculation (Figure 18). This is slightly higher than the statewide average for similar roadways which declined -0.4% per year between 2001 and 2006.¹

Figure 18: AADT (1997-2006)²



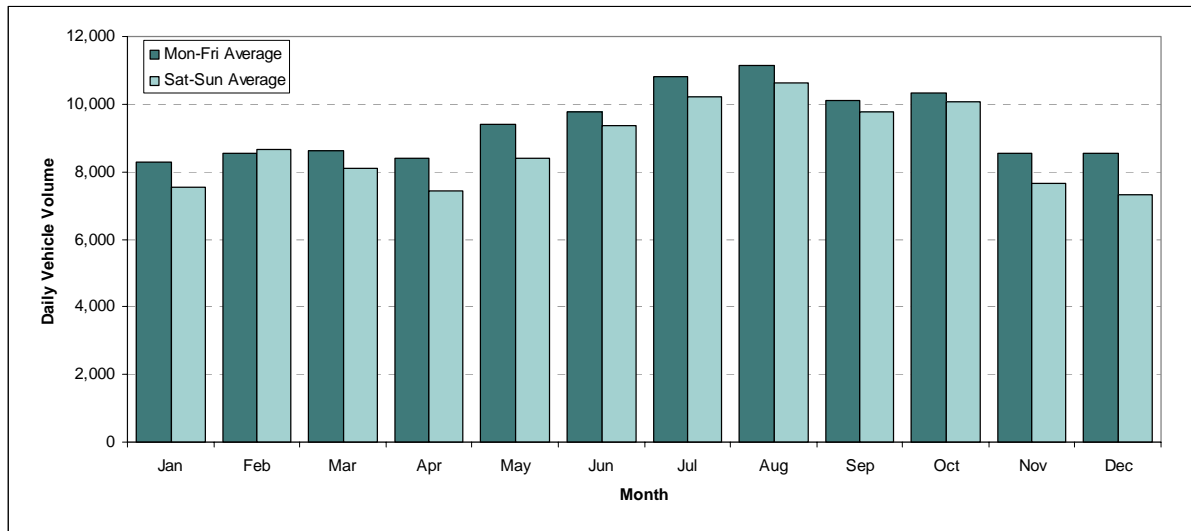
¹ VTrans, *2006 Continuous Traffic Counter Grouping Study and Regression Analysis Report* ("The Red Book"), Short Term Growth Factors for Rural Primary and Secondary Continuous Traffic Counters.

² From VTrans CTC P6Y119, located on US 4, 300 ft. east of Quechee Gorge.



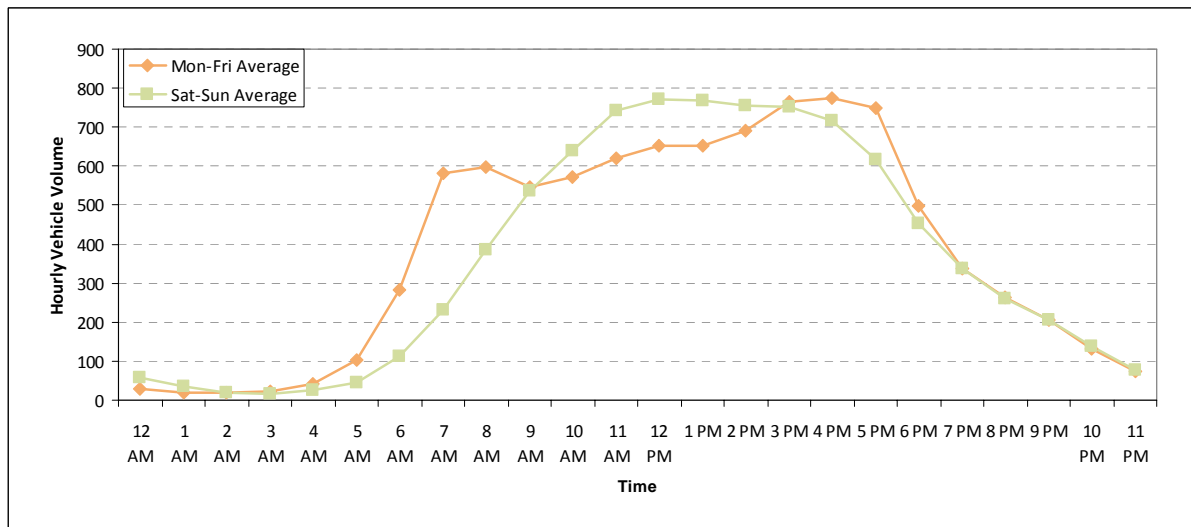
In the study area, traffic volumes tend to be highest in the late summer months and during fall foliage season, which reflects the tourist-driven nature of the corridor. With the exception of February (where ski traffic presumably peaks), weekday daily traffic volumes are greater than weekend daily traffic volumes (Figure 19).

Figure 19: 2007 Seasonal Traffic Volume Fluctuations on US 4 at Quechee Gorge



In 2007, Monday through Friday traffic volumes follow a typical workday cycle, with clear AM and PM peak hours. Saturday and Sunday traffic typically peaks during the midday hours (Figure 20).

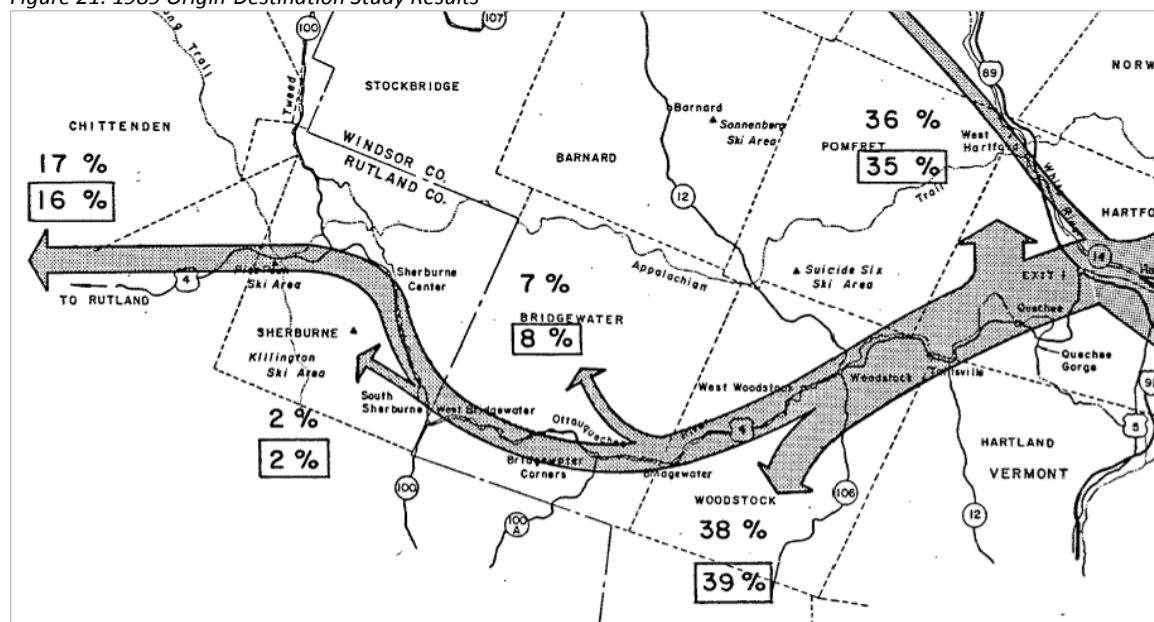
Figure 20: 2007 Daily Fluctuations on US 4 at Quechee Gorge



3.2 Local vs. Through Traffic on US 4

In the 1989 *US Route 4 Corridor Study*, an origin-destination study was conducted on a Friday and Saturday in the fall of 1986. Although that study looked at the broader scope of US 4 from Hartford to Rutland, it resulted in a key finding that 36% of weekday and 35% of weekend westbound daily traffic on US 4 had a destination in the Quechee area.¹ The implication of this finding was that a significant portion of the traffic along US 4 in Hartford was locally-generated.

Figure 21: 1989 Origin-Destination Study Results



The 1989 study was updated to validate the results of the 1989 study. The 2008 origin-destination survey was conducted on a Thursday and Saturday in July from 4:00 PM to 5:00 PM and 11:00 AM to 12:00 PM, respectively.² Surveyors recorded license plate characters on all passing vehicles at the following two stations:

- Westbound entering vehicles survey location: Mobil gas station adjacent to I-89 Exit 1
- Westbound exiting vehicles survey location: US 4/VT 12 intersection

The license plate data was then assigned an appropriate time stamp and analyzed using a spreadsheet model to match up corresponding entering and exiting vehicles.

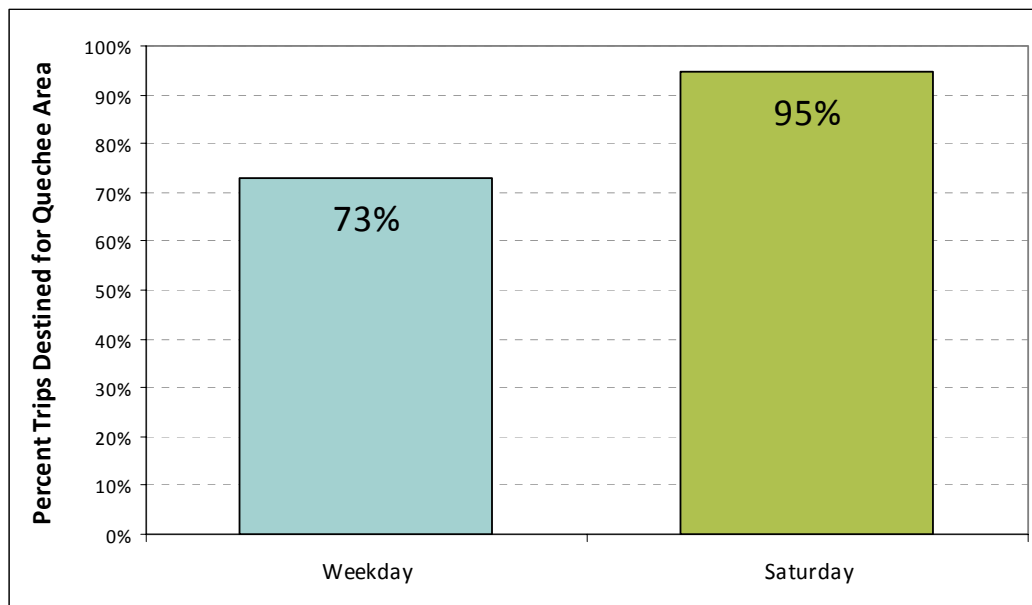
¹ Andrews and Clark, Inc. *US Route 4 Corridor Study* (March 1989) II-71.

² Survey data was taken on Thursday, 10 July 2008 and Saturday, 12 July 2008.



The 2008 origin-destination results indicate that a very high proportion of westbound vehicles that enter the study area during the PM peak and Saturday midday peak hours have destinations in the Quechee area or Hartland via Quechee-Hartland Road (i.e. do not pass through the US 4/VT 12 intersection). As Figure 22 indicates, 73% of weekday PM peak hour vehicles and 95% of Saturday midday peak hour vehicles are headed for destinations in the Quechee area. This is in contrast to the 1989 study that indicated 36% of daily PM trips and 35% of Saturday daily trips are destined for locations in the Quechee area.

Figure 22: Percentage of Trips Destined for Quechee Area (assuming 15-minute maximum travel time)



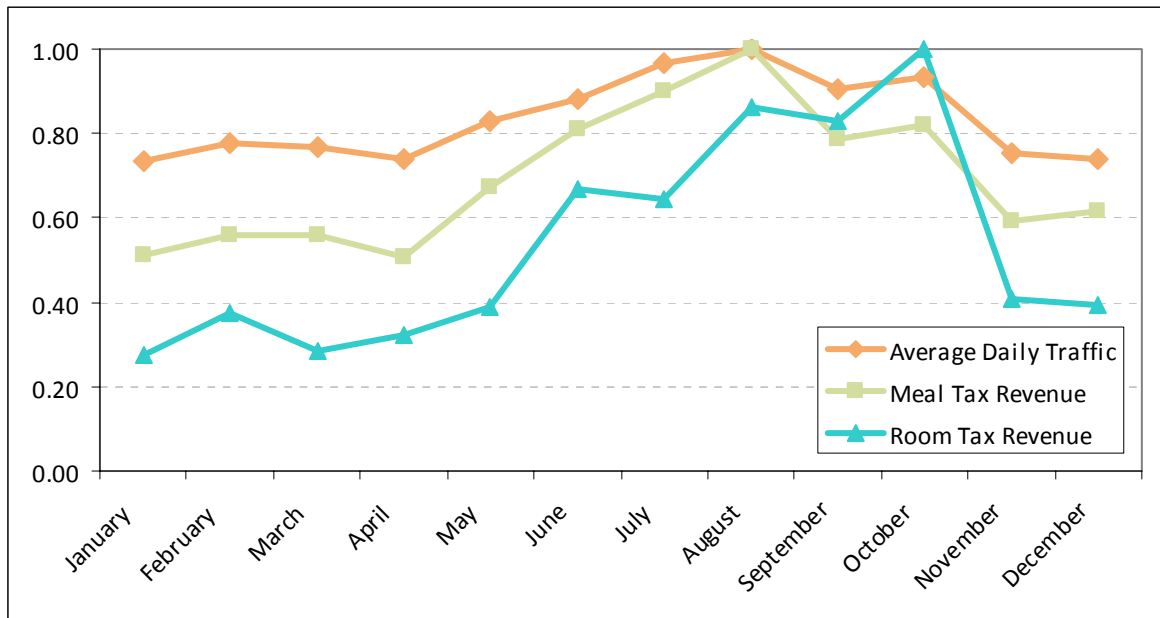
3.3 Traffic and Business Volume Fluctuations

Business activity in Hartford closely mirrors the average daily traffic, which peaks in August and is driven primarily by tourism, throughout the year (Figure 23). The one exception is in October, when there is a surge in Rooms Tax Revenue due to fall foliage season.¹

¹ Based on Room Tax Revenue and Meal Tax Revenue from the Vermont Department of Taxes, *Meals & Rooms Monthly Report*, 2007 Preliminary.



Figure 23: 2007 Seasonal Traffic and Business Fluctuations in Hartford



3.4 Average Volumes on Secondary Roads

Annual Average Daily Traffic Volumes were obtained from Two-Rivers Ottawaquechee Regional Council and VTrans for the secondary roads off of US 4 in the study area. These volumes are shown below in Figure 24.

Figure 24: AADT on Secondary Roads

Secondary Road	AADT	Location	Source
Quechee-Hartland Road	1,700	Near US 4 Intersection	TRORC, 2004
Waterman Hill Road	2,200	Between US 4 and River Street	TRORC, 2004
Deweys Mills Road	2,800	Between US 4 and Main Street	VTrans, 2003
Quechee Main Street	3,000	Near US 4 Intersection	TRORC, 2004

3.5 Traffic Growth Projections

Future year (2030 and 2050) traffic volumes along US 4 and at major intersections were developed by assigning traffic generation numbers to the following three areas of growth identified in the previous section:

- Development on parcels immediately adjacent to the study corridor
- Residential development within the Quechee Lakes development
- General external land use and subsequent traffic growth



Traffic generation from each of these three categories is summarized in detail below and then combined to represent future traffic conditions for use in the congestion analysis.

3.5.1 Traffic Increase from Residential and Commercial Growth along US 4

The commercial and residential development assumptions developed in the previous section are translated into future trips using national rates published in the Institute of Transportation Engineers' *Trip Generation*.¹ Figure 25 lists the land uses and associated trip generation rates used in the growth calculations. For assessment purposes, it was assumed that 60% of the growth would occur by 2030 and 100% by 2050.

Figure 25: ITE PM Peak Hour Trip Generation Rates

	Land Use Code	Trip Generation Rate	Enter %	Exit %
Single-Family Detached Housing	210	1.01 / unit	63%	37%
Residential Condominium/Townhouse	230	0.52 / unit	67%	33%
Hotel	310	0.59 / room	53%	47%
General Office	710	1.49 / 1,000 sf	17%	83%
Medical-Dental Office Building	720	3.72 / 1,000 sf	27%	73%
Shopping Center	820	3.75 / 1,000 sf	48%	52%
Supermarket	850	10.45 / 1,000 sf	51%	49%
Quality Restaurant	931	7.49 / 1,000 sf	67%	33%
High-Turnover (Sit-Down) Restaurant	932	0.42 / 1,000 sf	58%	42%

Figure 26 shows the number of new trips added to the study area due to residential and commercial growth along US 4 during the PM peak hour by road segment in 2030 and 2050.

Figure 26: Projected PM Peak Hour US 4 Residential and Commercial Growth Volumes by Road Segment

		2008-2030			2008-2050		
		Enter	Exit	Total	Enter	Exit	Total
1	Hartland Town Line to Waterman Hill Rd	152	142	294	253	236	490
2	Waterman Hill Rd to Deweys Mills Rd	1	1	2	2	1	3
3	Deweys Mills Rd to Quechee Main St	37	34	72	62	57	120
4	Quechee Main St to I-89 Exit 1 SB Ramps	226	227	453	377	378	755
5	I-89 Exit 1 SB Ramps to I-89 Exit 1 NB Ramps	19	49	69	32	82	115
		436	453	890	727	755	1483

¹ Institute of Transportation Engineers, *Trip Generation* 7th Edition (Washington, D.C.: Institute of Transportation Engineers, 2003).



3.5.2 Traffic Increase from Quechee Lakes Residential Development

Trips generated by the projected growth of Quechee Lakes are calculated based on the residential rates shown in Figure 25. Trips are then distributed to the study intersections based on external traffic and proximity to study intersections. There are two study intersections within the study corridor that serve as major access/egress points for Quechee Lakes units: US 4/Waterman Hill Road/Quechee Hartland Road and US 4/Quechee Main Street.

Figure 27 shows the volume of trips added to the road network by intersection in 2030 and 2050.

Figure 27: Projected PM Peak Hour Quechee Lakes Growth Volumes

	Total	Enters	Exits
Trips from 2008-2030			
US 4/Waterman Hill Rd/Quechee Hartland Rd	135	86	49
US4/Quechee Main Street	127	81	46
Trips from 2008-2050			
US 4/Waterman Hill Rd/Quechee Hartland Rd	253	162	91
US4/Quechee Main Street	237	152	86

3.5.3 Traffic Increase from External Growth

The final contributor to traffic growth along the US 4 corridor is growth related to development outside the study area, increase to tourist-related traffic, increase to through truck traffic, etc. This “external” traffic increase is calculated by assuming that historic traffic growth trends (measured at VTrans Continuous Traffic Counter P6Y119 at the Quechee Gorge) continue into the future. This annual adjustment factor increases existing volumes by 5.4% between 2008-2030 and 15.1% between 2008-2050.

3.5.4 Summary of Future Traffic Volume Projections

The projected future traffic volumes developed above are then combined to develop a comprehensive future year peak period traffic volume estimate. Figure 28 breaks down the total traffic growth by volume source: external growth, projected development along US 4, and Quechee Lakes development. As the figure shows, the majority of the future growth comes from the projected development along US 4. The figure also shows that the segment with the largest increase in traffic is Segment 4 (between Quechee Main Street and I-89) due to the significant development potential in this segment.



Figure 28: Projected PM Peak Hour Traffic Volume Growth by Source

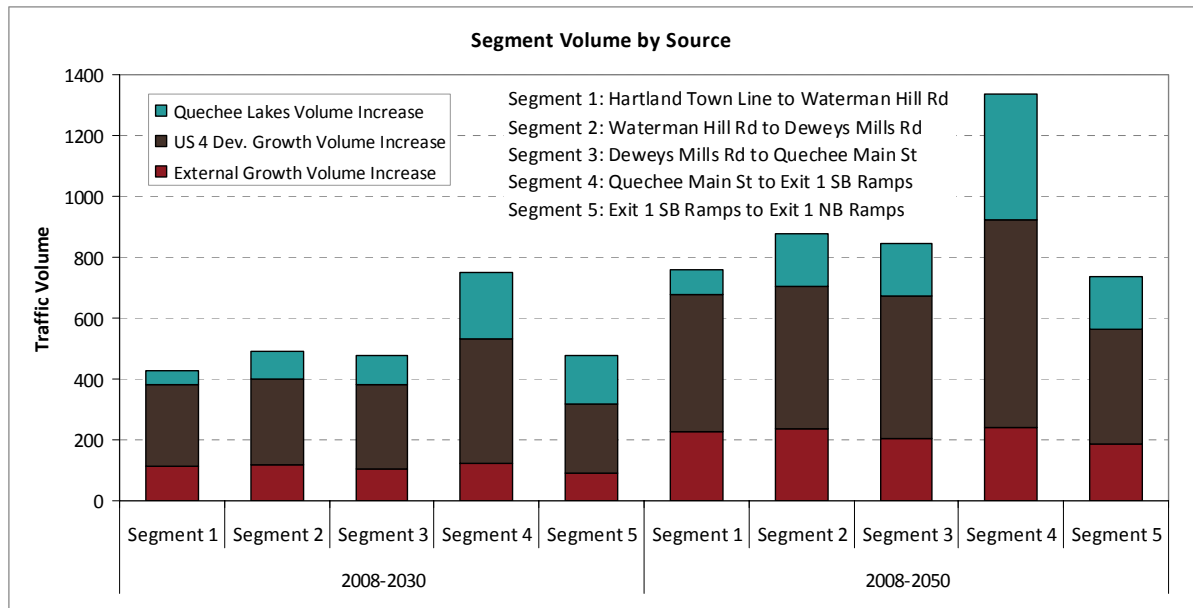
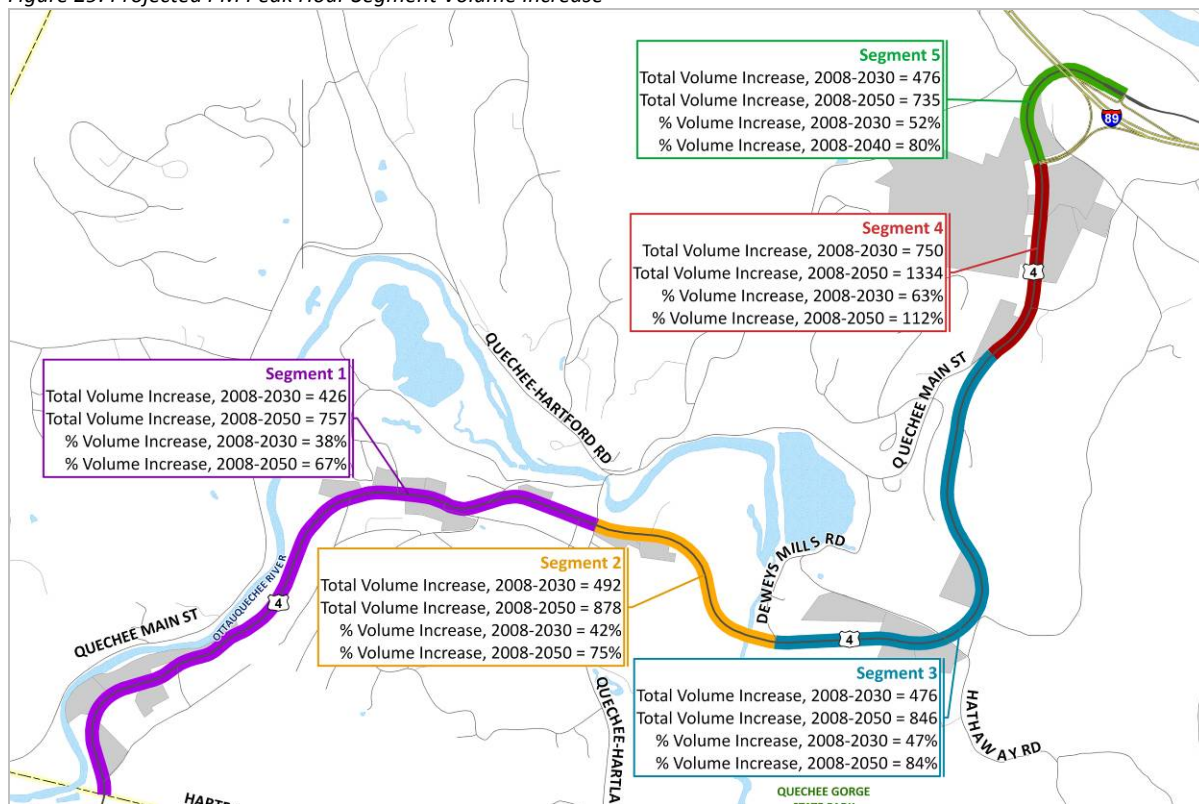


Figure 29 shows the total segment traffic volume increase as a result of external growth, future projected development along the corridor, and growth at Quechee Lakes.



