FINAL: Chittenden County Historic Development and Future Land Use/Transportation Analysis

On January 25, 2012 the Steering Committee accepted these Analysis Reports with the understanding that that as a part of the final ECOS product they remain open for amendment until the whole product is finalized.

1/25/2012

An ECOS Analysis Report

This report presents the historic and recent development patterns in Chittenden County, VT over the last sixty years and the potential impacts of various future land use/transportation scenarios.

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HIGHLIGHTS

Over the past 60 years, Chittenden County has experienced significant, but lately slowing, growth. Much of that development has gone to the more suburban and especially rural parts of the county. However, given the increasing costs associated with scattered rural development, and the public's apparent desire to re-channel growth into designated higher density centers, the Region is now presented with an opportunity to change the growth pattern dynamic and plan for a more sustainable development future.

Selected findings from this land use and transportation analysis include:

- Growth patterns over the past 60 years have shifted away from the metropolitan areas around Burlington, to more suburban and rural locales.
- Residential land consumption between 1990 and 2008 was dominated by rural homes on large lots – a pattern consistent with state and municipal development regulations.
- This shift may be reversing of late as there has been a recent (2005 – 2010) uptick in more growth going to traditional downtowns, their suburban fringes and designated growth areas – and less to rural areas.
- Over the past 60 years, the middle 20 (1971 to 1990) experienced the highest growth levels compared with the 1950 to 1970 and 1991 to 2010 eras.
- A continuing trend toward scattered development at low densities will result in negative transportation and environmental consequences.
- These consequences can be softened by shifting to higher development densities in designated areas supplemented by greater investment in transportation alternatives such as transit, and walking/bicycling infrastructure.
- Public support, as registered by survey responses to the CCRPC land use scenarios, suggests a willingness to shift development trends toward higher density/mixed use areas supported by a variety of transportation modes – as well as a willingness to increase public funding to facilitate this shift.
- Examining the impacts of very different future transportation scenarios reveals worsening congestion regardless of transportation future. Less total travel (as measured by vehicle miles travelled (VMT)) can be somewhat reduced by a more transit/walking/biking friendly transportation future.

INTRODUCTION

The ECOS Project Steering Committee is a broadly-based 60+ member partnership committed to implementing strategies to improve Chittenden County's long-term sustainability: economically, environmentally and socially. The Steering Committee has committed to a five-phase project:

1. Adopt common goal statements
2. Analyze reports regarding economic development, housing, energy, land use and transportation, natural resources and health/human services/education
3. Develop indicators tied to the goal statements
4. Prioritize implementation actions for the next five, ten and twenty years
5. Invest in high priority implementation actions.

The results will inform regional, municipal and other plans as they are updated. This report is part of ECOS' Phase Two.

The Chittenden County Regional Planning Commission (CCRPC) is a recipient of a Housing and Urban Development (HUD) Regional Sustainability Grant and is utilizing this opportunity to conduct the ECOS project. The ECOS project's overall goal is to identify and implement strategies that will improve Chittenden County's long-term sustainability. To achieve this, CCRPC has partnered with various regional partners to collect data and conduct analyses to expand information and decision making capacity to better plan for needed housing, economic development, energy, climate change, land use/transportation, and natural resources. This report presents how development has occurred over the last sixty years and examines the sustainability of future land use transportation scenarios and the associated impacts on the environment and travel.

ECOS outcomes are anticipated to reflect this unprecedented cooperation in regional planning and will be incorporated into the Metropolitan Transportation Plan (MTP) and the Chittenden County Regional Plan, as well as other plans, through the prioritization of implementation activities to advance the sustainability of our region. Indicators will be used in the ECOS project to gauge the region's progress towards reaching its sustainable development goals into the future. This report, as well as other assessments from ECOS partners forms the foundation for reaching our shared vision.

CHITTENDEN COUNTY REGIONAL PLAN

CCRPC has a statutory duty to prepare a regional plan at least every eight years to protect the environment and to guide the future growth and development of land, public services, and public facilities in Chittenden County. The Plan contains information on past conditions, current circumstances, likely future trends, and general policy statements. Individuals can use the data in the Plan to assist with decision making related to demographic, economic, and land use trends. The general policy statements in the 2006 Regional Plan are intended to be advisory for municipalities to adapt to suit local needs and circumstances and for use in reviewing the impact of certain developments in the Act 250 and Section 248 processes.

The Plan also uses a concept of Planning Areas to spatially designate areas that share similar characteristics and general land use goals. Designating the County in to six Planning Areas, as opposed to 19 municipalities, helps stakeholders to visualize the County from a regional perspective and to draw conclusions on how the region has changed and will continue to take shape over time. The Planning Areas are also way to target policies to different places in the County. Planning Area boundaries and definitions are determined from municipal zoning regulations. The Plan also contains policies associated with each Planning Area. These policies are intended to promote the desired future characteristics of each area. This report uses the Planning Areas concept to examine development both retrospectively and prospectively.

The six Planning Areas are (1) Center (2) Metro (3) Village (4) Suburban (5) Enterprise and (6) Rural. See Figure 1 on the next page for the location of each Planning Area. The following offers descriptions of each of these areas.

Center Planning Area

Center Planning Areas are intended to be regional centers or traditional downtowns that serve the County and beyond and contain mix of jobs, housing, and community facilities and have an urbanized character. Center Planning Areas may contain a state designated New Town Center or Growth Center. Center Planning Areas are areas where local zoning authorizes future residential, commercial, industrial, and institutional development to occur on the greatest scale and at the greatest densities in the County. Development in downtown centers primarily happens through infill development of underutilized vacant land adaptive reuse of older structures. Whereas, development in municipal Growth Centers is intended to occur in targeted areas that will accommodate future anticipated growth. Employment, commercial, institutional, recreational, educational, and cultural facilities serve regional and local needs. These land uses are locally planned and managed to coexist successfully with neighborhoods and natural areas. Places within Center Planning Areas typically are served by facilities and services that offer a variety of transportation options, including non-motorized modes.

Metro Planning Area

Metro Planning Areas are areas where local zoning authorizes places to accommodate jobs and housing in a compact development pattern that supports transit service and encourage pedestrian activity. Commercial land uses found in the Metro Planning Area are intended to serve the nearby residential area. Densities within Metro Planning Areas are typically higher than those found in the Suburban, Rural, Village, and Enterprise Planning Areas.

Enterprise Planning Area

Enterprise Planning Areas are areas where local zoning authorizes a future concentration of employment uses that attract workers from the County and multicounty region. Development in these Planning Areas is to be locally planned and managed to minimize adverse impacts on surrounding planning areas.

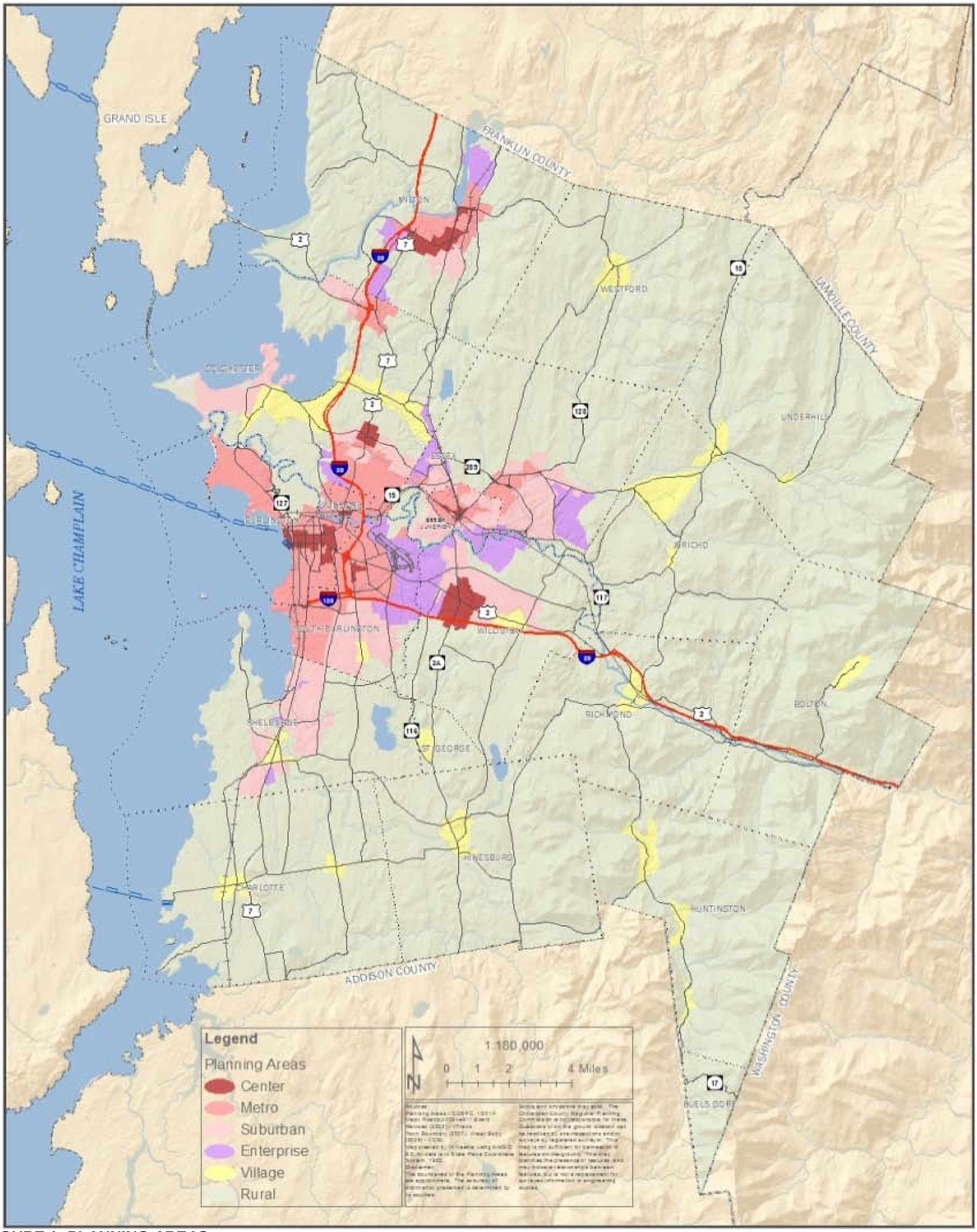


FIGURE 1: PLANNING AREAS

Suburban Planning Area

Suburban Planning Areas are areas near a Center Planning Area, Metro Planning Area, Village Planning Area, or Enterprise Planning Area where local zoning authorizes future development to occur at compatible scales, densities, and uses with existing development. CCRPC encourages future development efficiently to use limited land resources and infrastructure and to minimize adverse impacts on natural resources. Many parts of the Suburban Planning Area already have been developed, often in suburban styles of development. Future development and redevelopment in this Planning Area should use land resources and infrastructure investments efficiently, while minimizing adverse impacts on natural resources and protecting strategic open space.

Village Planning Area

Village Planning Areas are Areas where local zoning authorizes a variety of future residential and nonresidential development at densities and scales in keeping with the character of a Vermont village. Village Planning Areas are compact areas of mixed-use activities that maintain the character of a Vermont village. This type of Planning Area is intended to serve its local surroundings as a place where people can live, work, shop and recreate

Rural Planning Area

Rural Planning Areas are areas where regional and town plans promote the preservation of Vermont's traditional working landscape and natural area features. The Rural Planning Area also provides for low density development that is compatible with the needs of working lands and natural areas so that these places may continue to highlight the rural character and self sustaining natural area systems. The Regional Plan designates almost 85 percent of the County as Rural Planning Area. The single largest Rural Planning Area encompasses parts of 16 municipalities. The three municipalities that are not in this largest Rural Planning Area have other Rural Planning Areas within their boundaries.

CHITTENDEN COUNTY METROPOLITAN TRANSPORTATION PLAN

The Metropolitan Transportation Plan (MTP) is the long-range transportation element of the Regional Plan for the Chittenden County Regional Planning Commission. The MTP not only addresses current problems of congestion, accessibility and mobility but lays out the framework for the transportation system of the future. The MTP acknowledges today's fiscal, political and social realities to better integrate the disciplines of transportation and land use planning through regional collaboration.

The MTP is the region's principal transportation planning document and sets regional transportation priorities. It consists of short- and long-range strategies to address transportation needs that will, as federal regulations note, lead to development of an integrated, inter-modal transportation system that facilitates the efficient movement of people and goods. Federal regulations also note that the MTP must articulate and work towards the region's comprehensive long-range land use plans, development objectives, and the region's overall social, economic, environmental, system performance and energy conservation objectives as well – coordination efforts similar to those at the heart of the ECOS project. To achieve this, the MTP incorporates a scenario planning approach to understanding the region's broad range land use/transportation goals. The scenario planning process is discussed in a subsequent section.

The MTP also must incorporate a financial section that estimates how much funding will be needed over the life of the plan, how much will be available for the recommended transportation investments, and the costs to maintain and operate the existing system. The financial section must outline how the MPO can reasonably expect to fund all included projects and programs within a fiscally constrained environment, drawing on all anticipated revenues.

Analytical Tools

The MTP, Regional Plan, ECOS project analysis and other projects and strategy recommendations rely on and benefit the application of two powerful computer tools – Geographic Information Systems (GIS) and the Chittenden County Travel Demand Model. GIS is a system that integrates hardware, software, and data to obtain, manage, analyze, and display all kinds of geographical information. GIS allows its users to view, better understand, interpret, and visualize spatial data to more clearly reveal relationships, patterns, and trends. GIS data can be displayed in tables, graphs, or, as in the MTP and ECOS Plan, most often on maps.

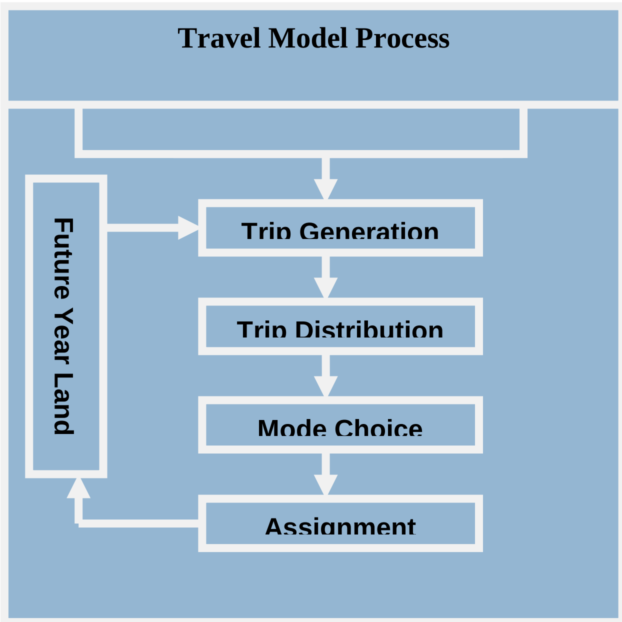


FIGURE 2: TRAVEL MODEL PROCESS

GIS was employed in several ways to assist with this report. GIS was used to determine historic growth from the last sixty years and in the Scenario Planning exercise to develop future land use and transportation scenarios. It was also used in the calculation of performance measures and to visualize future land use development types and patterns.

The Chittenden County Travel Demand Model (the "model") was used to conduct the analysis of existing transportation conditions, as well as the forecasts of future transportation conditions. The model simulates the interaction between housing, employment and a multi-modal transportation system. System-wide transportation models have been used in Chittenden County since the mid-1980s. The current model was developed in 1994 and updated in 1998 and 2011. The current model uses custom designed computer software and incorporates several advanced features including the ability to estimate bus, commuter rail, walk/bike and shared and single occupancy vehicle trips, and is sensitive to the effect transportation projects have on where trips are made.

The model is able to analyze morning (AM), afternoon (PM) peak hour, as well as all-day conditions. The afternoon peak hour was adopted for analysis of transportation alternatives because the PM peak represents the most congested conditions and therefore highlights any problem areas in the system.

The model follows a five-step process as shown below. This process is built first to replicate existing travel conditions and then adapted to simulate future scenarios.

The five model steps break down the relationship between the land use, economic activity and travel behavior. Trip generation, for example, estimates the total number of trips to be taken and trip distribution estimates where these trips will go. Both of these steps are based on economic activity and land use patterns. The mode choice model evaluates how people will travel (i.e. automobile, bicycle, walk, etc.) and trip assignment estimates which route or path travelers will use.

The Chittenden County Travel Demand Model is a powerful and important analytical tool, but it is just that – a tool for helping us to better understand transportation issues. The model does not make decisions, but is one of numerous resources the CCRPC calls upon to help make more informed choices about how to invest limited resources in the region's transportation system. Outputs from the model include data on a number of transportation and related land use measures. Comparing the measures across a variety of future land use and transportation scenarios allowed analysts to make decisions on selecting the most effective and efficient transportation strategies.

HISTORIC DEVELOPMENT ANALYSIS

Examining Historical Development in Chittenden County

A comprehensive look at historical development by total growth in the County and by Planning Area is useful for perspective in regional and local planning efforts. Seeing how Chittenden County has already been developed clarifies challenges going forward.

Many tools are available to help quantify existing development, and each of these tools has strengths and weaknesses. For this analysis, the Chittenden County Regional Planning Commission looked at structures that have been built in the different Planning Areas using both the University of Vermont's (UVM) Year-Built data and the Vermont Enhanced 9-1-1 Board's e911 ("e-site") data. This analysis uses the year-built data to show development from 1950-2005 and e-site data to show development in 2005 and 2010 to examine how development activity has occurred in Chittenden County.

The Chittenden County year-built data is a GIS dataset created by the UVM and was last updated in 2008. This data consists of over 44,500 points, which may be an underestimation of actual development. The year-built data is the best available dataset showing the construction date of structures, but it does not cover every structure in the county. For example, there are no year-built points in Buel's Gore, although several houses are located in the municipality. CCRPC's analysis only counted points that were built in 2005 or earlier, due to concerns about the completeness of the dataset for more recent years. The dataset only shows a few structures built in 2007-2008, with many towns showing few or no structures built more recently than 2004. In order to create a picture of development since 1950, the year-built points were divided into four categories: 1950 and earlier, 1951-1970, 1971-1990, and 1991-2005.

The e-site data was initially developed in the late 1990s and by 2005 covered every town in Chittenden County. This statewide dataset attempts to show a point at the location of each structure and is continually updated as new structures are added or locations of existing structures are refined. Points in the e-site data represent residential, commercial, industrial, and public buildings as well as accessory and utility structures, fire hydrants, and other features.

The landscape of Chittenden County has changed dramatically in the last 60 years, as shown in Figure 3 below and Figure 4 on the following page. In 1950, the year-built data shows only 10,352 structures. By 1970, the number of structures had almost doubled. By 2005, the number doubled again, to a total over 44,000. Significant growth occurred in all planning areas.

