CORNWALL TRANSPORTATION:

An Analysis of Current Structure and Possible Alternatives

Prepared by Mattie Ford, Ted Iobst, Shunsuke Kuwayama, & Tom Sullivan

with the help of Community Partner Andrew Hirsch

May 15, 2007

Special Thanks to: Jon Isham, Anne Knowles, and Cornwall School 5th & 6th grades

INTRODUCTION

Bingham Memorial School, located in Cornwall, Vermont, educates students in kindergarten through sixth grade, with a total student population of fewer than 100. As part of his curriculum, fifth and sixth grade teacher Andrew Hirsch has completed a unit on global climate change, educating his class on its causes and effects. Despite its small size, Cornwall School still contributes to climate change through carbon emissions and feels the impact of climate change through increased temperature and changing weather patterns. A significant source of carbon emissions from the school comes from transportation to and from school. Andrew brought this fact to the attention of Professor Jon Isham's Environmental Economics class in the hopes that students could assess the current transportation system for Cornwall School and explore possible alternatives that are ideally less environmentally damaging and less expensive than the current scenario.

Immediately after taking on the project, our group met with Andrew to speak further about his goals for the project. In speaking with Andrew, it became clear that currently, a majority of students are driven to school in personal vehicles. Only a small percentage of students, according to Andrew, ride the bus on a regular basis. Both the group members and Andrew saw clearly that alternatives, such as hybrid cars and carpooling could decrease both emissions and costs of transportation. Although the group thought their study would focus entirely on transportation to and from school, Andrew also noted that there is a large amount of commuting done from Cornwall to Middlebury for work, shopping, and other daily activities. Again, personal vehicles are used as the primary means of transport. As a result of Andrew's assessment, we also decided to address the transportation situation with regards to Cornwall-Middlebury transport. Before the conclusion of our meeting, Andrew also advised us to

investigate a bike path as an alternative method for both Cornwall School as well as Cornwall-Middlebury transportation, as the idea of a path has been supported by members of the community for a number of years.

DATA COLLECTION SURVEY

After meeting with Andrew and receiving a comprehensive overview of the current transportation situation as well as refining the goals of the project, we determined that our first step should be to design and distribute a survey to obtain specific information about the current individual transportation situations of Cornwall School families. We would then be able to aggregate the results to form an overall transportation picture to use as a baseline for comparison to possible alternatives.

In order to obtain the information necessary to calculate the carbon emissions of Cornwall School, we distributed a survey to each family asking them specific questions that would give us the required data. After meeting to discuss the different pieces of information we needed to make accurate calculations of the carbon emissions, we decided that the number of weekly trips for each student on the bus and by personal vehicle would be necessary information. If the students are driven to school, we needed to know how many miles to and from the school they are driven as well as what the make and model of the family's vehicle is. We also asked each family if they have any suggestions of alternative ways to get to school. It was our hope that the suggested alternatives would also be ones that would reduce carbon emissions. In addition to the questions regarding Cornwall School, the survey included another section that asked questions concerning traveling to and from the town of Middlebury. These questions were similar to the Cornwall School questions, but in reference to driving to Middlebury from

Cornwall. The questions asked for the model and year of each family's vehicle, the miles driven to and from Middlebury per week and suggestions for an alternative means of travel.

Once we finished creating the survey, we set a meeting with Andrew to visit the school and explain and distribute the survey to the students in his fifth and sixth grade class. While at the school, we met with Andrew's class, discussed our project with the students, and answered questions they had about climate change. The students were well-versed on the subject of climate change and understood the basics behind global warming, including the importance of emissions reductions. The students were very excited about learning more about our project and helping us in whatever way they could.

The results of our survey gave us a large sample of information with which we would be able to asses the current transportation scenario for Cornwall School. We created a template spreadsheet to facilitate dividing the surveys for data entry and eventually aggregated the information into a master sheet. After reviewing the data, we found that most of the students ride in a family vehicle to school. Remembering that several of Andrew's students expressed concern about the 45 minute bus ride to school, the trend seemed to make sense. It also appeared that some families were acutely aware of the problems inherent in the current transportation regime, as the most popular alternative suggestions included creating a bike path, carpooling, changing the bus route, and buying a more fuel- efficient car. For Cornwall-Middlebury travel, the alternative recommendations were largely the same, although carpooling was not as prevalent of a suggestion for logistical reasons.

CURRENT SITUATION

After compiling the data from the surveys, we began the construction of an "average family" from Cornwall School. We first calculated the total miles driven per week for each

family for Cornwall School and Cornwall-Middlebury trips, respectively, by multiplying the trip distance by the number of trips per week. We then determined the miles per gallon (MPG) for each family's vehicle.[1] We calculated the average miles per week related to Cornwall School and Cornwall-Middlebury trips, respectively, as well as an average MPG for all families to come up with an average family from Cornwall.