Figure 29: Projected PM Peak Hour Segment Volume Increase



3.6 PM Peak Hour Intersection Volumes

In addition to the road segment traffic volume assessment, turning movement volumes at the five intersections are also analyzed. Turning movement counts were conducted by VTrans and TRORC on 30 July 2007 and 18 March 2008 at the five study intersections along US 4:

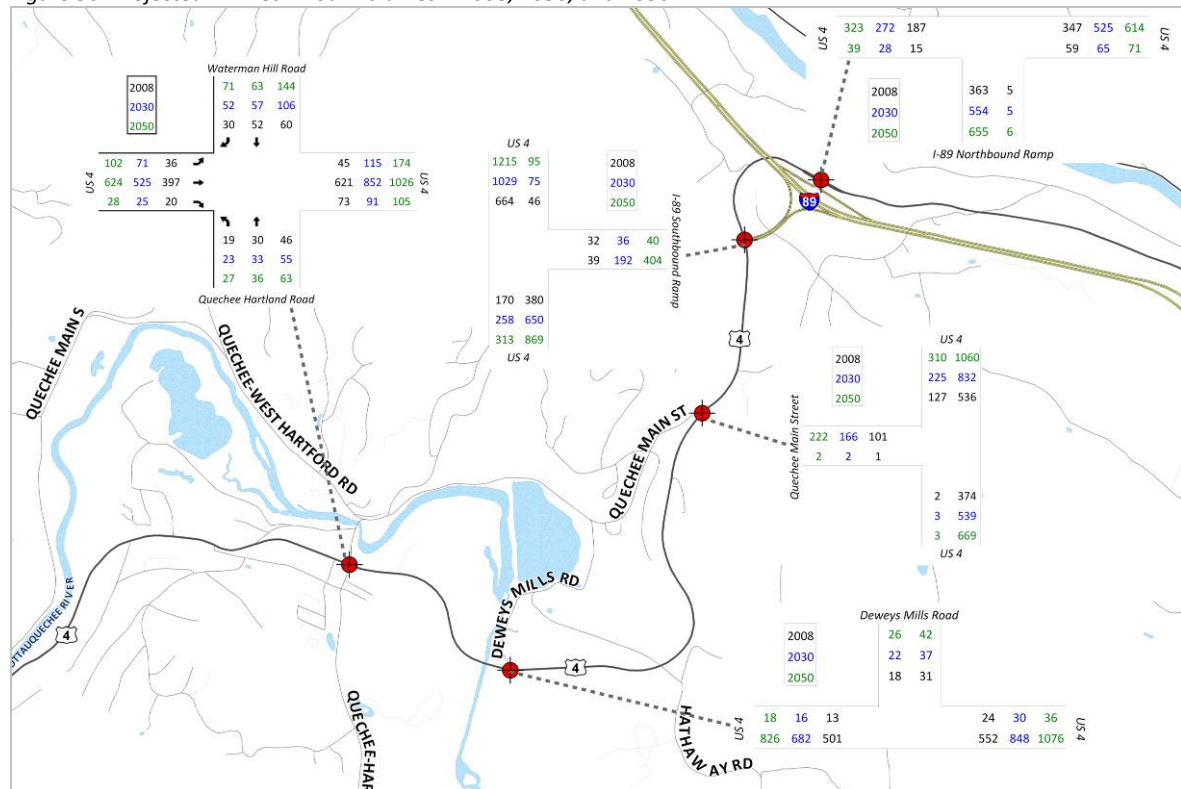
1. Waterman Hill Road/Quechee Hartland Road
2. Dewey's Mills Road
3. Quechee Main Street
4. I-89 Southbound Ramps
5. I-89 Northbound Ramps

Traffic volumes along the corridor were adjusted to represent the design hour volume (DHV) by applying the DHV adjustment factor of 18%, which is based on VTrans Continuous Traffic Counter P6Y119, located on US 4 300 feet east of the Quechee Gorge Bridge.



The trips generated by the projected future land use (Section 2.3) are distributed to the study intersections in proportion to existing traffic volumes to yield future projected turning movement volumes. The estimated 2008, 2030, and 2050 PM peak hour turning movement volumes are shown in Figure 30.

Figure 30: Projected PM Peak Hour Volumes – 2008, 2030, and 2050



4.0 PM PEAK HOUR TRAFFIC CONGESTION ASSESSMENT

US Route 4 is classified as a principal arterial through the study area. The VTrans policy on level of service for intersections along principal arterials is:

- Overall LOS C should be maintained for state-maintained highways and other streets accessing the state's facilities
- Reduced LOS may be acceptable on a case-by-case basis when considering, at minimum, current and future traffic volumes, delays, volume to capacity ratios, crash rates, and negative impacts as a result of improvement necessary to achieve LOS C.



- LOS D should be maintained for side roads with volumes exceeding 100 vehicles/hour for a single lane approach (150 vehicles/hour for a two-lane approach) at two-way stop-controlled intersections.

One of the criteria for determining regional impact in the *TRORC Regional Plan* is whether the development affects existing capacity of regional public facilities by:¹

- (a) contributing to a reduction in the peak hour Level of Service (LOS) from D to E or from E to F;
- (b) contributing five percent or more to the peak hour Level of Service (LOS) D on a regionally significant local or State highway in or immediately adjacent to regional growth areas or LOS C on regionally significant local or State highways in rural areas..."

Volume-to-capacity (v/c) ratios at an intersection compare the volume of each lane to the theoretical capacity of that lane. A v/c ratio of 1.00 means the lane volume is equal to the lane capacity. A v/c ratio greater than 1.00 indicates the lane volume is greater than the capacity.

4.1 LOS Methodology

A Level of Service (LOS) analysis is the analytical tool used to estimate congestion at intersections. LOS is a qualitative measure rating the operating conditions as perceived by motorists driving in a traffic stream. The *Highway Capacity Manual*² (HCM) defines six grades of LOS at an intersection based on the control delay per vehicle. Figure 31 shows the various LOS grades, qualitative descriptions, and quantitative definitions for unsignalized and signalized intersections.

Average delays and queues are calculated for the five study intersections during the 2008 PM peak hour.³

4.2 PM Peak Hour LOS Results

LOS grades, average delays, and v/c ratios are calculated for the five study intersections during the 2008, 2030, and 2050 PM peak hours (Figure 32).¹ Lanes that operate at LOS E or F, which is below the VTrans standard, are

Figure 31: LOS Criteria for Signalized and Unsignalized Intersections

LOS	Characteristics	--Unsignalized--	--Signalized--
		Total Delay (sec)	Total Delay (sec)
A	Little or no delay	≤ 10.0	≤ 10.0
B	Short delays	10.1-15.0	10.1-20.0
C	Average delays	15.1-25.0	20.1-35.0
D	Long delays	25.1-35.0	35.1-55.0
E	Very long delays	35.1-50.0	55.1-80.0
F	Extreme delays	> 50.1	> 80.1

¹ Regional Commission Staff and Committee, *Two Rivers-Ottawquechee Regional Plan* (30 May 2007) 268.

² Transportation Research Board, National Research Council, *Highway Capacity Manual: Special Report 209*, Washington DC, 2000.

³ Congestion estimates were calculated using Synchro 7, which applies the 2000 Highway Capacity Manual methodology.



highlighted in yellow in Figure 32 and shown geographically in Figure 33.

The key LOS results by intersection are as follows:

- US 4/Waterman Hill Road/Quechee Hartland Road – The minor legs at the intersection (exiting Waterman Hill Road and Quechee Hartland Road) operate at LOS E/F in all scenarios.
- US 4/Deweys Mills Road – The minor leg exiting Deweys Mills Road operates at LOS E in 2030 and LOS F in 2050.
- US 4/Quechee Main Street – The minor leg exiting Quechee Main Street operates at LOS F in 2030 and 2050.
- US 4/I-89 Southbound Ramps – The minor leg exiting the southbound exit ramp operates at LOS F in 2030 and 2050.
- US 4/I-89 Northbound Ramps – The minor leg exiting the northbound exit ramp operates at LOS F in all scenarios.

Projected future land use in this study assumes a significant amount of growth in the corridor (60% of corridor buildout by 2030 and 100% by 2050). Under existing 2008 conditions, vehicles exiting the ramps operate at LOS C (Southbound Ramp) and LOS F (Northbound Ramp). When trips generated by projected future land use and external growth are added in, both ramps operate at LOS F with traffic volumes well over the capacity of the ramps. The majority of projected traffic volume growth is attributable to land use growth along the corridor, as shown in Figure 28.

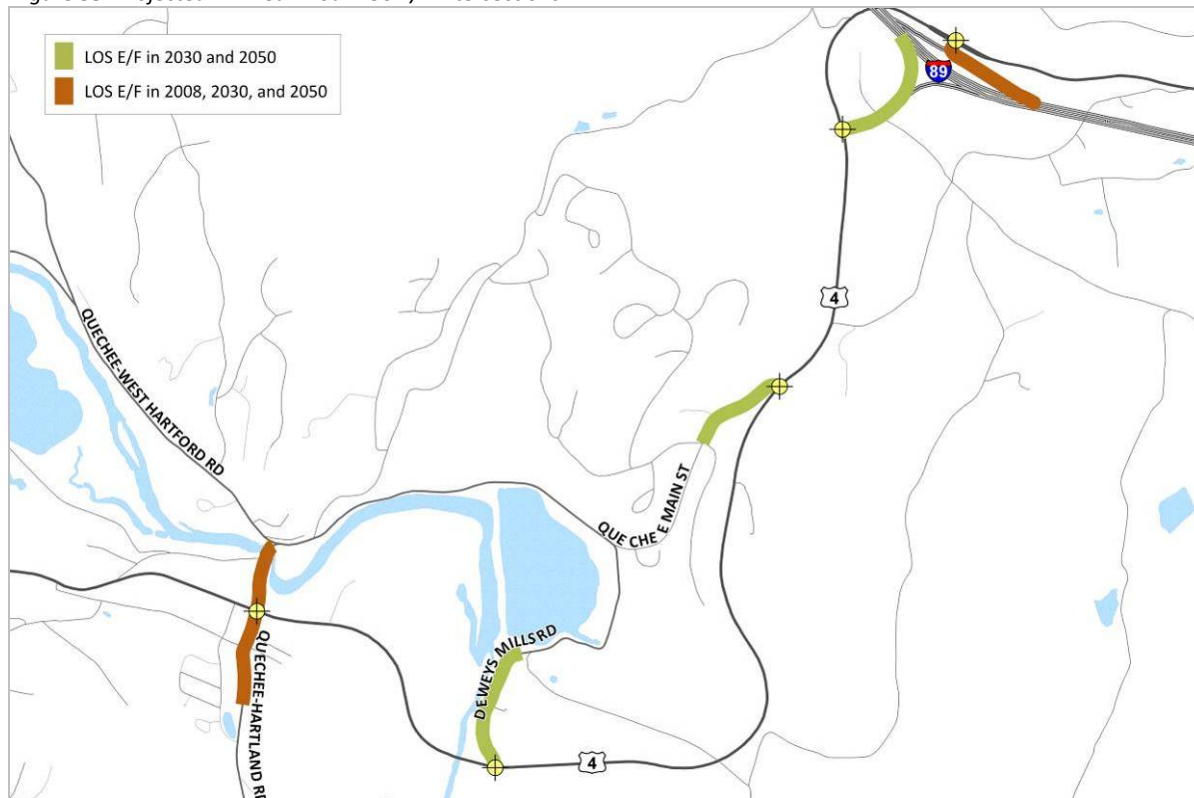
Figure 32: Projected PM Peak Hour LOS Grade, Average Delay (seconds) and v/c Ratios

	2008			PM Peak Hour 2030			2050		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
STOP US 4/Waterman Hill/Quechee Hartland Rd									
EB Left/Through/Right, along US 4 from Woodstock	A	1	0.04	A	3	0.10	A	5	0.18
WB Left/Through/Right, along US 4 from WRJ	A	2	0.06	A	3	0.09	A	4	0.11
NB Left/Through/Right, exiting Quechee Hartland Rd	E	42	0.50	F	>100	2.50	F	>100	>15.00
SB Left/Through/Right, exiting Waterman Hill Rd	F	>100	1.03	F	>100	4.95	F	>100	>15.00
STOP US 4/Deweys Mills Rd									
EB Left/Through, along US 4 from Woodstock	A	<1	0.01	A	<1	0.02	A	<1	0.03
SB Left/Right, exiting Deweys Mills Rd	C	20	0.17	E	42	0.38	F	>100	0.72
STOP US 4/Quechee Main St									
EB Left/Through, along US 4 from Woodstock	A	<1	0.00	A	<1	0.00	A	<1	0.01
SB Left/Right, exiting Quechee Main St	C	23	0.34	F	>100	1.05	F	>100	2.33
STOP US 4/I-89 Southbound Ramps									
WB Left/Through, along US 4 from WRJ	A	1	0.05	A	3	0.10	A	7	0.16
NB Left/Right, exiting I-89 SB Ramps	C	16	0.18	F	>100	1.55	F	>100	5.11
STOP US 4/I-89 Northbound Ramps									
WB Left, along US 4 from WRJ	A	8	0.04	A	8	0.05	A	8	0.06
NB Left/Right, exiting I-89 NB Ramps	F	71	0.89	F	>100	2.01	F	>100	2.98

¹ Congestion and queue estimates were calculated using the Highway Capacity Manual reports from Synchro 7.



Figure 33: Projected PM Peak Hour LOS E/F Intersections



5.0 PM PEAK HOUR QUEUING ANALYSIS

The results from five one-hour long SimTraffic v7 simulations of the 2008, 2030, and 2050 scenario volumes were averaged in order to project PM peak hour queues. The estimated average maximum queue lengths at each intersection are shown in Figure 34 through Figure 37.

In 2008, all queues range from 0-3 vehicles except for exits off the Northbound Ramps (11 vehicles). Projected queues at the US 4/Deweys Mills Road and US 4/Quechee Main Street intersections remain relatively minor even in 2050. However, there are four locations where projected future queues are extensive:

1. US 4/Waterman Hill Road/Quechee Hartland Road – projected 2050 queues exiting Waterman Hill Road back up onto Quechee Main Street, which would negatively impact operations at the Quechee Main Street/Waterman Hill Road intersection.
2. US 4/I-89 Southbound Ramps – projected 2050 queues exiting the ramp back up nearly onto the interstate



3. US 4/I-89 Southbound Ramps – projected 2050 queues entering the ramp from the north are extensive
4. US 4/I-89 Northbound Ramps – projected 2030 queues exiting the ramp back nearly onto the interstate

Figure 34: Projected 2008, 2030, and 2050 PM Peak Hour Queues – Waterman Hill Road and Quechee Hartland Road

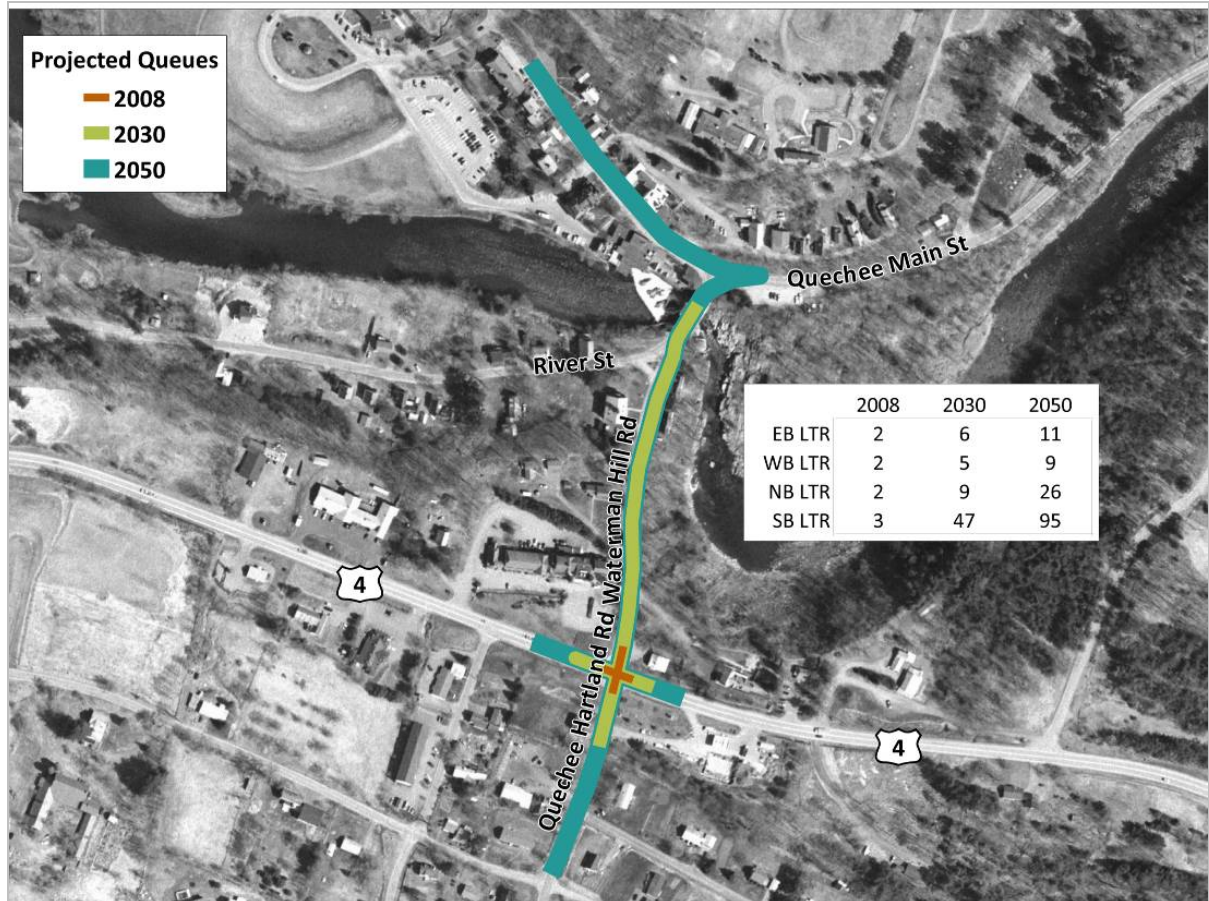


Figure 35: Projected 2008, 2030, and 2050 PM Peak Hour Queues – Deweys Mills Road

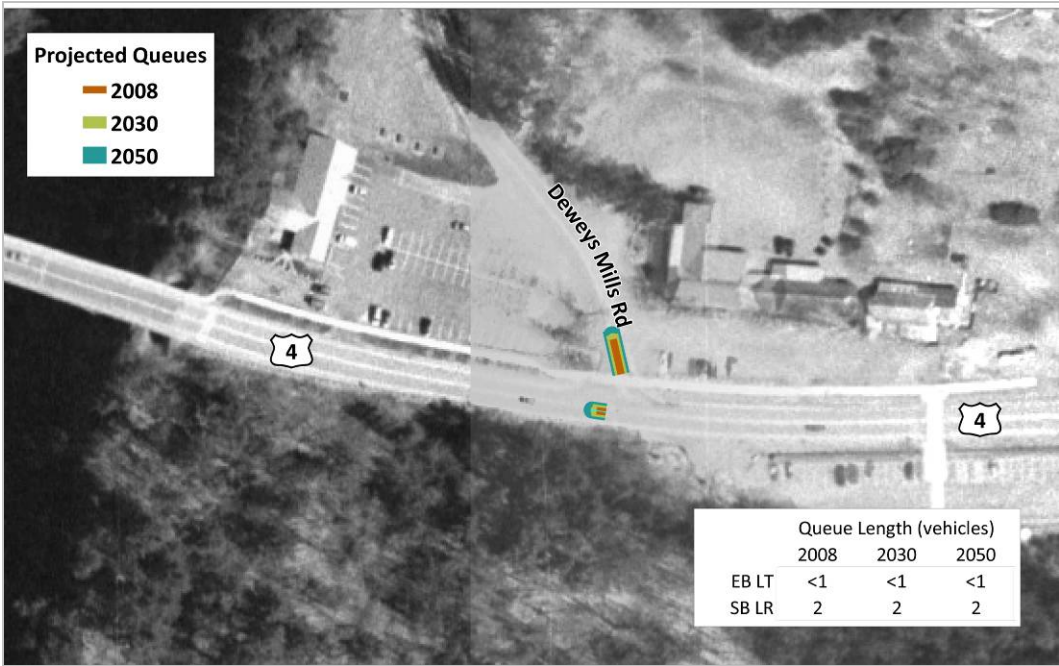


Figure 36: Projected 2008, 2030, and 2050 PM Peak Hour Queues – Quechee Main Street



Figure 37: Projected 2008, 2030, and 2050 PM Peak Hour Queues – I-89 Exit 1 Ramps



6.0 PM PEAK HOUR CORRIDOR TRAVEL TIME ASSESSMENT

End-to-end travel times along US 4 in the study area were both collected in the field for existing conditions as well as from the SimTraffic models.

Corridor travel time data was collected in the field for the US 4 study area over a two-week period from 26 February 2008 to 7 March 2008. Figure 38 shows the average travel time and average travel speed, and average posted speed by segment along the corridor. The bottom row of the table shows the ratio of travel speed to posted speed – where a figure greater than 1.0 indicates a segment where the average travel speed is greater than the posted speed (generally, free-flowing conditions). This condition is noted only along Segment B, likely due to the relatively low posted speeds in this section.

Figure 38: Projected PM Peak Hour Corridor Travel Time Assessment

	Segment A		Segment B		Segment C		Segment D	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
Average Travel Time (min)	03:44	03:39	01:09	01:16	02:30	02:32	01:03	01:02
Average Travel Speed (mph)	44	45	44	40	43	42	43	43
Average Posted Speed	46	46	38	38	47	47	50	50
Travel Speed/Posted Speed Ratio	0.96	0.98	1.16	1.07	0.92	0.90	0.86	0.86

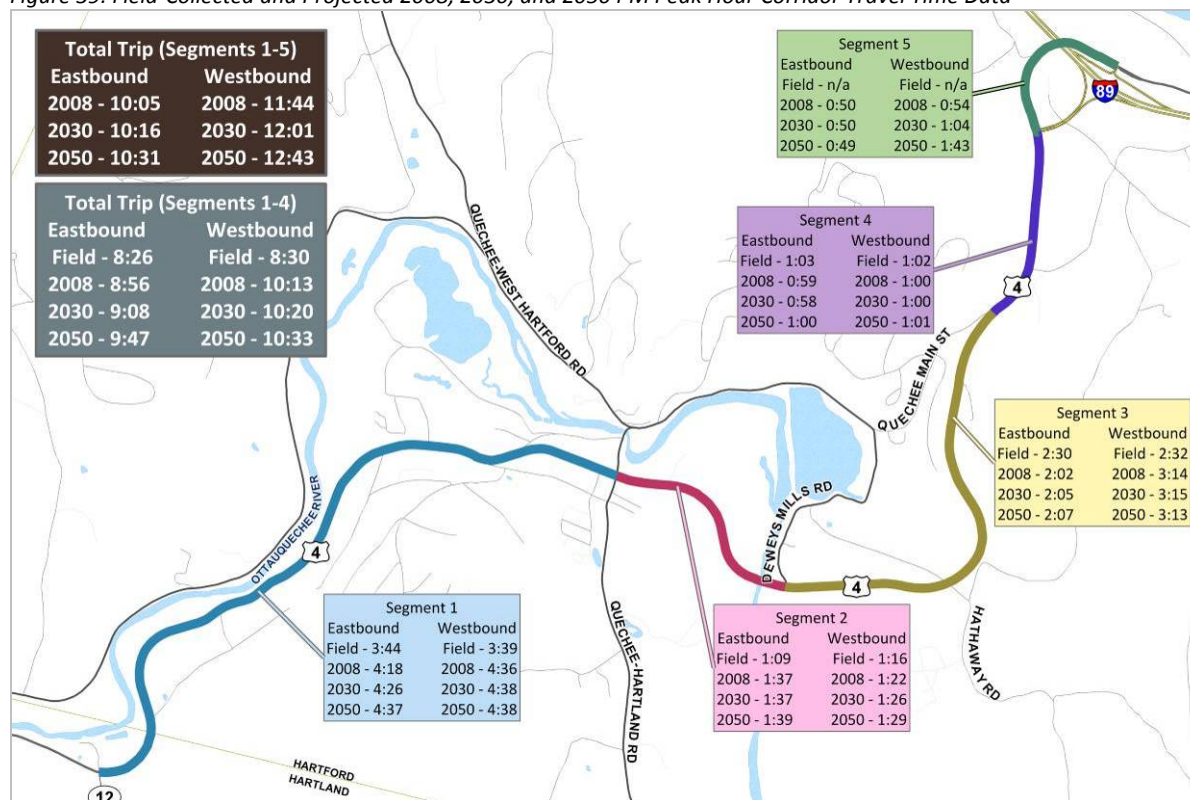


The SimTraffic models also estimated end-to-end travel times by segment and for the study area as a whole. The average directional travel times for each segment, as well as the entire trip, were calculated for the 2008, 2030, and 2050 scenarios.