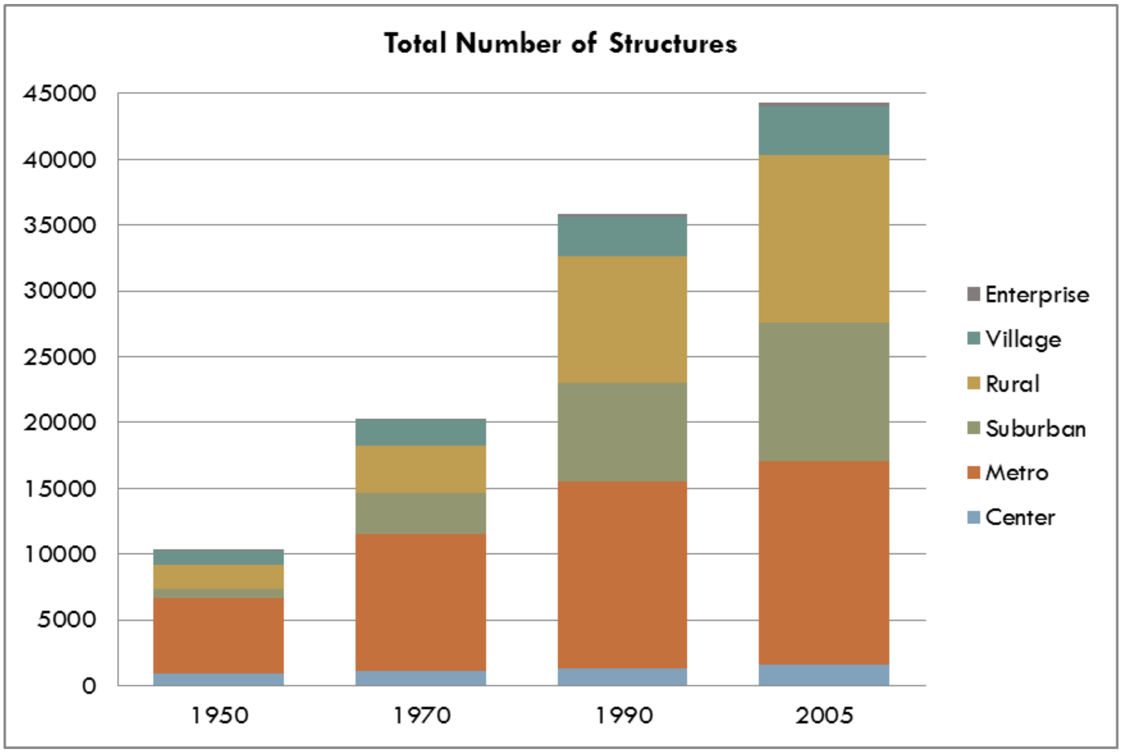


FIGURE 3: TOTAL NUMBER OF STRUCTURES BY PLANNING AREA

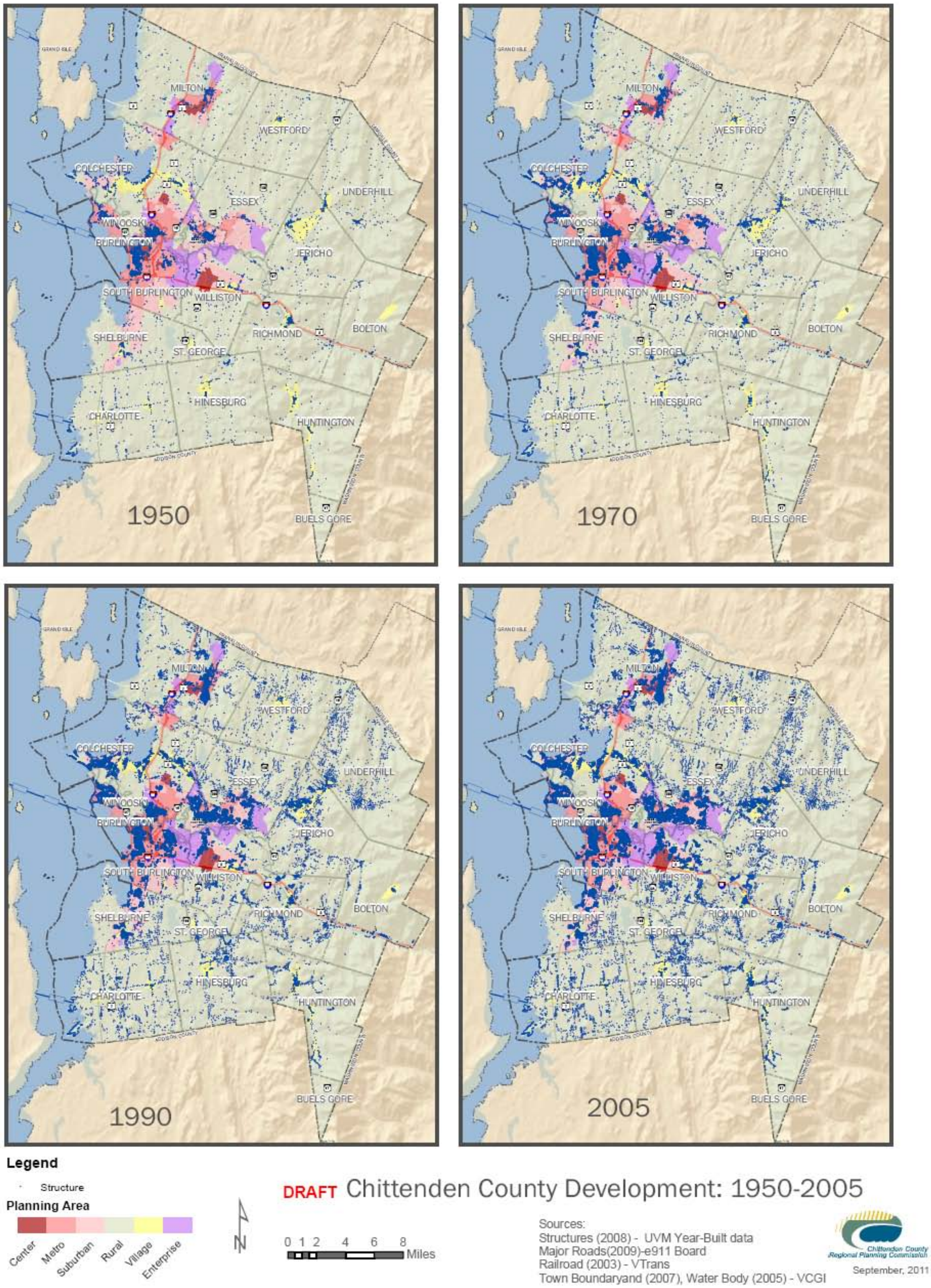


FIGURE 4: CHITTENDEN COUNTY DEVELOPMENT: 1950-2005

Historic Growth by Planning Area

As discussed earlier in this document, CCRPC uses the concept of Planning Areas to divide the County into six areas that share similar land use policies and development patterns. This section defines each Planning Area and examines how growth has occurred over the last sixty years.

CENTER PLANNING AREA

The Center Planning Areas are where municipal zoning encourages the most dense, mixed use development. These are areas formally designated by the state as "Downtown Development Districts", "Village Centers", "New Town Center Development Districts", or "Growth Centers". Some of these Center Areas (such as downtown Burlington) are historical and were already developed by 1950. However, other Center Areas (such as Severance Corners in Colchester) were largely undeveloped until recently.

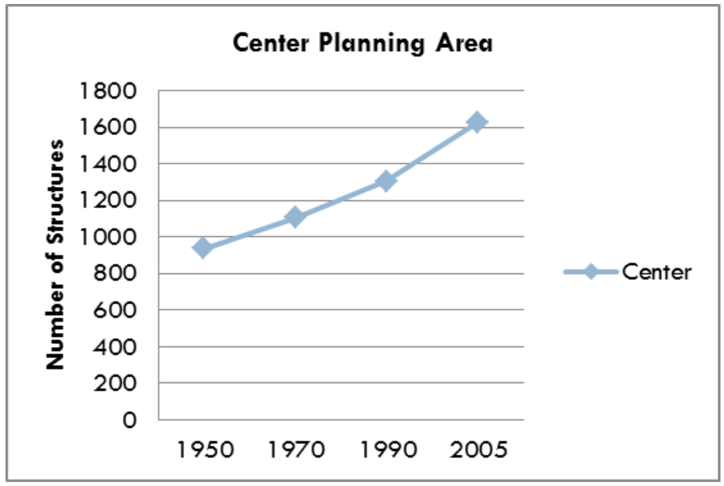


FIGURE 5: CENTER PLANNING AREA GROWTH

The increase in number of structures in Center Areas was not as great as in most other planning areas, partially because less than 1% of the county's land is in a Center Area. In terms of structure density, the Center Areas increased from about 194 structures per square mile to about 336. The most recent time period (1991-2005) showed an increase in Center Area development, both in terms of structures added and percentage of total growth. The two designated Growth Centers in the county—in Williston and Colchester—were not designated until after 2005, so some of the recent development in these areas is not reflected in this analysis.

METRO PLANNING AREA

In 1950, over 50% of the structures in the county were located in Metro Areas, primarily in Burlington and Winooski, even though Metro Areas only cover 4.5% of the county's land. It should be noted that there are more multi-family residential structures in the Metro Planning Area than in other Planning Areas. Metro Areas also have the highest structure density of any Planning Area in all time periods observed. Structure density almost doubled in the Metro Areas between 1950 and 1970, and overall increased from 234 structures per square mile in 1950 to 633 structures per square mile in 2005. The Metro Areas saw more development between 1950 and 1970 than other

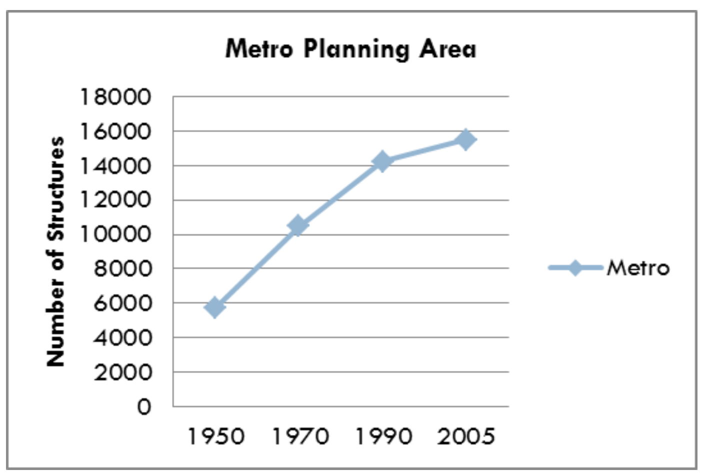


FIGURE 6: METRO PLANNING AREA GROWTH

planning areas. While significant development continued to take place in this Planning Area, fewer structures were added in the most recent time period (1991-2005).

The 2003 Regional Build-out Analysis of Chittenden County indicates that Burlington and Winooski, municipalities that consist largely of Metro Areas, have reached more of their development potential than other municipalities in the county. This may explain some of the reduction in growth in the Metro Areas in more recent years, though other factors such as economics and changes in demographic patterns may also have played a part. Changing transportation patterns, influenced by development decisions at the local, regional, and state levels, were likely also a factor. After 1970, most of the growth in Chittenden County took place outside Metro Areas, though infill development continued to occur.

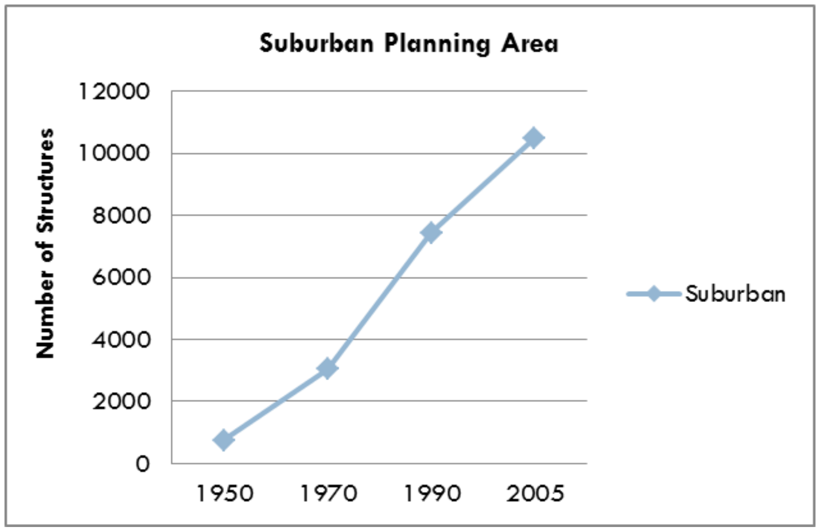


FIGURE 7: SUBURBAN PLANNING AREA GROWTH

SUBURBAN PLANNING AREA

The Suburban Planning Area was relatively sparsely developed in 1950, and much of it was rural in character at that time. The greatest period of Suburban growth took place between 1970 and 1990, though growth in this area continued steadily to 2005. The Suburban Planning Area saw the greatest change in structure density of any Planning Area. Structure density increased by almost 375 structures per square mile (from 28 structures per square mile to roughly 402) between 1950 and 2005.

Between 1970 and 1990, the number of structures added in the Suburban Planning Area was 4407, about 28% percent of county growth in that period. Between 1990 and 2005, the number of units increased by 3049, which was about 36% percent of the total regional growth during the period. In fact, almost a third of all county growth between 1950 and 2005 took place in the Suburban Planning Area. About 5% of the county's land area is located in the Suburban Planning Area, and about 24% of the county's structures were located in the area by 2005.

RURAL PLANNING AREA

The majority of Chittenden County's land area, 84%, lies in a Rural Planning Area. In 1950, the Rural Areas held only 7% of the county's structures, not counting accessory structures such as barns (which were excluded from all analyses). The number of structures increased somewhat from 1950 to 1970, but the bulk of growth in the Rural Areas—structure density more than doubled—took place from 1970 to 1990.

By 2005, almost 29% of structures in the county were located in Rural Planning Areas. Structure density was about 4 structures per square mile in 1950 and increased to about 28 structures per square mile in 2005. Between 1950 and 2005, more structures (10,857 in total) were added to the Rural Planning Area than to any other single Planning Area.

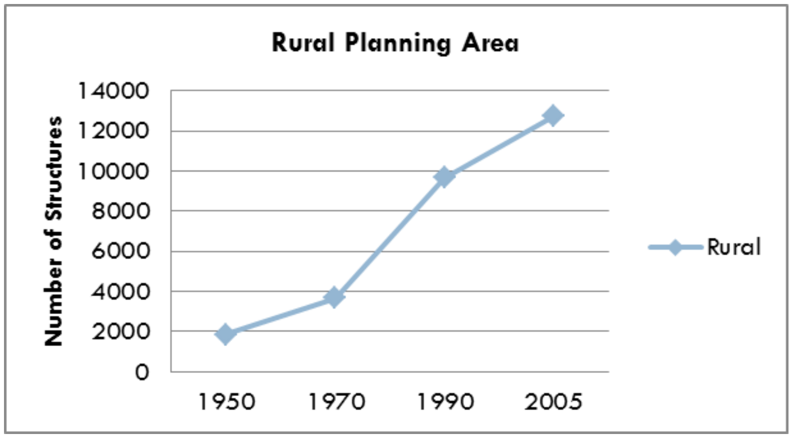


FIGURE 8: RURAL PLANNING AREA GROWTH

VILLAGE PLANNING AREA

The Village Planning Areas, consisting of mixed-use village centers mostly surrounded by rural areas, comprise a little over 3% of the county's land area. Village Planning Areas grew steadily between 1950 and 2005, with modest increases in number of structures and structure density.

In all time periods, Village Planning Areas accounted for slightly less than 10% of all county growth, and the percentage of county structures located in the Village Areas decreased slightly from 1950 to 2005, but not as much as the Metro or Center Areas.

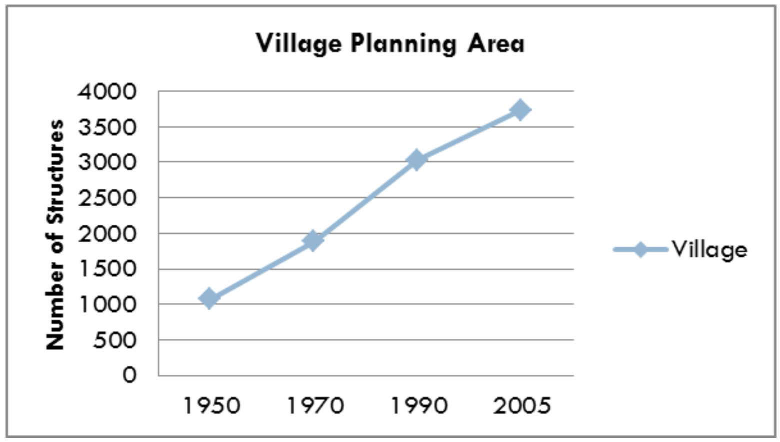


FIGURE 9: VILLAGE PLANNING AREA GROWTH

ENTERPRISE PLANNING AREA

The Enterprise Planning Area consists of about 2.4% of the county's land area, and contains the smallest number of structures of any planning area. Part of this may be due to the fact that the year-built data seems less complete for non-residential structures, which make up the majority of Enterprise Areas. This might also account for the fact that structure development density in the Enterprise Area was also the lowest of all Planning Areas, lower even than Rural Areas. However, development

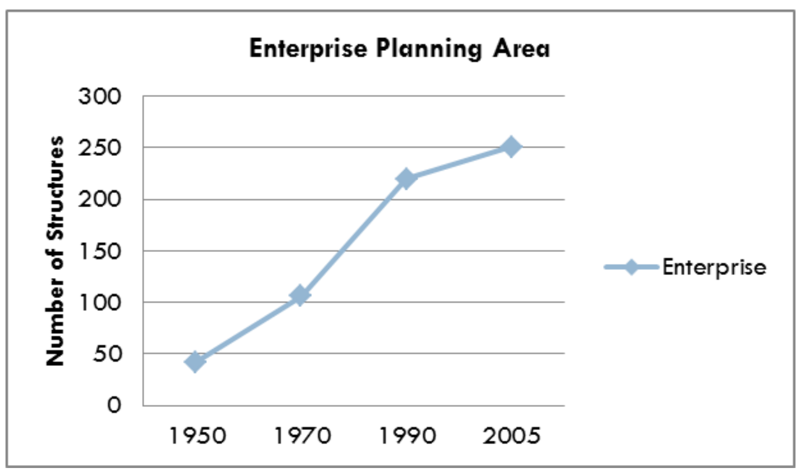


FIGURE10: ENTERPRISE PLANNING AREA GROWTH

density in the Enterprise Area increased nearly fivefold in the 1950-2005 time period, from about three to roughly nineteen structures per square mile.

Structure density may not be the best measure of development density in Enterprise Planning Areas, because some commercial/industrial land uses take up large amounts of land area but contain few (sometimes very large) structures. Growth in the Enterprise Area was fairly steady in all time periods, with slightly higher activity in the 1970-1990 period.