Once the average family was established, we could begin to determine the weekly cost for that family of the current transpiration arrangement for both Cornwall School trips and Cornwall-Middlebury trips (Figure 1). We determined the average gas price using historical prices from the last two years.[2] We made a distinction between Cornwall School gas prices and Cornwall-Middlebury gas prices, as the former did not include historical prices for the summer months. Because gas prices are higher in the summer, the Cornwall-Middlebury average gas prices are somewhat higher than those of Cornwall School trips. Using our previously calculated miles per gallon and miles driven, we were able to calculate the amount of gas used per week (in gallons) by the average family. The gas cost per week is simply the cost per gallon of fuel multiplied by the number of gallons used per week. In addition to gas costs, families also incur driving costs, also represented by depreciation of a vehicle. Given that a car depreciates in value $0.29 for each mile it is driven, the driving costs per week for the average family are simply the number of miles driven per week multiplied by 0.29.[3] The total weekly cost for the average family is the sum of the gas costs and the driving costs.

In addition to monetary costs, we also calculated the environmental costs of transportation. More specifically, we calculated the weekly carbon (CO_2) emissions for the average family, assuming each gallon of gasoline burned equates to 19.41 pounds of carbon

[1] www.fueleconomy.gov
[2] www.vermontgasprices.com
[3] www.commutesolutions.org

emissions.[4] Using inputs of weekly miles driven and vehicle MPG, we calculated the weekly CO_2 emissions for the average family.

It is important to note that weekly costs were calculated separately for Cornwall School and Cornwall-Middlebury transportation. We separated the cost calculations because different alternatives are available for each transportation arrangement. Therefore, when comparing alternatives to the current arrangements, it is more useful to have costs divided between Cornwall School and Cornwall-Middlebury arrangements within the current scenario.

Using the methodology outlined above, we calculated the current transportation situation for the average Cornwall School family. Consequently, the weekly per family cost of Cornwall School transportation is $14.49, while the monthly cost is $68.81 and the yearly cost is $753.72. The weekly per family cost of Cornwall-Middlebury transportation is $20.04, while the monthly cost is $86.82 and the yearly cost is $1,041.88. The average annual costs for the current situation of all travel are $4,822.20.

Our group also calculated the environmental impact of the current transportation situation. The average weekly CO_2 impact per family for Cornwall School travel is 28.51 pounds. The average weekly CO_2 impact per family for Cornwall-Middlebury travel is 37.83 pounds. The average annual CO_2 impact is 9,104.42.

ALTERNATIVES

For both the Cornwall School and Middlebury-Cornwall sections of the survey, families were asked to provide alternatives to their current transportation arrangements that would be more cost effective and possibly more environmentally friendly. Although carpooling and bussing were also suggested among the surveys collected, two proposals were suggested overwhelmingly: purchasing a fuel efficient or hybrid car and constructing a bike path.

[4] www.epa.gov

Fuel Efficient & Hybrid Cars

Many families suggested the alternative of purchasing a new car that is more fuel efficient that their current one. This may be due to the fact that changing the bussing schedule to accommodate all students' preferences in order to stimulate more bus ridership seems more difficult than simply changing a family's priorities the next time they purchase a new vehicle. Given the MPG of the average family vehicle of 25.22 MPG, families have a lot of room for improvement in fuel economy. The prevalence of more fuel efficient cars among suggested alternatives most likely confirms a realization of the inefficiency of current vehicles. For the purpose of our study, we analyzed two types of alternative vehicles for purchase: fuel efficient cars and hybrid cars. For purposes of definition, we consider a car to be fuel efficient if its average MPG is 30 MPG or greater and it is powered by a traditional gasoline engine.[5] Hybrid cars use gas/electric motors and also have a high average MPG. Hybrid cars that would not provide significant improvements in fuel economy over the current situation, such as several SUV models, were not included in the definition. For the purposes of the study, we used the Toyota Prius model as the definition of hybrid car because of its wide availability and good track record in the United States.

For both types of new cars, we calculated the initial cost of investment for each possible alternative as well as the savings of the alternative over the current situation. In determining the cost of a fuel efficient car to be $16,205, we made calculations based on the median MSRP of all cars that met the criteria for being fuel efficient (Figure 2). When determining the cost of the Prius hybrid, we used the MSRP from Toyota of $22,175. After determining the MSRPs for both new car alternatives, we deducted the trade-in value of the average family's car from the

[5] Average MPG=(2/3)City MPG + (1/3)Highway MPG

original price to get the investment required for the new vehicle.[6] The initial investment for a fuel efficient car is $7,250, while the initial investment for a hybrid car is $13,220. Each of these figures, however, does not include any considerations for the opportunity cost of the initial investment nor do they include considerations for the term of repayment. In order to account for these variables, we also determined the present discounted cost of a new car for all combinations of a 4 percent or 9 percent discount rate combined with a repayment term of 3, 5, or 10 years. We examined two distinct discount rates to represent one scenario where future benefits are emphasized and one where they are not. The 4 percent discount rate approximates the cost of investing in a car now as opposed to putting it in a savings account at the bank. The 9 percent discount rate approximates the cost of investing in a car now as opposed to investing in a less conservative medium, such as the stock market. The resulting present discounted costs range from a low of $8,155 to a high of $17,163 for the fuel efficient car and a low of $14,871 to a high of $31,297 for the hybrid car (Figure 3).