Figure 39 compares the field-collected travel times to the model-generated travel times. In total, 2050 traffic volumes increased PM peak hour travel times along US 4 by 8% in the eastbound direction and 18% in the westbound direction. Simulated travel times in the 2008 scenario are within 6-17% of the 2008 field-collected travel time data between Waterman Hill and the I-89 Southbound Ramps.

Travel times along US 4 generally remain consistent because traffic along US 4 does not currently yield to traffic signals or stop signs. Between the two Exit 1 ramps, the westbound travel time increases by over a minute due to the higher left-turning volume at the southbound ramp. Any future intersection improvements that include a traffic signal or roundabout would have a significant effect on end-to-end travel times along US 4.

Figure 39: Field-Collected and Projected 2008, 2030, and 2050 PM Peak Hour Corridor Travel Time Data



7.0 SAFETY ASSESSMENT

The safety assessment looks at the results of a previous safety study of the study area as well as trends in the most recent crash data.

7.1 Summary of the 2002 US Route 4 Safety Study

The *US Route 4 Report, Suggested Roadway Improvements*¹ report identifies safety issues and recommends potential projects to improve the safety along the US Route 4 corridor. Roadway improvement projects for the US Route 4 corridor are summarized in Figure 40 and discussed in more detail in Section 2.3.

Figure 40: Suggested Roadway Improvements – US Route 4 Safety Audit Report

Project	Area/Detail
Highest	Shoulder widening throughout the corridor – including improvements to pull-offs and addition of guardrail.
	Better signage along US 4, including attention to:
High	Between Quechee and Route 12
	Between Quechee Main Street and Hathaway Road, Hartford
	East of Quechee Main Street in Hartford
Moderate	Deficient signage and faded signs
	Signs indicating bicycle routes
	High Accident Location
Lowest	Reduce conflict between through and turning traffic
	Explore the feasibility of closing the Cross Road access to Route 4
	Investigate providing bike/ped access between Quechee Gorge and the Waterman Hill Road
No Priority	Left Turn Lanes near the Quechee Gorge tourist area
	Motorists confuse turn lane for the through lane.
	Poor visibility.
Lowest	Better signage.
	Realign West Gilson Road intersection
	Cut back brush.
Lowest	Concern that a fair amount of traffic that accesses the school uses this intersection. Need to assess traffic volume.
	Improvements to the River Street intersection
	Investigate solutions, intersection problematic
Lowest	No left turn sign would be a problem for residents.
	US 4 at Costello Road
	Poor sight distance
Lowest	Alternate Bike Routes
	Not necessary if shoulders are widened
	Bicycle signage is a high priority.
No Priority	US 4 at pull off on south side (mm 0.20)
	Poor sight distance
	Cut back bank at west end of pull-off
No Priority	Cut back the slope at mm 0.30
	US 4 at pull off on north side (mm 1.3 to 1.4)
	Poor sight distance
No Priority	Cut back curve or raise the level of the pull off
	US 4 at Cross Street (mm 2.44)
	Consider closing off access to reduce turning traffic
No Priority	US 4 at Quechee Gorge (mm 2.8 to 3.8) – preferred alternative selected
	Pedestrian safety is a major concern
	Widen sidewalk
No Priority	Install pedestrian railing
	Eliminate at-grade cross walks, provide underpass
	US 4 at I-89 Exit (mm 6.5)
	Modifications included in Hartford-Sharon-Royalton Interstate Project

¹ VTrans, with assistance from Two-Rivers Ottaquechee Regional Commission & Upper Valley Lake Sunapee Regional Planning Commission, January 2002.



7.2 Crash Data Analysis

Figure 42 shows the location of all reported vehicular crashes along the study corridor between 2002 and 2006. Reportable crashes generally involve a fatality, injury, and/or property damage in excess of \$1,000.

In the period from 2002 to 2006, there were a total of 104 reported crashes along the US 4 study corridor. These crashes included 39 injuries and 3 fatalities.

In order to be classified as a High Crash Location (HCL), an intersection or road section (minimum 0.3 mile section) must meet two conditions: 1) it must have at least 5 accidents over a 5-year period; and 2) the actual crash rate must exceed the critical crash rate.

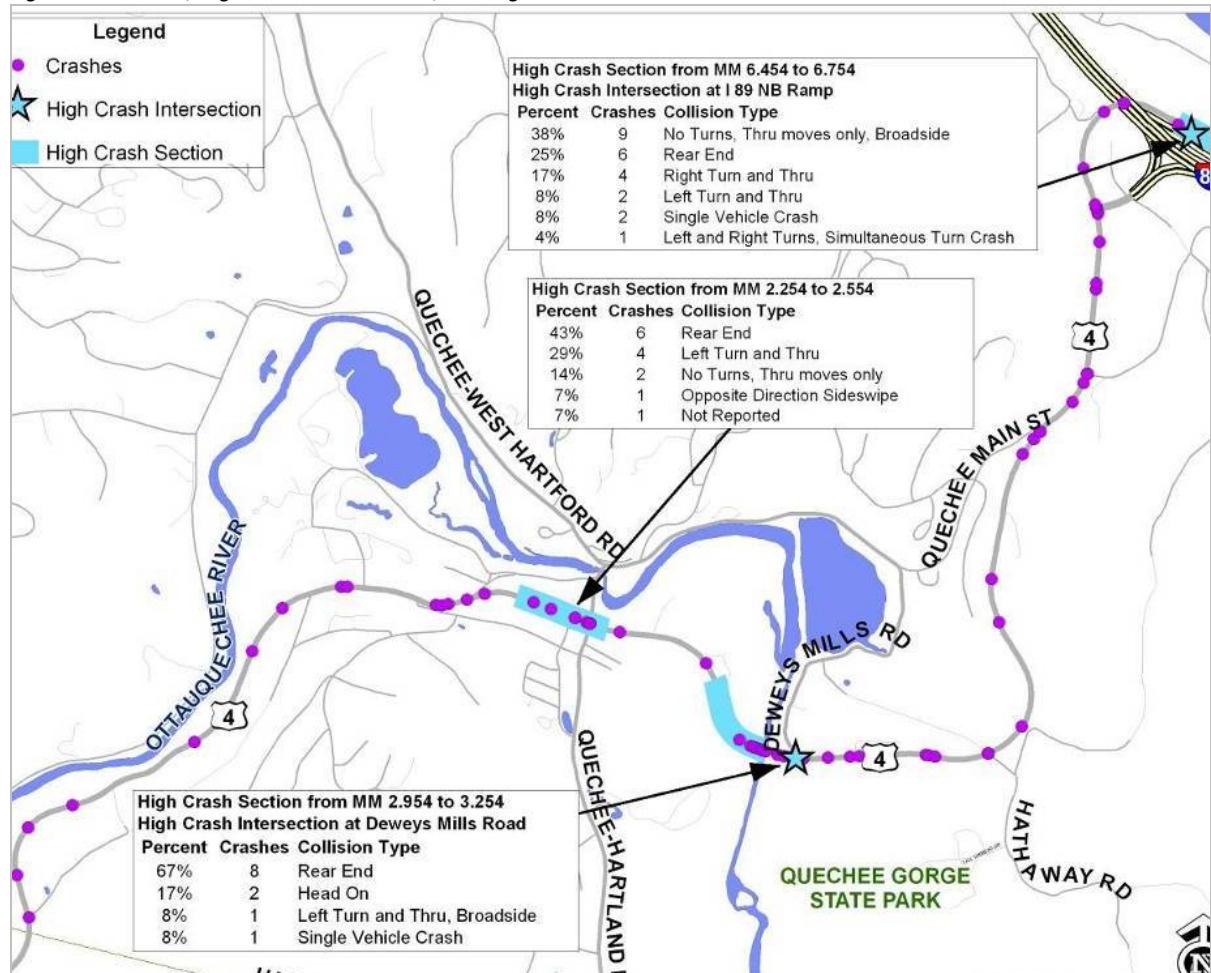
The most recent VTrans High Crash Location Report (2001-2005) identifies 616 High Crash Location road segments and 131 High Crash Location intersections statewide. Within the study area are three High Crash Location sections and two High Crash Location intersections within the study area (Figure 41 and Figure 42). The US 4/I-89 NB ramps intersection ranks number 13 statewide and the US 4/Deweys Mills Road intersection ranks 110.

Figure 41: High Crash Locations

Route	Mile Markers	Critical Rate	Actual Rate	Actual/Critical
<i>Intersections</i>				
US-4/Deweys Mills Road	3.310 - 3.390	0.612	0.672	1.097
US-4/I-89 Northbound Ramp	6.410 - 6.610	0.905	1.627	1.797
<i>Sections</i>				
US-4	2.254 - 2.554	1.666	2.193	1.316
US-4	2.954 - 3.254	1.609	1.712	1.063
US-4	6.454 - 6.754	1.836	6.474	3.524



Figure 42: Crashes, High Crash Intersections, and High Crash Sections



Weather is not a likely contributing factor, as nearly 70% of crashes occurred in clear or cloudy conditions.

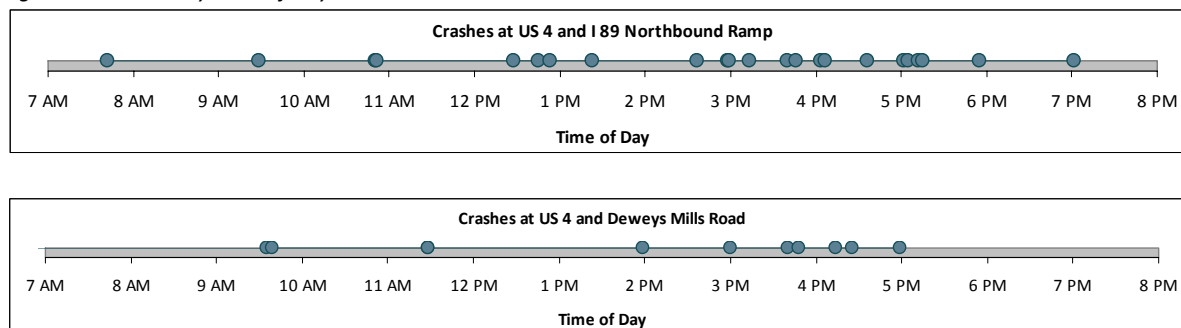
Figure 43: Crash Conditions

Percent	Crashes	Weather
43%	45	Clear
26%	27	Cloudy
19%	20	Snow
7%	7	Rain
2%	2	Unknown
1%	1	Fog, Smog, Smoke
1%	1	Not Reported
1%	1	Sleet, Hail (Freezing Rain or Drizzle)



For both of the High Crash Intersections, the time of day appears to be a significant contributing factor, as nearly 50% of all crashes cluster between 3 PM and 5 PM.

Figure 44: Crashes by Time of Day



At the US 4/I-89 Northbound Ramps intersection, the most common types of crashes were broadsides and rear ends. At the US 4/Deweys Mills Road intersection, two-thirds of the crashes were rear end collisions. The prevalence of rear-end collisions is often correlated with locations where unanticipated vehicular moves occur frequently (e.g. mid-block left turns without separate turn lane).

The High Crash Section from mile marker 2.25-2.55 includes the intersections of US 4 with Quechee Hartland Road and Cross Street in addition to multiple driveway access points within a short distance. As expected, the majority of crashes in this segment are rear end or left turn and through collisions, indicating high accident probability due to turning traffic.

Field observations indicate no sight distant deficiencies along the corridor with the exception of snow banks that sometimes obscure the sightlines for vehicles exiting minor roads onto US 4.

8.0 ACCESS MANAGEMENT ASSESSMENT

8.1 State's Access Management Design Standards Overview

VTrans has development design and construction standards to "preserve the public investment in the highway infrastructure, protect levels of service, protect public safety, and preserve the functional integrity of public highways."¹

The standards cover the following topics: reference sources, data requirements, access width, access radii, access surfacing and pavement markings, speed change lanes, corner sight distance, access spacing, corner clearance at intersections, and other design elements.

¹ Vermont Agency of Transportation, *Access Management Program Guidelines* (22 July 2005).



8.2 Inventory and Assessment of Existing Driveways

Driveways along the corridor were evaluated for conformance to access management guidelines in terms of driveway width and spacing.

The access management guidelines for driveway widths are as follows:

- Driveway widths should be 24-30 feet for two-way access with less than 5 single unit vehicle peak hour trips
- Driveway widths should be 30-40 feet for two-way access with more than 5 single unit vehicle peak hour trips
- Driveway widths should be 18-24 feet for one-way access

The access management guidelines for access spacing are as follows:

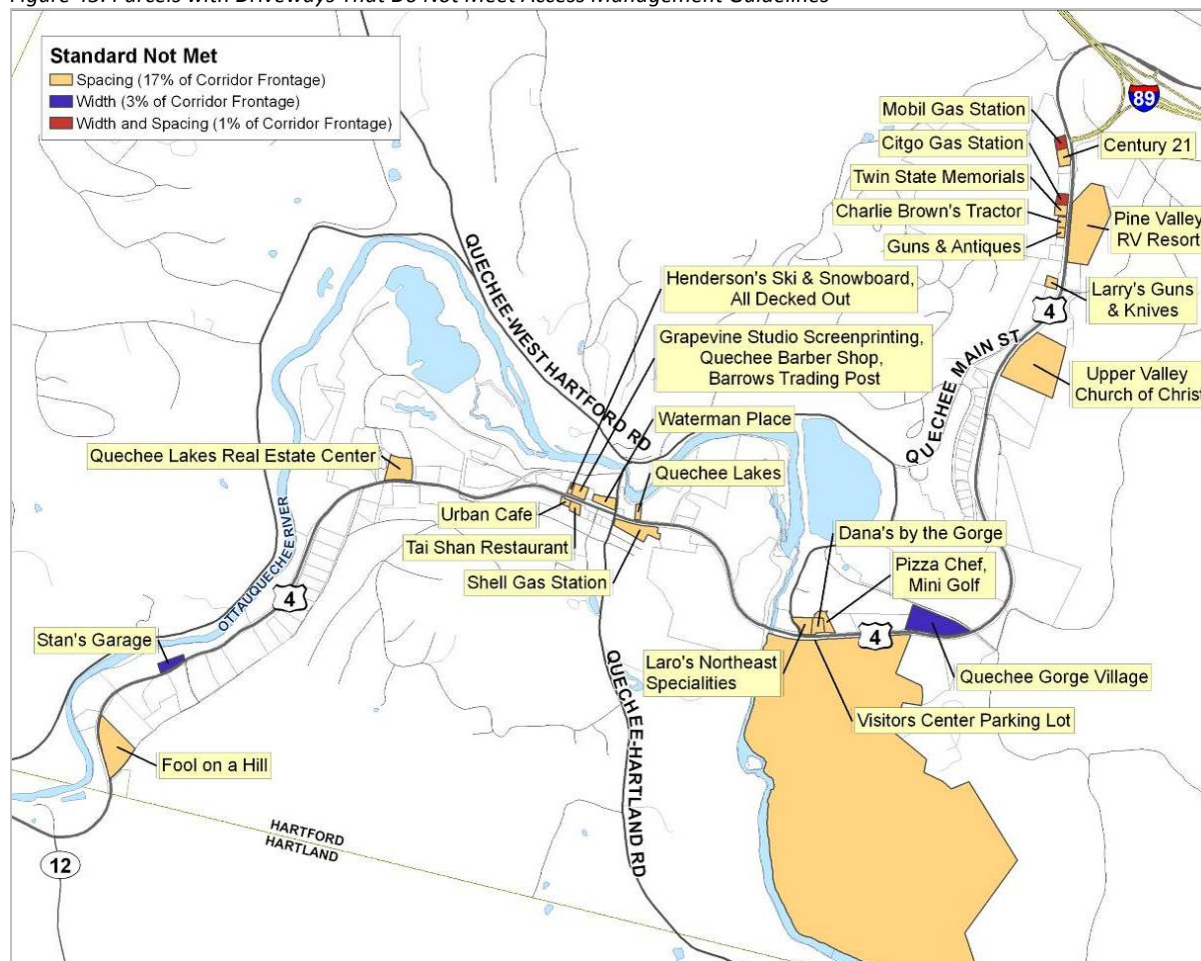
- For a posted design speed of 35 mph, accesses should be spaced at least 250 feet apart.
- For a posted design speed of 40 mph, accesses should be spaced at least 360 feet apart.
- For a posted design speed of 50 mph, accesses should be spaced at least 425 feet apart.

Figure 45 shows the locations of parcels whose driveways fall under the following three categories:

1. Greater than the maximum recommended driveway width
2. Spaced too closely to adjacent driveways
3. Both greater than the maximum recommended width and spaced too closely to adjacent driveways



Figure 45: Parcels with Driveways That Do Not Meet Access Management Guidelines



9.0 TRANSPORTATION INFRASTRUCTURE ASSESSMENT

9.1 Existing US Route 4 Highway System Classification

As an important east-west route through Central Vermont, US Route 4 through Hartford plays a critical role in both the statewide and regional transportation network and on the local level for business and residential access. Some of the important classifications for US 4 are highlighted here and discussed below.

1. Functional Classification: Rural Principal Arterial
2. Roadway Jurisdiction: US Route – under State jurisdiction for maintenance
3. Designated part of the National Highway System



4. Designated part of Vermont State Truck Network (with restrictions)

The Federal Highway Administration's roadway functional classification system, depicted in Figure 46, is organized as a hierarchy of facilities, based on the degree to which the roadway serves mobility and access to adjacent land uses. Freeways and interstate highways, at the top of the hierarchy, are devoted exclusively to vehicle mobility, with no direct access to adjacent land. Arterials and Collectors provide both mobility and access to adjacent land uses. The local road system is devoted exclusively to providing local access, with limited capacity and relatively slow speeds.

The functional classification of all roads along and adjacent to the study corridor is shown in Figure 47. The US 4 study corridor is designated a rural principal arterial along the entire length. The principal arterial designation places a higher priority on mobility than accessibility along the corridor. As the primary east-west route through central Vermont, the US 4 corridor serves a regional role to provide adequate mobility for through vehicles. However, the I-89 interchange and cluster of commercial and retail uses along the corridor also suggest that some level of access has been provided.

Figure 46: Conceptual Roadway Functional Hierarchy

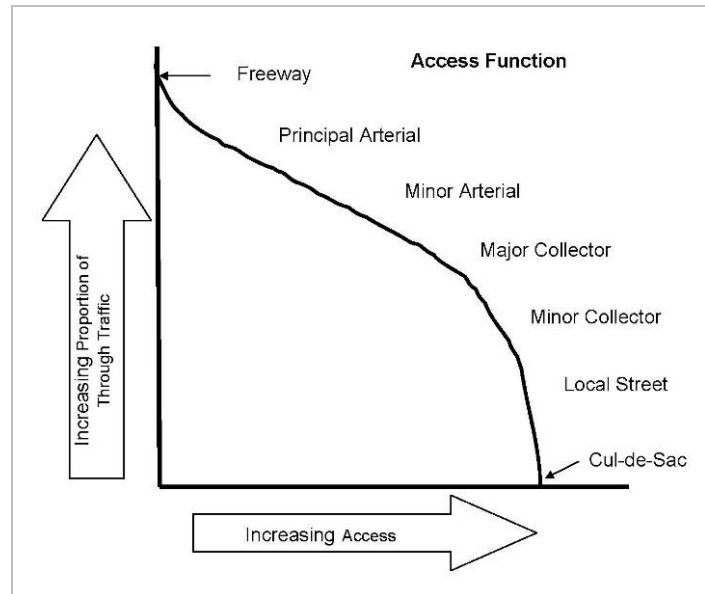
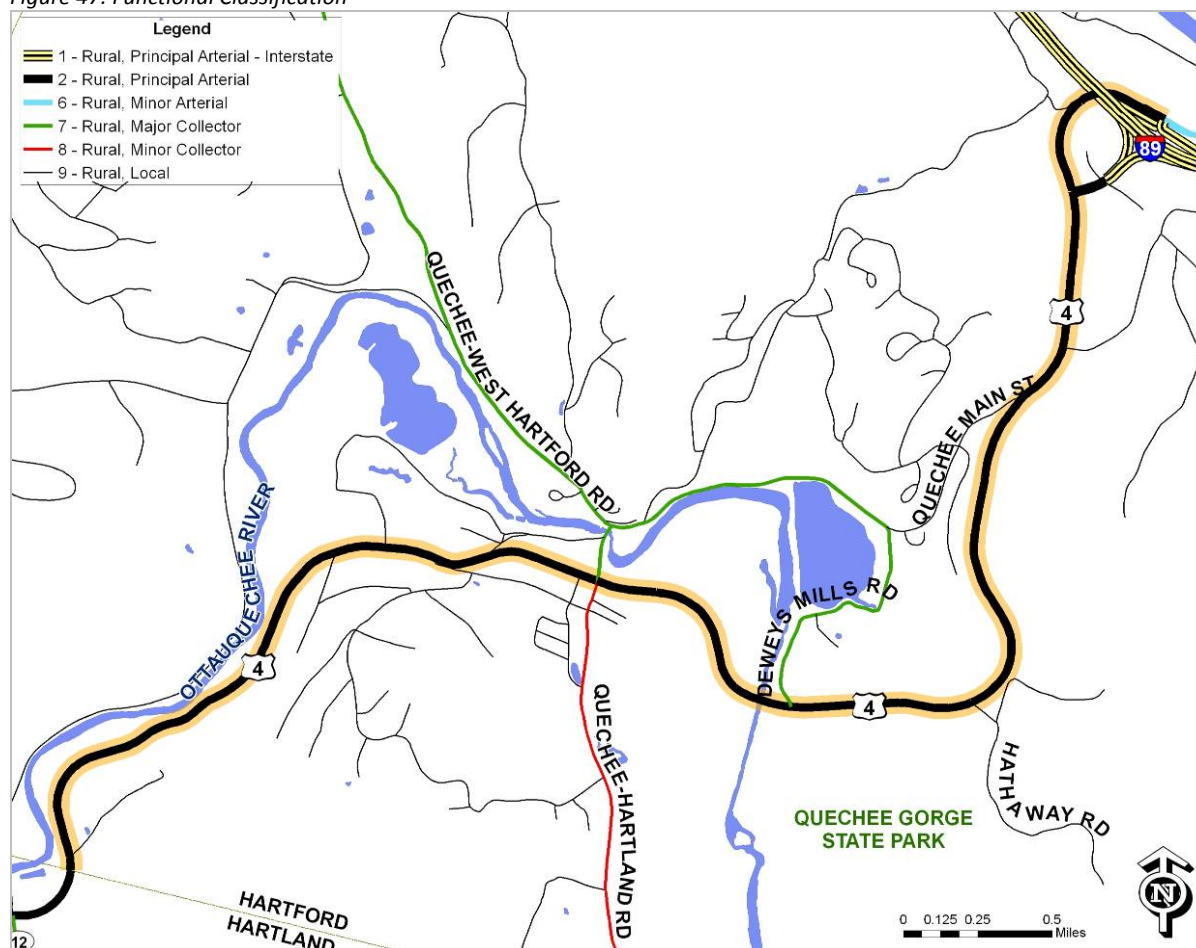


Figure 47: Functional Classification



In addition to being classified as a rural principal arterial, US Route 4 across the state is designated as part of the National Highway System (NHS). The 160,000-mile National Highway System (NHS) was established in 1995 by Congress, consisting of roadways judged to be important to the nation's economy, defense, and mobility. It consists of the Interstate system, the Strategic Highway Network (STRAHNET), nationally designated intermodal connectors, and principal arterials that serve both Interstate and interregional travel, and provide important intermodal connections. Vermont's NHS consists of 320 miles of Interstate Highways (which coincide with the STRAHNET system), 9.5 miles of intermodal connectors, and 374 miles of principal arterials.¹

US Route 4 is also classified as part of the statewide commercial vehicle network. The commercial vehicle network is established by Title 23 V.S.A. Section 1432 which contains the definition of the network and

¹ Vermont Highway System Policy Plan, VTrans, 2004.



establishes limits on the lengths of vehicles that can operate on different portions of the highway network. The statewide truck network is divided into the following four categories which identify limits on truck length: 1) National Network (no overall length limit), 2) Truck Network (72 foot length limit), 3) US 4 (permit required), 4) Remaining state highways (68 foot limit without a permit). On US Route 4, trucks with overall length between 68 and 72 feet may operate with single or multiple trip permits provided that the distance from the kingpin of the semitrailer to the center of the rearmost axle is not greater than 43 feet.¹

9.2 Roadway Geometric Assessment

On rural principal arterials with a DHV greater than 400 vehicles, lanes should be 11 feet in the 35 and 40 mph zones and 12 feet in the 50 mph zone. Shoulder widths should be 8 feet at all speed zones.² The maximum grade for rural principal arterials will be 7% for the 35mph zone, 6% in the 40 mph zone, and 5% in the 50mph zones.