Changing Development Patterns of Planning Areas

While the number of structures in Chittenden County has increased in all planning areas since 1950, the distribution of that development has changed substantially, as seen in Figure 11 and Table 1 below. In 1950, over 55% of structures in Chittenden County were located in the Metro Planning Area (mostly in Burlington and Winooski). By 2005, that percentage had fallen to about 35%. In the same time period, the percentage of county structures located in the Rural Planning Area grew from about 18% to almost 29%, and the percentage in the Suburban Planning Area grew from a little over 7% to almost 24%.

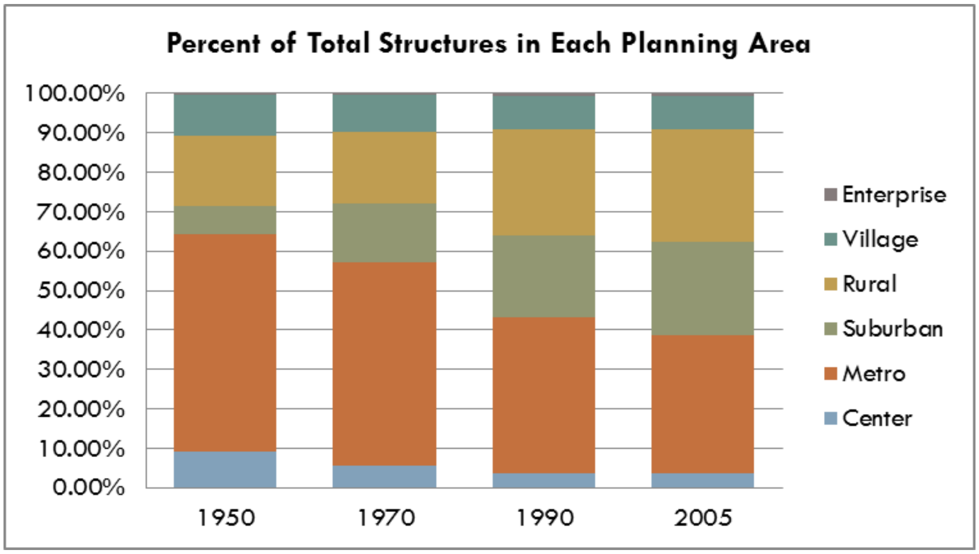


FIGURE 11: PERCENT OF TOTAL STRUCTURES BY PLANNING AREA, 1950-2005

TABLE 1: PERCENT OF TOTAL STRUCTURES BY PLANNING AREA

Planning Area	1950	1970	1990	2005
Center	9.04%	5.45%	3.63%	3.67%
Metro	55.21%	51.66%	39.65%	34.95%
Suburban	7.15%	14.99%	20.76%	23.69%
Rural	17.85%	18.07%	26.90%	28.69%
Village	10.35%	9.31%	8.46%	8.43%
Enterprise	0.41%	0.52%	0.61%	0.57%

A look at growth in each of the Planning Areas shows that about 90% of the growth that took place in the county between 1950 and 2005 was divided almost evenly between the Metro, Suburban, and Rural Areas, as seen in Figure 12. Almost half of the growth between 1950 and 1970 took place in the Metro Areas, but growth in the 1971-1990 and 1990-2005 time periods was concentrated in Rural and Suburban Areas. The most recent time period shows increased development in Center Planning Areas. About 4% of total county growth took place in Center Areas between 1990 and 2005, compared to less than 2% in earlier time periods.

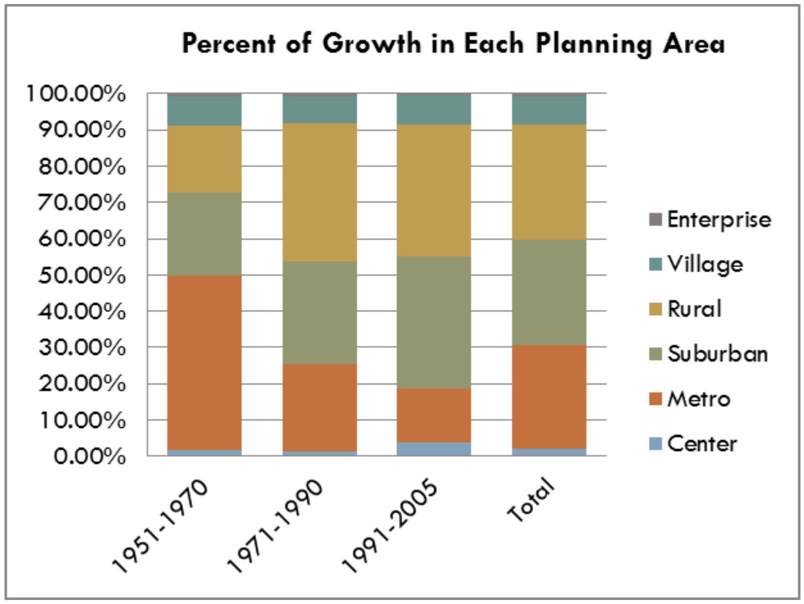


FIGURE 12: PERCENT OF GROWTH BY PLANNING AREA

TABLE 2: PERCENT OF GROWTH IN EACH PLANNING AREA

Planning Area	1951-1970	1971-1990	1991-2005	Total
Center	1.71%	1.27%	3.83%	2.03%
Metro	47.95%	24.05%	14.97%	28.77%
Suburban	23.18%	28.25%	36.19%	28.74%
Rural	18.30%	38.36%	36.32%	31.99%
Village	8.23%	7.35%	8.33%	7.85%
Enterprise	0.65%	0.73%	0.37%	0.62%

The 1971-1990 era resulted in the most overall growth, especially in the Rural and Suburban Areas, as seen in Figure 12 and Figure 13. Growth generally slowed in the 1991-2005 period, though proportionally most of the structure development in this time took place in Rural and Suburban Areas. The slowdown could be partially due to the year-built data being less complete for more recently built structures. However, some areas in the county, particularly Metro Areas such as Burlington, were closer to being fully developed (at least by current zoning standards, which may be subject to change) by this point, which might also account for a slowdown in growth. Toughened environmental/development laws, permitting processes, and stricter zoning in this time period may also be

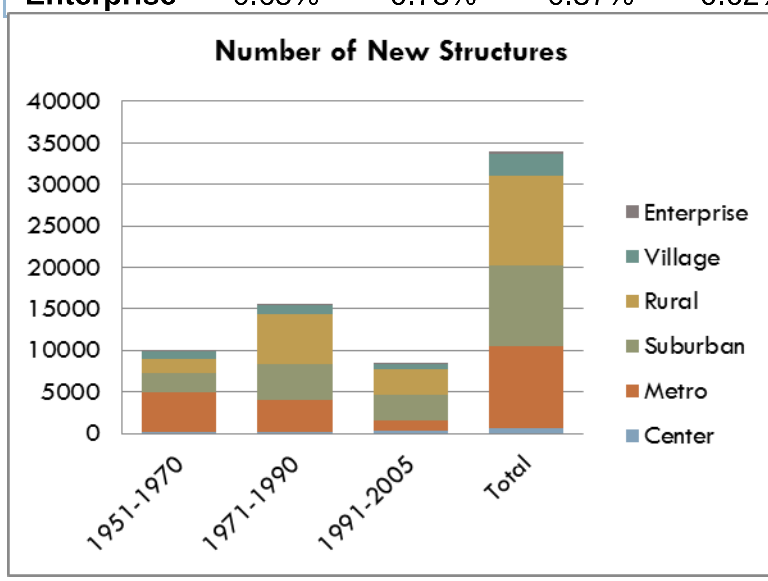


FIGURE 13: NUMBER OF NEW STRUCTURES

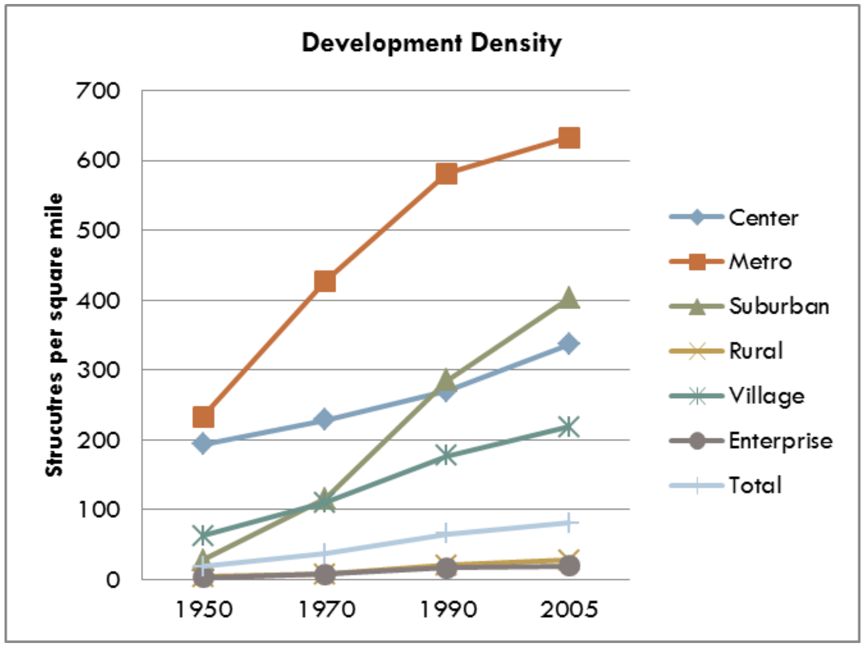


FIGURE 14: DEVELOPMENT DENSITY

a factor. Further analysis of zoning and permitting changes in this time period might clarify the reasons for the change.

Development density is shown in Figure 14. Development density in Rural areas increased from about 4 structures per square mile in 1950 to almost 28 structures per square mile in 2005. During the same time, Metro density increased from about 234 to about 633 structures per square mile. Suburban development density underwent the greatest percent change from 1950 to 2005: from about 28 structures per square mile to about 403. In 1950, Suburban development density was less than Village development density (which makes sense, as much of what is now suburban was rural at that time), but by 1970, it was slightly greater, and by 1990 it had exceeded Center Area development density.

The most recent time period (1991-2005) showed an increase in Center Area development, both in terms of structures added and percentage of total growth. Although the recent trend has been more toward development in Rural and Suburban Areas, and some Metro Areas are closer to fully developed, there is still large development potential in Center Areas. As of 2005, however, the Center Areas had fewer structures per square mile than either Suburban or Metro Areas, likely largely due to large parcels of yet to be developed land in some of the more recently designated Center areas.

Chittenden County Development, 2005-2010

Capturing a picture of development since 2005 requires a different method than determining development in earlier time periods. The year-built data was last updated in 2008, so it does not reflect any development since then. The year-built data is also less comprehensive for more recent years, with many towns showing few or no structures built more recently than 2004. To get a clearer picture of Chittenden County development in recent years, e-site data from the beginning of 2005 and from the middle of 2010 were compared. The e-site data measures structures differently than the year-built data. It differentiates between residential and non-residential structures, but does not contain a build date for each structure. Since the data is continually updated, structures are presumably added to the dataset as they are built, which can show development patterns when e-site data from different years are compared. This comparison was made between e-site points from 2005 and 2010 to get a picture of recent development in Chittenden County. Structures analyzed include all residential, commercial, industrial, and public structures (schools, government buildings, etc), and exclude accessory structures such as barns and sheds, utility structures such as substations, structures of an unknown type, and structures that are described as “developing”, which may not be built yet.

A year-by-year analysis of e-site data (Figure 15) shows that considerably more growth took place between 2005 and 2007 than in 2008-2010. This slowdown likely reflects changes in the economy and real-estate market.

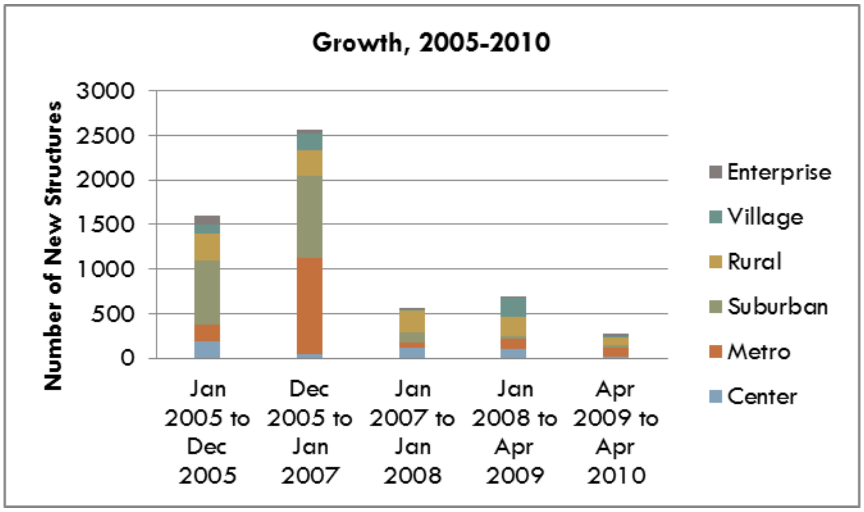


FIGURE 15: GROWTH BY YEAR, 2005-2010

To get a clearer comparison of recent growth, the rest of the analysis looks only at 2005 and 2010. The e-site data, like the year-built data from earlier time periods, shows growth in all Planning Areas between 2005 and 2010, as seen in Figure 16. In total, 5,642 new structures were added between 2005 and 2010. Of these, the majority (4,921) were residential structures. 721 non-residential structures were added. Although non-residential structures were added to the Enterprise Planning Area, the number of residential structures declined slightly. This could be because residential structures were being used for non-residential purposes.

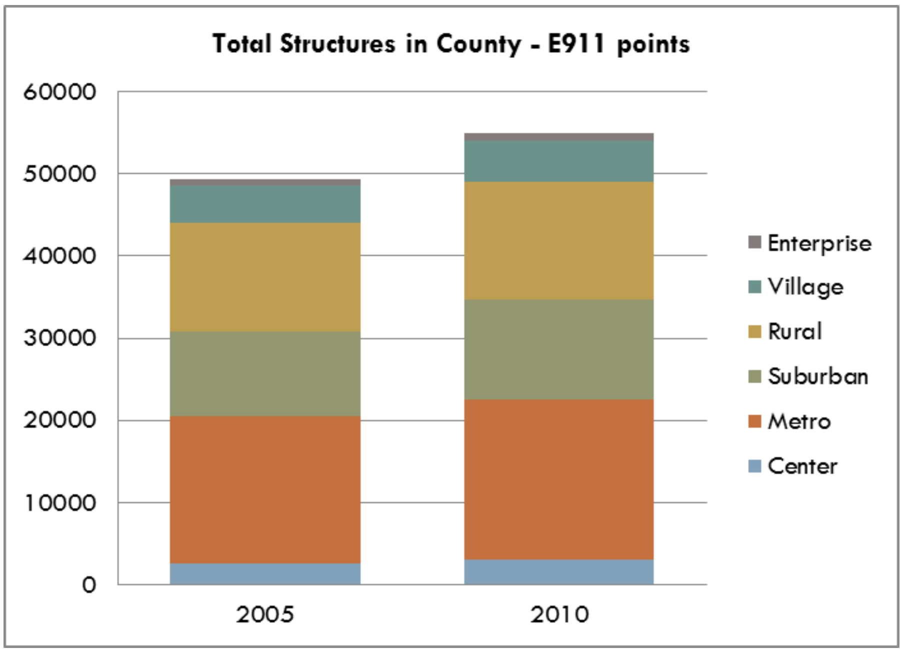


FIGURE 16: TOTAL STRUCTURES IN COUNTY, 2005 AND 2010

While substantially more residential than non-residential growth took place between 2005 and 2010, a greater proportion of the non-residential growth took place in Planning Areas designated for

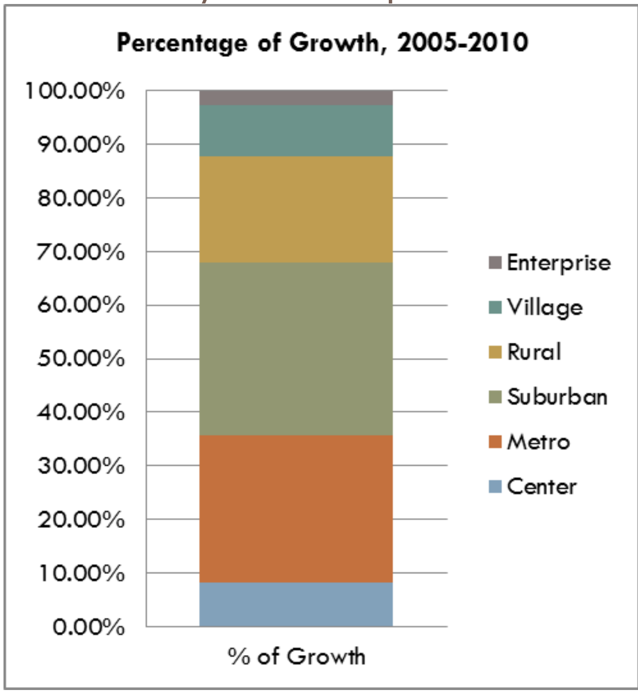


FIGURE 17: PERCENTAGE OF COUNTY GROWTH 2005-2010

mixed-use or non-residential development, notably the Center and Enterprise Areas (Figure 17). The greatest amount of residential growth took place in Suburban Areas followed by Metro and then Rural Areas. Roughly 32% of all growth in the county took place in Suburban Areas, while 27% took place in Metro Areas and about 20% took place in Rural Areas (Table 3).

In terms of development density (Figure 18), the greatest increase was in the Center Area, which increased by 96 structures per square mile between 2005 and 2010, followed by 70 in Suburban Areas, and 63 in Metro Areas. This likely reflects recent development in the two Growth Centers in Williston and Colchester. Suburban and Metro density also increased significantly, likely reflecting infill development in already developed areas.

TABLE 3: PERCENTAGE OF COUNTY GROWTH, 2005-2010

Planning Area	Percent of Growth
Center	8.24%
Metro	27.44%
Suburban	32.26%
Rural	19.89%
Village	9.38%
Enterprise	2.80%

While two data points are not enough to establish reliable trends, the e-site data from 2005 and 2010 does show an increase in development in Planning Areas where more development is encouraged (Center, Metro, and Suburban) and slightly less growth in Rural Areas. More data is needed, but this may reflect progress in sustainable land use policy as a result of regional and local planning efforts. Analysis of transportation costs, property tax trends, or other data might shed more light on the cause of the changing land use patterns.

