HIGHWAY TRANSPORTATION MANAGEMENT PLAN

FOR ESSEX

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PREFACE

The information for this report was first collected and reported in a bound version entitled "Highway Transportation Plan for the Town of Essex" dated 1991. Portions of the study were updated in subsequent years - 1993, 1997, 1998, 2001, 2005 and 2009 to include additions of new roads, changes in road conditions and revisions to the priority for repairs based on continuing road evaluations. The technical basis for the road evaluations and analysis has remained consistent in methodology since the initial work reported in 1991.

During the time frame from 2009 until the date of this report, new roads have been added and many of the highest priority roads identified for repairs corrected. Other roads have continued to decline in terms of condition and roughness; traffic volume has remained fairly consistent on most of the streets, with the exception of the limited access and arterial roadways.

This report represents an update of the 2009 study. Some portions, such as functional road definitions have not changed. However, the database used for analysis is current and includes a section-by-section analysis of all roads within the Town. The total road mileage in 1990 was 85.103 miles; in 2001, it was 97.392 miles; in 2009 it was 100.327 miles and in 2014, it is 101.142 miles. The rate of road mileage increase has slowed considerably from 14% between 1990 and 2001 to less than 1% between 2009 and 2014, as the pace of new development within the community has decreased.

An update to the Town's Highway Transportation Plan is required by VTRANS every three years to obtain the maximum State participation on highway grants.

I. INTRODUCTION

The quick, efficient and safe movement of people, goods and services both within and between communities requires a supporting transportation infrastructure. For some modes of transportation - walking, bicycling, train service - alternative facilities to roads such as trails, sidewalks and paths are generally needed. However, the majority of travel for pleasure and business purposes currently relies on a highway network to accommodate the movement. Public transit and car / van pools represent viable alternatives to reduce congestion and increase the number of people transported, but their use presupposes the existence of roads to handle the vehicles and passengers. Public highways will continue to be the primary method of transportation for the foreseeable future in Essex. The challenge facing the community is to not only develop the alternative transportation infrastructure, but to also maximize the potential of existing highway facilities and accomplish both within the constraints of limited financial resources.

II. FUNCTIONAL CLASSIFICATION SYSTEMS

A proven method to accomplish better allocation of scarce resources and provide for improved road transportation services is the development and use of a functional road classification system. Studies by the Institute of Transportation Engineers (ITE)***1** and the American Association of State Highway Transportation Officials (ASSHTO)***2** have recognized that road travel can be separated into a hierarchy of movement, with **access** being at one end of the scale and **movement** at the other.

One example of a road meant principally for access would be a cul-de-sac. Conversely, a limited access highway or expressway represents a facility built primarily for movement with little or no local access. There is a general gradation in function from access to movement and the "...efficiency and safe operation of the system requires that specific facilities be designed to serve a specific purpose within this spectrum."[*3] Conflicts and congestion occur when roads and intersections designed for one function are used for other functions.

Functional classification standards have been established and recognized nationally. In the following sections, a functional road classification system is recognized, with a description of classes and identification of specific existing roads within each category. Over time, a few streets may change functional classification due to construction of adjacent roads, but generally the classification will not change. It is important to note again that function controls the classification and not necessarily such issues as traffic counts, existing condition, type of road surface or political designation.

III. FUNCTIONAL CLASS OF ROADS IN ESSEX

A total of five functional classes have been designated including: Limited Access (Expressway), Major (Arterial) with two subclasses (Primary for State and Secondary for Town highways), Collector, Minor (Local) and Unimproved roads. A description and current list of roads in each class is provided on subsequent pages of this study. The total road miles in the Town of Essex, including State Highways and Class IV roads, is 101.142 miles as of January 2014.