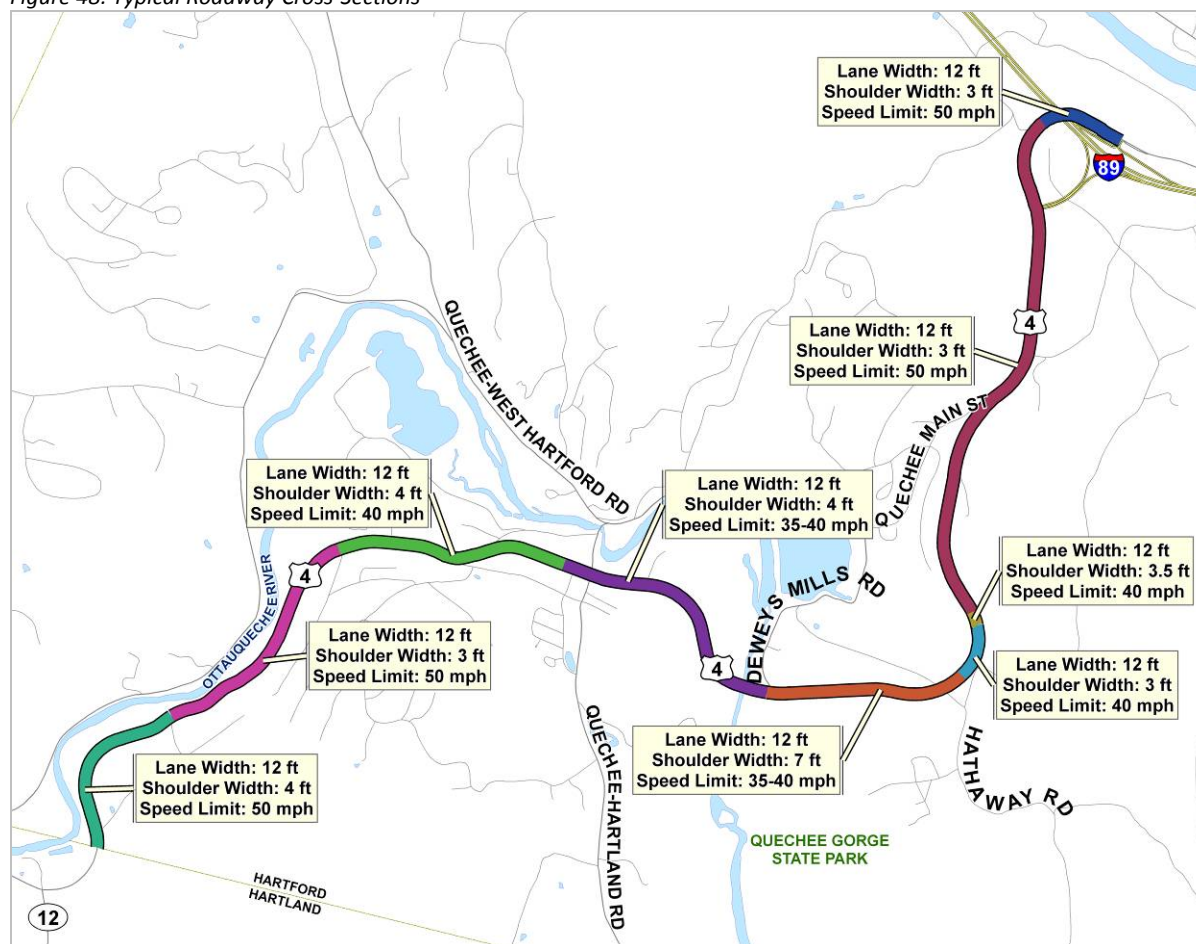
Typical cross-sections of US 4 in the study area were defined using the 2006 VTrans Highway Sufficiency Rating reports and supplemented with field verification (Figure 48).

¹ Ibid.

² These shoulder widths are considered necessary for adequate safety and service for this class of highway and may exceed the minimum paved widths needed solely to provide bicycle safety.



Figure 48: Typical Roadway Cross-Sections



In the study area, lanes along US 4 are all 12 feet in width and grades are within acceptable limits. However, shoulders range from 1-7 feet, which is below the design standard for new rural principal arterial roadways.

9.3 Assessment of Bridges and Culverts

Based on the VTrans Bridge Information System, there are two bridges of note in the study area.¹ The first is owned by VTrans and spans 285 feet across the Quechee Gorge. It is an arch-deck style bridge and is made of steel. Originally built in 1911 and last repaired in 1989, there are no quality control issues with

¹ The VTrans Bridge Inventory System (BIS) stores data for all VTrans-owned bridges as well as some information that is supplemented by towns and RPCs.



the bridge. The bridge's current condition is not identified. However, the repair cost is listed at \$2,918,000, and the cost of replacement is estimated at \$3,068,000.¹

The second bridge is also owned by VTrans and spans 311 feet across US 4 on I-89, with 16.5 feet of clearance. It is a Stringer/multi-beam or girder style bridge and is made of steel. The bridge was originally built in 1967 and has had no major repairs since. The bridge has no quality control issues. The current condition is not identified, however the repair cost is listed at \$2,796,000 and the replacement cost is listed at \$2,946,000.²

A maintenance project to address a number of the drainage concerns is currently under development and is located between mile marker 0.70 and 1.35. The project consists of rehabilitation/ replacement of fourteen culverts that are in poor condition and/or hydraulically undersized. Associated drainage improvements will be constructed such as defined, larger drainage channels and improved inlets. Slope stabilization at the culvert inlets and outlets will be provided where necessary. This project is estimated to be constructed in late 2008 or early 2009.

9.4 Pavement Assessment

The structural section of US 4 is asphalt over a concrete base (see Figure 49). While a concrete base typically provides a strong foundation for a roadway, it is much more costly to reconstruct and any sections of the lanes or shoulders that extend out beyond the original concrete base will be susceptible to differential settling and cracking. Approximately 9% of the lane miles in Vermont have asphalt on concrete sections.

¹ Cost estimates based on VTrans' last inspection on April 20, 2005.

² Cost estimates based on VTrans' last inspection on April 20, 2006.



Figure 49: Historic Photo of US 4 Showing Original Concrete Base Being Cured



Pavement condition is identified by multiple indexes that assess various aspects of the road condition. Elements that go into this assessment are road roughness, structural crack value, average depth of ruts, and condition of the ride. The indexes are based on a scale of 0 to 100, where 0 is very poor and 100 is good. These indexes are then compiled to create an Overall Condition Index, which is used to identify pavement condition of the road section.¹

The VTrans goal is for 25% or fewer of statewide lane miles to be classified in 'very poor' condition. VTrans has estimated that a nearly 100% increase in pavement management funding (from \$56 million per year to \$100 million per year) is needed to adhere to this goal.

The VTrans District 4 Regional Office cited the following concerns with pavement conditions on US 4:

1. The US 4 base is concrete with an asphalt overlay. The width of the concrete is narrower than the asphalt wearing course, which leads to wheel rutting. There are a couple of places in the study area where this is an issue.

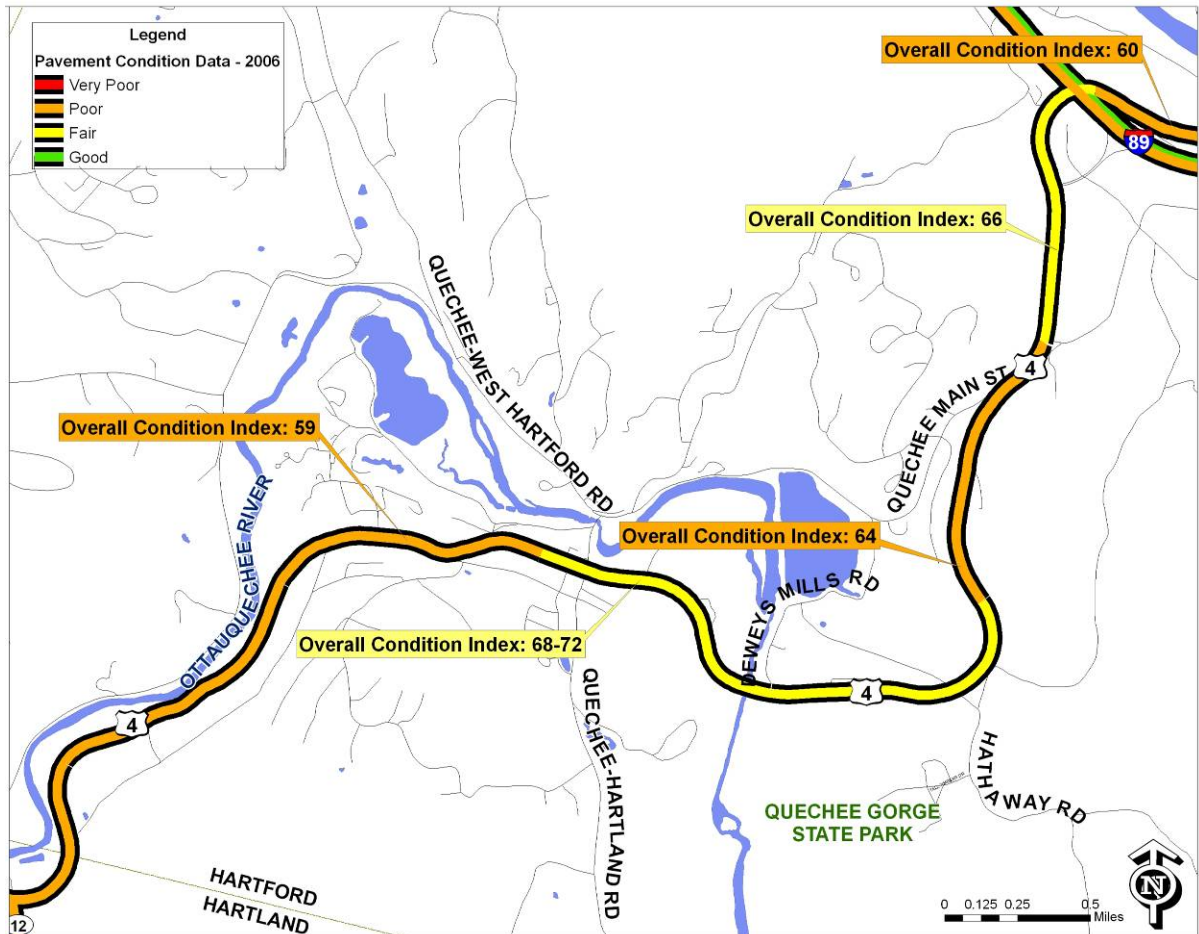
¹ Condition ratings were assessed by VTrans in 2006.



2. There are other drainage issues, such as steep embankments which lead to washouts and slope failures.

Pavement conditions are assessed in the study area as shown on Figure 50.

Figure 50: Pavement Condition on US 4



9.5 Signal Warrant Analysis

A signal warrant analysis is a set of tests that are run to determine whether a traffic signal would significantly improve operations, mobility, and safety at an intersection. There are a total of 8 warrants:

1. Eight-Hour Vehicular Traffic Warrant: when a large amount of intersecting traffic occurring over an 8-hour period is the principal reason for installing a traffic signal, or where excessive delays occur on minor approaches to an intersection.



2. Four-Hour Vehicular Traffic Warrant: when a large amount of intersecting traffic occurring over a 4-hour period is the principal reason for installing a traffic signal.
3. Peak Hour Warrant: when the minor-street traffic suffers unduly delay when entering or crossing the major-street during the average peak hour is the principal reason for installing a traffic signal.
4. Pedestrian Volume Warrant: when the traffic volumes on a major street are so heavy that pedestrians experience excessive delays.
5. School Crossing Warrant: when school children crossing a major street are the principal reason for installing a traffic signal.
6. Coordinated Signal System Warrant: when maintaining proper platooning of vehicles is the principal reason for installing a traffic signal.
7. Crash Experience Warrant: when the severity and frequency of accidents is the principal reason for installing a traffic signal.
8. Roadway Network Warrant: when the concentration and organization of traffic flow is the principal reason for installing a traffic signal.

Twelve-hour turning movement counts were conducted at the three following intersections on 30 July 2007 and 31 July 2007:

1. US 4/Waterman Hill Road/Quechee Hartland Road
2. US 4/I-89 Southbound Ramps
3. US 4/I-89 Northbound Ramps

Traffic volumes were adjusted to represent average traffic conditions in 2008, 2030, and 2050 assuming the growth in land use and traffic volumes from external growth, US 4 study area residential/commercial development, and Quechee Lakes development.

Figure 51: Signal Warrant Analysis Summary

	US 4/Waterman Hill Rd/Quechee Hartland Rd			US 4/Deweys Mills Rd			US 4/Quechee Main St			US 4/I-89 Exit 1 Southbound Ramps			US 4/I-89 Exit 1 Northbound Ramps		
	2008	2030	2050	2008	2030	2050	2008	2030	2050	2008	2030	2050	2008	2030	2050
Warrant 1: Eight-Hour Vehicular Volume Warrant	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Warrant 2: Four-Hour Vehicular Volume Warrant	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Warrant 3: Peak Hour Warrant	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Warrant 4: Pedestrian Volume Warrant	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant 5: School Crossing Warrant	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Warrant 6: Coordinated Signal System Warrant	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Warrant 7: Crash Experience Warrant	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant 8: Roadway Network Warrant	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Number of Met Warrants	3	3	3	0	0	0	2	3	3	3	3	3	3	3	3

A signal warrant analysis is considered advisory only. This means that simply meeting any warrant may not be sufficient cause for installing a traffic signal. For example, meeting the peak hour warrant is usually not sufficient in and of itself to warrant installing a traffic signal. The rationale for this is that one hour (or less) of congestion in a day is probably not severe enough to justify the investment in the traffic



signal controller and related equipment and software. Experience in Vermont suggests that meeting at least two other warrants is needed to justify investment in a traffic signal. This condition is met at all three study intersections even under current (2008) peak hour traffic volumes.

9.6 Turn Lane Warrant Analysis

Using the 2008, 2030, and 2050 scenario volumes, a turn lane warrant analysis was conducted to establish the necessity of adding a left or right turn lane to the five study intersections. Using standard VTrans methodologies,¹ left turn lanes are warranted in four new locations and right turn lanes are warranted in one new location.² Figure 52 summarizes the results of the turn lane warrant analysis.

Figure 52: Lane Warrant Analysis Summary

	Eastbound, towards WRJ		Westbound, towards Woodstock	
	Left Turn Lane	Right Turn Lane	Left Turn Lane	Right Turn Lane
US 4/Waterman Hill Rd/Quechee Hartland Rd				
2008	Yes	No	Yes	No
2030	Yes	No	Yes	Yes
2050	Yes	No	Yes	Yes
US 4/Deweys Mills Rd				
2008	No	-	-	No
2030	Yes	-	-	No
2050	Yes	-	-	No
US 4/Quechee Main St				
2008	No	-	-	Yes
2030	No	-	-	Yes
2050	Yes	-	-	Yes
US 4/I-89 Southbound Ramps				
2008	-	Yes	Yes	-
2030	-	Yes	Yes	-
2050	-	Yes	Yes	-
US 4/I-89 Northbound Ramps				
2008	-	No	Yes	-
2030	-	No	Yes	-
2050	-	No	Yes	-
Already exists				

¹ Harmelink's methodology for unsignalized intersections was utilized for the left turn lane warrant analyses.

² One left turn lane and two right turn lanes are warranted for locations where that turn lane already exists. The analysis confirms the need for the existing turn lanes.



10.0 FUTURE BICYCLE AND PEDESTRIAN FACILITY DEMAND

As development continues along and adjacent to the US Route 4 corridor and the viability of single-occupant automobile transportation is becoming more of a challenge (increasing fuel costs, aging population, etc.), the demand for alternative modes of transportation will continue to increase.

There are currently only limited bicycle and pedestrian facilities along the US 4 study corridor. This section examines the current system and provides recommendations, given the likelihood of increased demand in the future.

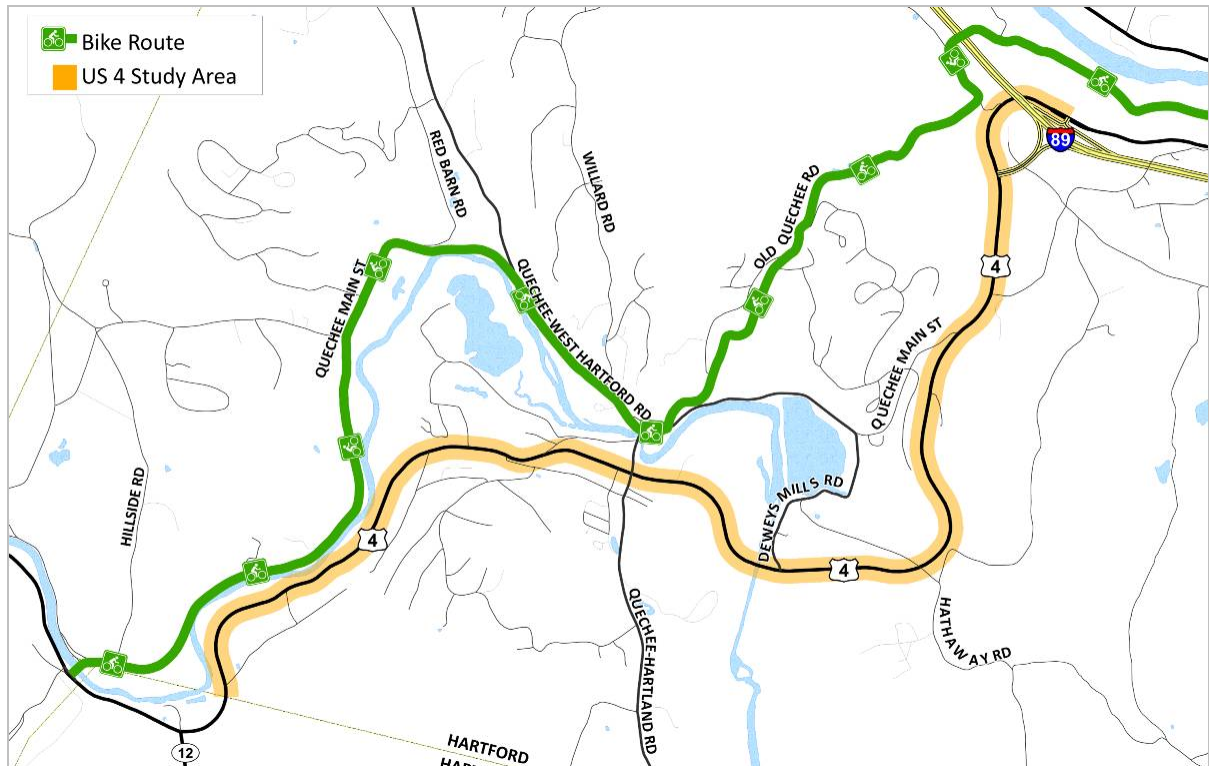
10.1 Bicycle Facilities

Safe and contiguous bicycle facilities are critical elements to support both commuter and recreational bicycle trips. Although the scale of the facility varies based on the skill level and age of the rider, even the most experienced rider will benefit from amenities such as moderate width shoulders (3-4 feet), bicycle lane striping through right-turn lanes, and clear and smooth pavement surfaces.

A major impediment to safe bicycle travel along US 4 through the project area is the variable (often narrow) shoulder widths and guardrails. The provision of consistent shoulder widths of 3-4 feet on both sides of US 4 would certainly help to improve conditions for moderate to experienced through cyclists. However, given the significant costs associated with widening US 4, a secondary off-alignment bicycle route was identified. This alternative route is shown in Figure 53 below and generally parallels US 4. This alternate route is nearly identical in total mileage (10 miles) from White River Junction to Taftsville.



Figure 53: Potential Off-Alignment Bicycle Route between White River Junction and Taftsville



10.2 Pedestrian Facilities

Similar to bicycle facilities, pedestrians of all ages greatly benefit from the safety and accessibility offered by a network of connected sidewalks, paths, and crossings. In addition to promoting a healthier lifestyle through walking, the addition of new sidewalks and paths can lead to an offset in vehicle trips generated as people either walk between short destinations, or use the sidewalks to access public transportation services (see next section).

Along the study corridor, pedestrian facilities are limited to the Quechee Gorge and Quechee Village areas. Although sidewalks may not be reasonable (or desirable) along the entire section of US 4, there are two specific areas that have been identified for pedestrian facility enhancement.

10.2.1 Exit 1 Area

During the summer months, the visitors to the RV campground immediately south of the Exit 1 interchange are frequently crossing US 4 to reach services on the other side of the road. Figure 54 below shows a proposed mid-block crossing of US 4 proximate to the RV campground and approximately 250 feet of new sidewalk connecting north to the Mobil gas station at the southbound I-89 ramp entrance.



Given the potential for additional growth in and around the interchange area, this pedestrian connection would likely become even more important over time.

10.2.2 Quechee Gorge Area

As shown in Figure 55 below, the only pedestrian facilities along the project corridor are located around the Quechee Gorge and in Quechee Village. Given the high clustering of tourist-related destinations in this area and the residential density in Quechee Village and nearby Quechee Lakes, it seems reasonable to extend the pedestrian network to provide connections between the existing sidewalks and to logical destinations.