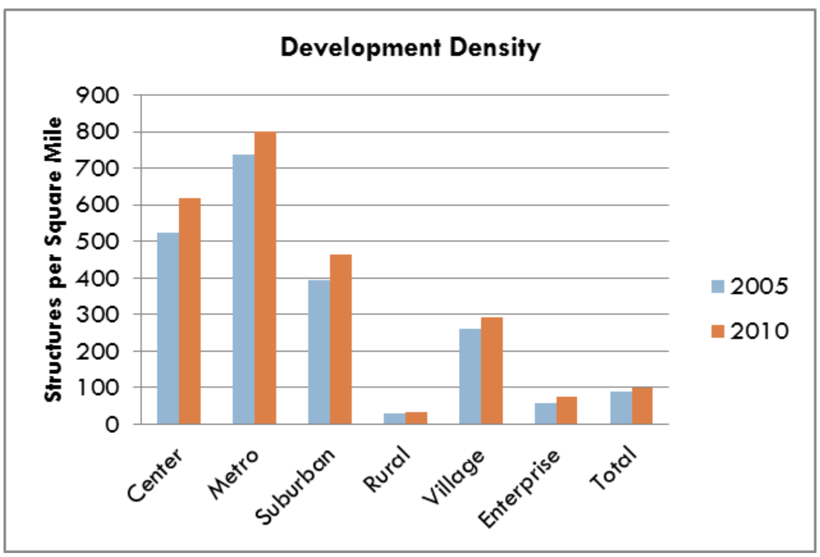


FIGURE 18: DEVELOPMENT DENSITY, 2005 AND 2010

Comparing Historic and More Recent Development Patterns

The year-built and e-site datasets are different enough that discussing overall development patterns from 1950 to 2010 is problematic. However, after explaining the differences between the datasets, a look at the different trends shown in the two historical analyses yields some useful information about how land use and development patterns may be changing.

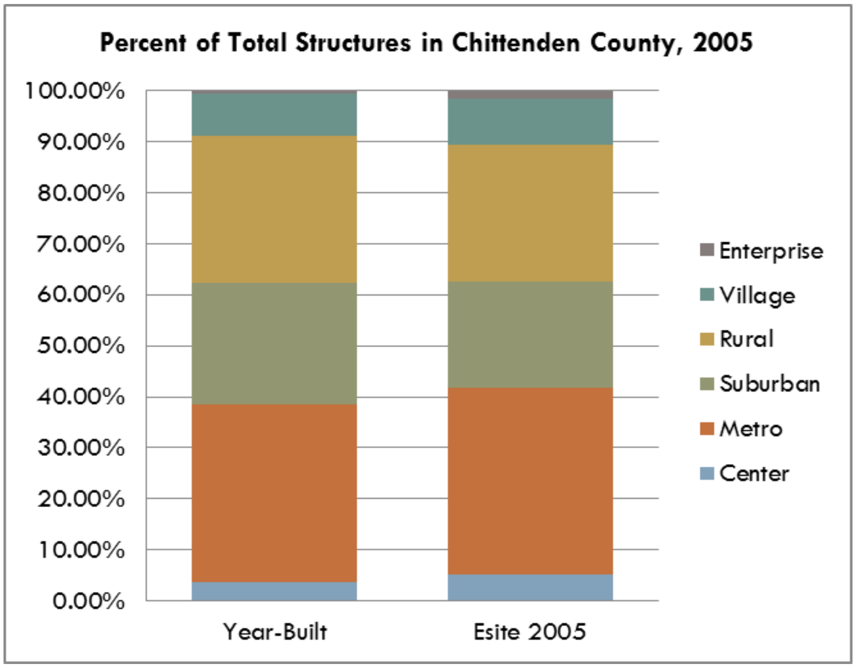


FIGURE 19: PERCENT OF TOTAL STRUCTURES BY PLANNING AREA, 2005

The e-site data is generally more comprehensive than the year-built data. While the year-built data to 2005 contains 44,286 points, e-site data from the end of 2005 shows 50,927 points (after accessory structures and fire hydrants were removed). Some of the discrepancy reflects differences in how structures are counted—a duplex, for example, might have two e-sites and only one year-built point. The e-site data might also be more comprehensive for non-residential structures than the year-built data. When compared directly (Figure 19), the e-site data from the beginning of 2005 shows a smaller percentage of structures in Rural and Suburban Planning Areas than the year-built data, and a larger percentage in other areas.

Similarly, a look at development density differences between the year-built and e-site data (Figure20) indicates that while development density is fairly comparable in the Suburban and Rural Areas, e-site density is greater in the other areas, especially Center and Enterprise.

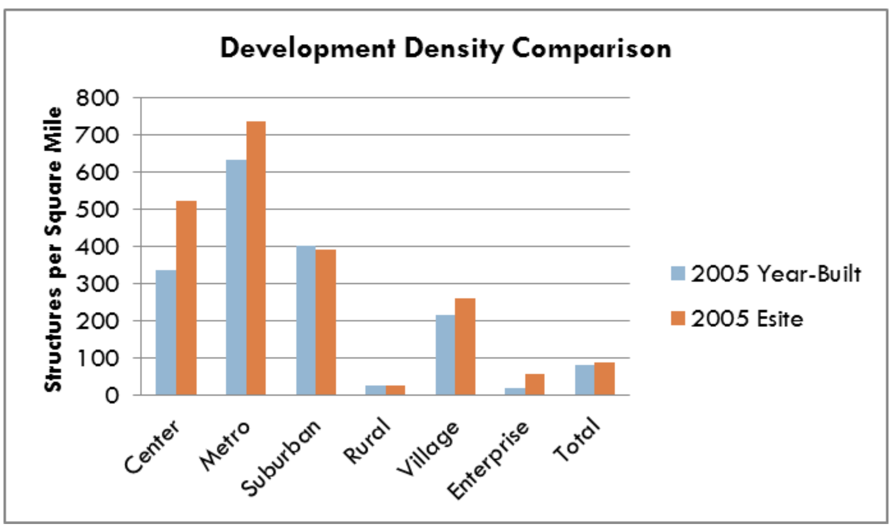


FIGURE 20: COMPARISON OF 2005 DEVELOPMENT DENSITY

The year-built analysis showed that much of the growth in Chittenden County after 1970 took place in Rural and Suburban Areas, but that overall growth slowed in the 1990-2005 time period. The e-site analysis showed that the majority of the growth in the 2005-2010 time period took place in Suburban and Metro Areas. This reversal of the trend seen in the year-built data, with more growth in Metro Areas than Rural Areas, may indicate some success in sustainable planning efforts to concentrate growth in areas with greater development density.

Similarly, about 4% of total county year-built growth took place in Center Areas between 1990 and 2005, but the e-site data shows over 8% growth in Center Areas between 2005 and 2010. Even accounting for the differences in data—structures in the Center Planning Area are likely underrepresented in the year-built data—this still indicates a recent uptick in Center Area development.

Chittenden County's late 20^{th} century pattern of growth in areas where local and regional plans discourage extensive development does appear to be changing. The reasons for this change are not entirely clear at this time, but the Future Land Use section of this report indicates that public opinion appears to be moving in the direction of increased sustainability.

Land Use and Lot Size

Another way of looking at recent land use and development trends is to compare development type and land consumption. In order to establish land use trends as part of scenario planning for the 2035 Metropolitan Transportation Plan (MTP), CCRPC and consultants looked at a lot size/development comparison from 1990 to 2008. Data from the entire region for housing growth between 1990 and 2008 was analyzed, and characterized into five different types, as shown on the graphic on the following page (Figure 21). The charts below show the distribution of the different types of residential development by number of units on the left, and by area of land consumed on the right (NOTE: Large lot SF are those greater than three acres). While this study does not directly compare to the Planning Area analyses above, some analogies can be made. In the graphic below, "Large Lot SF" generally occurs in Rural Planning Areas, while "Medium Lot SF" can be compared to Suburban Areas. "Multi-Family" and "City Center" development is more likely to take place in Center and Metro Areas. "Village SF" likely takes place in Village Planning Areas. Additionally, Figure 22 on page 24 illustrates current zoning standards for

Development Types by Number of Units	*Development Types by Land Consumed*

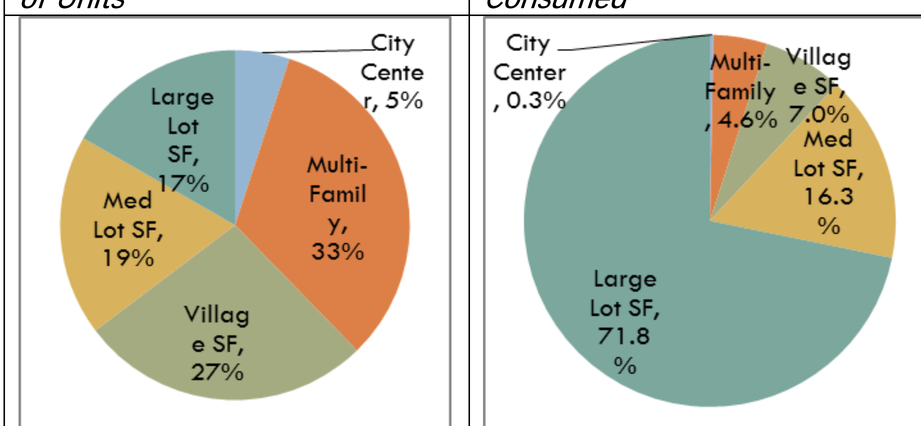


FIGURE 21: DEVELOPMENT TYPES BY NUMBER OF UNITS AND LAND CONSUMPTION

residential density throughout the County. Low density or large lot zoning currently dominates the County, outside of Burlington.

These various ways at looking at lot-size, density, and land consumption show the long-term un-sustainability of continued low-density growth in rural areas. Housing structures in areas zoned for more dense development tend to be more efficient in terms of land consumption than large-lot rural structures.

Further examination of the land use policies inside the Rural Planning is necessary to identify how to continue to preserve scenic resources, working landscapes, and reduce greenhouse gas emissions and travel times. The following section on scenario planning provides invaluable information for understanding the impacts of continuing the development pattern of the recent past into the future.

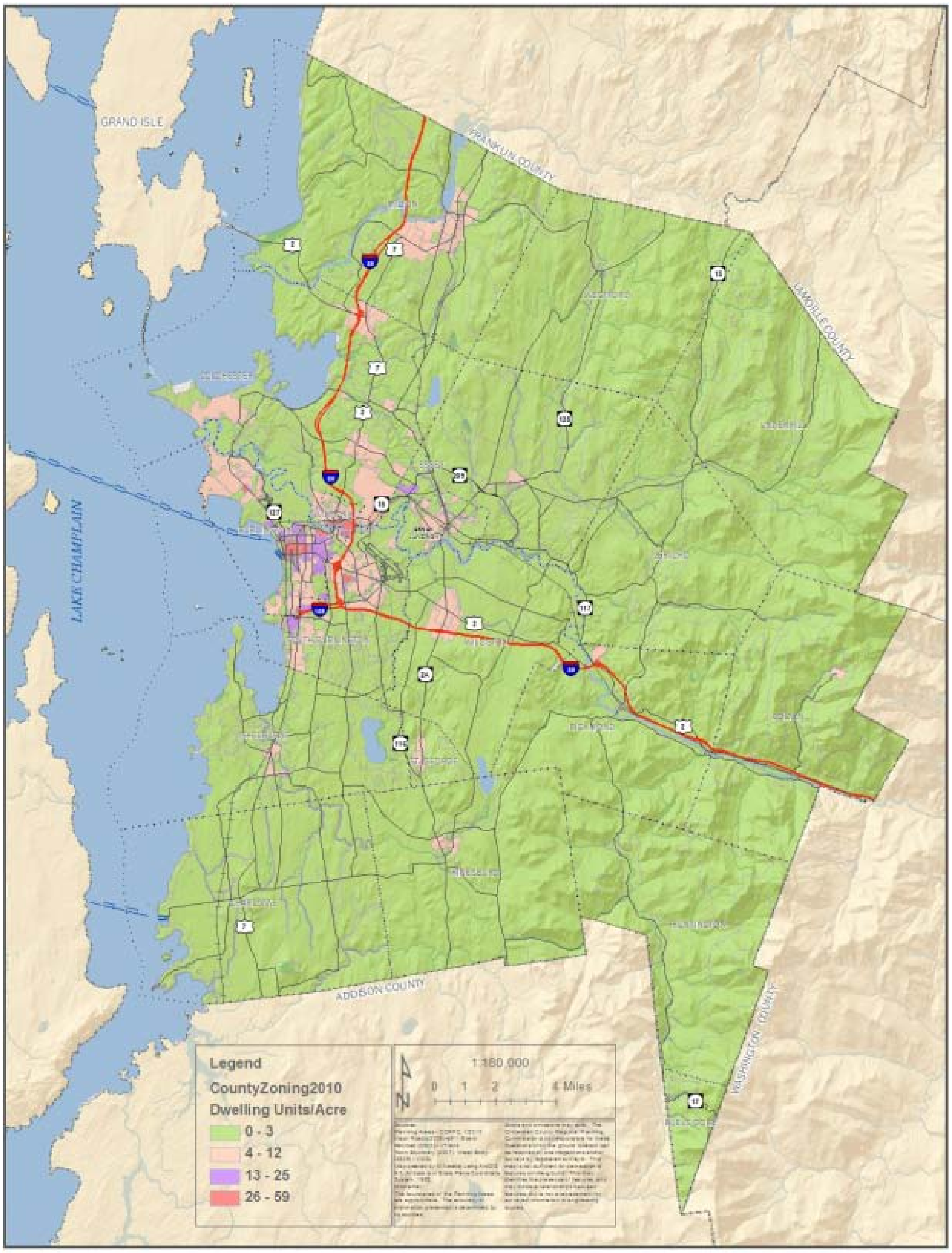


FIGURE 22: COUNTY ZONING, DWELLING UNITS PER ACRE

FUTURE LAND USE SCENARIOS

Four scenarios were developed by CCRPC to analyze land use patterns that either follow trend development or deviate from it to increase density in the Burlington area. These land use scenarios coupled with various transportation alternatives help stakeholders to focus their discussions on various options for increasing sustainability.

Scenario Planning

In the spring of 2008, the Chittenden County Metropolitan Planning Organization (CCMPO) began a scenario planning approach to developing the MTP. The primary goal for this effort was to incorporate substantial public input to assist planners in understanding the region's broad range of concerns and aspirations for the future, in terms of both land use and transportation, and to include this feedback in a more integrated regional land use/transportation plan. Scenario planning has been shown to effectively engage the public in long range transportation planning because it allows participants to discuss the larger regional community more comprehensively and not focus solely on transportation.

The scenario planning effort included three major steps:

- A series of Community Workshops, where participants worked together to develop 50-year land use/transportation scenarios;
- Review and refine the scenarios as needed for clarification, and
- Public outreach in the form of a survey to provide input on a vision of future growth and transportation.

At the community workshops, participants worked in teams to develop future growth scenarios, by placing "land use chips" on a base map (see Figure 23, next page). This time horizon was selected because the overall growth forecasts for the region for the near term horizon were relatively modest. It was helpful, therefore, to go further into the future so that growth scenarios would reflect a more significant change from the existing conditions. The base map identified areas with new development potential, areas where redevelopment could occur, and conserved lands – areas off-limits for future development. The chips were small colored squares that represented a continuation of the current trend land use pattern over the next 50 years. The chip types were classified into seven types of growth. (see Figure 24, next page).

While each workshop map was unique, there were several common themes that all of the workshop maps reflected to some degree. For example, all groups elected to trade a significant portion, and in several cases all, of their low density single family home chips for higher density chips. All the scenarios consumed land considerably less than historical trends (between 20 and 56 square miles as compared to 124 should current trends continue). Another common thread among all of the workshop scenarios was that all included at least some focus on growth in the centers of nearly each town in the region. An example of a regional growth and transportation workshop scenario is seen in Figure 25 (next page).

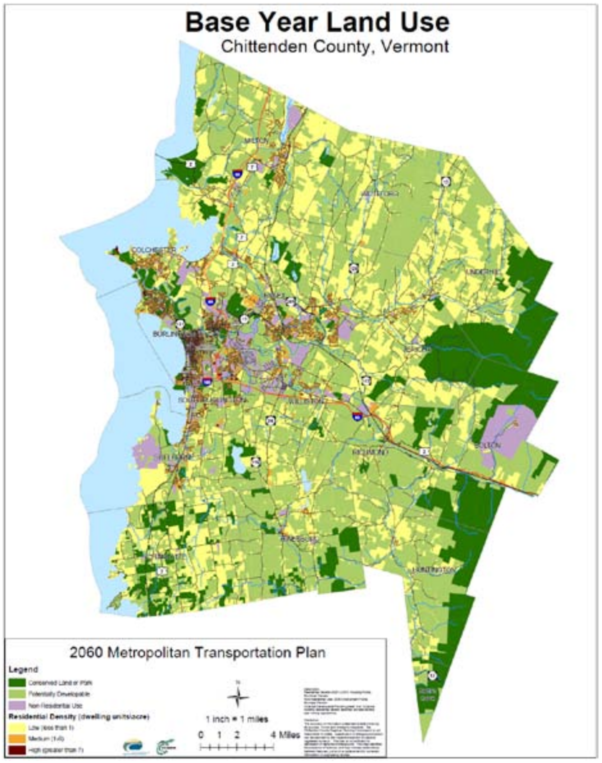
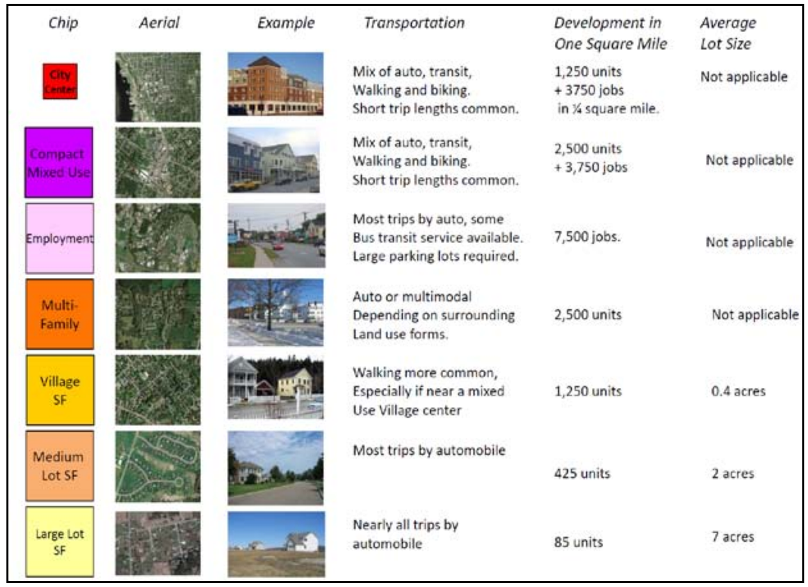


FIGURE 23: BASE MAP FOR SCENARIO WORKSHOP



Chip	Aerial	Example	Transportation	Development in One Square Mile	Average Lot Size
City Center			Mix of auto, transit, Walking and biking. Short trip lengths common.	1,250 units + 3750 jobs in ¼ square mile.	Not applicable
Compact Mixed Use			Mix of auto, transit, Walking and biking. Short trip lengths common.	2,500 units + 3,750 jobs	Not applicable
Employment			Most trips by auto, some Bus transit service available. Large parking lots required.	7,500 jobs.	Not applicable
Multi-Family			Auto or multimodal Depending on surrounding Land use forms.	2,500 units	Not applicable
Village SF			Walking more common, Especially if near a mixed Use Village center	1,250 units	0.4 acres
Medium Lot SF			Most trips by automobile	425 units	2 acres
Large Lot SF			Nearly all trips by automobile	85 units	7 acres