We consider the present discounted values for a 5 year repayment term with a discount rate of 4 percent to be the most realistic of all calculated present discounted values because we believe that population of Cornwall, located in rural Vermont, is more likely to put money it does not spend into a bank as opposed to into the stock market, despite current positive performance of the markets. We consider a 5 year repayment term to be most realistic because it is on the medium term. Under these conditions, the present discounted cost of the fuel efficient car is $8,820 and the present discounted cost of the Prius hybrid is $16,084. With the hybrid's present discounted cost nearly double that of the median fuel efficient car; it is clear that in terms of initial investment cost, the fuel efficient car presents itself as the most cost-effective alternative to the current situation.

[6] www.kbb.com

In addition to determining overall cost of the initial investment in an alternative vehicle, we also calculated the weekly cost savings of driving a fuel efficient or hybrid vehicle as opposed to the current vehicle of the average family (Figure 4). Using the average MPG for a fuel efficient car, 32.33 MPG, the average family will have a calculated weekly savings of just less than one dollar for Cornwall School trips and a calculated weekly savings of $1.17 for Cornwall-Middlebury trips. For overall annual travel, the average family will save about $230 dollars per year by using a fuel efficient car instead of their current vehicle. Using the MPG of the Prius hybrid, 57 MPG, the average family will have a calculated weekly savings of $2.08 for Cornwall School trips and a calculated weekly savings of $3.28 for Cornwall-Middlebury trips. For overall annual travel, the average family will save just less than $700 per year by using a Prius hybrid instead of their current vehicle. It is clear from the calculated savings that both alternative vehicles result in a significant annual savings. However, because Cornwall School trips and Cornwall-Middlebury trips account for only 16% and 22% of all weekly travel, respectively, the savings accrued for these specific trips does not appear significant when looked at on a weekly basis. However, when considered on monthly and yearly levels, the savings from just these two areas of overall travel does appear significant. It is clear that the Prius hybrid results in more weekly and annual savings for the average family than the fuel efficient alternative, as the annual savings of a Prius is well over twice as large as the annual savings of the fuel efficient car.

In addition to saving the average family money, alternative vehicles also reduce the carbon emissions of the average family. The average family's carbon emissions drop to 22 pounds per week for Cornwall School trips and 30 pounds per week for Cornwall-Middlebury trips when using a fuel efficient vehicle. The average family's carbon emissions drop to 13

pounds per week for Cornwall School trips and 17 pounds per week for Cornwall-Middlebury trips when using a Prius hybrid. The average family's annual vehicular carbon emissions are reduced 22% by using a fuel efficient vehicle and are reduced 56% by using a Prius hybrid. With respect to carbon emissions reductions, the Prius hybrid sets itself apart from fuel efficient, gas-powered vehicles by reducing annual vehicular carbon emissions by almost three times as much as a fuel efficient, gas-powered vehicle would.

In short, alternative vehicles were widely supported among surveyed families, and purchasing a fuel efficient or hybrid vehicle seems to be an option for reducing the monetary and environmental costs of transportation. When compared to the median fuel efficient vehicle, the Prius hybrid's initial cost of investment is almost double that of the median fuel efficient vehicle. However, the annual savings from using a hybrid vehicle as well as the annual reduction of carbon emissions from using a hybrid vehicle certainly provide a substantial monetary and social return on the initial investment in a new vehicle.

Bike Path

The survey results indicated that in addition to a change in personal vehicle type, Cornwall residents are also receptive to the construction of a bike path as an alternative to the current transportation situation. In order to explore the bike path alternative, we approached Anne Knowles, a professor in Middlebury's geography department and Cornwall resident. She, along with as other members of the community has been actively exploring options for various bike paths that would provide alternatives for Cornwall and surrounding communities. In meeting with Anne, we discovered that a comprehensive feasibility study had already been carried out over the past few years. She provided us with the *Town of Cornwall- Bicycle and Pedestrian Planning and Feasibility Study,* which documents seven bike path options (labeled

Alternative A through Alternative G) and the costs and benefits associated with each (Figure 5). The study also includes maps and itemized cost lists for each of the different bike paths. All bike path options involve Cornwall-Middlebury transportation, with some paths leaving Cornwall via Route 125 and others via Route 30. Alternative C proposes a pathway that will bring the pedestrians from Cornwall to Route 30 near Middlebury via Morse Road. This particular alternative is one which avoids major roads like Route 30 and provides a safe, non-road route to Middlebury. However, it cuts through private farmland, and construction would be costly, as the low-lying area would have to be built up. Alternative F also provides some safety for riders, as it is a shared pathway parallel to Route 125 from Cornwall to Middlebury. However, the path would require extra maintenance during the winter and would expose Middlebury College to a large amount of liability, as the study views the college as a primary sponsor of the alternative.

After consulting Anne and examining the feasibility study more closely, Alternative A presents itself as one that could be most easily implemented and also one that serves a direct focus of our study: Cornwall-Middlebury transportation (Figure 6). Alternative A involves the construction of a four foot wide bike lane on both sides of Route 30 along the 2.6 mile stretch from Cornwall to Middlebury. The lanes would require no private maintenance, as the state of Vermont would complete bike lane maintenance along with other roadway repairs. Construction of the lanes would not involve building on private property or low-lying areas, thus, eliminating much of the "red tape" inherent in other alternatives. Additionally, if Middlebury College were to fund the project, the college would not bear any liability. Despite its advantages, Alternative A does not provide the safety that other alternatives do, as it is not separated from the roadway. Additionally, Alternative A is the most expensive of all alternatives presented in the feasibility study, and the timetable for commencement of construction would depend greatly on when the

2.6 mile stretch of road is scheduled to be resurfaced. Nevertheless, according to Anne and the feasibility study, Alternative A stands the best chance of all alternatives of actually being carried out.