Figure 54: Potential Crosswalk and Sidewalk in the Exit 1 Area

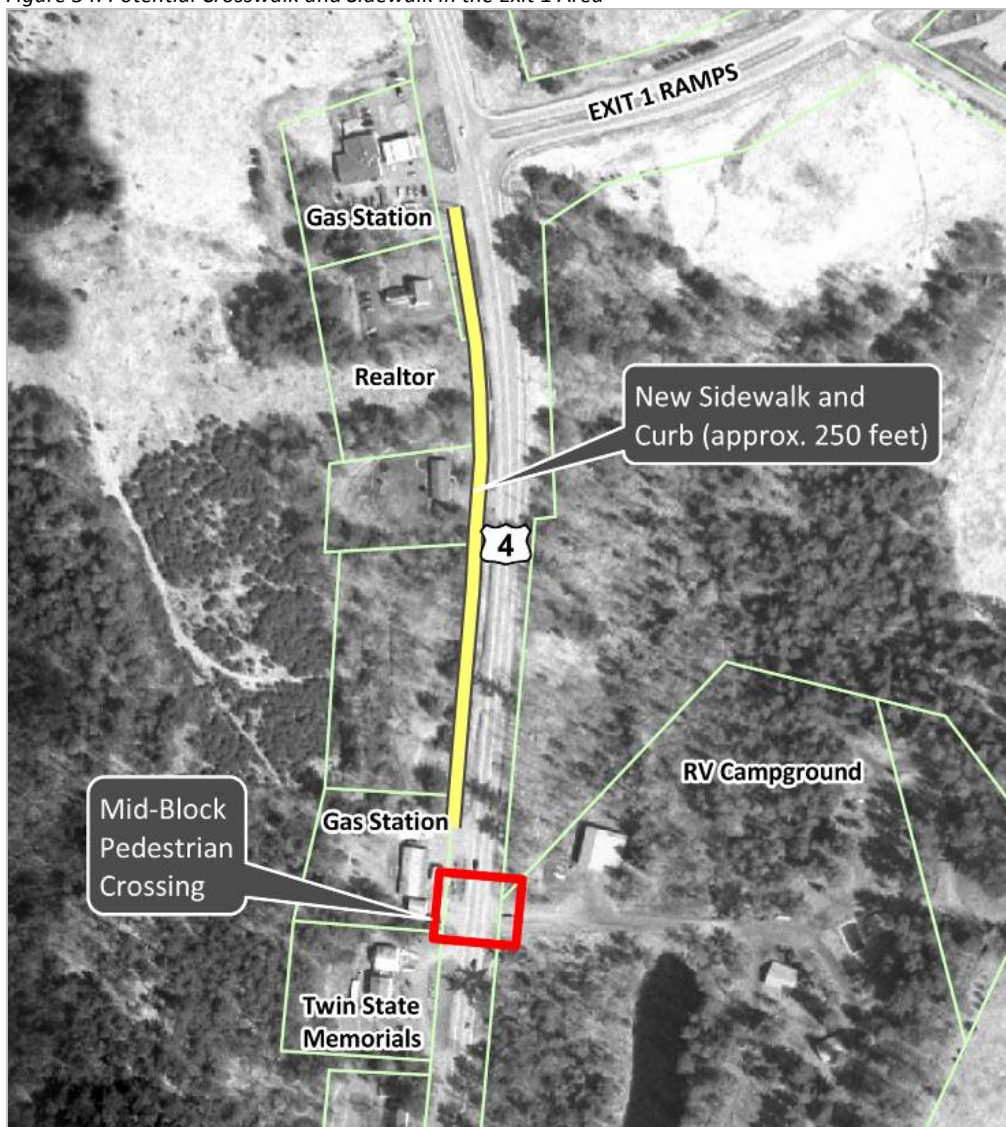


Figure 55 shows a new sidewalk connecting the Quechee Gorge village sidewalks with US 4 and the shops along US 4. Also shown is an approximately 1 mile section between the Quechee Gorge parking area and Waterman Hill Road that could be a potential route for a multi-use trail. A multi-use trail is typically offset from the road by 10 or more feet, is typically 10-12 feet wide and is often paved. This multi-use trail would provide a distinctive connection between popular visitor destinations and could provide connectivity for walkers, roller bladders, and cyclists. Figure 56 below shows an example of a multi-use trail.

Figure 55: Potential Sidewalk and Multi-Use Path in the Gorge Area

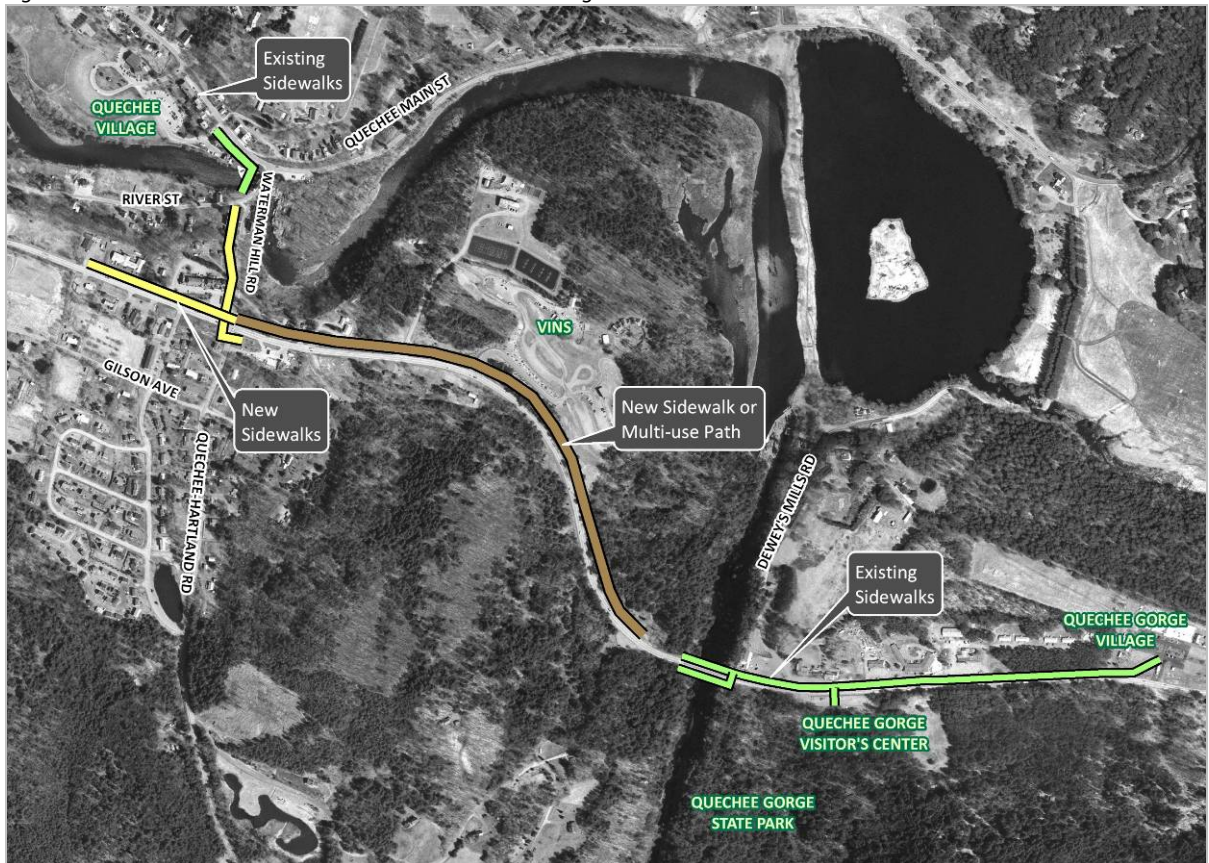


Figure 56: Example of a Multi-Use Trail

10.3 Future Public Transportation Services

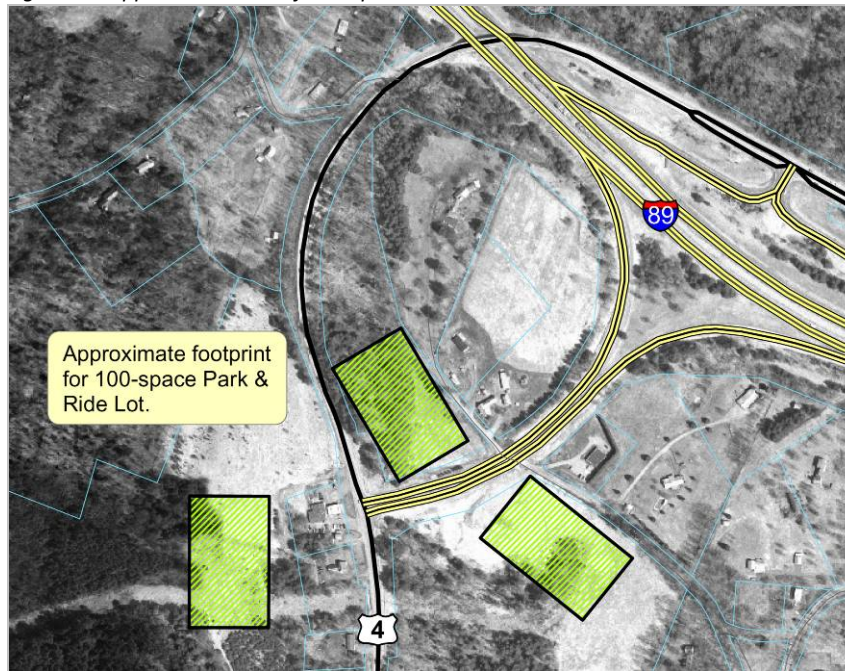
Although there has historically been public transportation service along US 4, there is currently no transit service option for residents or employees along the corridor. Given that the predominant commuter flow in the Upper Valley is into and out of the Lebanon/Hanover employment center, the US 4 corridor provides a logical, linear corridor to provide connectivity via public transit to the employment and shopping destinations in this area. Given the amount of visitors coming to the Quechee area, public transportation, in the form of a local shuttle, is also an interesting option to consider.

10.3.1 Public Transit

One of the most important “big picture” benefits of offering frequent, coordinated public transit service along US 4 is the effects it can have on travel demand, congestion, and delay. By transferring automobile trips to public transportation, the need for costly road expansions could be deferred or eliminated.

However, given the relatively sparse development pattern along the corridor (even under future conditions), achieving transit-supportive density will remain a challenge. One way to help create this density is through the use of park-and-ride lots, which serve as a central collection point for the transit service. Along the US 4 corridor, one often-mentioned location for a future park-and-ride is the area around the Exit 1 interchange. Figure 57 below shows potential locations and relative size of a 100-vehicle park-and ride facility around Exit 1.



Figure 57: Approximate Size of 100-space Park and Ride Lots

The Exit 1 location for a potential park-and-ride has a number of benefits, including proximity to the interstate and an existing transit route (Stagecoach 89'er route) and the availability of vacant land. However, one important factor to consider is that this location would not provide any measurable vehicle trip reductions along the corridor west of this point since commuters would still travel along US 4 to reach this lot before boarding the bus. Other potential location for a park-and-ride lot that would provide more significant corridor trip reductions would be in Quechee Village, around the Waterman Hill Road intersection, or in Woodstock Village. Though the Exit 1 location would not directly reduce vehicle trips along US 4 as well as other park & ride locations farther west on US 4, it is optimally located for vehicle and bus access due to its centralized location

The logical providers of future transit service along US 4 are either Stagecoach Transportation Services (currently provides 89'er commuter service) or Advance Transit (currently provides multiple routes throughout the Upper Valley). Both transit agencies are currently conducting short-term public transit plans and should consider the provision of this US 4 service as part of these efforts.

10.3.2 Local Shuttle Service

The proximity of visitor destinations to the Quechee Gorge area provides an interesting opportunity to provide a seasonal shuttle service. This shuttle service would serve to greatly enhance visitor mobility and may help to drive visitor traffic to destinations they may not otherwise have stopped in.



Figure 67 below shows a potential route for a Quechee area shuttle. This seasonal shuttle (which could use a trolley or other unique vehicle) would primarily serve to shuttle visitors to major attractions in Quechee. The shuttle could be run on a frequent headway (10-12 minutes) and provide service between VINS, Quechee Village, and the Quechee Gorge Village area.

Figure 58: Potential Route for Quechee Area Shuttle



11.0 RECOMMENDATIONS

The listing of recommendations presented in this section came out of a comprehensive investigation of existing and future land use and transportation conditions, as well as input from the Corridor Steering Committee, members of the public, and the following studies and reports:

- Route 4 in the Ottauquechee Valley: A Transportation Analysis, MIT, 1972
- US Route 4 Corridor Study: White River Junction to Sherburne, Andrews & Clark, Inc., 1989
- U.S. Route 4 Transportation Study and Land Use Planning Study, TRORC, 1992
- East-West Highway Study, VTrans, 2001
- US 4 Report: Suggested Roadway Improvements, VTrans, 2002



Many of the previous studies for the US 4 corridor have examined new road alignments, village bypasses, or other costly recommendations to address identified capacity and safety concerns. However, each of these large-scale recommendations was ultimately passed over due to their significant costs.¹ Given this precedent for bypassing more costly recommendations, and VTrans' current "Road to Affordability" initiative, the recommendations identified below attempt to address identified concerns along the corridor with less-costly transportation and land use policy/regulatory alternatives.

11.1 Transportation Recommendations

The transportation recommendations are divided between short-term recommendations (to be implemented in 0-10 years) and long-term recommendations (to be implemented in 10+ years). To assist with prioritization, each recommendation was assigned a score ranging from -3 to +3 based on its ability to satisfy the following goals for the corridor:

- MOBILITY: Maintain current corridor travel time
- ACCESS: Improve access & circulation
- SAFETY: Improve safety along corridor
- MULTIMODAL: Improve travel for pedestrians, cyclists & transit users
- LAND USE: Support local and regional land use & development goals
- ENVIRONMENT: Enhance natural & scenic attributes
- ECONOMIC: Encourages economic growth
- CRITICALITY: Reflects the critical nature of the project.

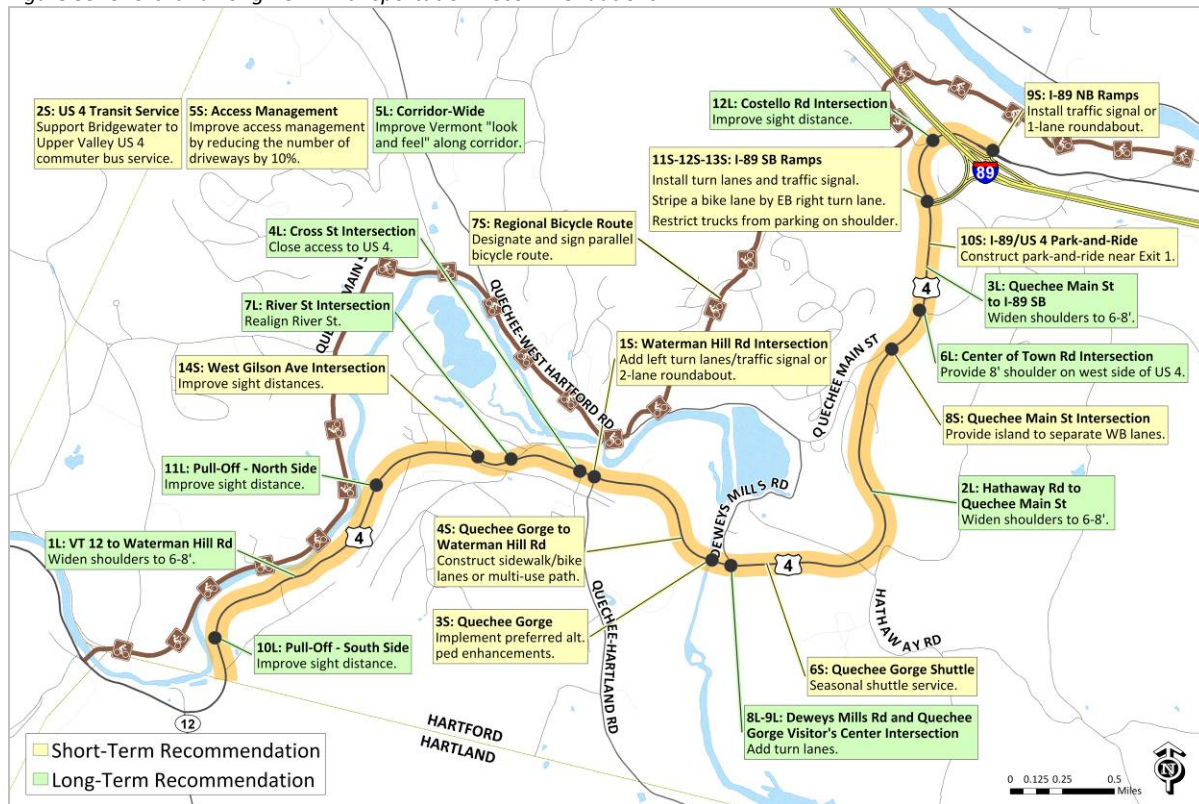
Figure 59 shows the locations of the short- and long-term recommendations in the study area. Recommendations are assigned a project number which is referenced in the remainder of this section. The (S) suffix denotes a short-term recommendation. An (L) suffix denotes a long-term recommendation.

Figure 60 and Figure 76 summarize the short-term and long-term transportation recommendations identified for the study corridor, along with estimated cost, jurisdictional authorities, and whether the project could be funded through developer traffic mitigation requirements. Decreasing highway trust fund revenues resulting from more fuel efficient vehicles, less driving, a shift in priority from new construction to maintenance of the existing system has led to a current and projected future financial crunch. Lack of funds, required environmental permits, and right-of-way acquisition with state and federal funds could potentially put some of these recommendations beyond the stated time horizon. There are also increasing expectations for developers to mitigate transportation impacts as a result of town/state inability to pay for improvements.

¹ One report even noted that a potential new alignment would cost more than VTrans spends on all roads in the state in five years combined.



Figure 59: Short- and Long-Term Transportation Recommendations



11.1.1 Short-Term Transportation Recommendations (0-10 Years)

Figure 60 provides a brief summary of the short-term transportation recommendations identified for the study corridor, along with estimated cost, jurisdictional authorities, and whether the project could be funded through developer traffic mitigation requirements. Recommendations are listed in descending order based on their total score for satisfying the corridor goals, as described above. Following the table are more detailed descriptions and relevant graphics for each of the short-term recommendations.



Figure 60: Short-Term Transportation Recommendations

ID	Improvement	Preliminary Cost Estimate*	Timeline		Total Score
1S	WATERMAN HILL RD INTERSECTION: Improve safety and capacity at the US 4/Waterman Hill Rd intersection. Add left turn lanes and traffic signal or 2-lane roundabout.	\$400,000 (traffic signal, turn lanes); \$1,600,000 (2-lane roundabout)	Short	VTrans, Town of Hartford	14
2S	US 4 TRANSIT SERVICE: Support the start of the Bridgewater to the Upper Valley US 4 commuter bus service.	\$300,000 (new bus); \$120,000 (annual operating)	Short	Advance Transit, Stagecoach Transportation, VTrans, Town of Hartford	13
3S	QUECHEE GORGE: Implement preferred alt. pedestrian enhancements at Quechee Gorge to minimize at-grade crossings. Close US 4 curb cut to Gorge Gift Shop/Ott-Dog and better define curb cuts along Deweys Mills Rd	\$700,000	Short	VTrans	13
4S	QUECHEE GORGE TO WATERMAN HILL RD: Construct a sidewalk and bicycle lanes, or a separated multi-use path between the Quechee Gorge Village and Quechee Village.	\$475,000 (Sidewalk & Bike Lanes); \$500,000 (Shared Use Path)	Short	Town of Hartford, VTrans	12
5S	ACCESS MANAGEMENT: Improve access management along corridor by reducing or consolidating the number of driveways by 10%.	Varies	Short	VTrans, Town of Hartford	10
6S	QUECHEE GORGE AREA SHUTTLE: Implement seasonal shuttle service between VINS, Quechee Village, and the Quechee Gorge Village area.	\$50,000 / year	Short	Quechee Gorge Area Merchants, FTA, VTrans, Town of Hartford	9
7S	REGIONAL BICYCLE ROUTE: If shoulders not widened along US 4, designate and sign parallel bicycle route along Old River Rd > Costello Rd > Old Quechee Rd > Quechee Main St.	\$2,000 (new signs)	Short	Town of Hartford	8
8S	QUECHEE MAIN ST INTERSECTION: Improve safety at the US 4/Quechee Main St intersection by providing an island (or wide striped) separator between westbound through and right-turn lane.	\$250,000	Short	VTrans, Town of Hartford	8
9S	I-89 NB RAMPS: Install a traffic signal at the US 4/I-89 Northbound Ramps intersection.	\$150,000 (new traffic signal)	Short	VTrans, Town of Hartford	8
10S	I-89/US 4 PARK & RIDE: Construct a park-and-ride near I-89 Exit 1 (potential locations: Punt parcel, Milne parcel, parcel between Briar Rose Ln & US 4).	\$1,500,000	Short	VTrans, Town of Hartford, Transit Agencies	7
11S	I-89 SB RAMPS: Install turn lanes and a new traffic signal at the US 4/I-89 Southbound Ramps intersection.	\$350,000	Short	VTrans, Town of Hartford	6
12S	I-89 SB RAMPS: Stripe a bicycle lane along eastbound US 4 in the area of the eastbound US 4 right-turn lane onto I-89 southbound.	\$500	Short	VTrans, Town of Hartford	6
13S	I-89 SB RAMPS: Restrict tractor trailer trucks from parking on the wide shoulder near the Exit 1 Mobil which block sight distance for vehicles exiting the Mobil.	\$500 (new signs)	Short	Town of Hartford, Vtrans	5
14S	WEST GILSON AVE INTERSECTION: Move the US 4/West Gilson Ave intersection approximately 150 feet to the east to improve sight distances. Trim the brush and trees back in both directions in the short-term.	\$5,000 (Brush trimming); \$75,000 (Re-alignment)	Short	VTrans, Town of Hartford	4

* Costs are based on 2008 construction costs

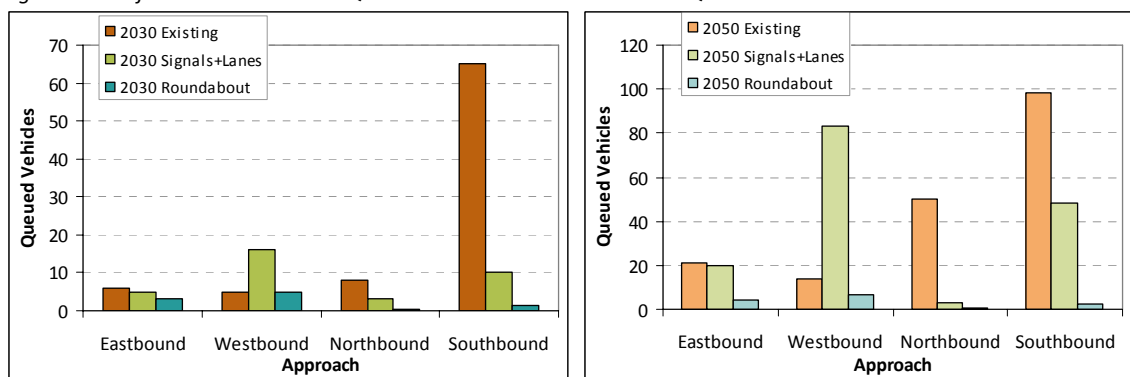


- 1S. WATERMAN HILL ROAD INTERSECTION: Improve safety and capacity at the US 4/Waterman Hill Road intersection. Add left turn lanes and traffic signal or 2-lane roundabout (see Figure 63). From a traffic analysis perspective, the 2-lane roundabout has better LOS, delay, and queuing results than a new signal with turn lanes. Figure 61 below compares LOS grade and average vehicle delay (seconds) for the existing, signalized, and 2-lane roundabout options. Figure 62 compares the projected queue lengths by approach for the three alternatives.