It should be noted that the Town's functional classes differ from the State Highway classification system. The road classes established under Chapter 3, Title 19, Section 302 of the Vermont State Statutes are primarily for the purpose of receiving State aid. The defined State classes in law are:

"Class 1 Town highways are those town highways which form the extension of a state highway route and which carry a state highway route number."*4

"Class 2 Town highways are those town highways selected as the most important highways in each town. As far as practicable, they shall be selected with the purpose of securing trunk lines of improved highways from town to town and to places which by their nature have more than the normal amount of traffic."*4

"Class 3 town highways are all traveled town highways other than Class 1 or 2 highways." "…The minimum standards for class 3 highways are a highway negotiable under normal conditions all seasons of the year by a standard manufactured pleasure car."*4

"Class 4 town highways are all other town highways."*4

The Town currently has no Class I Town highways, eight Class 2, and the majority Class 3, with only a limited number of Class 4. The mileage under each class for 2013 is: State highway = 22.312 miles, Class 1 = 0, Class 2 = 10.830 miles, Class 3 = 64.60 miles, Class 4 = 3.40 miles for a total of 101.142 miles.

In effect, each road in Essex has a dual designation - a functional class for Town highway planning purposes and a state-aid class for State funding.

As a note of explanation, there are data columns which provide traffic information in the tables that list the roads included within each classification. In the 1990 study, an analysis was performed which provided a method to categorize average daily traffic volume within 5 ranges -- from low to high. The following table provides the basis for the traffic volume classification. This system of volume characterization remains as the same basis in the current plan.

TRAFFIC VOLUMES IN ESSEX

Road Volume	Unpaved	Paved
low	0 to 100	0 to 161
low-moderate	101 - 300	162 - 554
moderate	301 - 600	555 - 3069
moderate - high	601 - 715	3070 - 6830
high	716 & higher	6831 & higher

The road volume is listed as being low, low-moderate, moderate, moderate-high or high. It is very important to note that the range for gravel roads has been set differently than the range of paved roads. The table is based upon a cumulative frequency distribution analysis of roads where traffic counts were available or where accurate estimates could be made.
Because the analysis programs run separately for gravel and paved roads, this choice of values for traffic volume is appropriate and does not lead to erroneous results.

Limited Access (Expressway) Roads

The primary purpose of a limited access highway is movement with emphasis on higher speeds (generally 45 to 55 mph), prohibition of parking, substantial distance between intersections and limited or no access rights by individuals. The designation of such a roadway must be in accord with Chapter 17 of Title 19 of the Vermont State Statutes.

Under the law, a limited access highway is defined as "... a highway or street over, from, or to which owners, or occupants of abutting land, or any other person have no right, or easement, or only a limited right, or easement, of access, light, air or view by reason of the fact that their

property abuts upon the limited access facility or for any other reason."*5

The only roads to be so designated in Essex are the Circumferential Highway from VT 117 to VT2A and the Susie Wilson Road Bypass, extending from Kellogg Road to VT2A.

TABLE 1 - LIMITED ACCESS (EXPRESSWAY)

Name of Road	Length (miles)	Current Average Daily Traffic (ADT) and Volume Classification
VT289 (Circumferential Highway – State)	7.463 (including all ramps)	16,000 between VT15 and VT2A (2009); 5,000 between VT15 and VT117 (2008): 6900 between VT15 and Essex Way (2005) High
Susie Wilson Bypass (Town)	.77 (classified as Class 2 for State aid)	15,000 (2010) High

Total 8.233 miles

Percent of Total Essex Mileage = 8.1 %

Note: In 1990, the percentage was 3%; in 2009 the percentage was 8.2%. The significant increase was due to the completion of the Circumferential Highway.

Major (Arterial) Highways

The Subdivision Regulations define a major road as " . . . a street which is being used or will be used primarily as a street between different communities or portions of the Town or which will otherwise carry a heavy volume of traffic."*6

In the literature, a major street is commonly referred to as an arterial and the terms are used synonymously in this document. The characteristics include higher operating speeds (40 to 45 mph in the off-peak and 30 to 35 mph in the peak hour), appropriate levels of service as outlined in the Highway Capacity Manual,***7** on the designated road and turning movements at intersections that usually do not exceed 20% of total traffic. Movement is the primary function with a secondary function of land access. Access management is an essential component to preservation of capacity on the arterial roads. Signalized intersections should be spaced far enough apart (1/4 to 1/2 mile) to permit efficient two-way progressive movement of traffic between intersections at desirable off-peak and peak hour speeds. Park and ride opportunities should be provided on the major highways within close proximity of Town boundaries to encourage mass transit and also preserve capacity.