Although the feasibility study presents the initial costs of investment for Alternative A, it does not utilize any type of discount rate in its calculations. The total cost of construction for Alternative A is $2,163,000. The majority of the cost comes from construction, which includes a 15% contingency estimate (Figure 7). In discounting the initial investment required for Alternative A, we calculated the present discounted value (PDV) for the total construction cost four different repayment terms (5 years, 10 years, 25 years, and 50 years) and two different discount rates (4 percent and 9 percent) (Figure 8). As we did with discounting alternative personal vehicles, the discount rate of 4 percent represents a lower opportunity cost for the initial investment than the 9 percent rate does.

For the purpose of estimating the actual PDV for the Cornwall community, we believe a 25 year repayment term to be a realistic estimate. A 25 year term allows for costs to be defrayed over many years, but also provides the generation from whom the investment is mobilized to see their investment become paid for in full. Determining the most realistic discount rate depends upon who the primary provider of the investment funding is. If average individuals or public entities provide the funding, the 4 percent discount rate would be most applicable, as those sources are most likely to invest their money in a savings account or in low-risk investments like bonds. If wealthy individuals provide the funding, then perhaps a 9 percent rate would be more applicable. However, in the case of Cornwall, we believe the 4 percent rate is more realistic than the 9 percent rate. Under a 25 year repayment term and a 4 percent discount rate, present discounted cost for Alternative A is $5,766,203.99.

In addition to spelling out alternatives, the feasibility study also provides information about possible funding solutions. Each bike path described in the feasibility study can possibly receive funding from the Scenic Byway Program and the VTrans Enhancements Program, as well as private donors. The Scenic Byway Program has funds that will help construct projects to improve the access or aesthetics within a one mile corridor of designated routes. All of the alternative bike paths along Route 30 qualify for this type of funding. The Enhancements Program distributes federal grants and will consider any bike or pedestrian system for them. However, this program will typically favor paths that are off the main road and have the consent of the impacted property owners. Therefore, it would not apply to Alternative A. Finally, private donors for the bike path include Middlebury College, the Town of Middlebury, and interested landowners.

In an attempt to construct a bike path, funding would have to come from various sources, as the feasibility study and Anne believe one-source funding is unrealistic due to the high initial cost of investment. Multiple-source funding would create difficulty in coordinating efforts to secure the amount of money needed to construct Alternative A. Given the present discounted cost of over $5.75 million, it will be hard to justify allocating such a large amount of money on a bike path that is not the safest alternative and that will only be built at the state of Vermont's discretion.

Although Alternative A is the most supported by the feasibility study and seems the easiest to put in place, its initial costs as well as present discounted cost are the highest of all alternatives. It will be hard to convince individual investors to invest in an alternative with such high costs relative to the final product, as the per-mile cost equates to over $800,000 per mile, undiscounted. Although the construction of a bike path receives overwhelming support from

Cornwall residents, the social benefits do not seem to outweigh the tremendous economic costs of investment.

CONCLUSIONS

Given the survey data from our study, it is clear that the residents of Cornwall are actively considering alternatives to their current transportation situation. Based on suggested alternatives to the heavy reliance on personal vehicles currently seen in the town, two popular alternatives set themselves apart from the others: purchasing a fuel efficient or hybrid vehicle and constructing a bike path. Unfortunately, neither of the two alternatives is achievable without significant initial costs. Although the alternatives have significant initial costs in common, they represent alternative approaches from to different levels of investment.

The alternative vehicle approach illustrates a significant individual investment. Although the initial costs of investment in a more efficient personal vehicle, even when discounted, are relatively low when compared to the initial investment in a bike path, the fact that one family will have to make the entire initial investment still prevents some families from having the option of immediately purchasing an alternative personal vehicle. However, given that the cost of a fuel efficient car and even some of the most inexpensive hybrids is comparable to a moderately priced conventional vehicle, we see purchasing an alternative vehicle as the most likely scenario for families to reduce their weekly cost of driving as well as their emissions.

In terms of the environment, the hybrid options provide more than twice as much CO_2 reduction as their fuel efficient counterparts. In order to ensure environmental benefits from alternative vehicles and not just monetary ones, some incentive must be created in order to ensure that families choose a hybrid car over a fuel efficient one, as the median fuel efficient car creates a modest amount of weekly savings in addition to requiring a significantly smaller initial

investment than a hybrid one. Perhaps a subsidy or tax credit for purchasing a hybrid car rather than a conventional or fuel efficient one would ensure that families choose the most environmentally friendly option. Simply taxing fuel would not suffice, for families would still see a monetary savings over the current situation from purchasing a fuel efficient car and might actually see greater savings under a high gasoline tax.