Figure 61: PM Peak Hour LOS Grade and Average Delay (seconds)

	Existing		2030 PM Peak Hour				2050 PM Peak Hour			
	LOS	Delay	Signals+Lanes LOS	Delay	Roundabout LOS	Delay	Existing LOS	Delay	Signals+Lanes LOS	Delay
US 4/Waterman Hill/Quechee Hartland Rd										
EB Left/Through/Right, along US 4 from Woodstock	A	3	A	7	A	5	A	5	E	59
WB Left/Through/Right, along US 4 from WRJ	A	3	B	17	A	5	A	4	E	58
NB Left/Through/Right, exiting Quechee Hartland Rd	F	>100	C	21	A	6	F	>100	C	28
SB Left/Through/Right, exiting Waterman Hill Rd	F	>100	C	32	A	9	F	>100	F	>100

Figure 62: Projected PM Peak Hour Queues – Waterman Hill Road and Quechee Hartland Road – 2030 & 2050

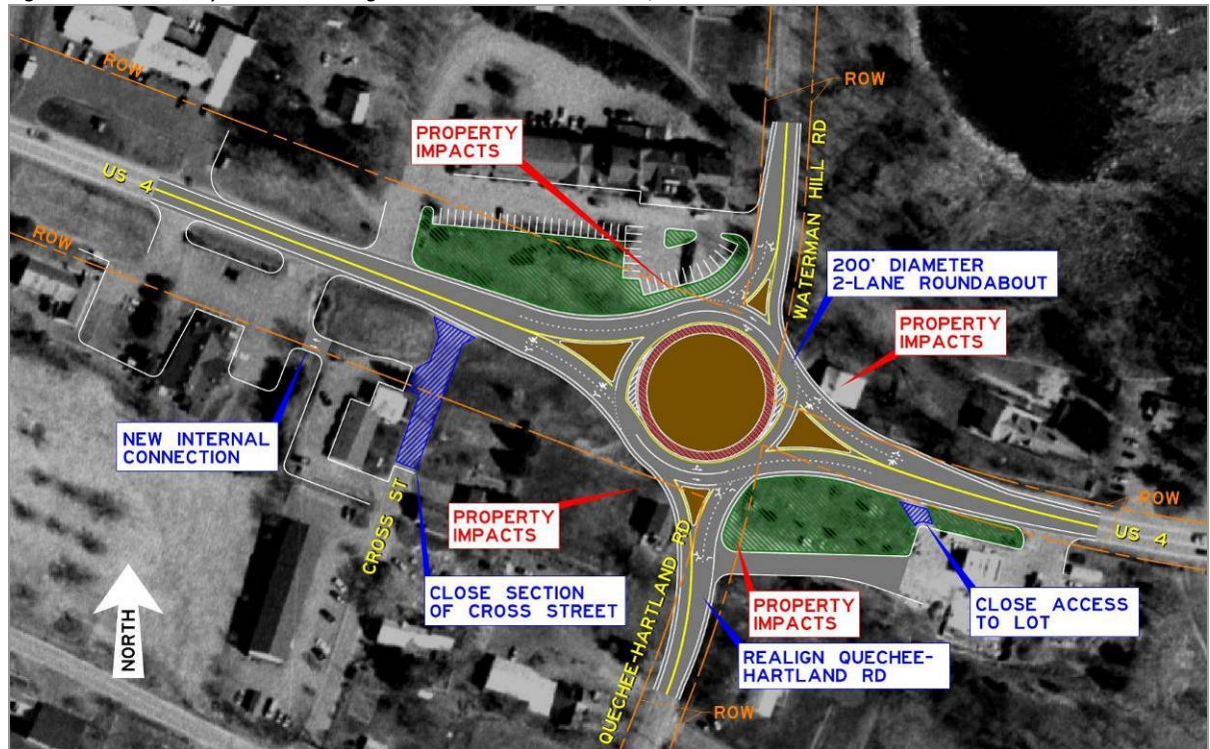


While the 2-lane roundabout (Figure 63) offers significant operational advantages to the signal, the roundabout would need a diameter of approximately 200 feet, which would result in adjacent property impacts, despite the relatively wide right-of-way along US 4 in this area¹. The roundabout would also be a significantly more expensive option. Both recommendations should help to address the high crash rates proximate to the intersection. This improvement was categorized as a high priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002).

¹ West of the intersection, the state owns 100 feet of ROW both sides. East of the intersection, the State owns 25 feet on the north side and 40 feet on the south side (VTrans, 2002)



Figure 63: Preliminary Sketch Showing 2-Lane Roundabout at US 4/Waterman Hill Road Intersection

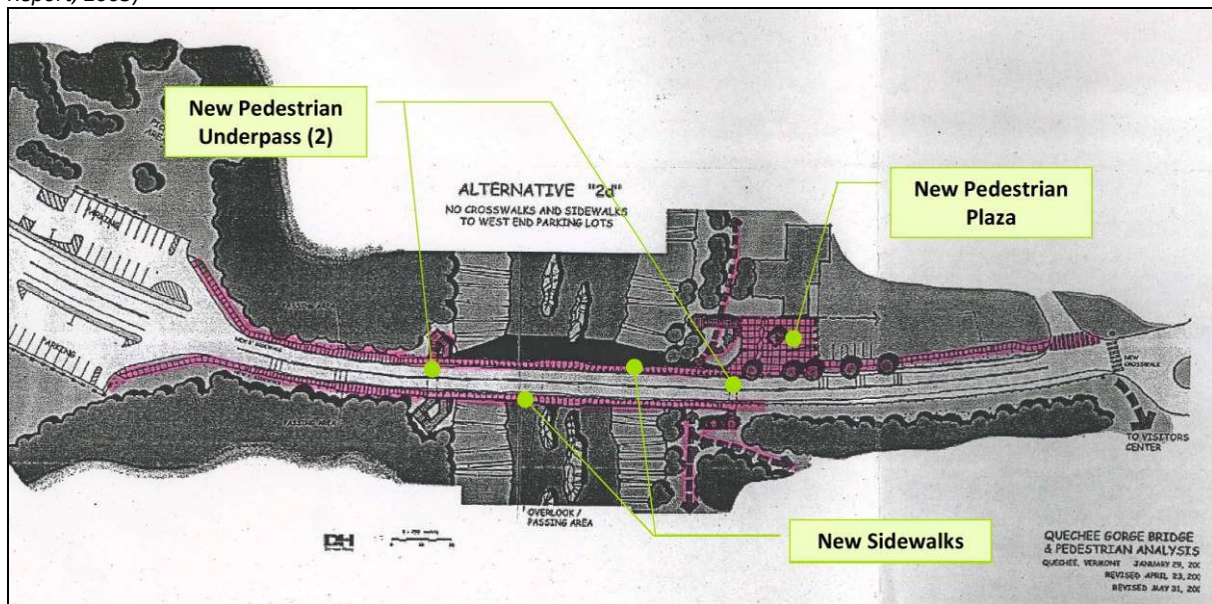


- 2S. US 4 TRANSIT SERVICE: Support the start of the Bridgewater to the Upper Valley US 4 commuter bus service. Peak period or full day service could be provided by either Stagecoach Transportation Service or Advance Transit. Both transit agencies are currently going through a short-range transit planning process and should consider this route in their deliberations.
- 3S. QUECHEE GORGE: Implement the previously-defined preferred alternative pedestrian enhancements¹ at the Quechee Gorge to minimize at-grade pedestrian crossings. Enhancements include enhanced pedestrian facilities on the gorge bridge, a new pedestrian plaza and overlook near the gift shop, stair underpasses on the east and west side of the bridge, and new sidewalk connections (Figure 64). A formal scoping report was prepared for these improvements and the recommended alternative has been endorsed by the Hartford Selectboard.

¹ The preferred alternative pedestrian crossing was identified in a 2003 VTrans Scoping Report, prepared by Dufresne-Henry.



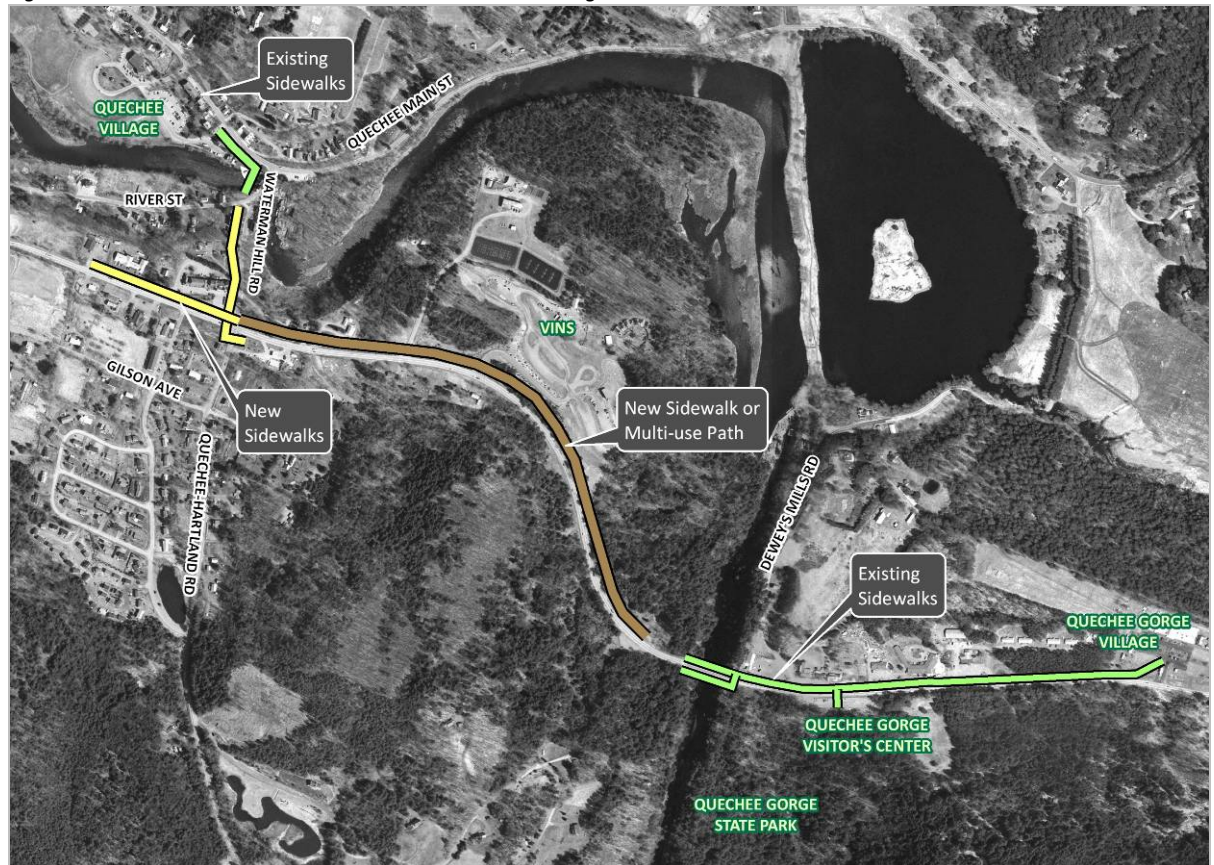
Figure 64: Quechee Gorge Pedestrian Improvements - Preferred Alternative (source: Dufresne-Henry Scoping Report, 2003)



- 4S. QUECHEE GORGE TO WATERMAN HILL ROAD: Enhance bicycle and pedestrian connectivity by constructing a sidewalk and bicycle lanes, or a separated multi-use path between the Quechee Gorge Village and Waterman Hill Road (Figure 65). The sidewalk should be constructed with a concrete surface, 5-foot width, and concrete or granite curbing. The multi-use path would be 12 feet wide with an asphalt surface and would be offset from the edge of US 4. These improvements would help to facilitate safer bicycle and pedestrian connection between the Quechee Gorge, VINS, and Quechee Village.



Figure 65: Potential Sidewalk and Multi-Use Path in the Gorge Area



- 5S. **ACCESS MANAGEMENT:** Improve access management, mobility, and safety along the corridor by reducing the number of existing and potential driveways by 10%. This reduction can be achieved through consolidation of existing driveways, relocating existing US 4 driveways to side streets, or by requiring new development to access US 4 via an existing curb cut or a side street. More detail on the mechanisms that can be employed to encourage this access management goal are described in more detail in Section 0.7.

One of the more important and quantifiable benefits of access management is the safety improvements achieved by having fewer conflicting movements on US 4. The safety impact of this 10% driveway reduction was calculated using the methodology outlined in Impacts of Access Management Techniques (NCHRP, 1999) for each road segment and the study area as a whole (Figure 66).



Figure 66: Safety Impact of 10% Driveway Reduction

Segment	Average Crashes per Year (2002-06)	Number of Driveways	Estimated Change in Accident Rate with 10% Driveway Reduction
1 Hartland Town Line to Waterman Hill Rd	6	12	-1%
2 Waterman Hill Rd to Deweys Mills Rd	4	6	-3%
3 Deweys Mills Rd to Quechee Main St	6	9	-2%
4 Quechee Main St to I-89 Exit 1 SB Ramps	3	10	-3%
5 I-89 Exit 1 SB Ramps to I-89 Exit 1 NB Ramps	2	1	0%
Total Study Area	21	38	-2%

- 6S. QUECHEE AREA SHUTTLE: Implement seasonal shuttle service between VINS, Quechee Village, and the Quechee Gorge Village area. This seasonal shuttle (which could use a trolley or other unique vehicle) would primarily serve to shuttle visitors between major attractions in the Quechee area. A potential route is shown below in Figure 67 which could be operated on a 10-12 minute headway.

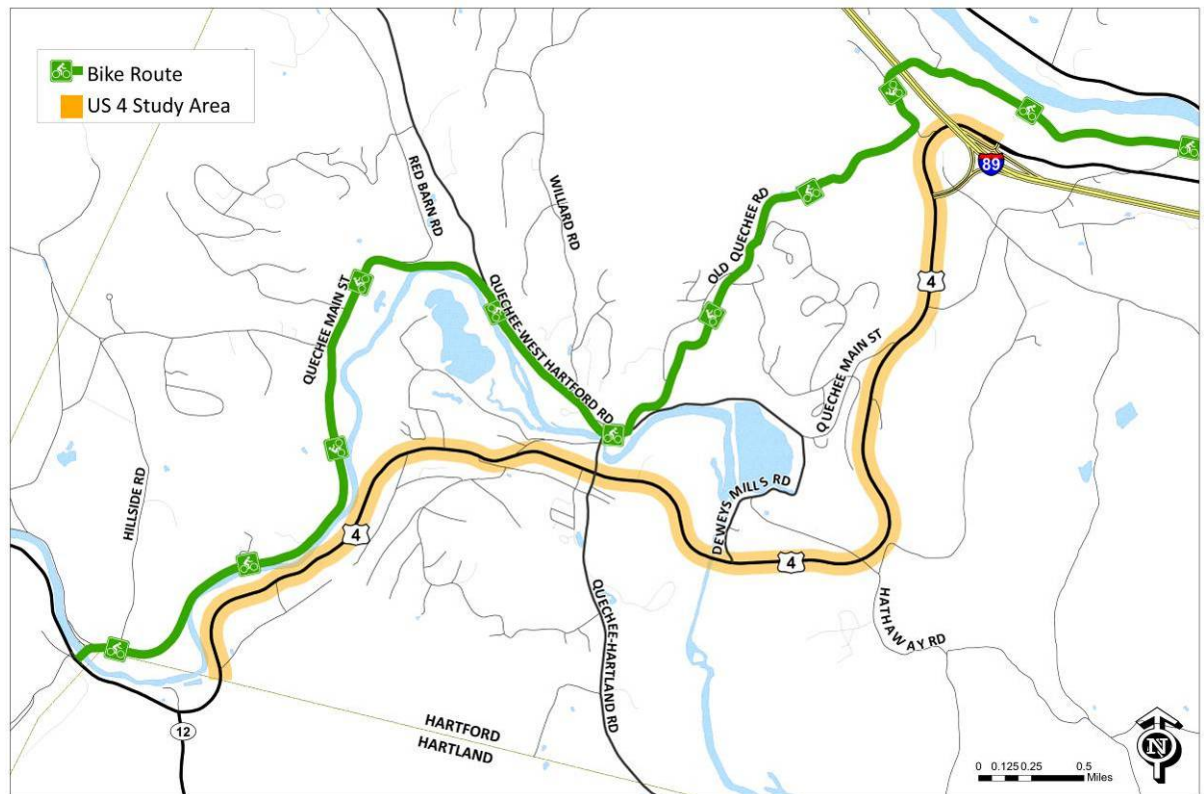
Figure 67: Potential Route for Quechee-Area Shuttle



- 7S. REGIONAL BICYCLE ROUTE: If shoulders are not widened along US 4, designate and sign parallel bicycle route along Old River Road > Costello Road > Old Quechee Road > Quechee Main Street (Figure 68). This alternate route is nearly identical in total mileage (10 miles) from White River Junction to Taftsville.



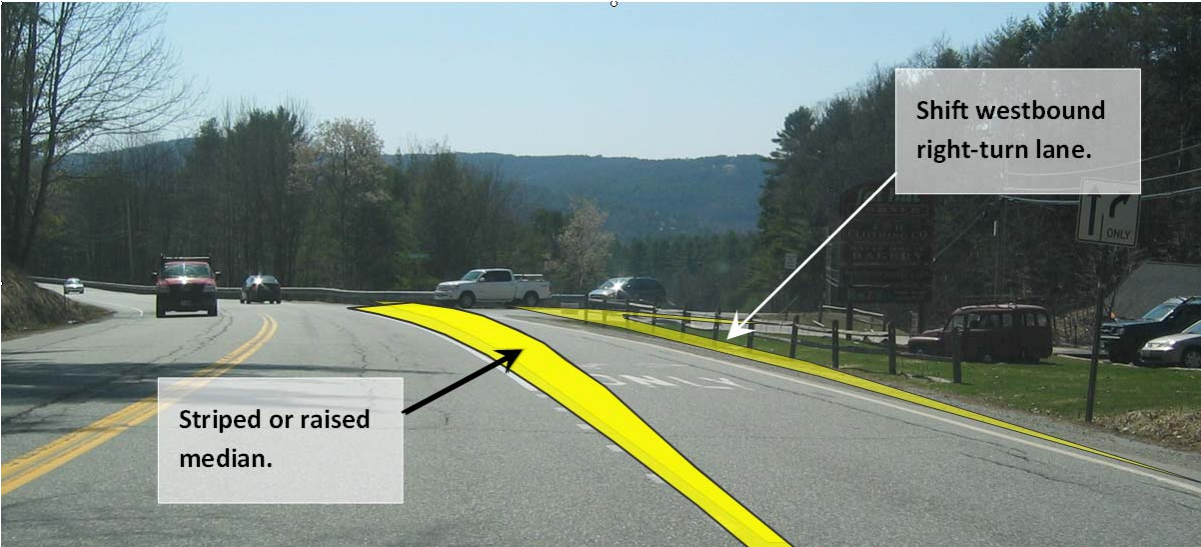
Figure 68: Regional Bicycle Route



- 8S. **QUECHEE MAIN STREET INTERSECTION:** Improve the safety at the US 4/Quechee Main Street intersection by providing an island (or wide striped) separator between the westbound through and right-turn lanes. Safety concerns have been raised over the alignment of the intersection; in particular, concerns were raised that some westbound US 4 drivers think the right-turn lane was a second through lane and would attempt to proceed straight through the intersection in this lane. The westbound US 4 approach to the intersection occurs along a vertical and horizontal curve. A schematic of the recommended improvement is shown below (Figure 69) which involves creating a striped or raised median between the through and right-turn lane and shifting the right-turn lane to the west to accommodate this expansion. This improvement was categorized as a high priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002). Although the existing volumes meet several traffic signal warrants, a traffic signal is not recommended at this intersection due to the increased delay and queuing that would be generated on US 4 and the lack of significant queuing projected on the Quechee Main Street approach even in the 2050 scenario (11 cars).



Figure 69: Potential Improvements to the Westbound US 4 Approach to Quechee Main Street



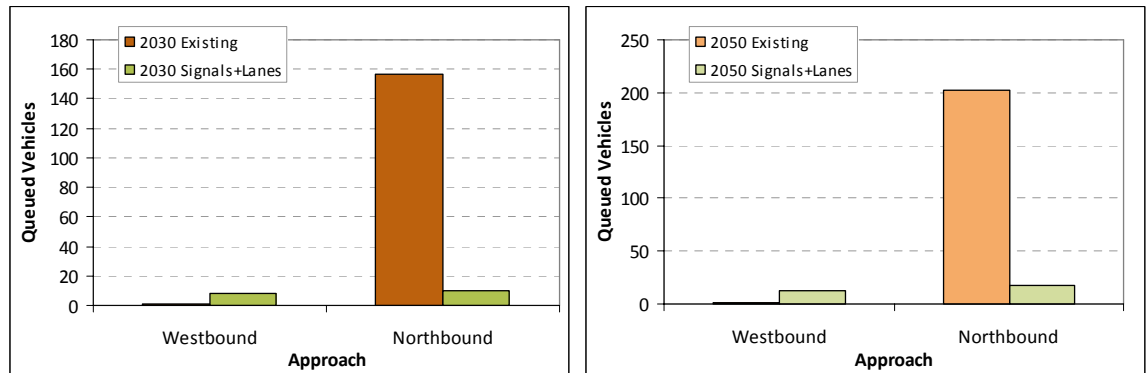
- 9S. I-89 NB RAMPS: Install a fully-actuated traffic signal at the US 4/I-89 Northbound Ramps intersection. The existing traffic volumes at this intersection meet several traffic signal warrants. The intersection is also classified as a High Crash Location intersection. A new actuated traffic signal (with no additional turn lanes) could improve LOS grades and delay significantly (Figure 70). The signal would also significantly reduce queuing at the intersection, particularly on the northbound off-ramp, where queues in 2050 are projected to be longer than 200 vehicles (Figure 71). A roundabout was not evaluated for this intersection because of the significant grade constraints adjacent to the intersection.

Figure 70: PM Peak Hour LOS Grade and Average Delay (seconds)

	2030 PM Peak Hour						2050 PM Peak Hour					
	Existing LOS	Existing Delay	Signals+Lanes LOS	Signals+Lanes Delay	Roundabout LOS	Roundabout Delay	Existing LOS	Existing Delay	Signals+Lanes LOS	Signals+Lanes Delay	Roundabout LOS	Roundabout Delay
US 4/I-89 Northbound Ramps												
WB Left, along US 4 from WRJ	A	8	B	18			A	8	C	26		
NB Left/Right, exiting I-89 NB Ramps	F	>100	C	21			F	>100	C	30		

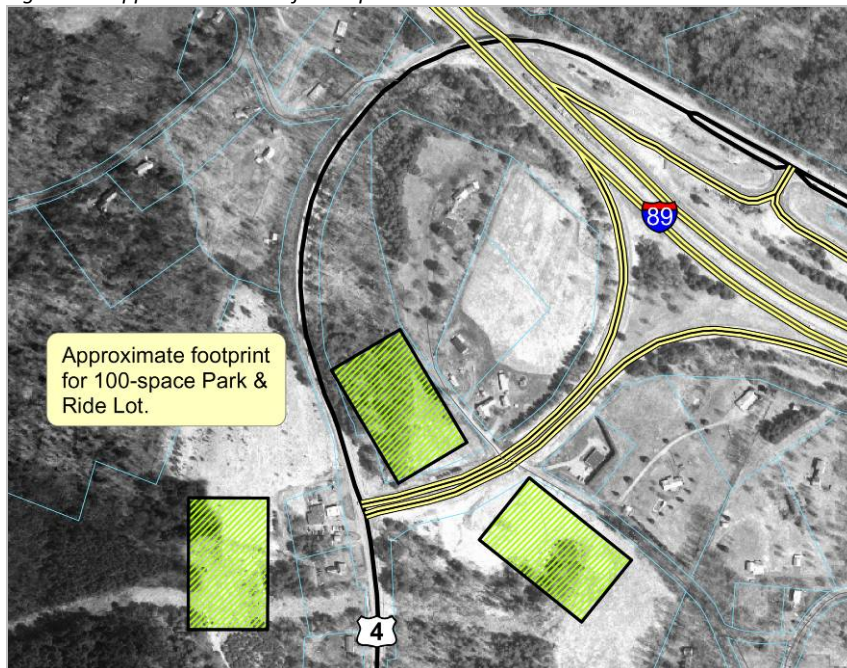


Figure 71: Projected PM Peak Hour Queues – I-89 Exit 1 Northbound Ramps



- 10S. I-89/US 4 PARK & RIDE: Construct a park-and-ride near I-89 Exit 1. Potential locations include the following sites near the interchange: the “Punt” parcel (south of I-89 southbound ramps), the “Milne” parcel (behind Mobil gas station), and the parcel between Briar Rose Lane and US 4 (shown below in Figure 72). The lot could be used for carpooling and could also be served by the current Stagecoach I-89’er route for transit connections to Lebanon and Hanover. The proximity of these relatively large parcels to the interstate interchange also makes the identified locations highly marketable for commercial or, to some degree, residential purposes. Therefore, any intention to make use of all, or a portion, of these parcels for a park-and-ride facility would need to be conveyed to the landowner(s) as soon as possible.