In some cases, the terms primary arterial and secondary arterial are used to differentiate roads with trips of somewhat shorter length and slightly lower level of service. A secondary arterial interconnects residential, shopping, employment and other activities at the local level. The intent of both primary and secondary arterials is not to "... penetrate identifiable residential neighborhoods."***3**

In Essex, the differentiation between major (primary) and major (secondary) follows the designation of State versus Town highways.

TABLE 2 - MAJOR (ARTERIAL) ROADS

PRIMARY ARTERIALS

Road Name	Length (Miles)	Current Average Daily Traffic (ADT) and Class
VT. Rte. 15 (State Highway)	5.436	20,100 west of Susie Wilson Rd (2008); 15,300 east of Old Stage Rd (2010); 13,400 east of VT128 (2010; 11,500 east of Weed Rd (2010) High
VT. Rte 2A (State Highway)	1.807	10,300 north of Circ (2010); 6500 south of Circ (2010); 7200 east of Pinecrest Drive (2010) High
VT. Rte. 117 (State Highway)	3.204	6500 west of Circ (2010); 6300 east of North Williston Rd (2010); 8500 east of Sand Hill Rd. (2005); 7700 west of Sand Hill Rd. (2005) Moderate High to High
VT. Rte. 128 (State Highway)	4.402	3800 east of VT15(2009); 4200 west of Weed Rd (2002) Moderate High

Total 14.849 miles

Percent of Total Essex Mileage = 14.7%

TABLE 3 - SECONDARY ARTERIAL ROADS

PAVED

Road Name	Town Highway Number	State Class	Length (Miles)	1990 ADT Traffic	1990 Traffic Class	Current ADT Traffic (year of count)	Current Traffic Class
Allen Martin Dr.	8	2	.93	683	MH	3,081 (2011)	MH
Essex Way*a (VT15 to Circ H.)	7	2	.46	Est	M	6,100 (2007)	MH
Kellogg Road	5	2	.55	11,934	H	12,000 (2007)	H
No. Williston Rd.	1	2	.34	3069	M	5,735 (2012)	MH
Old Stage Road	2	2	4.0	2500	M	5,100 at VT15 2005)	MH
Pinecrest Drive	6	2	1.00	4758	MH	3,700 at Susie Wilson (2010)	MH
Sandhill Rd with ramps	4	2	2.29	6500	MH	5,100 by VT117 (2005) 4,700 by VT15 (2005)	MH
Susie Wilson Rd*b (VT15 to Kellogg)	3	2	.49	15524	H	23,330 (1998)	H

Total Miles 10.06

Percent of Total Essex Mileage = 9.9%

Note: In 1990, the percentage was 12%.

***a** Essex Way is considered a major road for 0.46 miles, from VT15, to the Circumferential Highway. The remainder of the road is considered to be a collector.

***b** With completion of the first phase of the Circumferential Highway (VT117 to VT2A), the Susie Wilson Bypass was constructed. The Susie Wilson Road Bypass is a limited access highway. The existing portions of Susie Wilson Road north of Kellogg Road changed function class from major to collector (Kellogg to Abare) and from major to minor (north of Abare Ave. to the dead end at the new bypass) and minor from the dead end south of the new bypass to VT.Rte.2A (now Gardenside Lane). Because the bypass portion is considered a limited access highway, the remaining section between VT15 and Kellogg Road is designated as a secondary arterial highway (0.49 miles).