The bike path alternative, unlike the fuel efficient and hybrid vehicle alternative, requires a significant initial investment made by a group. The majority of potential sources of initial investment for the bike path, including VTrans Enhancement Program and private sources, would not be able to fund the entire project on their own. A well-organized, collaborative fundraising effort by Cornwall citizens to mobilize investor groups would be required for any bike path alternative to come to fruition. In contrast to a family's decision to purchase a fuel efficient or hybrid vehicle when the time comes, such an effort seems relatively difficult to accomplish. In addition to coordination problems, the funding itself has not been guaranteed by all groups. Furthermore, despite the advocacy by ESPC and our recommendations for Alternative A to receive priority consideration, it is still possible that another alternative could become an individual investor's "pet project," resulting in further delays and costs in achieving a Cornwall School and Cornwall-Middlebury transportation alternative.

It is also important to note the option of school bussing. Although not explored in detail in our study due to lack of support from surveyed families, bussing does also seem to be a simple option for reducing costs and environmental impact of Cornwall School transportation. If a family is unwilling or unable to purchase a new car, they can still save money and reduce their emissions by putting their child on a bus instead of driving them in their personal vehicle. Although the bus schedule seems to be the primary deterrent to riding the bus, the possibility

remains that a family will encourage its children get up earlier and ride the bus after seeing the cost savings available from riding the bus. In fact, riding the bus is the simplest alternative to the current transportation scenario for Cornwall School trips. However it is also one of the least popular as well.

In short, purchasing a fuel efficient or hybrid vehicle presents itself as the most attractive alternative because the decision to pursue an alternative personal vehicle is made on the individual level and does not require collective action. Despite its initial investment requirements, there is a better chance of such an alternative actually producing the desired results: reduction of driving costs and reduction of carbon emissions. Additionally, because we have constructed an "average family" from Cornwall, individual families will be able to estimate with a fair deal of accuracy the amount of savings they will receive from purchasing an alternative personal vehicle. The savings from a bike path is not as definitive or quantifiable. Although our study does not encourage the construction of a bike path, the study does not conclude that the citizens of Cornwall will not obtain funding and construct one. The results simply indicate that construction will be very costly. Notwithstanding our recommendation, the decision regarding alternatives to the current transportation situation in Cornwall will ultimately lie in the hands of its residents.

Figure 1: Current Transportation Situation

Current Situation

To and From School:	**Assumptions**		gas cost	driving cost	total weekly cost	total monthly cost	total annual cost
(weekly statistics)	Average MPG	25.22	$3.75	$10.75	$14.49	$62.81	$753.72
	Average Gas Price	2.55					
	Average Gallons Used	1.47					
	Average Miles Driven (weekly)	37.06					
	Depreciation Rate	$0.29					
	% of Weekly Travel	16.06%					
	Average weekly C02/family (lbs.)	28.51					
	Average monthly C02/family (lbs.)	123.53					
	Average annual C02/family (lbs.)	1482.40					

To and From Middlebury:	**Assumptions**		gas cost	driving cost	total weekly cost	total monthly cost	total annual cost
(weekly statistics)	Average MPG	25.57	$5.58	$14.46	$20.04	$86.82	$1,041.88
	Average Gas Price	2.86					
	Average Gallons Used	1.95					
	Average Miles Driven (weekly)	49.86					
	Depreciation Rate	$0.29					
	% of Weekly Travel	21.61%					
	Average weekly C02/family (lbs.)	37.83					
	Average monthly C02/family (lbs.)	163.93					
	Average annual C02/family (lbs.)	1967.10					

Average Annual Travel:	**Assumptions**		gas cost	driving cost			total annual cost
(annual statistics)	Average MPG	25.57	$1,342.20	$3,480.00			$4,822.20
	Average Gas Price	2.86					
	Average Gallons Used	469.30					
	Average Miles Driven (annually)	12000					
	Depreciation Rate	$0.29					
	Average weekly C02/family (lbs.)	175.08					
	Average monthly C02/family (lbs.)	758.70					
	Average annual C02/family (lbs.)	9104.42					

Figure 2: Hybrid Calculations

Make	Model	MPG City	MPG Highway	MSRP	Weighted MPG	Hybrid?	Annual Fuel Cost
BMW	Cooper	30	37	18700	32.33		1295
Chevy	Aveo	27	37	10560	30.33		1324
Ford	Escape 2wd	36	31	25740	34.33	H	1169
Ford	Focus	27	37	14130	30.33		1284
Honda	Civic	50	50	22600	50.00	H	795
Honda	Accord	30	37	31090	32.33	H	1284
Honda	Civic	30	40	16205	33.33		1204
Honda	Fit	33	38	14445	34.67		1137
Hyundai	Accent	32	35	10995	33.00		1204
Hyundai	Elantra	28	36	13994	30.67		1284
Kia	Rio	32	35	14330	33.00		1240
Mazda	3	28	35	18275	30.33		1284
Mercury	Mariner	33	29	26430	31.67	H	1284
Nissan	Altima	42	36	25025	40.00	H	1018
Nissan	Sentra	29	36	16175	31.33		1240
Nissan	Versa	30	34	13175	31.33		1240
Pontiac	Vibe	30	36	17345	32.00		1204
Toyota	Prius	60	51	22175	57.00	H	723
Toyota	Camry	43	37	26200	41.00	H	1018
Toyota	Highlander 2wd	33	28	32490	31.33	H	1371
Toyota	Yaris	34	40	11770	36.00		1073
Toyota	Carolla	32	41	14925	35.00		1105
Toyota	Matrix	30	36	16030	32.00		1240
Averages		33.869565	37.04347826	18817.57	34.93		1174.783
Medians		32	36	16205	32.33333333		1240