Figure 72: Approximate size of 100-space Park and Ride Lots



- 11S. I-89 SB RAMPS: Install turn lanes and a new actuated traffic signal at the US 4/I-89 Southbound Ramps intersection. To accommodate projected 2030 traffic volumes, the signalized intersection should include a new westbound left turn lane on US 4 (100 foot storage length) and a dedicated left turn lane on the I-89 southbound off-ramp approach (200-foot storage length). To accommodate projected 2050 traffic volumes, the intersection should be expanded to include a second left turn lane from the southbound off-ramp (with increased storage length to 350 feet), increased storage length on the westbound US 4 left turn lane to 175 feet, and the addition of a short section of two through receiving lanes on the westbound US 4 exit from the intersection. These configurations significantly improve LOS (Figure 73) and queuing (Figure 74) at the intersection, particularly on the southbound off-ramp approach. A two-lane roundabout was analyzed at this intersection but showed extensive queuing, primarily on US 4 westbound due to the heavy southbound off-ramp left-turn volume. Figure 75 shows the proposed 2030 and 2050 geometric improvements at the intersection.

Figure 73: PM Peak Hour LOS Grade and Average Delay (seconds)

	Existing			2030 PM Peak Hour			Roundabout			Existing			2050 PM Peak Hour			Roundabout		
	LOS	Delay		LOS	Delay		LOS	Delay		LOS	Delay		LOS	Delay		LOS	Delay	
US 4/I-89 Southbound Ramps																		
WB Left/Through, along US 4 from WRJ	A	3		B	18					A	7		A	10				
NB Left/Right, exiting I-89 SB Ramps	F	>100		C	27					F	>100		B	16				

Figure 74: Projected PM Peak Hour Queues – I-89 Exit 1 Southbound Ramps

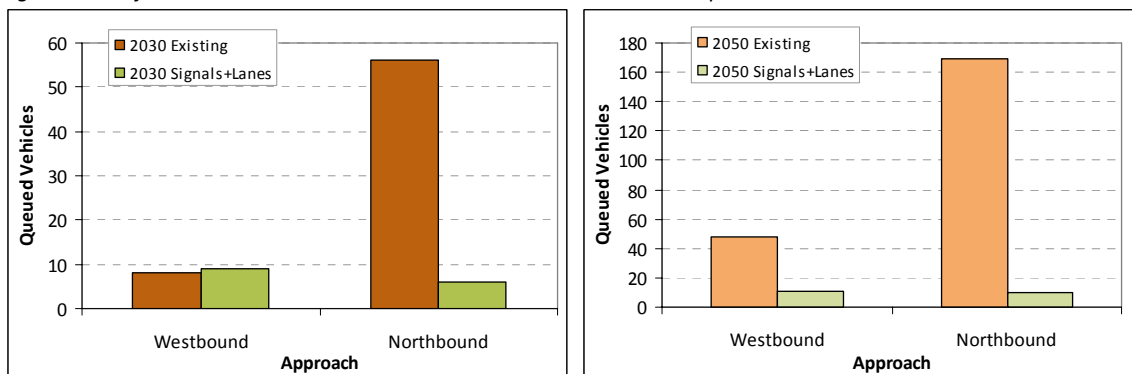


Figure 75: I-89 Southbound Ramps Intersection Improvements (left: 2030 geometry, right: 2050 geometry)



- 12S. I-89 SB RAMPS: Stripe a 150 foot bicycle lane along the eastbound US 4 through lane in the area of the eastbound US 4 right-turn lane onto I-89 southbound. Bicyclists traveling eastbound on US 4 are currently susceptible to a dangerous situation as eastbound vehicles transition into the right lane to turn onto the southbound I-89 on-ramp.
- 13S. I-89 SB RAMPS: Restrict tractor trailer trucks from parking on the wide shoulder near the Exit 1 Mobil which can create an unsafe condition by blocking sight distance for vehicles exiting the Mobil.
- 14S. WEST GILSON AVENUE INTERSECTION: Realign West Gilson Avenue intersection with US 4 to improve sight distances by moving the intersection approximately 150 feet to the east. A short-term recommendation to improve sight distances is to trim the brush and trees back in both directions. On the east side, brush and trees should be cut for 250 feet along the north side. On the west, the brush should be cut back 300 feet under the power lines. This would improve the sight distance greatly to the east and a little to the west. This improvement was categorized as a moderate priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002).

11.1.2 Long-Term Recommendations (10+ Years)

Figure 76 provides a brief summary of the long-term transportation recommendations identified for the study corridor, along with estimated cost, project implementing agencies, and whether the project could



be funded through developer traffic mitigation requirements. Recommendations are listed in descending order based on their total score for satisfying the corridor goals. Following the table are more detailed descriptions and relevant graphics for each of the long-term recommendations.

Figure 76: Long-Term Transportation Recommendations

ID	Improvement	Preliminary Cost Estimate*	Timeline		Total Score
1L	VT 12 TO WATERMAN HILL RD: Widen 3'-4' shoulders to 6'-8' width. Work includes rehabilitation of subbase (as needed), necessary earthwork, grading, drainage, guardrail, and signage improvements.	\$16,500,000	Long	VTrans	8
2L	HATHAWAY RD TO QUECHEE MAIN ST: Widen existing 3'-4' shoulders to 6'-8' width. Work includes rehabilitation of subbase (as needed), necessary earthwork, grading, drainage, guardrail, and signage improvements.	\$7,000,000	Long	VTrans	8
3L	QUECHEE MAIN ST TO I-89 SB: Widen existing 3'-4' shoulders to 6'-8' width. Work includes rehabilitation of subbase (as needed), necessary earthwork, grading, drainage, guardrail, and signage improvements.	\$4,750,000	Long	VTrans	8
4L	CROSS ST INTERSECTION: Close access to US 4 from Cross St to reduce turning movements in this designated High Crash Section of US 4.	\$10,000	Long	VTrans, Town of Hartford	6
5L	CORRIDOR-WIDE: Improve Vermont "look and feel" along corridor.	Varies	Long	Varies	5
6L	CENTER OF TOWN RD INTERSECTION**: Provide 8' shoulder on west side of US 4 at Center of Town Rd intersection to facilitate passing of queued westbound US 4 turning vehicles.	\$150,000	Long	VTrans	5
7L	RIVER ST INTERSECTION: Realign River St intersection to meet US 4 at a right angle to better facilitate left turns from River St onto US 4.	100000	Long	VTrans, Town of Hartford	4
8L	QUECHEE GORGE: Add 50-foot westbound left turn lane on US 4 at Quechee Gorge Visitor's Center entrance.	\$70,000	Long	VTrans, Town of Hartford	3
9L	DEWEYS MILLS RD INTERSECTION: Add 50-foot eastbound left turn lane on US 4 at Deweys Mills Rd. Add 50-foot southbound left turn lane.	\$50,000 (eastbound lane); \$30,000 (southbound lane)	Long	VTrans, Town of Hartford	3
10L	PULL-OFF - SOUTH SIDE: Improve sight distance at US 4 pull-off on south side (mm 0.20) by cutting back bank and brush west of pull-off.	25000	Long	VTrans	2
11L	PULL-OFF - NORTH SIDE: Improve sight distance at US 4 pull-off on north side by raising the elevation of the pull-off approximately 1 foot.	\$20,000	Long	VTrans	2
12L	COSTELLO RD INTERSECTION: Flatten approach grade on Costello Rd to improve sight distance at US 4/Costello Rd intersection.	\$100,000	Long	VTrans, Town of Hartford	1

* Costs are based on 2008 construction costs

** Project not necessary if adjacent roadway widening project(s) are completed.







- 1L. WATERMAN HILL ROAD TO VT 12: Widen existing 3'-4' shoulders from Waterman Hill Road to Route 12 to 6' -8' width. Work to include complete rehabilitation of subbase (as needed), as well as necessary earthwork, grading, drainage, guardrail, and signage improvements. The additional road width will better accommodate bicycles, truck traffic, and will serve to expand the available capacity of the roadway. This improvement was categorized as a highest priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002).
- 2L. HATHAWAY ROAD TO QUECHEE MAIN ST: Widen existing 3-4' shoulders from Hathaway Road to Quechee Main Street to 6-8' width. Work to include complete rehabilitation of subbase (as needed), as well as necessary earthwork, grading, drainage, guardrail, and signage improvements. The additional road width will better accommodate bicycles, truck traffic, and will serve to expand the available capacity of the roadway. This improvement was categorized as a highest priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002).
- 3L. QUECHEE MAIN STREET TO I-89 SOUTHBOUND: Widen existing 3-4' shoulders from Quechee Main Street to I-89 SB ramps to 6-8' width. Work to include complete rehabilitation of subbase (as needed), as well as necessary earthwork, grading, drainage, guardrail, and signage improvements. The additional road width will better accommodate bicycles, truck traffic, and will serve to expand the available capacity of the roadway. This improvement was categorized as a highest priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002).
- 4L. CROSS STREET INTERSECTION: Close access to US 4 from Cross Street to reduce turning movements in this designated High Crash Section of US 4. This intersection is located on the south side of US Route 4, about 200 feet west of the Hartland-Quechee Road. The residences and businesses located on and adjacent to Cross Street could access Route 4 by way of West Gilson Road and Hartland-Quechee Road (see Figure 63).
- 5L. CORRIDOR-WIDE: Improve the Vermont "look and feel" along the corridor by encouraging scenic easements, preserving viewsheds, consolidating growth in development nodes, preserving and enhancing natural features and plantings along the corridor. See Section 11.2.2 for specific measures that can be taken to advance this goal. The Town of Hartford can seek a Transportation Enhancement Grant from VTrans to help implement this recommendation.
- 6L. CENTER OF TOWN ROAD INTERSECTION:¹ Provide 8' shoulder on west side of US 4 at Center of Town Road intersection to facilitate passing of queued westbound US 4 turning vehicles. The widened shoulder would serve to enhance capacity along US 4 westbound, and improve safety levels by reducing the potential for queued vehicles in the westbound travel lane (5 of the 6 reported crashes occurring at this intersection between 2002 and 2006 involved rear-end collisions).

¹ Project not necessary if adjacent roadway widening project(s) are completed.



- 7L. RIVER STREET INTERSECTION: Realign River Street intersection to meet US 4 at a right angle to better facilitate left turns from River Street onto US 4. Closing this access off is not an option due to slippery winter conditions at the Waterman Hill/River Street intersection. This improvement was categorized as a low priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002).
- 8L. QUECHEE GORGE: Add a 50 foot westbound left turn lane on US 4 at the Quechee Gorge Visitor's Center entrance. This left turn lane would help improve capacity for eastbound US 4 traffic. This improvement was categorized as a high priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002)
- 9L. DEWEYS MILLS ROAD INTERSECTION: Add 50 foot eastbound left turn lane on US 4 at Deweys Mills Road. Although the future left-turning traffic volumes are not projected to be large (17 vehicles during 2030 PM peak hour), the level of conflicting vehicles (westbound traffic) is high enough to warrant a left turn lane for this movement under 2030 conditions. A second approach lane is needed in 2050 to the Deweys Mill approach to accommodate future demand and minimize delays (Figure 77).

Figure 77: PM Peak Hour LOS Grade and Average Delay (seconds)

	Existing			2030 PM Peak Hour			Roundabout			Existing			2050 PM Peak Hour			Roundabout		
	LOS	Delay		LOS	Delay		LOS	Delay		LOS	Delay		LOS	Delay		LOS	Delay	
US 4/Deweys Mills Rd																		
EB Left/Through, along US 4 from Woodstock		A	<1		A	<1					A	<1		A	<1			
SB Left/Right, exiting Deweys Mills Rd		E	42		D	37					F	>100		F	91			

- 10L. PULL-OFF - SOUTH SIDE: Improve sight distance at the US 4 pull-off on the south side at mile marker 0.20 by cutting back the embankment and brush west of the pull-off. The site distance to the west is poor and could be improved by cutting back the bank at the west end of the pull-off, although there may be ledge in this area.
- 11L. PULL-OFF - NORTH SIDE: Improve sight distance at the US 4 pull-off on the north side at mile marker 1.35 by raising the elevation of the pull-off approximately 1 foot.
- 12L. COSTELLO ROAD INTERSECTION: Flatten the approach grade on Costello Road to improve sight distance at the US 4/Costello Road intersection. Costello Road currently approaches US 4 at an - 11% grade adjacent to US 4. To bring the approach up to standard VTrans design specifications, with a 20 foot landing with a maximum slope of -3% at US 4, significant regrading of Costello Road would be needed. This improvement was categorized as a low priority in the US 4 Suggested Roadway Improvements Report (VTrans, 2002).

11.2 Land Use Management and Policy Recommendations

In the absence of coordinated comprehensive corridor management, anticipated development along the US 4 corridor will significantly degrade highway capacity, safety and function through Hartford and, by extension, through neighboring communities. Integrated transportation and land use planning, coordinated development and access management, and targeted infrastructure improvements are critical



components of highway corridor management. Effective, long-term corridor management can be achieved through a variety of techniques that typically include a combination of:

- Administrative strategies to improve inter-jurisdictional coordination between the state, the town and the regional planning commission – especially to regulate access to and development along the US 4 corridor, and to schedule and finance needed infrastructure improvements;
- Planning strategies specific to the US 4 corridor that include detailed site planning for key areas or parcels identified for major development –for example around the Quechee interchange area;
- Regulatory strategies that more specifically control the type, density and location of development (and redevelopment) along the corridor, transportation demand and associated impacts, highway, transit and pedestrian access, and required dedications and infrastructure improvements; and
- Infrastructure development and financing strategies that identify existing and planned infrastructure capacities, targeted levels of service, and infrastructure improvements needed to remedy existing deficiencies, and to support additional development in specified locations along the corridor.

Recommended corridor management techniques are presented here for further discussion and consideration in implementing the US 4 Corridor Management Plan.

11.2.1 Administrative Initiatives

The Vermont Agency of Transportation, the Town of Hartford, and the Two Rivers-Ottawaquechee Regional Commission all have jurisdiction over various interrelated aspects of land use and transportation planning, transportation improvement programming, development regulation and access management along the US 4 corridor. Efficient and effective corridor management among these multiple jurisdictions requires a level of coordination that often is lacking, to the detriment of the highway and the communities and development it serves. Avenues currently exist for voluntary cooperation, including limited opportunities to participate in planning and project review at all levels, but there are few formal mechanisms in place to ensure inter-jurisdictional cooperation – particularly between VTrans and the town who shoulder most permitting responsibilities within the US 4 corridor.

Ongoing communication and cooperation between VTrans, Hartford, the Two Rivers-Ottawaquechee Regional Commission, neighboring communities and local property owners is critical to effectively address development, traffic and associated infrastructure and management issues along the corridor. The following are recommended strategies to strengthen and formalize inter-jurisdictional coordination:

1. **Execute a memorandum of understanding – an “Intergovernmental US 4 Corridor Management Memorandum of Understanding”** – between the agency, regional planning commission, and town that references the US 4 Corridor Management Plan, outlines joint notification requirements, coordinates state and local permitting processes, and addresses needed access and infrastructure improvements within and along the US 4 corridor in conformance with plan



recommendations. The draft Memorandum of Understanding is available in Appendix D and is included as general guidance. Any agreement will be subject to negotiations between the participating parties, undergo legal review, and not supersede statutory authority.

Intergovernmental corridor management agreements have long been used to coordinate access management along state highways in rapidly developing states such as Florida, and are currently being instituted for use in New Hampshire. They have also been proposed, if not yet enacted, for consideration elsewhere in Vermont. Typically, such agreements at minimum require that:

- The state and RPC must provide information and technical assistance to the town in developing acceptable access management standards, and site- or parcel-specific access management plans for parcels along the highway corridor.
- All corridor or site/parcel specific access management plans must be filed with the state and the RPC.
- The town must adopt and administer access management standards acceptable to the state for development that accesses state highways. At minimum, these should be consistent with accepted state access management guidelines.
- The town must notify the state (e.g., the District Transportation Administrator or Utilities and Permits Unit) and RPC when it receives a development proposal that requires a state access permit, and request input on access location and design.
- The town must require that all access points comply with adopted access management standards and any applicable site specific access management plans.
- The town must inform the state of any waivers or variances from the access management standards or plans prior to local approval and provide appropriate notice for comments.
- The state will defer final action on a driveway access permit until the town has had a reasonable opportunity to review any related development application.
- The state must give the town and regional commission 30 days notice, and opportunity for written comment, if it is required under state law and associated management guidelines to allow for reasonable access to a project that differs from that approved by the town.
- In accordance with 19 VSA §1111, the state must require compliance with all local ordinances and regulations relating to highways and land use as a condition of any state highway access approval.

VTrans is understandably wary of entering into individual management agreements with every municipality in the state but, in the absence of other statutory coordination mechanisms (as proposed but not yet enacted under 19 VSA §1111), the agency must consider this option for municipalities such as Hartford that regulate development along major state highways (e.g., the National Highway System) and interchange areas. The town also may be reluctant to adopt state guidelines and associated notification requirements that could compound or extend the local



permitting process but, in doing so, may avoid inter-jurisdictional conflicts that could further delay or ultimately supersede locally approved development. There is also a role for the regional planning commission, as the major source of technical assistance to the town for both planning and development review, and as a statutory party to Act 250 proceedings for major development along the corridor.

The following related strategies are intended to effect the terms of a corridor management agreement, but also may be considered separately.

2. **Incorporate state agency application referral and notification requirements under zoning and subdivision regulations for all land development¹ proposed along state highways, including US 4.** The regulations should specify that the administrative officer (zoning administrator) will refer all applications for development that fronts on or accesses state highways to VTrans and the RPC for review, and that no local permit or approval will be issued until comments are received from the state, or 30 days have elapsed from the date of referral.² The regulations should also specify that applications for development on town highways – especially town highways that intersect the US 4 corridor– be referred to the town’s highway superintendent for review and comment under the town highway ordinance, in accordance with local practice. An application for development on an intersecting town highway that will affect or require modifications to a state highway corridor or intersection also should be referred to VTrans and the regional commission for review and comment.
3. **Update and adopt local development regulations and highway ordinances to reference or incorporate applicable state access management standards,** as currently recommended in town and regional plans, to ensure that local, regional and state access management policies and standards for development on state highways are compatible. At minimum these should incorporate or reference Vermont Agency of Transportation Access Management Program Guidelines (rev. 2005) as used by the state in issuing state highway access permits and also, as applicable:
 - *Vermont State Standards for the Design of Transportation Construction, Reconstruction and Rehabilitation on Freeways, Roads and Streets* (1997), ³and
 - State design and construction standards – e.g., Standard A-76 (Town and Development Roads), Standard B-71 (Residential and Commercial Drives), etc. – to include standards that supplement, or may be more restrictive, than current town highway standards – particularly for town and development roads that intersect state highways.

¹ “Land development,” as defined for this purpose under the Vermont Planning and Development Act (24 V.S.A. §4303) and Hartford’s land use regulations, also includes the subdivision of land into two or more parcels and changes in use. Hartford currently regulates the subdivision of land under separately adopted subdivision regulations.

² The Vermont Planning and Development Act included a similar application referral requirement for any proposed development located within 500 feet of an interstate ramp, but this requirement was repealed in a 2004 update of the statutes and no longer applies. It also is not referenced under the town’s current regulations, which have since been updated, but is still referenced in the state’s permitting handbooks.

³ As recommended for update in the current Vermont Highway System Policy Plan.



4. **Applications for §1111 permits must include a copy of any local permit or approval** – including the site plan or subdivision plat as approved by the town – or a copy of any local permit denial.
5. **Conduct joint and ongoing, local, regional and state corridor planning and transportation project development efforts**, coordinated through the regional planning commission, to ensure that local and regional transportation plans and improvement programs incorporate priority US 4 road, intersection, and access management improvements.
6. **Participate in joint local, regional and state efforts to finance and develop needed infrastructure improvements** – through existing municipal, regional and state infrastructure transportation improvement and enhancement programs, municipal and state permitting requirements, and through other public/private partnerships.
7. **Participate collectively and individually in state Act 250 proceedings for development proposed on US 4 and other highways in the vicinity** to ensure that traffic, access and infrastructure impacts and recommended improvements are in the permitting process and conform to the US 4 Corridor Management Plan.
8. **Support efforts currently under development to strengthen state, regional and local coordination and review of proposed development projects along state highway corridors** – e.g., by reinstituting application referral and notification requirements under 24 VSA Chapter 117, and by clarifying, under 19 VSA §1111, VTrans access management jurisdiction over existing accesses to state highways when there is a proposed change in the use of a property or the access serving it.

11.2.2 Planning Initiatives

The 2007 Two-Rivers Ottauquechee Regional Plan and 2007 Hartford Town Plan are the primary public policy documents guiding land use and development along the US 4 corridor. These plans, which include growth projections, resource protection standards, land use and transportation elements, and associated maps, are considered in the review of development under Act 250. The Hartford Town Plan also provides the statutory basis for adopting local land use regulations, including amendments to the town's zoning and subdivision bylaws;¹ and for other non-regulatory programs such as interchange area planning, capital improvement programming, and land conservation initiatives that may affect both development and transportation infrastructure capacity along the highway corridor.

Both town and regional plans recognize the importance of US 4 as the major east-west highway serving the region, and the fact that it supports a variety of sometimes conflicting functions. Both plans recommend improved corridor and access management at the regional level to preserve highway capacity and functions, and at the local level to maximize development capacity. Both plans also call for concentrating development within designated, compact growth areas (nodes or activity centers), and

¹ Under 2004 amendments to the state planning statutes, local land use regulations now must conform to and have the purpose of implementing the adopted municipal plan.



restricting development and highway access outside of these areas to preserve existing settlement patterns, to avoid strip development and sprawl, and to protect rural, cultural and scenic resources.

The plans differ, however, in their recommendations for the Quechee interchange area. The Hartford plan identifies this as a new growth area, targeted for high density, mixed use development, and recommends zoning changes to that effect. As highlighted in related analyses (Section 3.5), proposed zoning changes could significantly alter local development patterns, trip generation rates, and associated impacts to the transportation network. The regional plan, which includes specific policies for interchange areas, recommends only limited transportation and travel-related development at this interchange because of its close proximity to White River Junction, the regionally designated growth area.

Given these observations, and the results of more detailed build-out analyses conducted for the Quechee interstate interchange area (expanded QII district) as part of this study, the following planning initiatives are recommended for local and regional consideration:

1. **Adopt the US 4 Corridor Management Plan or its policies and recommendations as an amendment to both the Hartford Town Plan and the Two Rivers-Ottauquechee Regional Plan.** Current plans provide the legal basis to pursue previously identified management options, including some infrastructure improvements and the incorporation of state access management guidelines under local regulations; but, by adopting the more detailed US 4 corridor management plan by reference or as an addendum to these plans, it will carry more weight in Act 250 proceedings. It can then also service as the policy basis for zoning and subdivision changes and other management strategies not identified or covered under current plans.
2. **Develop an interchange area plan – including a detailed access management plan – for the Quechee Interstate Interchange (QII) District.** Given the significant differences between town and regional plan recommendations for this interchange area (which could be an issue in Act 250 proceedings)¹, and also the effect that proposed zoning around the interchange will have on the US 4 highway corridor and interchange area, it is strongly recommended that the town, regional commission, and affected landowners work together with VTrans to develop a more detailed, site-specific interchange plan for this area – focusing on proposed types, densities and patterns of development, and related access management – as a supplement to the corridor management plan. This should be done prior to the adoption of any proposed zoning changes to further assess and address needed infrastructure capacity, and anticipated impacts to the highway corridor and interchange area, other land uses in the vicinity, and to downtown White River Junction.
3. **Re-introduce LOS standards for all state highways**, including US 4, in the next iteration of the regional plan.

¹ Regional plan policies and recommendations may override the municipal plan in Act 250 proceedings for development determined to have “substantial regional impact,” as defined under the regional plan (pp. 268-271). Currently this includes but is not limited to development that modifies existing regional settlement patterns or that affects the capacity (or level of service) of regional public facilities, including state highways and interchange areas.