FIGURE 24: SCENARIO CHIP DESCRIPTIONS

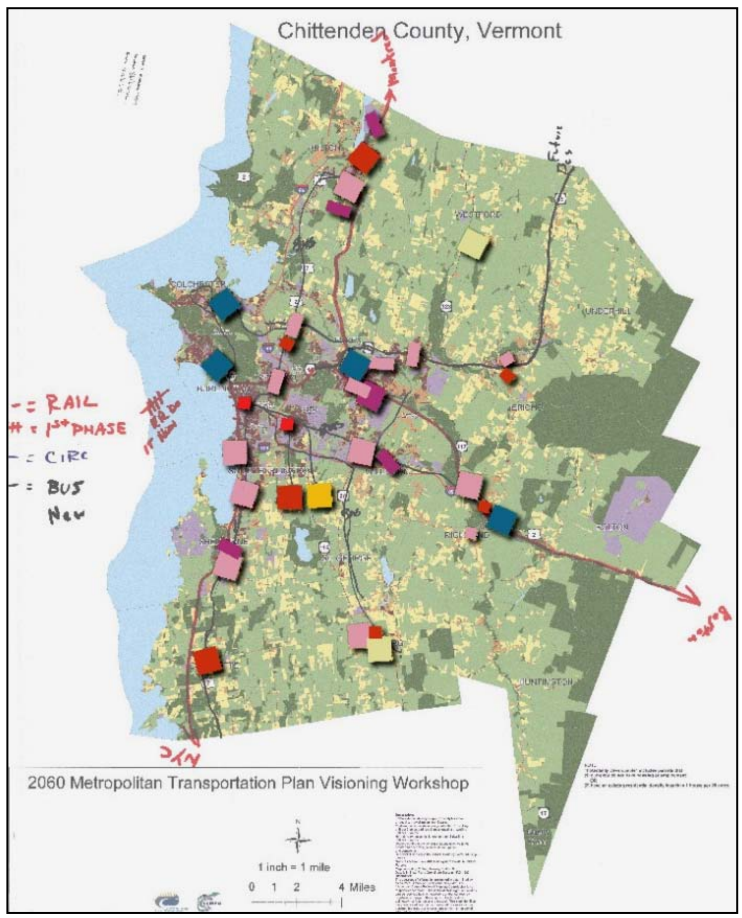


FIGURE 25: EXAMPLE OF COMPLETED WORKSHOP MAP

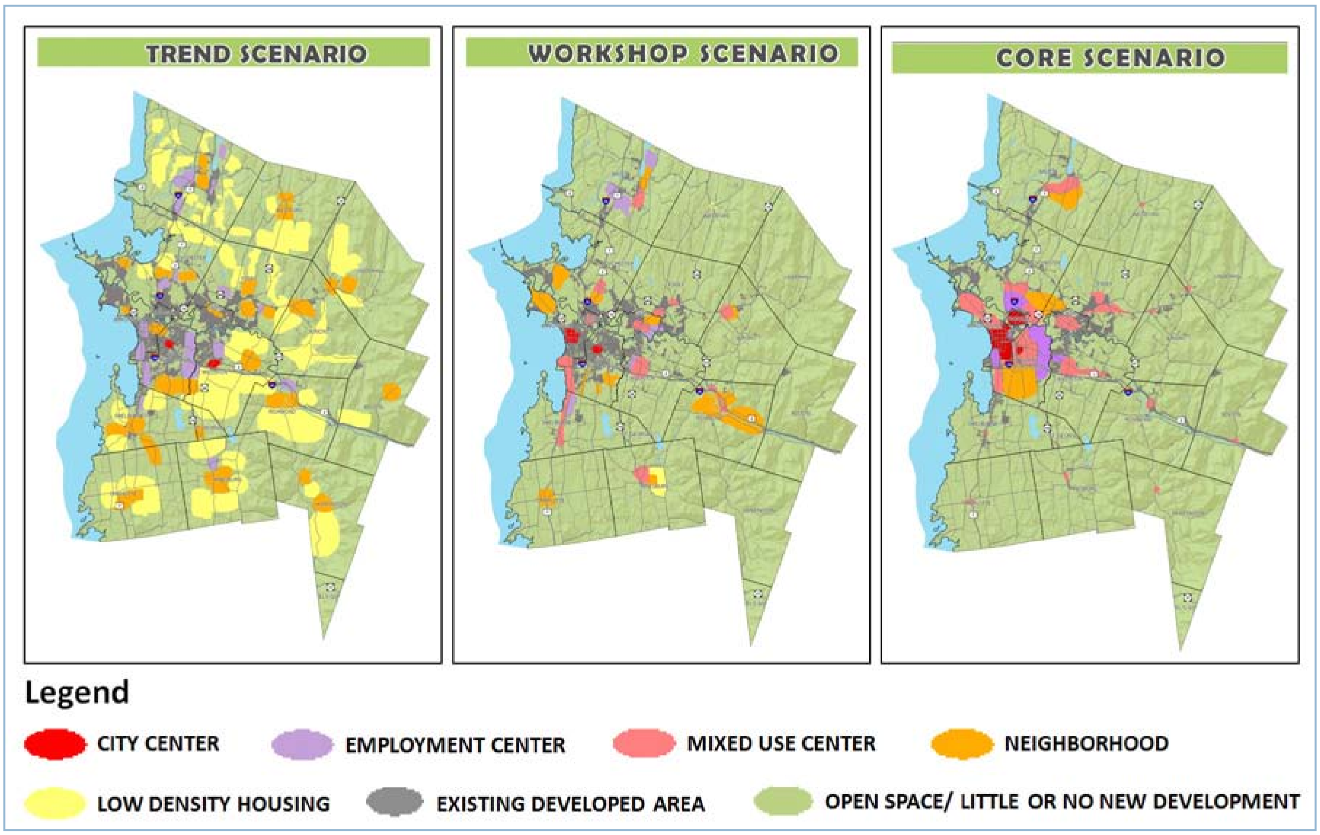
Selected Scenarios

The twelve workshop scenarios were reviewed with the goal of narrowing down the total number to three or four for a public reaction process. This was to allow the public to comprehend the scenarios in a relatively short amount of time. Three scenarios (see Figure 26, next page) were finally agreed to:

- The "Trend" scenario (a continuation of the past twenty years' growth pattern) developed by CCRPC staff as a baseline, because all of the workshop scenarios deviated quite considerably from the current development trend.
- The "Workshop" scenario taken from one of the small groups at the Essex Junction workshop and was representative of all of those created

out of the public workshops. It had similar land consumption totals as the other small group workshop scenarios, and a pattern of growth distribution that included growth in Burlington as well as the other larger village centers in the region.

- CCRPC staff created the "Core" scenario, a "bookend" to the "Trend" scenario above, in which 45% of the regional growth was assigned to Burlington; with other core towns (South Burlington, Colchester, Winooski and Essex) receiving lesser amounts and the rural towns even less. This scenario more than doubled the number of housing units in Burlington, with concentrated growth in existing core areas which are the most suitable for alternative modes of transportation. Of the three, this scenario would be the most challenging to implement, but would provide a more striking difference in transportation performance and other indicators – especially when compared to the Trend.



Legend Descriptions

- City Center – High density mix of housing and jobs
- Employment Center – Thousands of jobs clustered in a defined area
- Mixed Use Center – Medium density mix of housing and jobs
- Neighborhood – Combination of single and multi-family homes at medium density
- Low Density Housing – Single family homes on large lots
- Existing Developed Area – Areas currently covered by buildings and the infrastructure to service them
- Open Space – Farms, forests, parks, conserved lands and scattered low density housing

FIGURE 26: SELECTED SCENARIOS

Scenario Analysis

Indicators were developed to better understand and explain the implications of the regional scenarios on the environment and the transportation system. The transportation indicators were developed using the regional travel demand model, utilizing the different regional growth scenarios as inputs to the model. The scenarios were scaled back to represent anticipated growth that would occur by 2035, which is the planning year for the regional model. The table below shows the indicator results for each scenario.

One of the more stark findings is the last indicator on the table showing the difference in land consumption under each of the scenarios. These are essentially calculated using the density characteristics of each development totaled for each scenario. The Core and Workshop have nearly identical amounts of land consumed, and the trend scenario is nearly five times the other two scenarios.

TABLE 4: INDICATOR RESULTS FOR SCENARIOS RELATIVE TO 2005 CONDITIONS

	2005	Trend	Workshop	Core
Congestion (Weekday PM Peak Hour Annual Vehicle Hours of Delay)	6.6	15.4	13.6	10.4
Weekday Daily Greenhouse Gas Emissions (tons)	1,790	2,550	2,500	2,260
Annual Transit Ridership (million boardings)	1.9	4.1	5.8	10.8
Percent of Daily Trips by Walking or Bicycling	4.8%	4.3%	5.0%	8.3%
Land Consumption (square miles)	-	124	25	25

These indicators reveal the significant impacts of future growth on the environment and our transportation system. They also show how different development patterns and densities will vary, in some ways considerably, that impact. These indicator results were critical in helping the public understand the scenarios and in the next step of the scenario planning process – seeking public feedback.

The ECOS housing analysis report includes information on the connection between housing density, affordability, and transportation costs (see p 53-55) which is also an important consideration in future land use development patterns and their connection to transportation.

Public Survey on Scenarios

Two of the scenario planning project's goals were achieved by bringing the scenario analysis results to the public for their reaction/input. One was to educate the public on the very real impacts different growth scenarios will have on transportation and the environment. Another was to allow for, and encourage, widespread public participation. While it was called a survey, it really was an opportunity for the public to participate and share their views and concerns, similar to other types of public engagement activities conducted by CCRPC. While not a statistically representative sample of Chittenden County residents, it did provide a clear venue for the public to engage and participate in regional planning. It is no more or less representative than typical attendees of other types of workshops or public forums, and resulted in engaging a much larger share of the public than would attend public meetings.

TABLE 5: RANKING OF THREE SCENARIOS

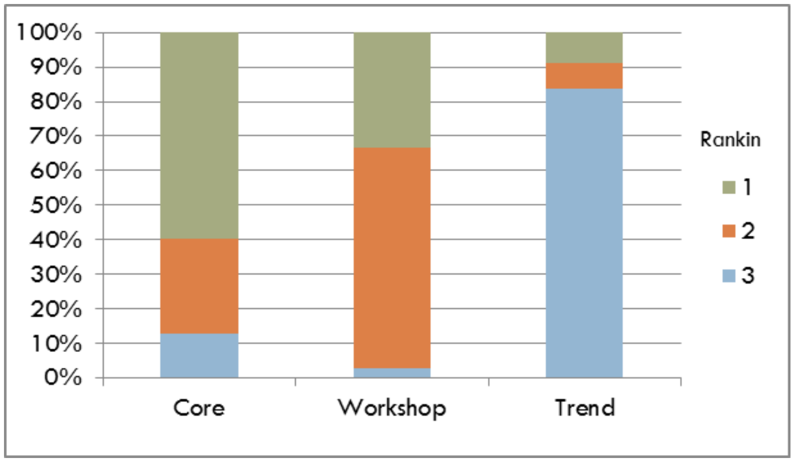
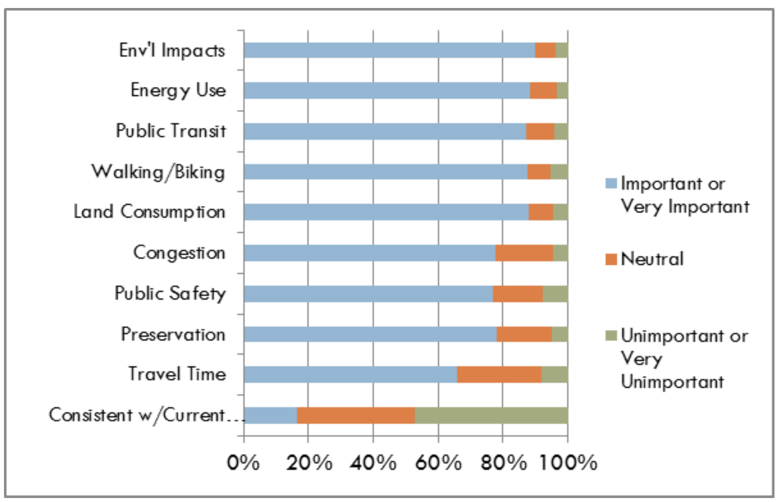


TABLE 6: IMPORTANCE OF FACTORS FOR SCENARIO RANKING



The survey was conducted through Survey Gizmo, promoted through mass emailing and blanket Front Porch Forum postings, and was open from October 6, 2010 through November 29, 2010. A total of 835 useable responses were received and analyzed. In reviewing the responses to get an idea of how representative of the region the response pool was, we noted we at least achieved a very good gender balance. However in other areas - geography and age – the responses varied from a regional representative sample. For instance we saw over representation from urban and rural areas and under representation from suburban communities. Young people were also underrepresented in the response sample. As stated above however, the survey was not intended to be a statistical representation of the overall Chittenden County population, but rather a way to broadly engage the public on an issue many of them clearly felt important.

One of the key outcomes of the survey was to specify a ranked order of the three scenarios: Core, Workshop and Trend – as described earlier. The chart below shows the distribution of rankings of the three. Approximately 60% of the respondents ranked the Core scenario as their first choice. Also noted, since both Core and Workshop are different variations of allocating growth to designated areas, i.e. growth centers, over 90% of respondents felt that this land use development type is preferred over historical trends.

Another part of the survey elicited the motivating factors in preferring one scenario over another. A number of factors were listed for survey respondents to select from and the results are illustrated in the chart below.

The summary results show several tiers of factors. Five factors show the highest level of importance, between 87% and 90%: environmental impacts, energy use, public transit, walking/biking, and land consumption. Congestion, public safety and community character were in a slightly lower tier (77 – 78%) and lower still, at 66% was travel time. These relative rankings, especially those with overwhelming support, could be useful to CCRPC for policy setting and project priority ranking.

This question also provided space for comments, which were used extensively by respondents. The following, in order of their frequency, were the most common themes expressed in these comments - along with the number of comments that mentioned this sentiment:

- Support for blending of Core and Workshop scenarios. (68)
- Scenarios should include increase amount of public transit. (50)
- Urban green spaces are important in planning denser communities. (40)
- Scenarios should include increase amount of bicycle facilities. (31)
- Mixed uses are very important, especially in smaller communities. (28)
- Good urban design is very important for higher density scenarios. (26)

A follow-up question asking: “Please describe any other important issues you would consider in evaluating the scenarios?” elicited considerable comment. Here were the most common themes with the number of respondents contributing:

- Transportation Alternatives: improve alternatives to driving to implement Core or Workshop scenarios. (86)
- Design Quality/Aesthetics: Support for Core was tempered by concerns about the impacts to Burlington and Winooski’s historic character. (70)
- Access to Green Space: Green spaces for recreation, gardening, etc. need to be planned in higher density areas. (54)

These survey responses and comment demonstrated strong support for a change in direction of growth and development away from the trend, and toward a more compact form. However, there were concerns that the transportation plans match the land use patterns, and more than a few respondents thought the workshop or core scenarios might not be realistic, and that trend development would happen despite our planning efforts.

TABLE 7: SUPPORT FOR INCREASING THESE FEES

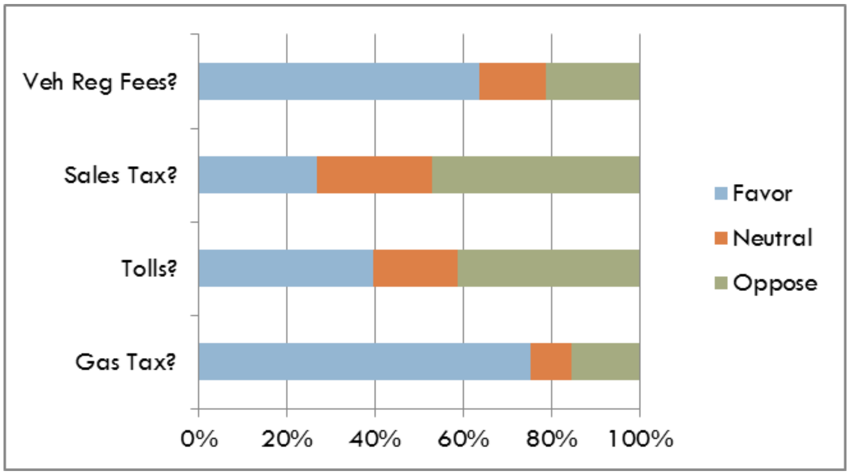
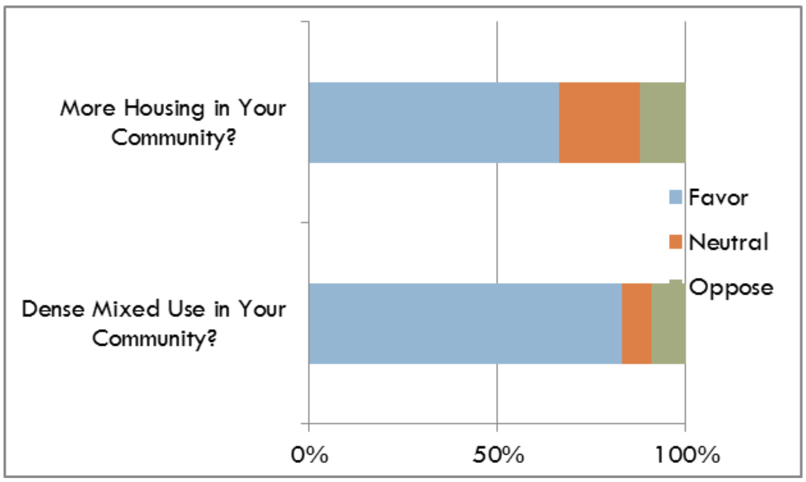


TABLE 8: SUPPORT FOR INCREASED HOUSING AND DENSITY



Other survey questions sought the public's thoughts on funding transportation and increasing housing and mixed use densities in their communities. See Tables 7 and 8 (next page).

Respondents were generally favorable to increasing the gas tax and vehicle registration fees to support transportation investment and allowing more housing and greater densities in their towns – these last two points are critical to implementing the development proposed in the workshop and/or core scenarios.

Conclusions from the survey included the following:

- Workshop participants and survey responses alike demonstrated a clear rejection of the current trends of land development of large lot, low density residential patterns, and strong support for more compact development types.
- The most important factors in preferring these development types were environmental impacts; energy consumption; transportation alternatives of walking, biking, and transit; and land consumption.
- There was support for higher fuel taxes or higher vehicle registration fees to implement transportation improvements to realize the future vision.
- Respondents showed a high degree of support for increased residential or mixed use density in their communities.

Having created, analyzed, presented and received feedback on three distinctively different future land use scenarios, the CCRPC has created a fourth – one firmly grounded on the plans assembled by local governments in the region and referred to as the 2035 MTP and Regional Plan Land Use Scenario. In contrast to the other three (where one represented "business as usual" and the other two hypothetical "what ifs"), the new scenario builds a regional future land use on the zoning established in municipal regulations. The new land use forms the development background for alternative transportation scenarios analyzed in the next section of this analysis.