Figure 3: Alternative Personal Vehicles Discounted Costs

	Median Fuel Economy Car	Toyota Prius
MSRP:	$16,205.00	$22,175.00
Median Trade-in Value (current car):	$8,955.00	$8,955.00
Weekly Savings:	$0.83	$2.09
Yearly Savings:	$29.88	$75.24
Monthly Savings:	$2.49	$6.27
Investment In New Vehicle:	$7,250.00	$13,220.00
Discount Rate:	4.0%	4.0%
Payment Plan (Years):	3	3
Present Discounted Cost:	$8,155.26	$14,870.70

	Median Fuel Economy Car	Toyota Prius
MSRP:	$16,205.00	$22,175.00
Median Trade-in Value (current car):	$8,955.00	$8,955.00
Weekly Savings:	$0.83	$2.09
Yearly Savings:	$29.88	$75.24
Monthly Savings:	$2.49	$6.27
Investment In New Vehicle:	$7,250.00	$13,220.00
Discount Rate:	9.0%	9.0%
Payment Plan (Years):	3	3
Present Discounted Cost:	$9,388.96	$17,120.28

	Median Fuel Economy Car	Toyota Prius
MSRP:	$16,205.00	$22,175.00
Median Trade-in Value (current car):	$8,955.00	$8,955.00
Weekly Savings:	$0.83	$2.09
Yearly Savings:	$29.88	$75.24
Monthly Savings:	$2.49	$6.27
Investment In New Vehicle:	$7,250.00	$13,220.00
Discount Rate:	4.0%	4.0%
Payment Plan (Years):	5	5
Present Discounted Cost:	$8,820.73	$16,084.15

	Median Fuel Economy Car	Toyota Prius
MSRP:	$16,205.00	$22,175.00
Median Trade-in Value (current car):	$8,955.00	$8,955.00
Weekly Savings:	$0.83	$2.09
Yearly Savings:	$29.88	$75.24
Monthly Savings:	$2.49	$6.27
Investment In New Vehicle:	$7,250.00	$13,220.00
Discount Rate:	9.0%	9.0%
Payment Plan (Years):	5	5
Present Discounted Cost:	$11,155.02	$20,340.61

	Median Fuel Economy Car	Toyota Prius
MSRP:	$16,205.00	$22,175.00
Median Trade-in Value (current car):	$8,955.00	$8,955.00
Weekly Savings:	$0.83	$2.09
Yearly Savings:	$29.88	$75.24
Monthly Savings:	$2.49	$6.27
Investment In New Vehicle:	$7,250.00	$13,220.00
Discount Rate:	4.0%	4.0%
Payment Plan (Years):	10	10
Present Discounted Cost:	$10,731.77	$19,568.83

	Median Fuel Economy Car	Toyota Prius
MSRP:	$16,205.00	$22,175.00
Median Trade-in Value (current car):	$8,955.00	$8,955.00
Weekly Savings:	$0.83	$2.09
Yearly Savings:	$29.88	$75.24
Monthly Savings:	$2.49	$6.27
Investment In New Vehicle:	$7,250.00	$13,220.00
Discount Rate:	9.0%	9.0%
Payment Plan (Years):	10	10
Present Discounted Cost:	$17,163.39	$31,296.55

Figure 4: Alternative Personal Vehicles Savings

Fuel Economy Car

			gas cost	driving cost	total cost	savings
To And From School:	**Assumptions**					
	Average MPG	32.33	$2.92	$10.75	$13.67	$0.82
	Average Gas Price	2.55				
	Average Gallons Used	1.15				
	Average Miles Driven	37.06				
	Depreciation Rate	$0.29				
	% of Weekly Travel	16.06%				
	Average weekly C02/family (lbs.)	22.24				
	CO2 reduction (%)	22%				
To and From Middlebury:	**Assumptions**					
	Average MPG	32.33	$4.41	$14.46	$18.87	$1.17
	Average Gas Price	2.86				
	Average Gallons Used	1.54				
	Average Miles Driven	49.86				
	Depreciation Rate	$0.29				
	% of Weekly Travel	21.61%				
	Average weekly C02/family (lbs.)	29.92				
	CO2 reduction (%)	21%				
Average Yearly Travel:	**Assumptions**					
	Average MPG	32.33	$1,061.55	$3,480.00	$4,541.55	$232.65
	Average Gas Price	2.86				
	Average Gallons Used	371.17				
	Average Miles Driven	12000				
	Depreciation Rate	$0.29				
	Average yearly C02/family (lbs.)	7200.74				
	Average weekly C02/family (lbs.)	138.48				
	CO2 reduction (%)	21%				