The roads designated as being major (arterial) account for a combined total of 24.6% of total highway mileage in the community. The ITE guidelines indicate that nationally 5 to 10% is common for primary arterials and 10 to 20% for secondary arterials.***3** The Town of Essex arterial classification falls within the combined totals of these scales, although there are more primary and less secondary arterials than would be expected using the national averages.

Collector Roads

The primary function of a collector road is to distribute traffic between minor (local) streets and the major (arterial) system.

A secondary function is land access and a tertiary function is to handle inter-neighborhood traffic movement. In general, collectors should penetrate but should not have continuity through residential areas (i.e., through traffic should be discouraged). Operating speeds should be between 25 and 30 mph. With slower speeds and more expected turning movements, closer spacing for driveways and intersections can be used than on major streets.

The Subdivision Regulations define a collector road "…as a street which is being used or will be used to carry a substantial volume of traffic from a minor street(s) to a major street or

community facility, and normally including the principal entrance street to a large subdivision or group of subdivisions and the principal circulation streets within such subdivisions.″***6** This definition is more inclusive than is implied in the literature and, therefore, more Town roads fall within this category than would normally be expected. Typically, 5 to 10% of a community's mileage is within the collector category, whereas the percentage in Essex is 33.1%.

Essex also has a number of rural unpaved roads which function primarily as interconnections with neighboring communities but do not carry high traffic volumes. They are also not used principally for local access. These roads account for 15.80 miles of the 33.1 miles of collectors, or 15.8% of the Town's total highway mileage.

It should be noted that some collector roads are dead end streets. This is a unique physical characteristic and does not relate specifically to function. Expressways and arterials are by nature of their movement function never dead-ended. Collector, minor and unimproved roads can be dead-ended, with more of these types of road on the unimproved road end of the spectrum than the collector end.

TABLE 4 - COLLECTOR ROADS

PAVED SECTIONS

Road Name	Town Highway Number	State Class	Length (miles)	1990 ADT Traffic	1990 Traffic Class	Current ADT traffic	Current Traffic Class
Abare Avenue	9	3	.21	-	ML	327 (2010)	ML
Alder Lane	718	3	.15	-	ML	808(2012)	M
Allen Martin Parkway	735	3	.37	EST	M	1200 (2005)	M
Billie Butler Dr	772	3	.07	NA	NA	5600 (2010)	MH
Bixby Hill Rd (paved section)	714	3	.20	1122	M	477 (2010)	ML
Blair Road	6	3	.15	-	ML	690 (2013)	M

Brigham Hill Rd (paved section)	36	3	.89	715	M	662 (2013)	M
Cabot Drive	749	3	.27	-	ML	483 (2010)	ML
Carmichael Street	796	3	.26	-	M	802 (2013) West end	M
Chapin Road	42	3	1.00	-	ML	524 (2013) Near Towers	ML
Clover Drive	754	3	.57	804	M	1348 (2010)	M
CorporateDrive	801	3	.21		NA	1328 (EST)	M
Craftsbury Ct	751	3	.29	-	ML	255 (2008)	ML
Essex Way (p)	731	3	.54	-	M	3000 (2010)	M
Ethan Allen Ave	3	3	.25	-	M	1065 (2010)	M
Foster Rd	742	3	.55	1419	M	985 (2009)	M
Gauthier Drive	121	3	.60	NA	NA	1786 (2011)	M
Gentes Road	24	3	.91	-	ML	1000 (2007)	M
Greenbriar Dr	776	3	.72	757	M	437 (2013)	ML
Greenfield Rd-part	717	3	.54	1514	M	1678 (2012)	M
Greenfield Rd Ext	779	3	.05	-	ML	530 (EST)	ML
Hickory Lane	737	3	.07	292	ML	328 (2011)	ML
Irene Avenue	798	3	.43	--	-	214 (2011)	ML
Iris St	715	3	.08			336 (2011)	ML
Joshua Way	138	3	.08	-	-	720 (2005)	M
Lamore Rd	23	3	.08	-	M	499 (2010)	ML