2035 MTP and Regional Plan Land Use Scenario

The 2035 land use scenario was developed to quantify the future potential amount of household and employment for each Planning Area for the purpose of analyzing the interaction of land use and transportation and its associated impacts on travel, the environment and population health. Future growth amounts at the county level were determined from the 2011 Woods and Poole demographic forecast (see Table 9). This forecast was purchased by CCRPC for use in long range planning efforts and takes into account interactions between the national economy, the northwest Vermont economic region, and Chittenden County. Forecasts of regional employment are based on the economic activities expected in the future and these estimates are then used in conjunction with existing population and household characteristics to develop the 2035 totals.

TABLE 9: 2011 WOODS AND POOLE FORECAST FOR CHITTENDEN COUNTY 2005-2035

	2005	2010	2010 Census*	2015	2020	2025	2030	2035	*2005-2035*
Population	149,983	154,264	156,545	164,170	174,348	184,694	195,070	205,445	*55,462*
Housing	58,672	60,825	61,827	65,693	70,480	74,987	74,987	83,020	*24,348*
Employment	122,241	123,862	122,458	133,864	142,620	151,854	151,854	171,783	*49,542*

* -2010 Census STF1 County Population and Occupied Housing; 2009 US BEA Total Employment, (Table CA04)

TABLE 10: PROPORTIONS OF TOTAL HOUSING AND EMPLOYMENT BY PLANNING AREA

Planning Area	Households		Employment	
	Existing 2005 Proportion	Proposed 2035 Proportion of Housing	Existing 2005 Proportion	Proposed 2035 Proportion of Employment
Center	14%	21%	30%	27%
Metro	39%	33%	35%	38%
Suburban	18%	18%	4%	4%
Rural	20%	20%	4%	4%
Village	8%	8%	6%	6%
Enterprise	1%	0%	21%	21%
Total	100%	100%	100%	100%

These county level totals for 2035 were then allocated to Planning Areas using the proportion of existing housing and employment in these Areas.   The Center and Metro planning area future growth proportions also took into consideration additional factors beyond existing housing and employment patterns. The Center planning area boundaries reflect areas where municipalities have received state designation as Growth Centers, New Town Centers, or TIF districts (see planning area descriptions on pages 2-3).The growth forecasts for the Center areas took into account existing plus known or planned growth documented in local plans and studies. The Metro planning area proportions were then adjusted to balance the regional totals. Table 10 summarizes the outcome of this analysis with the existing 2005 and Planned 2035 proportions of total housing and employment.

Table 11 below displays 2005 and 2035 land use totals by planning areas as well as how much growth would be allocated between 2005 and 2035 to each planning area type to achieve the proposed 2035 total proportions of housing and employment shown in Table 10 above.

TABLE 11: 2005 & 2035 LAND USE TOTALS AND GROWTH INCREMENTS BY PLANNING AREA

	2005 Total		**2035 Total**		**2005-2035 Growth**	
	Housing	Employment	Housing	Employment	Housing	Employment
Center	*8,214*	*36,672*	*17,288*	*46,002*	*9,074*	*9,329*
Metro	*22,882*	*42,784*	*27,226*	*65,657*	*4,344*	*22,873*
Center+Metro	31,096	79,457	44,514	111,659	13,418	32,202
Suburban	10,561	4,890	14,838	6,871	4,277	1,982
Rural	11,734	4,890	16,487	6,871	4,752	1,982
Village	4,694	7,334	6,595	10,307	1,901	2,973
Enterprise	587	25,671	587	36,074	-	10,404
Total	58,672	122,241	83,020	171,783	24,348	49,542

The CCRPC endorsed the 2035 Planning Area in Table 10 above at their September 2011 meeting and the growth assumptions were used to support the regional transportation model analysis of transportation scenarios described in the next section by allocating growth to the Model's 335 Transportation Analysis Zones (TAZs) and the TAZ's development potential relative to others within the same type of planning area. Assumptions were made to assign the planning area growth to the TAZs as their boundaries are not coincident.

2035 Transportation Scenario Analysis

Similar to the way the CCRPC developed land use scenarios described on page 24 of this report, we also examined three distinct transportation scenarios in order to clearly contrast transportation system alternatives. The following three scenarios were constructed for analysis.

TABLE 12: 2035 TRANSPORTATION SCENARIO DESCRIPTIONS

Scenario Name	Scenario Elements
1. Basic Transportation/ Constrained Funding	This is the existing transportation system plus permitted projects – those identified in the MPO'S Transportation Improvement Program (TIP) that have also completed permitting. Not included are major road projects such as the CIRC or Champlain Parkway (Southern Connector), both of which have not completed the permitting process.
2. Energy conservation/Social equity	• All of #1 above, plus… • Transit intensive – full implementation of CCTA's 2010 Transit Development Plan (TDP) - More services to more places more frequently • CCMPO Bike/pedestrian Plan build out – More sidewalks, shared use paths and on-road bike lanes • Transportation Demand Management – Employer incentive programs to encourage transportation alternatives (similar to CATMA but more widespread around the county), implementation of extensive park and ride facilities per 2011 CCMPO Park & Ride Plan • Intelligent Transportation Systems (ITS) improvements to reduce delays on key highways and provide better experiences for transit users. • Passenger and commuter rail - Connecting North, East and South • Expanded Carshare – to less urban locations • A ten-fold increase in the per-mile operating costs for automobiles reflecting an assumption of a significant increase in fuel and energy costs.
3. Enhanced Road Capacity	• All of #1 above plus… • Full Circumferential Highway • Champlain Parkway • Three lanes on I-89 from the proposed Circ Interchange in Williston East of Exit 12 to the proposed Circ Interchange in Colchester north of Exit 16 (Colchester US RT 7). • New I-89 exits at VT 116 (Hinesburg Rd) and W. Milton Rd • Colchester Exit 16 upgrades (double-crossover diamond) • Intelligent Transportation Systems (ITS) improvements to reduce delays on key highways and provide better experiences for transit users. • Williston Grid Streets • Local connectors from official town maps • Other potential capacity increases on arterial highways in identified congested areas

In addition to the list of transportation projects in the above scenarios, CCRPC has identified modern roundabouts as one potential transportation solution which can work to increase safety and reduce delay and pollutant emissions. The CCRPC website has an informational page dedicated to modern roundabouts and how they are different from the old style of rotaries many motorists strongly dislike, see http://www.ccrpcvt.org/roundabouts/ . Corridor and scoping studies completed by CCRPC over the past ten years frequently reference roundabouts as potential solutions to transportation deficiencies, and these traffic control devices will be considered as the transportation scenarios are refined and further developed through the transportation project development process.

Scenario Implementation Costs

The transportation scenarios were examined to develop planning level cost estimate ranges for the component parts of each scenario. Table 13 below includes itemized cost ranges for the scenarios analyzed. The basic transportation scenario requires approximately $114 million in funds, while the energy conservation and road capacity scenarios require $500-770 million in total funding.

The energy conservation and road capacity scenarios require similar levels of funding. The full build-out of the bicycle and pedestrian shared use path and on-road networks along with the commuter rail costs require major capital investments. The table presents the capital costs for equipment and infrastructure - additional funds would be required for operating the expanded CCTA Transit Development Plan system and the commuter rail service to adjoining regions as well as maintaining any new roads which are built over time. The commuter rail capital cost range only includes those costs reflecting infrastructure upgrades and equipment within Chittenden County.

TABLE 13: TRANSPORTATION SCENARIO COST RANGES (2010 DOLLARS)

1. Basic Transportation / Constrained Funding

Item Description	Cost Range
Highway related capacity increases and maintenance projects in CCRPC's Transportation Improvement Program (TIP) that have completed permitting	***$114 million***
Scenario 1 Total	***$114 million***

2. Energy conservation / Social equity

Item Description	Cost Range
All of Scenario 1	$114 million
Full implementation of CCTA's 2010 Transit Development Plan (TDP)	$25 - 37 million
CCMPO 2008 Bike/Pedestrian Plan build out	$176 - 265 million
Transportation Demand Management – 2011 Park and Ride Plan Implementation, Employer incentive programs, and Carshare program expansion	$57 - 85 million
Intelligent Transportation Systems (ITS) plan implementation	$9 - 14 million

Passenger and commuter rail - Connecting from outside the County to the North, East and South	$169 - 253 million
Scenario 2 Total	***$550 - 767 million***

3. Enhanced Road Capacity

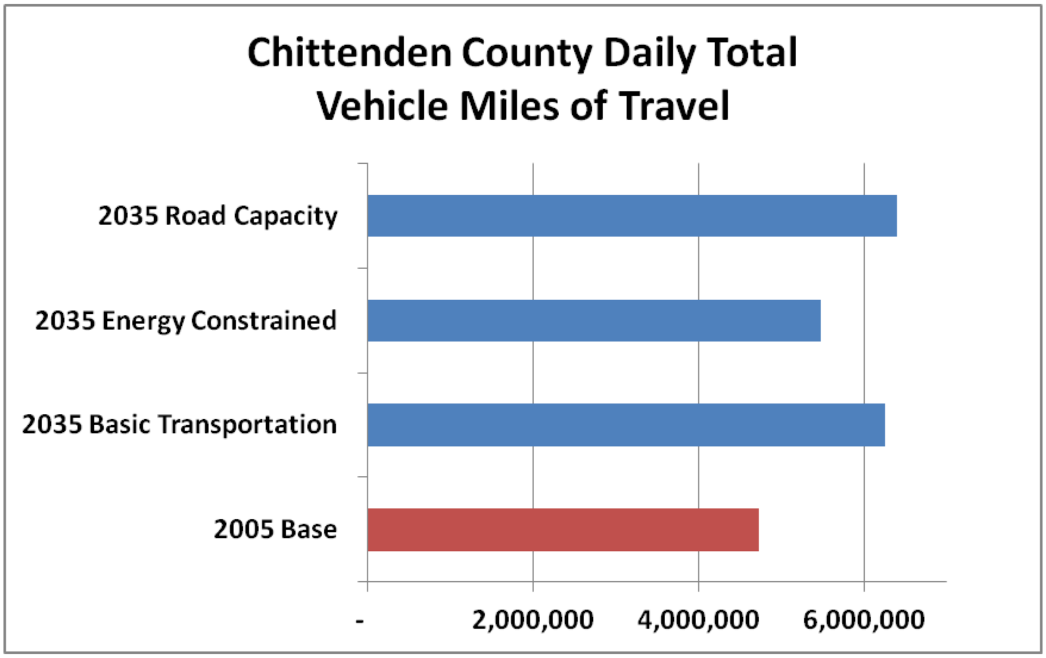
Item Description	Cost Range
All of Scenario 1	$114 million
Full Circumferential Highway	$126 - 190 million
Champlain Parkway	$23 - 34 million
Three lanes on I-89 from the proposed Circ Interchange in Williston East of Exit 12 to the proposed Circ Interchange in Colchester north of Exit 16	$80 - 120 million
New I-89 exits at VT 116 (Hinesburg Rd) and W. Milton Rd	$53 - 80 million
Colchester Exit 16 upgrades (double-crossover diamond)	$4 - 6 million
Intelligent Transportation Systems (ITS) plan implementation	$9 - 14 million
Williston grid of Connecting Streets around Tafts Corner	$3 - 5 million
Other Local Streets from Municipal Official Maps	$13 - 19 million
Additional capacity increases on arterial highways in congested areas	$74 - 112 million
Scenario 3 Total	***$500 - 693 million***

Scenario Analysis Results

The transportation scenarios were analyzed using the travel demand model in combination with the 2035 regional land use described in the previous section of this report. The model forecast results are directly related to the future growth expected to occur at the county level. According to the county forecasts in Table 6 above, housing and employment in Chittenden County are expected to grow by about 40% between 2005 and 2035. The transportation model estimates the number of trips people make to, from, and within the county at about 780,000 person trips in 2005, and in all three of the 2035 transportation scenarios the number of person trips increases to about 1,080,000 trips per day (or about a 40% increase). While the basic economic inputs of future housing and employment determine the general order of magnitude of future travel demand, there are important distinctions in the way the transportation scenarios perform which will be reviewed in more detail below.

The most general measure of the amount of travel in the county provided by the model is known as Vehicle Miles of Travel (VMT). One vehicle traveling one mile on a road represents 1 unit of VMT, so a 1 mile long stretch of highway carrying 100 vehicles per day would contribute 100 units of VMT to the regional total. Figure 27 below shows the change in VMT between 2005 and the three 2035 transportation scenarios.

FIGURE 27: 2035 TRANSPORTATION SCENARIOS DAILY VEHICLE MILES OF TRAVEL

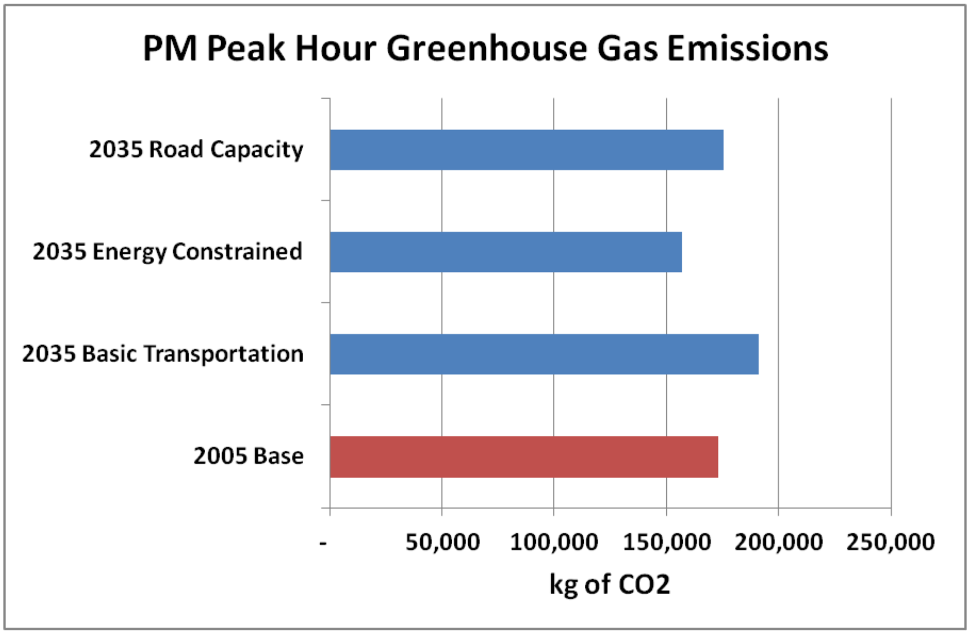


The VMT estimates in the chart above include all travel on highways within Chittenden County, including trips made wholly within or to/from the county from outside (e.g. St Albans to Burlington commuters). The impact of travel to/from Chittenden County is an important consideration in our regional future as these trips represent a significant proportion of the total and almost half of regional VMT since these "external" trips tend to be longer.

VMT is also directly related to fuel consumption and greenhouse gas emissions, although estimates of these items requires information on the speed of travel. Figure 28 below shows the Greenhouse Gas (GHG) emissions estimates for each scenario. The federal government is significantly increasing fuel efficiency requirements placed on automobile manufacturers which is very beneficial for this type of emission. The data included in figure 28 is based on the currently enacted federal efficiency standards which run through the year 2016 and will reduce per-capita GHG emissions in Chittenden County by up to 20% compared to 2005 levels by 2035. Further increases in efficiency are under consideration and have the potential for additional significant reductions in per capita GHG emissions beyond what is indicated in the figure below.

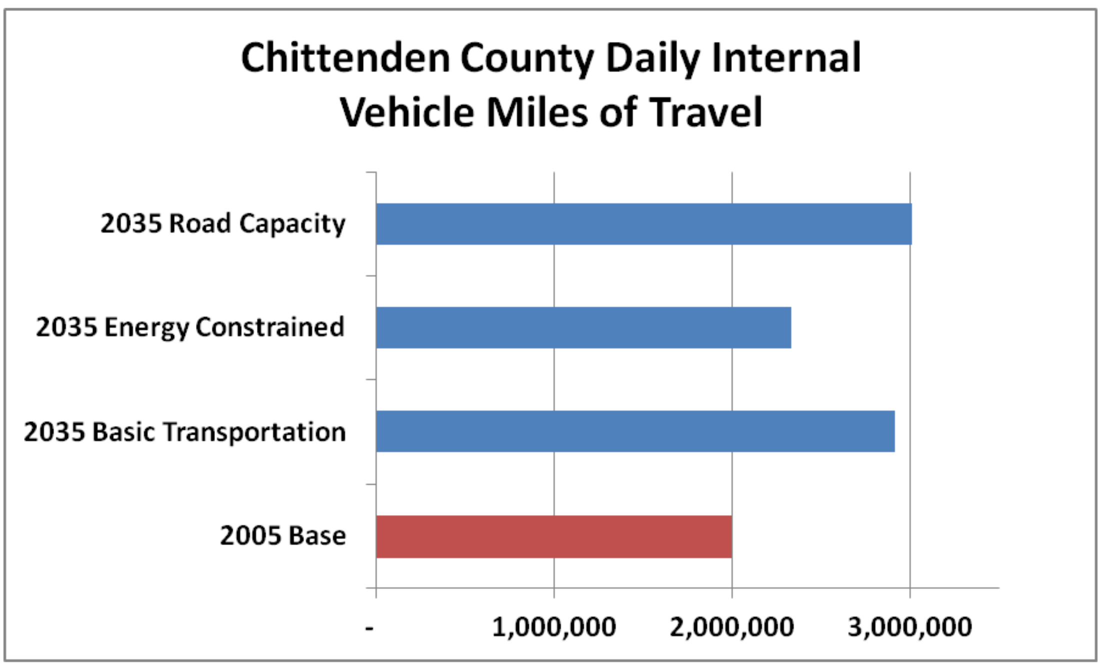
The decrease in GHG is also indicative of decreases in other types of pollutants, such as the precursors to ozone which is a major component of the smog experienced in most large metropolitan areas in the United States. These pollutants impact respiratory health and can lead to increased rates of asthma in heavily traveled areas. Decreasing fuel use and pollutant emissions thus has many benefits beyond direct transportation issues.

FIGURE 28: 2035 TRANSPORTATION SCENARIOS PM PEAK HOUR GREENHOUSE GAS EMISSIONS



Another way of thinking about travel patterns is to just look at trips that are made within Chittenden County, or "internal" trips. These are the types of trips municipal and regional decision-makers within the County will have the greatest ability to influence through policy making. Figure 29 below includes the estimates of internal VMT for Chittenden County.

FIGURE 29: DAILY "INTERNAL" VEHICLE MILES OF TRAVEL WITHIN CHITTENDEN COUNTY



A closer look at the Internal VMT estimates for the three scenarios indicates a 20% decrease in internal VMT between the energy constrained scenario and the road capacity scenario. This decrease is primarily due to fewer vehicle trips in areas targeted for Travel Demand Management

(TDM) programs as well as non-automobile travel and more trips being made via public transportation. The road capacity and basic transportation scenarios both have about 92,000 daily trips made by walking, bicycling, or transit. The energy constrained scenario has about 154,000 of these non-automobile trips representing an increase of about 67% over the scenarios which do not include significant investments in these modes and the assumption of much greater costs to operate automobiles included in the energy conservation scenario.