Toyota Prius

			gas cost	driving cost	total cost	savings
To And From School:	**Assumptions**					
	Average MPG	57	$1.66	$10.75	$12.41	$2.08
	Average Gas Price	2.55				
	Average Gallons Used	0.65				
	Average Miles Driven	37.06				
	Depreciation Rate	$0.29				
	% of Weekly Travel	16.06%				
	Average weekly C02/family (lbs.)	12.61				
	CO2 reduction (%)	56%				
To and From Middlebury:	**Assumptions**					
	Average MPG	57	$2.50	$14.46	$16.96	$3.08
	Average Gas Price	2.86				
	Average Gallons Used	0.87				
	Average Miles Driven	49.86				
	Depreciation Rate	$0.29				
	% of Weekly Travel	21.61%				
	Average weekly C02/family (lbs.)	16.97				
	CO2 reduction (%)	55%				
Average Yearly Travel:	**Assumptions**					
	Average MPG	57	$602.11	$3,480.00	$4,082.11	$692.09
	Average Gas Price	2.86				
	Average Gallons Used	210.53				
	Average Miles Driven	12000				
	Depreciation Rate	$0.29				
	Average yearly C02/family (lbs.)	4084.21				
	Average weekly C02/family (lbs.)	78.54				
	CO2 reduction (%)	55%				