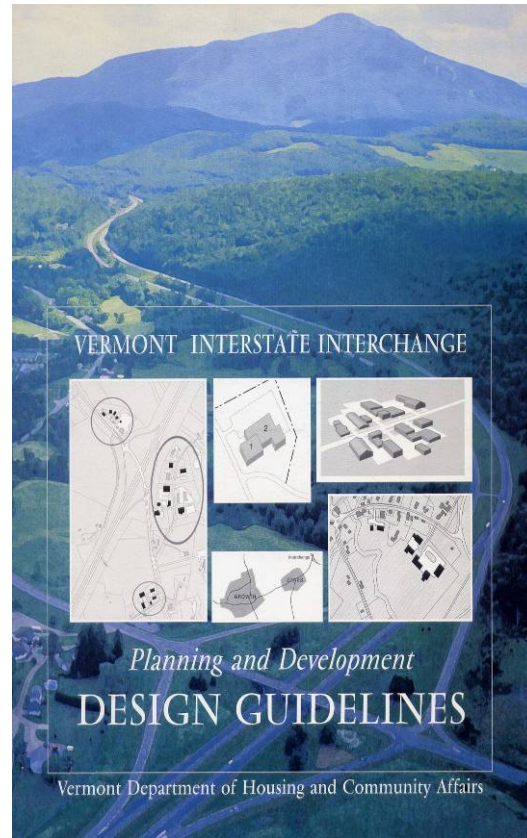
Interchange Area Planning

Vermont's interstates and interstate interchange areas are considered state resources, formally recognized as such under a 2001 Executive Order signed by former Governor Howard Dean, and under subsequent state and local planning initiatives. As a result, interchange overlay districts and access management plans are now specifically authorized under the Vermont Planning and Development Act.

Interchange areas will continue to attract development, but development in these areas should be consistent with state goals and objectives. The Department of Housing and Community Affairs has published *Vermont Interstate Interchange Planning and Development Design Guidelines* (2004) to assist communities in creating development plans and bylaws specific to these areas (available on-line at www.dhca.state.vt.us/Planning/GuidelinesFinal.pdf).

For planning purposes, the Quechee interchange in Hartford is classified as a "Type D" interchange that carries primarily local traffic, or traffic headed to a downtown area located more than 1.5 miles away. Design guidelines specific to this type of interchange area are included in the handbook.

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4. **Update Hartford Town Plan's land use (zoning district) designations and related policies and proposed development standards along the US 4 corridor** – particularly for the Quechee interchange area and key intersections – as needed to incorporate and better support corridor management plan goals and objectives. At minimum this should include further consideration of:

- Current plan recommendations to include the Quechee interchange area as a proposed growth center, and to create a new zoning district around the interchange (p. 57). The build-out analysis conducted for this study, unlike that completed for the town plan update, identifies potentially significant impacts from proposed commercial development densities – to the capacity and function of both the interchange area, and the US 4 corridor through Hartford and beyond. Any changes to zoning around the interchange area should be postponed until associated infrastructure needs, capacities and impacts can be addressed through an interchange planning process. Once this area is "up-zoned" to allow for concentrated, mixed use development, it will understandably raise landowner expectations, and make it more difficult to "down zone" land



around the interchange as needed to address associated impacts to highway infrastructure and settlement patterns.

- Proposed study recommendation to establish a “US 4 Corridor Management Overlay District” as described in more detail in Appendix E, the intent of which would be to more specifically regulate development along and access to US 4.
- Expanding proposed low density rural districts (e.g., the RL-10 District) to include rural parcels along the US 4 corridor west of Quechee (for example the, scenic sections identified in the town plan) to further limit development and the need for additional highway access in these areas – or to include these areas in the proposed Agricultural/Scenic Overlay District.
- Related bicycle, pedestrian, and park-and-ride concerns and recommendations.
- Specific policies to avoid strip development along town and state highways, including US 4 – consistent with state planning goals (24 VSA §4302), and town plan recommendations to direct and concentrate new development in Hartford’s traditional villages and downtown.
- Specific policies that support ongoing corridor planning efforts, link proposed development to existing and planned infrastructure capacity, and recommend the implementation of corridor management and preservation strategies as initially outlined in this report.

5. Update the town plan’s transportation chapter to address corridor management recommendations in more detail, to include:

- An expanded access management section that assigns functional and access management classifications to all public roads (as shown on the transportation map) – including collector and local roads that intersect the US 4 corridor– and that references applicable state access management guidelines, identifies needed access management improvements, and lists recommended regulatory and non-regulatory access management tools or techniques for local application. For example these should include specific recommendations to limit direct access onto arterials such as US 4 to collector roads, and to promote connectivity between parcels and uses along the corridor through shared or interconnected parking areas and access roads.
- Identification of accepted and planned levels of service (LOS) for key roads and intersections, in relation to related access management recommendations and guidelines – for reference in development review and infrastructure improvement programs.
- Related bicycle, pedestrian, and park-and-ride concerns and recommendations.

11.2.3 Regulatory Initiatives

The regulation of development along the US 4 corridor is largely the responsibility of the Town of Hartford under its land use regulations. As noted earlier, VTrans retains jurisdiction over access to the state highway right-of-way, which extends to the subdivision of adjacent parcels. Act 250 review also applies to larger developments along the corridor.



Hartford has comprehensive bylaws (evaluated in more detail under Project Memo #1) which include zoning regulations that control the type, location, scale, and density of development, and separate subdivision regulations that regulate the pattern of development and related infrastructure improvements. These regulations are intended to implement the Hartford Town Plan, and are now being updated to incorporate 2007 plan recommendations. The town also has a highway ordinance that includes driveway and road standards, and regulates connections (accesses, intersections) to town roads – including roads that intersect the US 4 corridor. This ordinance is also in the process of being updated, with the assistance of regional planning commission staff.

The town's bylaws have been updated frequently over the years to respond to changing circumstances and community objectives. They currently contain provisions and standards for the review of:

- subdivisions – to evaluate lot layouts, roads and other infrastructure improvements,
- site plans – to evaluate internal site layout, traffic and pedestrian circulation and design,
- conditional uses – to evaluate the external effects of proposed development, including potential impacts on traffic and highways in the vicinity; and
- planned unit development – to allow for more flexible, creative and efficient patterns of development that may require modification of zoning or subdivision standards.

These bylaws offer a well-established framework for regulating development along the US 4 corridor. They do not, however, incorporate many district- or use-specific corridor and access management standards. They also, as noted earlier, do not currently address issues of overlapping jurisdiction between the state and town, and between local officials and boards, for corridor management.¹ The town's land use regulations now require only that applicants obtain all necessary state and municipal permits, including state and local highway access permits. Town staff provide critical coordinating functions – applications are referred among staff and between boards for review. There is still the outside chance however, that overlapping jurisdiction – e.g., for the review of development impacts on traffic and road conditions – may result in conflicting decisions or inconsistent findings and conditions of approval.

A matrix of commonly recommended access management techniques under local regulations is presented in Figure 78. Key regulatory strategies identified to date for local consideration are also highlighted below – however, the intent and effect of some of these recommendations extend beyond corridor management, and should therefore be carefully considered in relation to the town's overall program for the review and regulation of development. Draft US 4 Corridor Overlay District language is presented in Appendix E. Appendix F includes detailed checklists for use in updating local bylaws to incorporate corridor management plan recommendations.

¹ Under the town's current land use and highway regulations, the zoning administrator, planning commission, board of adjustment, highway superintendent and selectboard all have separate, but often overlapping jurisdiction for development on and access to public highways.



Figure 78: Regulatory Corridor Management Options Matrix

Regulatory Access Management Options	May be Defined or Applied Under:					
	Zoning Map	Zoning District Standards	General Zoning Standards	Site Plan Review	Conditional Use Review	Subdivision Review
Zoning District Designations						
1. Avoid "ribbon" or "strip" zoning along road corridors	✓					
2. Define compact development districts – e.g., villages, growth centers, transit nodes – in appropriate locations (e.g., adjacent to existing centers, major intersections)	✓					
3. Define "Interstate Interchange District" to regulate development, access management within interchange areas	✓					
4. Define "Access Management Overlay District(s)" to apply access management criteria to a particular corridor or intersection	✓					
Land Uses (by Zoning District)						
1. Consider allowed uses in relation to context, trip generation, transit		✓				
2. Rural: agriculture, forestry, low density residential		✓				
3. Village/Growth Center: mixed commercial, residential, civic		✓				
4. Interchange: limited mixed use (travel, highway-oriented uses)		✓				
Densities of Development (by Zoning District)						
1. Limit scale, density of development along undeveloped sections		✓				
2. Rural: low overall density, large lots, wide frontage, deep setbacks and/or clustered development off the road		✓				
3. Village/Growth Center: high density, small lots, reduced frontage and setbacks, increased height, coverage		✓				
4. Interchange Area: planned, clustered development, low-moderate overall density, d		✓				
General Access Standards						
1. Limit access (curb cuts) to one per lot, or one per specified length of road frontage, consistent with access separation guidelines			✓	✓	✓	✓
2. Require access from a secondary road where feasible			✓	✓	✓	✓
3. Require that new or relocated driveways be aligned with facing driveways where feasible			✓	✓	✓	✓
4. Allow driveway and parking areas within side yard setbacks			✓	✓	✓	
5. Separate curb cuts and road intersections; set minimum distances			✓	✓	✓	
6. Require the relocation, consolidation or elimination of non-conforming accesses upon development or redevelopment			✓	✓	✓	
7. Define access and driveway design standards (e.g., width, length, alignment, grade) which may vary by the type of use			✓	✓	✓	
8. Limit access and driveway widths to the design width, require curbing or other access control features			✓	✓	✓	
9. Require adequate driveway length for storage and stacking			✓	✓	✓	
10. Require driveway turn around areas; prohibit direct parking that requires backing into rights-of-way (except for on-street parking)			✓	✓	✓	
11. Specify access requirements for Class IV (seasonal) roads			✓			
Site Layout Standards						
1. Rural: minimize the linear density of development along roads, maximize internal site circulation (access to outparcels)				✓	✓	✓
2. Village/Growth Center: maximize connectivity, create or maintain a pedestrian scale and orientation				✓	✓	✓
3. Village/Growth Center: reduce or eliminate on-site parking requirements (e.g., based on the availability of on-street, shared or public parking, or the use of parking or transit credits)				✓	✓	✓
4. Limit parking to the side or rear of buildings				✓	✓	✓
5. Require shared access and interconnected parking with adjoining properties and uses (joint and cross access) where feasible; or access easements that connect to adjoining parcels in the event they are developed or redeveloped				✓	✓	✓
6. Require pedestrian sidewalks or paths between buildings, parking areas, and where feasible to adjoining parcels				✓	✓	✓
7. Require the installation of mid-block pedestrian crossings where appropriate				✓	✓	✓
8. Require the installation of public transit facilities, where served				✓	✓	✓
9. Require the installation of bicycle racks for commercial, industrial, civic, multi-family and recreational uses				✓	✓	✓
Multi-Property Standards						
1. Allow for or require planned unit (and planned residential development); include requirements for clustering					✓	✓
2. Require the submission of a master plan for phased development, showing planned access points, road and pedestrian extensions						✓
3. Require that the pattern of subdivision ensures proper access and street layout in relation to existing or proposed roadways						✓
4. Discourage or prohibit the creation of flag and other irregularly shaped lots that do not meet access or frontage requirements						✓
5. Require that newly subdivided parcels be served by existing or planned accesses; limit the creation of new accesses associated with resubdivisions						✓
6. Require access to individual lots from internal/service roads						✓
7. Define road and road intersection standards						✓
8. Discourage the creation of dead-end roads, including cul-de-sacs						✓
Infrastructure Requirements						
1. Require traffic impact analyses for larger projects, to be paid for by the developer, to determine traffic and infrastructure impacts associated with a proposed development					✓	✓
2. Require the installation of on- and/or off-site access, road and/or traffic management improvements necessitated by the development, to be paid for by the developer				✓	✓	✓



1. **Recommendations for coordinating and streamlining the development review process include the following:**

- **Reconsider the establishment of a development review board** to review all proposed development under the town's zoning and subdivision regulations, for greater internal consistency and coordination, and to consolidate review processes where feasible.
- **Consider the adoption of a unified regulation** that integrates subdivision, site plan, conditional use and planned unit development review standards – including related standards under each for access management, driveway and road design, parking, and infrastructure improvements. For example, this would allow for the consolidation of all access management standards under one section of the ordinance, for reference and consistent application under each review processes, and also better support consolidated or concurrent review processes.
- **Specify the timing and sequence of all development review processes in the regulations**, as now required by statute (24 VSA §4462). For consistency, also incorporate or reference prior findings and conditions of approval under subsequent development review processes as appropriate.
- **Incorporate recommended state application referral and notification requirements under zoning and subdivision regulations** – i.e., the requirement that applications for development along state highways, or within 500 feet of an interchange ramp, be forwarded to the Vermont Agency of Transportation for review or, for development along town highways, to the Town Highway Superintendent.
- **Consolidate and expand application requirements for site plan and conditional use review** (as specified in the bylaw or under associated application checklists) to make sure that the information provided for each type of review (site plans, trip generation rates, traffic impact studies, etc.) is consistent and sufficient to effectively evaluate the impacts of proposed development along the corridor and intersecting town highways.
- **Update current checklists for use in the review of applications** to include applicable corridor and access management standards.

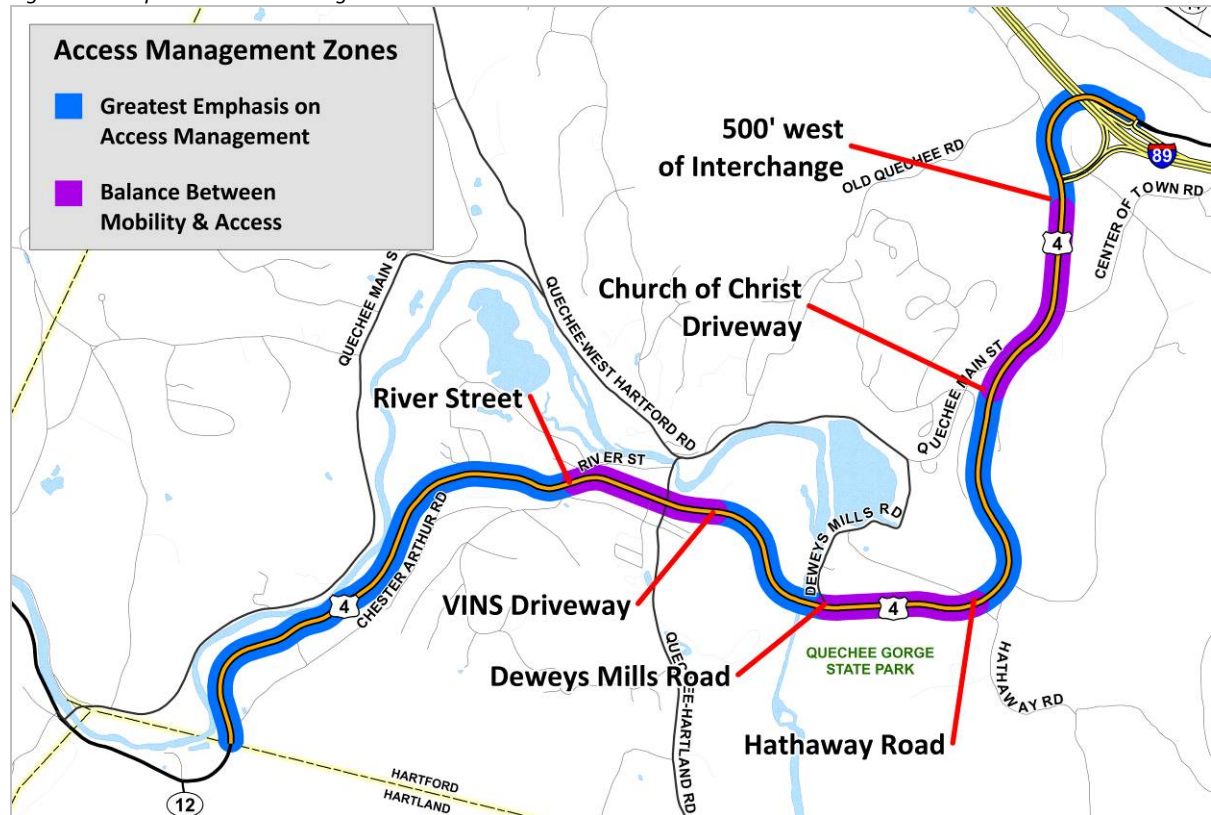
2. **Recommendations for zoning district (land use) designations along the US 4 corridor, corresponding with proposed planning recommendations, include the following:**

- **Re-evaluate existing and proposed zoning districts along the corridor** – especially the proposed Quechee Interstate Interchange District and associated district standards (e.g., allowed uses and densities of development) – in relation to projected trip generation rates and traffic conditions, available road frontage, the potential for new accesses and connecting roads, transit stops, and intersection capacities. As recommended earlier, this should be done in association with a more comprehensive interchange area planning process.
- **Consider the adoption of a US 4 Corridor Management Overlay District** that references the corridor management plan, and applies recommended standards (e.g., access restrictions,



separation distances, intersection LOS, identified infrastructure improvements, pedestrian access, along the highway etc.) to the development or redevelopment of parcels along the corridor (see Appendix E).

Figure 79: Proposed Access Management Zones



- Consider extending the proposed RL-10 district, or Agricultural/Scenic Overlay district to include rural parcels along US 4 west of Quechee, and thereby further limit development densities and the need for additional access along undeveloped, scenic sections of the road.
3. **Recommendations for updating associated development review standards for highway corridor and access management include the following** (more specific options for consideration are presented in Appendix F:
- **Re-evaluate district dimensional requirements along the US 4 corridor** – particularly required front setbacks and lot widths. Consider adopting minimum frontage standards (as measured along the road right-of-way) rather than, or in addition to, current lot width requirements (as measured along the required front setback line). Increase lot width/frontage requirements for parcels along the US 4 corridor in relation to recommended access spacing distances (as recommend in the town plan).



- **Consolidate and update existing access management and driveway standards (e.g., under one access management section)** for reference and consistent application under subdivision, site plan, and conditional use review, and the town highway ordinance.
- **Update general access management standards** (that apply to all development) to limit the number of access points per lot (or lot frontage distance), to require access from secondary roads where feasible, and to require the consolidation or relocation of access points upon redevelopment or in association with a change in use.
- **Incorporate or reference applicable state access management guidelines under the town highway ordinance and adopted land use regulations** (under subdivision, site plan and conditional use review) – particularly for the review of development on state highways – to ensure consistent application (as currently recommended in town and regional plans).
- **Incorporate by reference town highway ordinance standards under the zoning regulations** (as done under the subdivision regulations), to ensure that review standards are consistent, and consistently applied.
- **Develop additional, quantitative access management standards** (e.g., tied to road function, traffic volumes, speed limits and targeted levels of service) to clarify “considerations” under subdivision, site plan and conditional use review.
- **Require the merger of pre-existing, nonconforming small lots – including lots that don’t meet frontage requirements – that come under common ownership**, at minimum for access management purposes when one or more lots are developed or redeveloped.
- **Further regulate minor subdivisions (lot splits) to avoid the creation of flag and through-lots, and to limit direct access onto state and town highways** (as recommended in the town plan). Allow public road frontage requirements to be waived for minor subdivisions where appropriate to limit the number of direct accesses onto state and town highways.
- **Incorporate more detailed access management standards under the town’s subdivision regulations** that are consistent with the town highway ordinance and state access management guidelines – particularly those guidelines that limit access upon re-subdivision.
- **Consider “reverse frontage” requirements** for through lots fronting on both a state highway (arterial) and other collector or local road –I.e., that require frontage along and access from the secondary road, and the associated dedication of access rights or easements along the state highway to the town or state.

Related Regulations:

- **Adopt an updated town highway ordinance**, currently in draft form, to include standards for access management, driveways and public and private roads that incorporate or reference state access management and design guidelines as appropriate.



11.2.4 Infrastructure Development & Financing Initiatives

Maintenance and upkeep of the US 4 corridor, as a state highway, is largely the responsibility of the state. VTrans, however, has very little ability to control and manage anticipated development that may require significant upgrades to affected transportation infrastructure. Federal and state funding for highway corridor improvements is not adequate at present – nor into the foreseeable future – to address existing deficiencies, let alone upgrades needed to support new development. Vermont is one of many states that, in association with the federal government, are now exploring innovative methods to finance needed transportation improvements – to include joint financing arrangements and public-private partnerships.¹

These strategies recognize that both the benefits and responsibilities for managing, maintaining, and improving state highway infrastructure are shared. The town, local businesses and property owners served by the US 4 corridor also have a stake in making sure that the highway can serve its intended functions – to allow for safe, multi-modal travel to and from local destinations, to provide reasonable access to adjoining properties, and to support new growth and development in targeted locations served by existing and planned infrastructure and services.

VTrans can require the installation of improvements within and adjacent to the highway corridor that are necessitated by a proposed project. The town has direct control over off-corridor transportation improvements, including internal subdivision and site circulation, and intersecting roads and driveways. Developers, under the town's existing regulations, can be required to install or pay for their fair of the cost of the improvements needed to accommodate their development. They cannot be expected, however, to remedy existing deficiencies that predate their projects, as identified in this study.

Many infrastructure development and financing strategies currently under consideration nationally – particularly those that would give VTrans more leverage to enter into public-private cost sharing arrangements – will require specific enabling legislation. Others, such as official maps, concurrency requirements, special assessment and tax increment financing districts, and impact fees are already authorized by the state for adoption and use at the local level, if linked to adopted town plan policies and capital improvement programs.

As such, the following programs are recommended for further consideration, for infrastructure development and financing within and along the US 4 corridor:

1. **Incorporate recommended levels of service and identified corridor improvements in the town's capital improvement program (CIP) and regional and state transportation improvement programs (TIPs).** The CIP and TIPs are used to schedule public investments in corridor infrastructure (roads, sidewalks, etc.) as funding becomes available. The CIP also provides the basis for imposing project phasing requirements or for levying impact fees to fund corridor

¹ Long deferred system maintenance, rising construction costs, and declining gas tax revenues that fund both the federal highway trust fund and state transportation funds have precipitated national efforts to identify alternative system financing mechanisms. The government-supported clearing house, "InnovativeFinance.org" provides information on strategies currently under consideration in all areas of transportation finance.



improvements needed to support new development. The state or town can also require, in lieu of project phasing or fees, that the developer pay for or install improvements needed to accommodate the proposed development and maintain desired levels of service along the corridor.

2. **Incorporate concurrency requirements under local zoning and subdivision regulations** that allow the town to require the phasing of development in relation to available and planned transportation infrastructure capacity – especially for development around the Quechee interchange and other key intersections that are or are expected to become deficient. “Adequate public facility” phasing requirements are specifically allowed under the Planning and Development Act if tied to an adopted improvement program, as noted above (24 V.S.A. §4422). Developers who do not want to wait for scheduled, publicly-financed improvements, would then have the option of installing needed improvements at their own expense.
3. **Institute formal programs to acquire land or interests in land (rights-of-way, easements) through purchase or dedication** – including access rights, sidewalk or bicycle path easements, bigger setbacks, and rights-of-way needed to accommodate identified improvements (e.g., road widening). This could also include the purchase of development rights or conservation easements on designated parcels to further access management goals in association with broader land conservation and open space protection objectives – particularly along less developed, scenic sections of the US 4 corridor. The purchase or acceptance of rights-of-way, easements or other development rights must conform to adopted town plan policies and recommendations (24 V.S.A. §4431). Sources of potential assistance and funding (as available) include VTrans’ enhancement grant program, the Vermont Housing and Conservation Trust Fund, the Vermont Land Trust, and the state’s Municipal Planning Grant Program.
4. **Consider the adoption of an official map (bylaw) that identifies the location of proposed road improvements, sidewalks and bicycle/recreation paths along the corridor** – particularly in areas scheduled for development (e.g., the Quechee interchange area) – for use in local development review and land or easement acquisition programs. The town can deny projects that do not incorporate public facilities depicted on the map, but must then institute measures to purchase easements or rights-of-way (24 V.S.A. §4421).
5. **Consider the adoption of transportation or recreation impact fees**, tied to the capital budget, targeted levels of service and anticipated rates of growth as identified in the corridor management and town plan, to help finance road, sidewalk or bike path improvements along the corridor. Impact fees, however, can be used only to pay for that portion of infrastructure improvements that is attributable to new development – they cannot be used to correct existing deficiencies or to cover operational expenses. There also must be enough development to raise needed funds, and to initiate fee-financed projects within six years of fee collection (24 V.S.A. Chapter 31).
6. **Consider provisions for “latecomer agreements” (also referred to as recovery or reimbursement agreements) under state or local development agreements.** Though not specifically enabled under the Planning and Development Act, latecomer agreements could be established under related development agreements (as authorized) that allow a property owner who



has installed required corridor improvements to recover the costs of those improvements from other property owners in the vicinity who later develop property and use the improvements.