Public transportation via bus and potentially rail service in the future is expected to continue playing an important role in providing services to riders who depend on the service for basic transportation as well as the increasing number of people who may have other transportation options available, but choose to use the service. Figure 30 below contains estimates of the percent of total person trips within Chittenden County which could be made via transit service. The additional bus and rail services included in the energy constrained scenario increase the transit possible percentage from 45% to about 60% of the total internal person trips making this option available to a much larger segment of the population. Figure 31 shows the drastic increase in transit ridership in the energy conservation scenario as the services are available to a larger population and the higher automobile operating costs increases the attractiveness of transit.

FIGURE 30: PERCENT OF TOTAL INTERNAL TRIPS POTENTIALLY MADE VIA TRANSIT

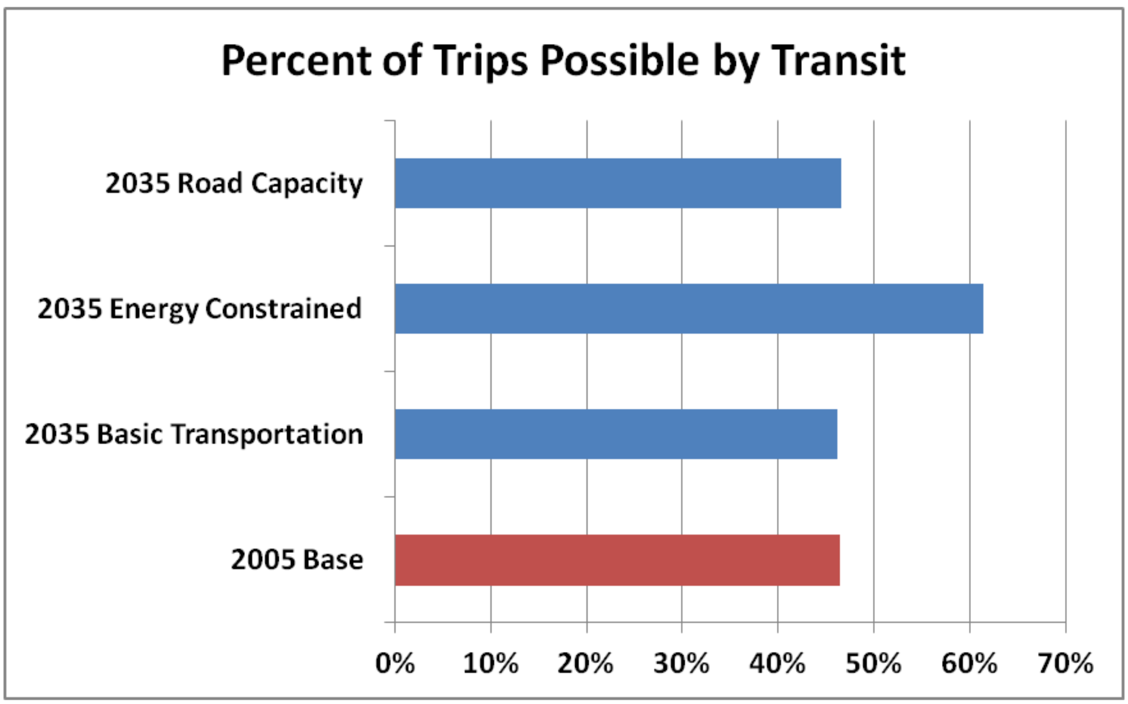
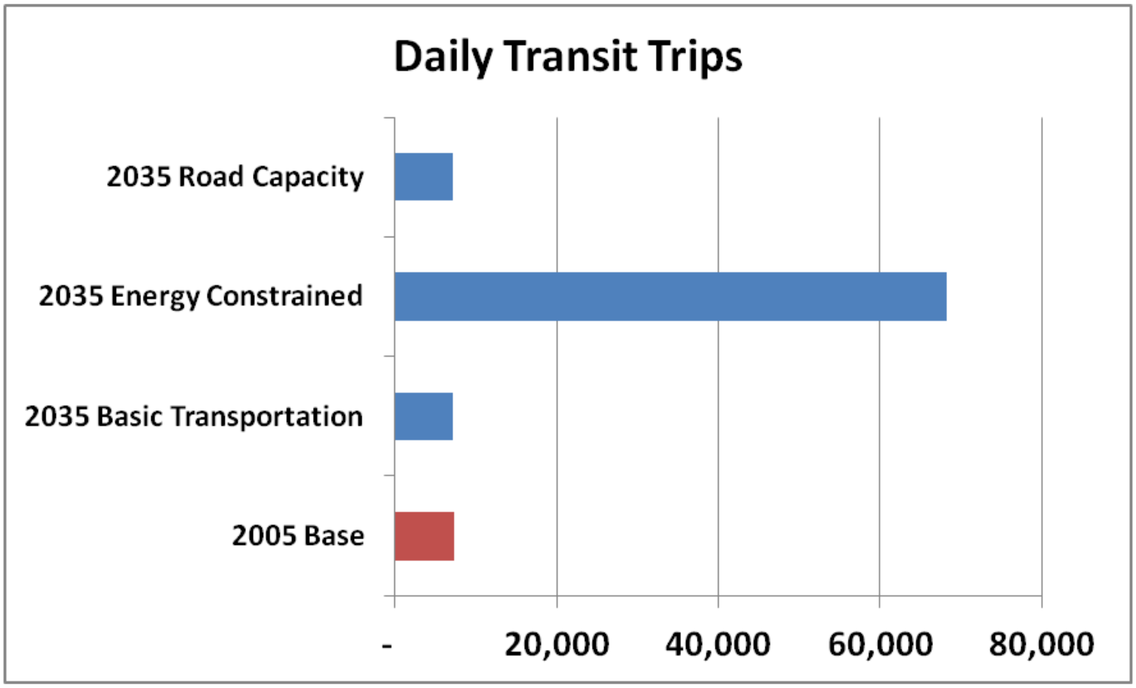


FIGURE 31: WEEKDAY DAILY TRANSIT TRIPS

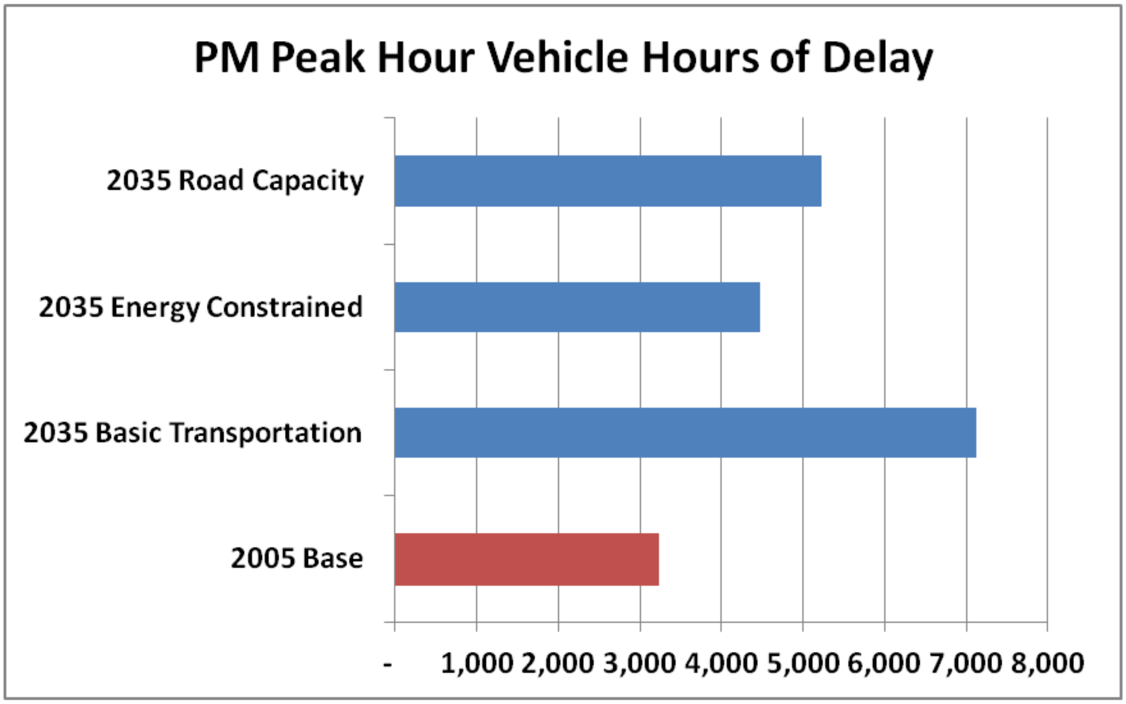


Congestion on the transportation system is expected to increase in the future as travel needs place additional demands on the transportation system. The transportation model can be used to compare the difference between uncongested travel on the highways (known as free flow) and congested travel. The highest travel demand occurs in the afternoon rush hour period (roughly 5-6 p.m.) and this leads to the greatest concentration of congestion over the course of the day. Figure 32 below shows total PM peak hour delay is expected to increase between 2005 and 2035 in all three scenarios, although both the road capacity and energy constrained scenarios decrease total delay significantly compared to the 2035 basic transportation scenario which does not invest in congestion relief roadway projects or TDM programs and public transportation alternatives.

The appendix to this document includes more detailed tabulations of various model-related outputs from the transportation scenario analysis.

These 2035 Scenarios will continue to be refined and analyzed with the goal of identifying critical elements which will work together in creating a blended strategy of transportation projects and policies which will best serve the residents, businesses, and travelers in Chittenden County as the CCRPC Metropolitan Transportation Plan advances. The CCRPC long range planning committee, transportation advisory committee, and ECOS steering committee will continue to oversee this effort.

FIGURE 32: PM PEAK HOUR VEHICLE HOURS OF DELAY



The final CCRPC long range transportation plan developed over the coming months will include additional elements related to:

- Detailed cost estimates for the transportation elements along with how these investments fit within the anticipated resources available to the county for transportation spending.
- Environmental impacts and mitigation efforts related to the existing and future transportation system.
- Projects/strategies identified by travel corridor and timeframe.

CONCLUSIONS AND RECOMMENDATIONS

Over the past 60 years, Chittenden County has experienced significant, but lately slowing, growth. Much of that development has gone to the more suburban and especially rural parts of the county. However, as this analysis has demonstrated, there are increasing transportation and environmental costs associated with our scattered rural development trends. Combine this with the public's apparent desire to refocus future growth into designated higher density, mixed use centers, and we are now presented with an opportunity to readjust, even reverse, our growth trends and plan for a more sustainable development future.

The first phase of ECOS involved a comprehensive effort to identify the shared goals that will guide the County's future sustainability. The goals that specifically relate to land use and transportation are:

- All future development will support, maintain, and reinforce Vermont's historic settlement pattern of compact hamlets, villages and urban centers separated by and harmonizing with working and natural rural countryside; adhere to sustainability principles of environmental quality, economic vitality, fiscal responsibility, and social and inter-generational equity.
- Increase and improve the accessibility, affordability, safety, connectivity, security, social equity and choices of our regional and local multi-modal transportation system.
- Maintain our transportation system and improve its safety and efficiency.

Our analysis has shown that development trends are mostly running counter to the desired pattern of downtowns and villages surrounded by working landscapes and scenic vistas. For example, as illustrated in Figure 21 on page 22, recent housing development trends show that only 17% of new housing units consumed nearly 72% of all housing development land. This is because the 17% were on large lots of over three acres – development permitted under current regulations that, according to our scenario planning exercise, runs counter to the public's aspirations. In addition to this inefficient use of land, we see implications in other areas. For instance our transportation system becomes more congested, worsens air quality, makes alternatives to the car less attractive, and diminishes public health.

Creating a built environment that meets the goals above requires a coordinated effort at the state, local, and regional levels to balance our land use, transportation, and environmental needs. The coordination efforts require an unprecedented level of collaboration across sectors and geographical jurisdictions – the sort of broad reaching effort this ECOS project is creating. We also need our permit and planning processes to be aligned with these goals by streamlining land use permitting to encourage predictability of outcomes, providing development incentives for targeting growth in smart growth areas, and making farmland and open space preservation programs more robust. In addition, it is essential that we plan for transportation infrastructure that improves mobility and accessibility, decreases greenhouse gas emissions, and increases transit use, car sharing, walking and bicycling, while making the entire multimodal transportation system more efficient. And all of this requires the continued collection of relevant data and their analysis in order to confidently know we're moving toward our goals.

The implementation priorities identified in ECOS Phase 4, based largely on the weaving of these Phase 2 analyses reports and the ECOS goals established earlier, will set us in a direction to a more sustainable development and transportation future.

FINAL DRAFT Chittenden County Historic Development and Future Land Use/Transportation Analysis

1/18/2012

APPENDIX: DATA TABLES AND MAPS

ecos

ENVIRONMENT | COMMUNITY | OPPORTUNITY | SUSTAINABILITY

A SUSTAINABLE FUTURE FOR CHITTENDEN COUNTY

Historic Development Analysis Data Tables and Maps

Year-Built Analysis Data Tables:

TABLE 1

Land Area in Chittenden County			
Planning Area	Acres	Square Miles	% of County
Center	3093.42	4.83	0.89%
Metro	15654.36	24.46	4.50%
Suburban	16683.23	26.07	4.80%
Rural	293219.17	458.15	84.29%
Village	10944.56	17.10	3.15%
Enterprise	8286.09	12.95	2.38%
Total	347880.83	543.56	100.00%

TABLE 2

Total Number of Structures in Each Planning Area				
Planning Area	1950	1970	1990	2005
Center	936	1105	1303	1626
Metro	5715	10465	14217	15478
Suburban	740	3036	7443	10492
Rural	1848	3661	9645	12705
Village	1071	1886	3032	3734
Enterprise	42	106	220	251
Total	10352	20259	35860	44286

TABLE 3

Percent of Total Structures by Planning Area				
Planning Area	1950	1970	1990	2005
Center	9.04%	5.45%	3.63%	3.67%
Metro	55.21%	51.66%	39.65%	34.95%
Suburban	7.15%	14.99%	20.76%	23.69%
Rural	17.85%	18.07%	26.90%	28.69%
Village	10.35%	9.31%	8.46%	8.43%
Enterprise	0.41%	0.52%	0.61%	0.57%

TABLE 4

Center Planning Area			
Year	Total Number of Structures	Growth Since Last Increment	Growth since 1950
1950	936	NA	NA
1970	1105	169	169
1990	1303	198	367
2005	1626	323	690

TABLE 5

Metro Planning Area			
Year	Total Number of Structures	Growth Since Last Increment	Growth since 1950
1950	5715	NA	NA
1970	10465	4750	4750
1990	14217	3752	8502
2005	15478	1261	9763

TABLE 6

Suburban Planning Area			
Year	Total Number of Structures	Growth Since Last Increment	Growth since 1950
1950	740	NA	NA
1970	3036	2296	2296
1990	7443	4407	6703
2005	10492	3049	9752

TABLE 7

Rural Planning Area			
Year	Total Number of Structures	Growth Since Last Increment	Growth since 1950
1950	1848	NA	NA
1970	3661	1813	1813
1990	9645	5984	7797
2005	12705	3060	10857

TABLE 8

Village Planning Area			
Year	Total Number of Structures	Growth Since Last Increment	Growth since 1950
1950	1071	NA	NA
1970	1886	815	815
1990	3032	1146	1961
2005	3734	702	2663

TABLE 9

Enterprise Planning Area			
Year	Total Number of Structures	Growth Since Last Increment	Growth since 1950
1950	42	NA	NA
1970	106	64	64
1990	220	114	178
2005	251	31	209

TABLE 10

Growth in Each Planning Area				
Planning Area	1951-1970	1971-1990	1991-2005	Total
Center	169	198	323	690
Metro	4750	3752	1261	9763
Suburban	2296	4407	3049	9752
Rural	1813	5984	3060	10857
Village	815	1146	702	2663
Enterprise	64	114	31	209
Total	9907	15601	8426	33934

TABLE 11

% of Total Growth in Each Planning Area				
Planning Area	1951-1970	1971-1990	1991-2005	Total
Center	1.71%	1.27%	3.83%	2.03%
Metro	47.95%	24.05%	14.97%	28.77%
Suburban	23.18%	28.25%	36.19%	28.74%
Rural	18.30%	38.36%	36.32%	31.99%
Village	8.23%	7.35%	8.33%	7.85%
Enterprise	0.65%	0.73%	0.37%	0.62%
Total	100.00%	100.00%	100.00%	100.00%

TABLE 12

Density: Structures Per Square Mile				
Planning Area	1950	1970	1990	2005
Center	193.65	228.61	269.58	336.40
Metro	233.65	427.84	581.24	632.79
Suburban	28.39	116.47	285.53	402.49
Rural	4.03	7.99	21.05	27.73
Village	62.63	110.29	177.30	218.35
Enterprise	3.24	8.19	16.99	19.39
Total	19.04	37.27	65.97	81.47

E-Site Analysis Data Tables:

TABLE 13

Number of Structures in Each Planning Area						
	Residential		Non-Residential		Total	
Planning Area	2005	2010	2005	2010	2005	2010
Center	1581	1836	946	1156	2527	2992
Metro	16838	18272	1198	1312	18036	19584
Suburban	9990	11759	266	317	10256	12076
Rural	12886	13881	369	496	13255	14377
Village	3974	4450	514	567	4488	5017
Enterprise	204	196	553	719	757	953
Total	45473	50394	3846	4567	49319	54999

TABLE 14

Growth: 2005-2010			
Planning Area	Residential	Non-Residential	Total
Center	255	210	465
Metro	1434	114	1548
Suburban	1769	51	1820
Rural	995	127	1122
Village	476	53	529
Enterprise	-8	166	158
Total	4921	721	5642

TABLE 15

Percentage of County Growth, 2005-2010	
Planning Area	Percent of Growth
Center	8.24%
Metro	27.44%
Suburban	32.26%
Rural	19.89%
Village	9.38%
Enterprise	2.80%
Total	100.00%

TABLE 16

Density: Structures per Square Mile			
Planning Area	2005	2010	Change
Center	522.81	619.02	96.20
Metro	737.37	800.66	63.29
Suburban	393.44	463.26	69.82
Rural	28.93	31.38	2.45
Village	262.44	293.38	30.93
Enterprise	58.47	73.61	15.14
Total	90.73	101.18	10.45

Year-Built and E-Site Comparison Tables:

TABLE 17

Number of Structures: E-Site and Year-Built Data Difference				
Town	E-Site 2006	Year-Built	Difference	Percent Undercount
Bolton	466	386	80	17.17%
Buel's Gore	12	0	12	100.00%
Burlington	11212	7508	3704	33.04%
Charlotte	1659	1565	94	5.67%
Colchester	5806	4922	884	15.23%
Essex Junction	3022	3150	-128	-4.24%
Essex Town	3330	3854	-524	-15.74%
Hinesburg	1670	1178	492	29.46%
Huntington	819	759	60	7.33%
Jericho	1736	1736	0	0.00%
Milton	3759	3843	-84	-2.23%
Richmond	1569	1422	147	9.37%
St. George	279	274	5	1.79%
Shelburne	2676	1845	831	31.05%
South Burlington	5590	5371	219	3.92%
Underhill	1120	1119	1	0.09%
Westford	735	711	24	3.27%
Williston	3667	3052	615	16.77%
Winooski	1800	1591	209	11.61%
Total	50927	44286	6641	13.04%