FIGURE 5: Bike Path Alternatives Map

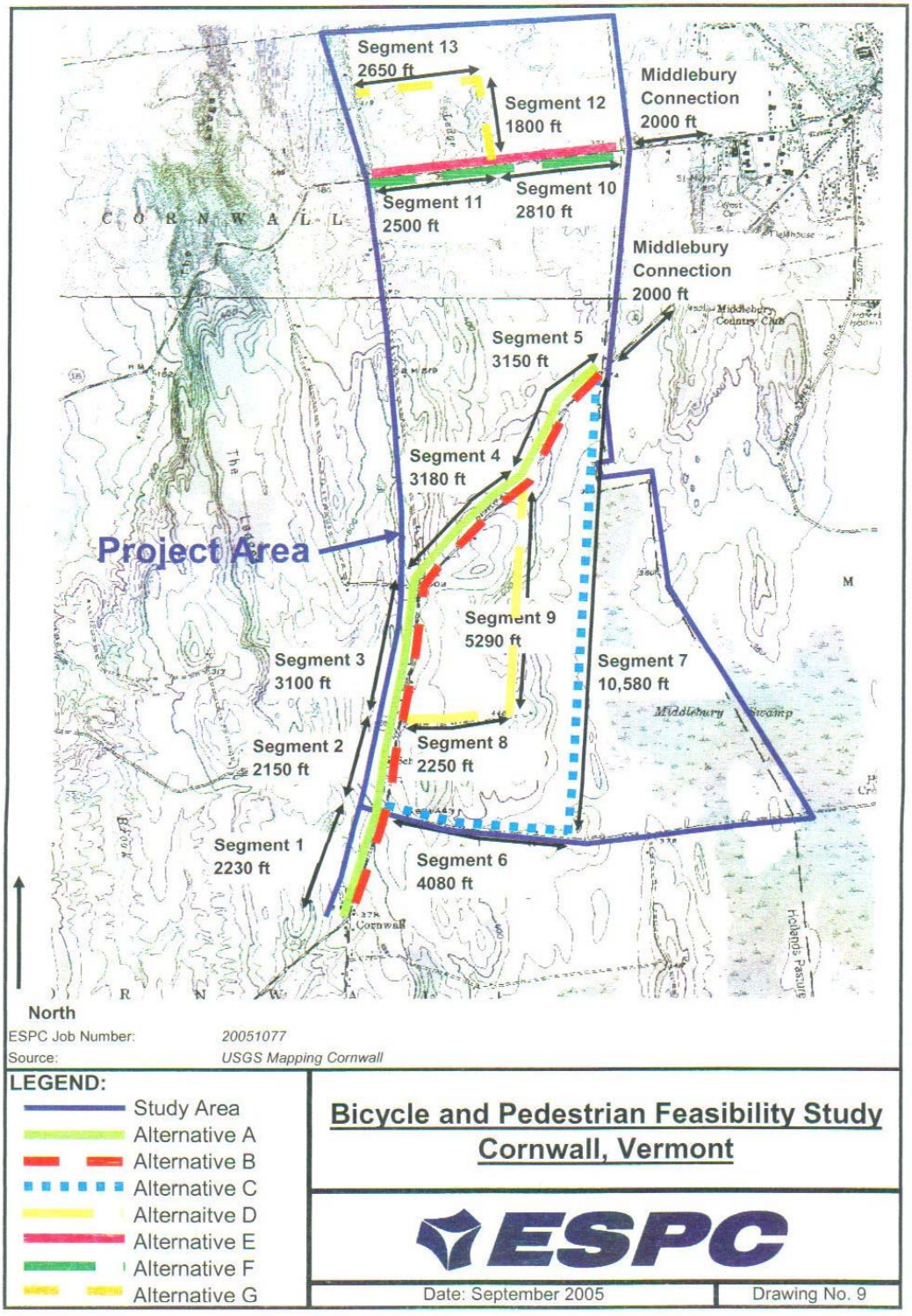

FIGURE 6: Bike Path "Alternative A" Explanation

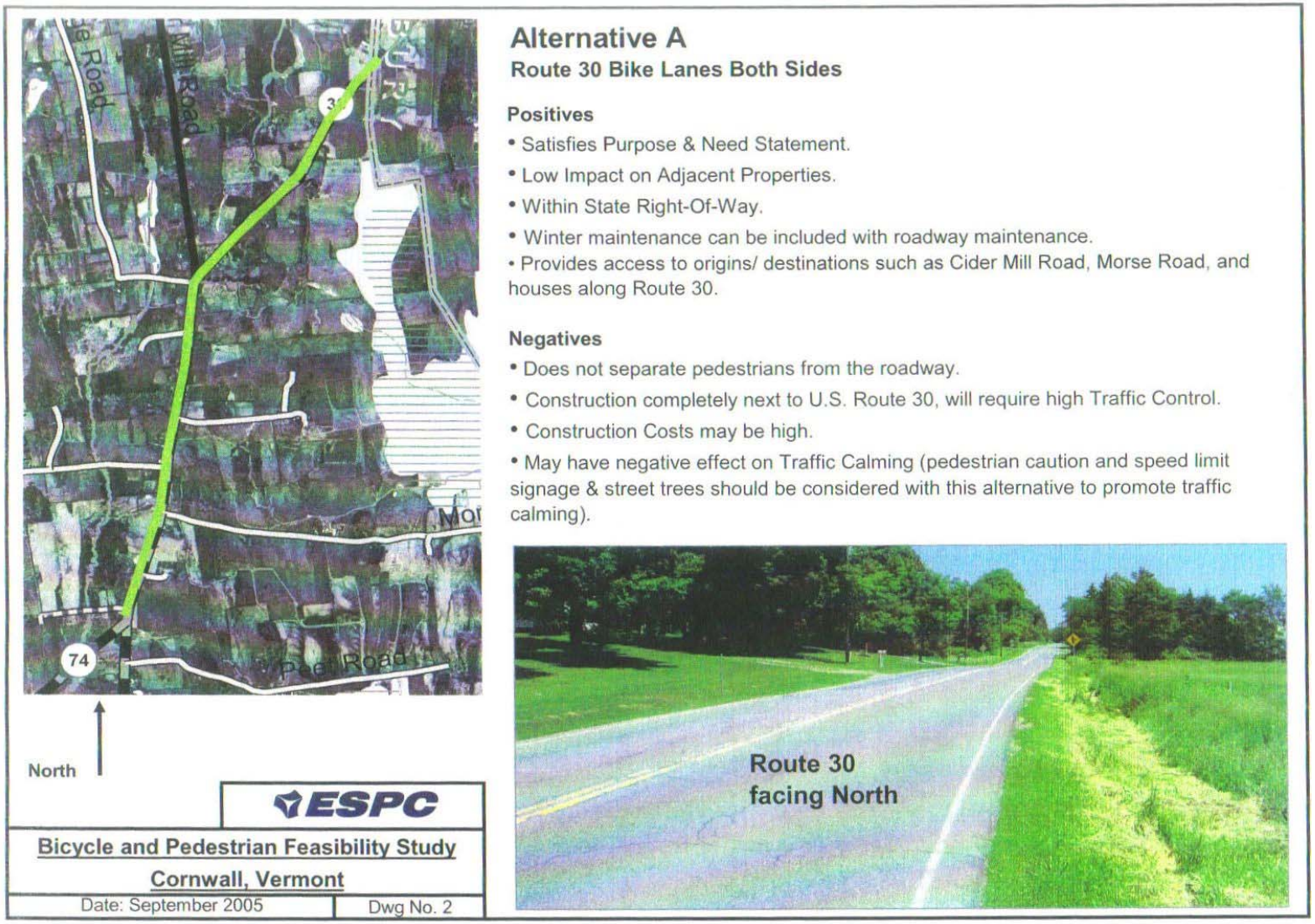

Figure 7: Alternative A Cost Breakdown

Construction	15% contingency		$1,545,000
Engineering		20%	$309,000
Municipal Manager		10%	$154,500
Contruction Inspection		10%	$154,500
TOTAL COST			**$2,163,000**

FIGURE 8: Bike Path Discounted Costs

Cost of Path (Alternative A):	$2,163,000.00	Cost of Path (Alternative A):	$2,163,000.00
Discount Rate:	4.0%	Discount Rate:	9.0%
Years of Repayment:	5	Years of Repayment:	5
Discounted Cost:	$2,631,620.23	Discounted Cost:	$3,328,043.61

Cost of Path (Alternative A):	$2,163,000.00	Cost of Path (Alternative A):	$2,163,000.00
Discount Rate:	4.0%	Discount Rate:	9.0%
Years of Repayment:	10	Years of Repayment:	10
Discounted Cost:	$3,201,768.39	Discounted Cost:	$5,120,607.63

Cost of Path (Alternative A):	$2,163,000.00	Cost of Path (Alternative A):	$2,163,000.00
Discount Rate:	4.0%	Discount Rate:	9.0%
Years of Repayment:	25	Years of Repayment:	25
Discounted Cost:	$5,766,203.99	Discounted Cost:	$18,651,723.47

Cost of Path (Alternative A):	$2,163,000.00	Cost of Path (Alternative A):	$2,163,000.00
Discount Rate:	4.0%	Discount Rate:	9.0%
Years of Repayment:	50	Years of Repayment:	50
Discounted Cost:	$15,371,756.08	Discounted Cost:	$160,835,315.92