TABLE 18

2005 Percent of Total Structures Comparison		
Planning Area	Year-Built 2005	E-Site 2005
Center	3.67%	5.12%
Metro	34.95%	36.57%
Suburban	23.69%	20.80%
Rural	28.69%	26.88%
Village	8.43%	9.10%
Enterprise	0.57%	1.53%

TABLE 19

2005 Structures Per Square Mile Comparison		
Planning Area	Year-Built 2005	E-Site 2005
Center	336.40	522.81
Metro	632.79	737.37
Suburban	402.49	393.44
Rural	27.73	28.93
Village	218.35	262.44
Enterprise	19.39	58.47
Total	81.47	90.73

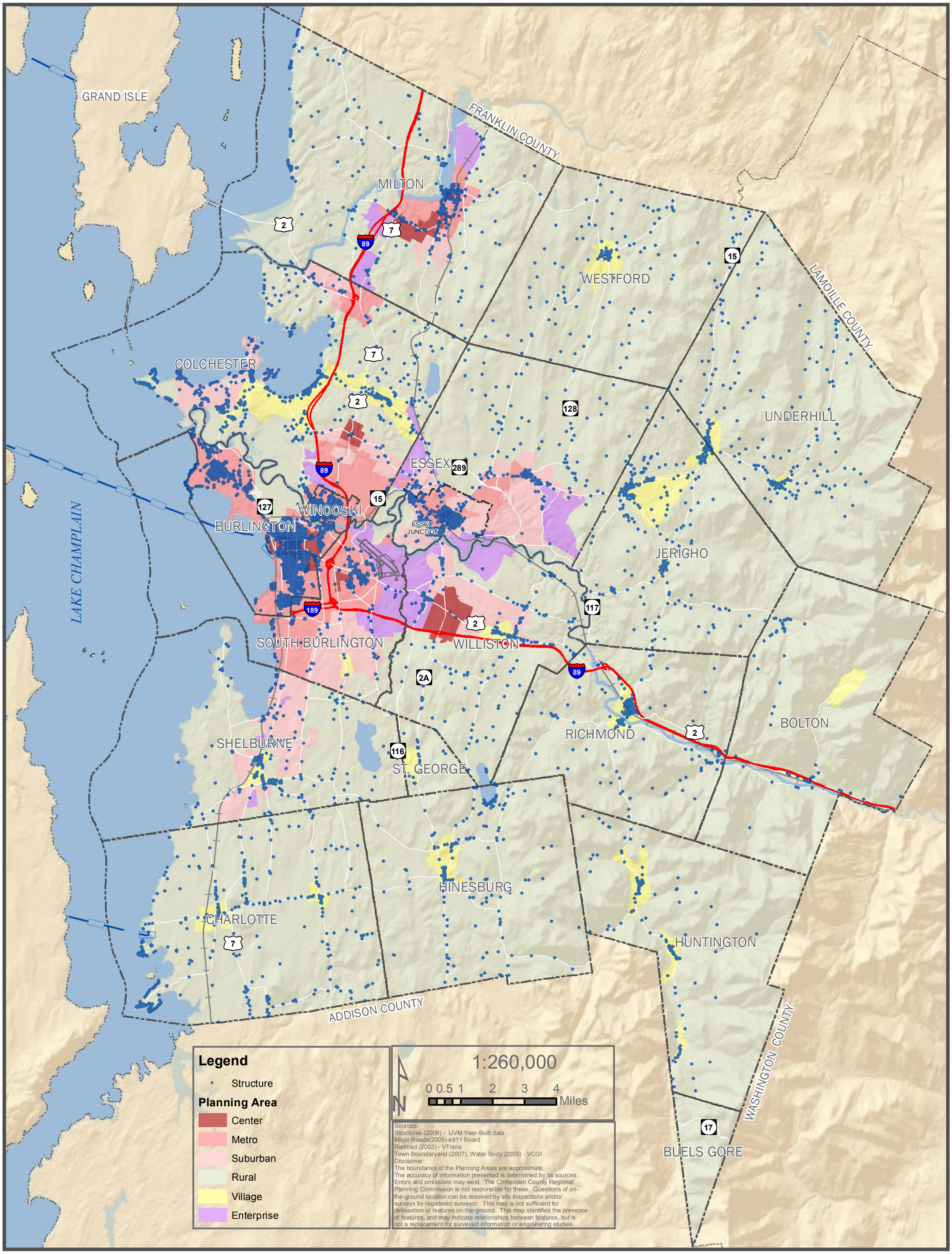
Maps

MAP 1: STRUCTURES BUILT BY 1950

MAP 2: STRUCTURES BUILT BY 1970

MAP 3: STRUCTURES BUILT BY 1990

MAP 4: STRUCTURES BUILT BY 2005



Structures Built by 1950

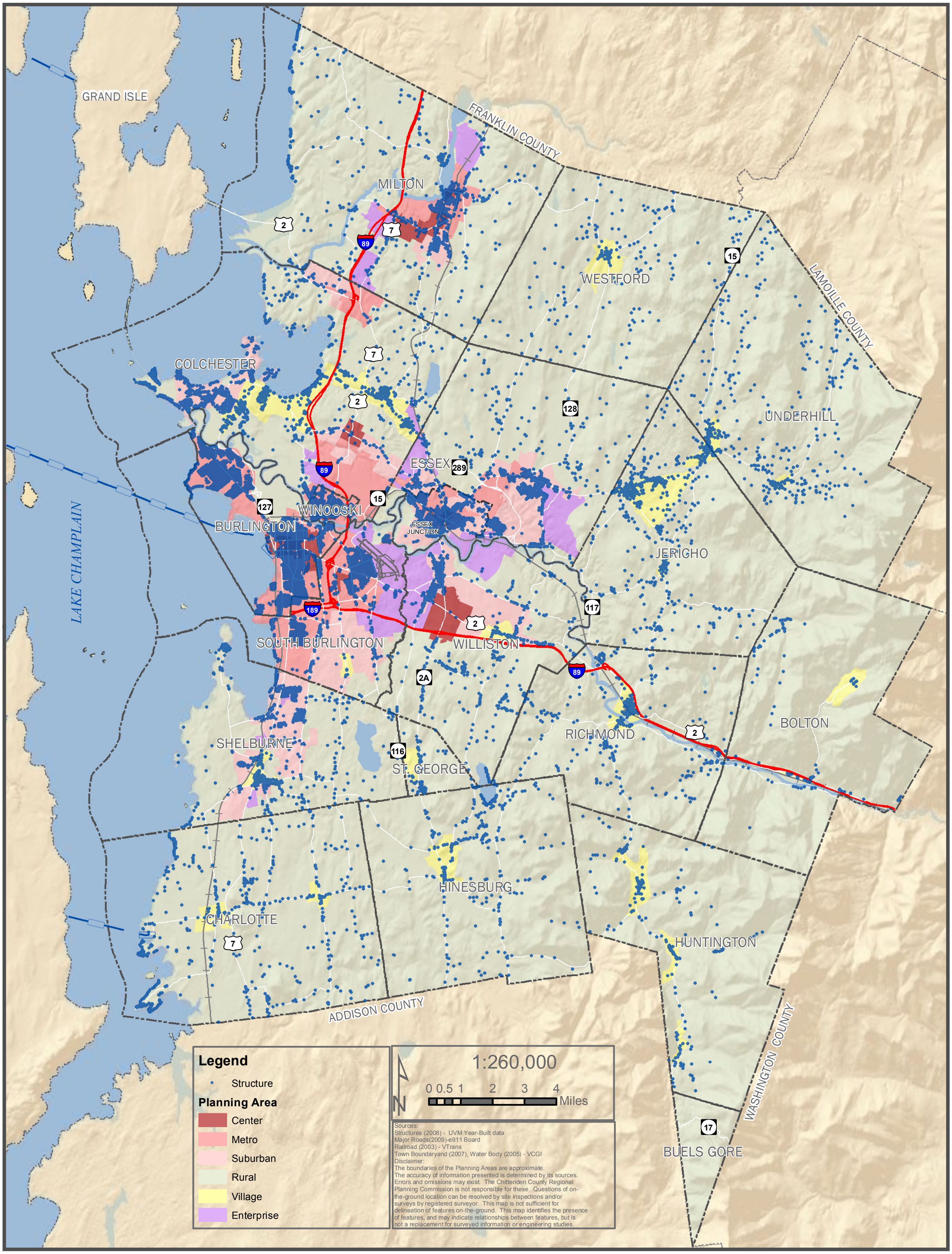
Chittenden County, Vermont

DRAFT

Note: Data used is best available. Not all structures in county are represented here.

Chittenden County Regional Planning Commission

September, 2011



Structures Built by 1970

Chittenden County, Vermont

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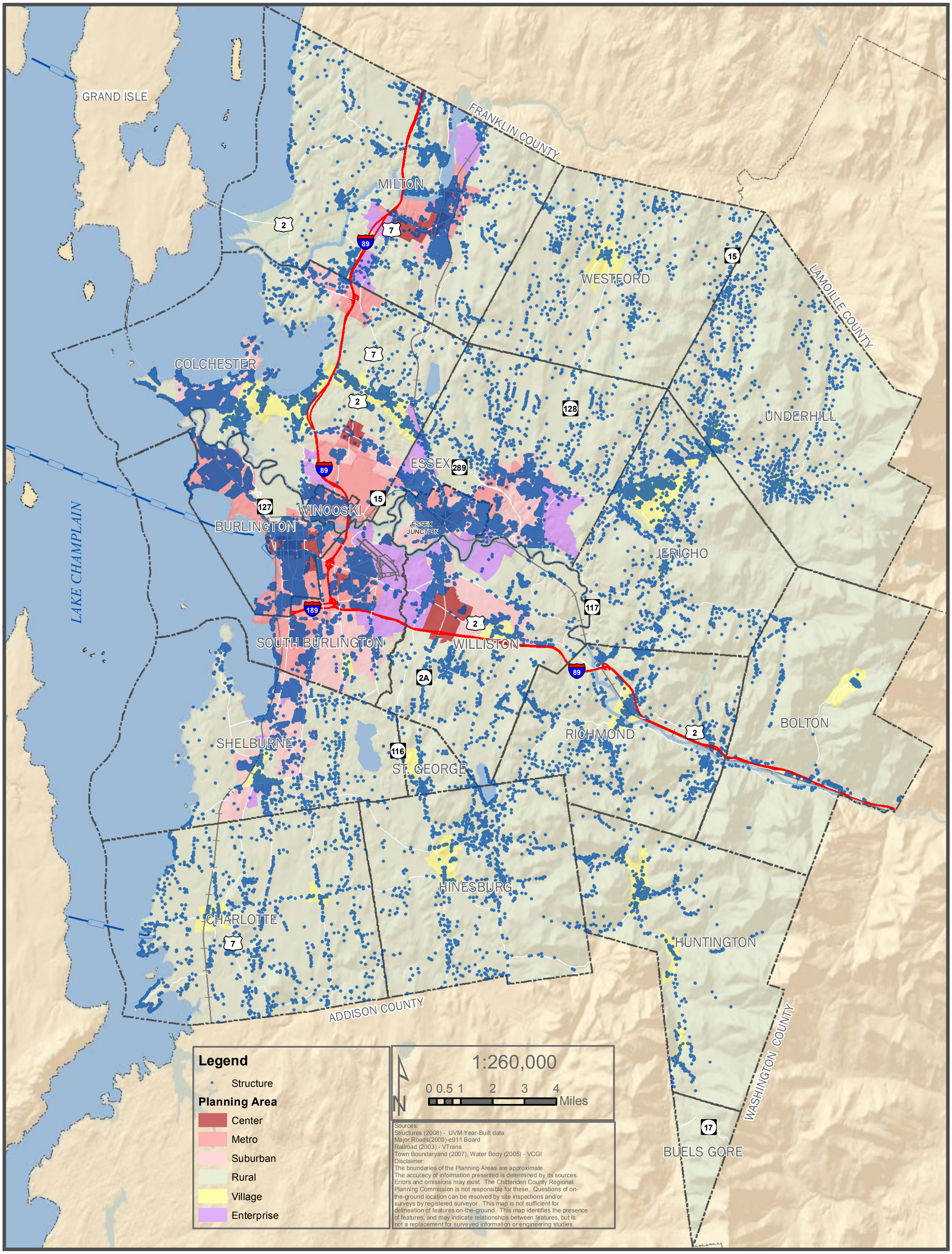
Note: Data used is best available. Not all structures in county are represented here.

Chittenden County Regional Planning Commission

September, 2011



Structures Built by 1990

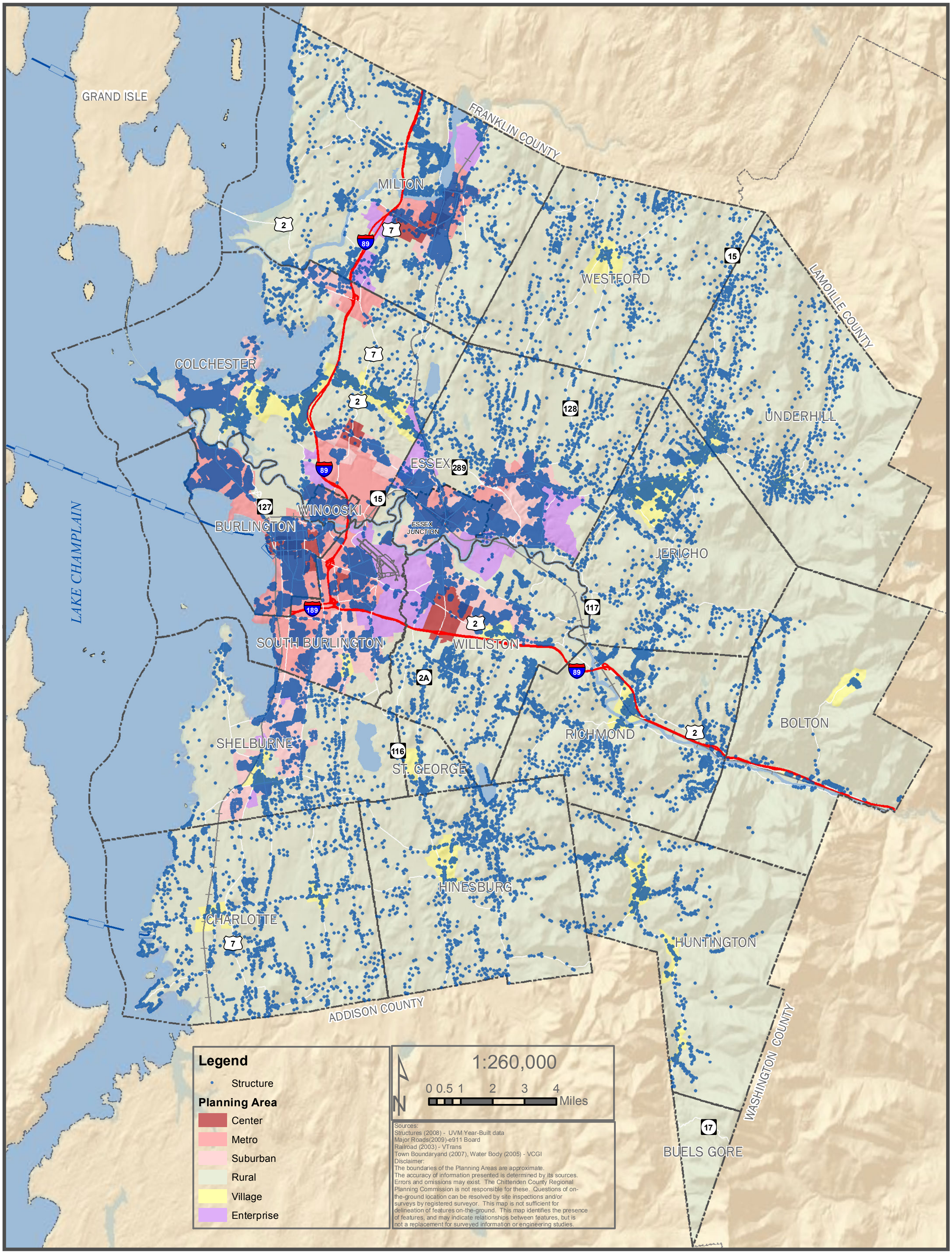
Chittenden County, Vermont

DRAFT

Note: Data used is best available. Not all structures in county are represented here.

Chittenden County Regional Planning Commission

September, 2011



Structures Built by 2005

Chittenden County, Vermont

DRAFT

Note: Data used is best available. Not all structures in county are represented here.

Chittenden County Regional Planning Commission

September, 2011

DRAFT 2035 ECOS Transportation Scenario Analysis Results				
November 11, 2011				
	Scenario			
Transportation Indicator[1]	**2005 Base**	**2035 Basic Transportation**	**2035 Energy Constrained**	**2035 Road Capacity**
Person Trips	784,442	1,088,703	1,084,137	1,088,744
Internal Trips	563,812	801,587	802,856	801,628
Vehicle Trips	582,308	803,338	735,360	803,431
Walk Trips	50,201	84,884	85,593	84,843
Bus Trips	7,087	7,178	34,780	7,081
Rail Trips	-	-	33,437	-
Percent of Trips Possible to Take Transit	46%	46%	61%	47%
Percent Auto Trips	93.1%	92.2%	86.8%	92.2%
Percent Walk Trips	6.0%	7.2%	7.4%	7.2%
Percent Bus Trips	0.9%	0.6%	3.0%	0.6%
Percent Rail Trips	-	-	2.9%	-
Avg Trip Distance (miles)	8.1	7.8	7.4	8.0
Avg Trip Time (minutes)	16.8	17.7	16.9	16.7
Total Vehicle Miles of Travel (VMT)	4,718,080	6,257,448	5,477,994	6,407,651
Total Vehicle Hours of Travel (VHT)	163,020	236,411	206,627	224,139
Total Vehicle Hours of Delay (VHD)	21,384	43,074	29,476	32,844
"Internal"[2] VMT	1,992,437	2,910,743	2,332,057	3,008,766
PM Peak Veh Trips	52,956	72,658	65,804	72,667
PM Peak VMT	426,276	562,224	481,715	574,467
PM Peak VHT	13,019	20,256	15,671	18,198
PM Peak VHD	3,216	7,119	4,471	5,230
PM Peak kg CO2	172,533	191,296	156,940	175,666
PM Peak kg CO2 per Capita	1.15	0.93	0.76	0.86

1 - All indicators are calculated from CCRPC's Regional Transportation Model based on Average Weekday Travel unless otherwise noted.

2 - Internal VMT is calculated as the sum of Home Based Work, Home Based Other, and Non Home Based Trips. Truck trips and trips to or from outside the county are not included in this measure.

G:\HUD Regional Sustainability Program\MPO work\20111111_2035_Scenarios_Summary_Stats.xlsx