LaSalle Rd	736	3	.06	215	ML	374 (2012)	ML
Laurel Drive (p)	800	3	.06	-	-	200 (EST)	L
Londonderry Rd	702	3	.20		M	337 (2009)	ML
Old Colchester Rd	20	3	.50	2271	M	1400 (2008)	M
Partridge Dr	797	3	.04	-	-	420 (EST)	ML
Pinewood Dr	757	3	.44	NA	NA	1500 (2005)	M
Pioneer St	11	3	.43		M	704 (2011)	M
Richard St	724	3	.10	554	ML	487 (2011)	ML
Saxon Hill Road (paved section)	66	3	.17		L	250 (2012)	ML
Saxon Hollow Road	756	3	.42		ML	3264 (2013)	MH
Saybrook Rd	753	3	.31	685	M	758 (2008)	M
Suffolk Lane	105	3	.23	383	ML	408 (2008)	ML
Susie Wilson Road (p)	132	3	.22	15524	H	20,790 (1998)	H
Tanglewood Dr	744	3	.58	1143	M	1237 (2011)	M
Thompson Dr	777	3	.29		MH	1011 (EST)	M
Towers Rd	710 +41	3	1.57	1926	M	1390 (2013)	M
Valleyview Dr	765	3	.65	1920	M	1156 (2011)	M
Weed Rd	63	3	1.5	853	M	950 (2013)	M
Willoughby Rd	758	3	.19	NA	NA	700 (2011)	M

Total miles: 17.50 miles in 2009; in 2013 it is the same at 17.50 miles

Percent of Total Essex Mileage = 17.3%

TABLE 5 - COLLECTOR ROADS

GRAVEL SECTIONS

Road Name	Town Highway Number	State Class	Length (miles)	1990 ADT Traffic	1990 Traffic Class	Current ADT traffic	Current Traffic Class
Brigham Hill Rd	36	3	2.06	715	MH	662 (2013)	MH
Curve Hill Road	26	3	.20	-	ML	187(2008)	ML
Chapin Road	42	3	2.53	-	ML	271 (2013)	ML
Discovery Road	21	3	.50	-	M	359 (2011)	M
Indian Brook Rd	30	3	1.25	-	M	649 (2005)	MH
Lost Nation Rd	27	3	2.80	-	M	390 (2007)	M
Lamore Rd	23	3	1.14	-	ML	520 (2009)	M
Old Pump Rd	59	3	1.04	-	L	123 (2003)	ML
Osgood Hill Rd	51	3	2.46	-	M	620 (2004)	MH
Pettingill Rd	44	3	.76	-	ML	-	L
Sleepy Hollow Rd	60	3	1.20	-	ML	197 (2013)	ML

Total Miles: 15.94 miles

Percent of Total Essex Mileage in 2009 was 15.9%; it is now 15.8%

Minor (Local) Roads

The Subdivision Regulations define a minor street as one which is "…being used or will be used primarily to provide access to adjacent properties and which does not provide for use by through traffic."***6**

A minor road is commonly referred to as a local road, because its principal purpose is land access. The speed limit is low, usually 25 mph or less. Movement is not a primary function of this class of road and, therefore, trip ends are short and volumes low. On-street residential parking is permitted, where streets are sufficiently wide to allow it.

Greater protection needs to be afforded to vulnerable users, including children, the disabled and the elderly. The streets also have to be designed to accommodate convenient and efficient pickup and deliveries, emergency access, maintenance services and where densities justify, public transit services.

TABLE 6 - MINOR (LOCAL) ROADS

PAVED

Road Name	Town Highway Number	State Class	Length	1990 ADT Traffic	1990 Traffic Class	Current ADT Traffic	Current traffic Class
Alderbrook Rd	719	3	.35	-	ML	-	ML
Andrew Ave	123	3	.13	NA	NA	-	L
Baker St	725	3	.22	-	ML	778 (2010)	M
Bashaw Dr	793	3	.13	NA	NA	-	L
Blackberry Rd	743	3	.15	101	L	110 (EST)	L
Bluestem	760	3	.19	NA	NA	-	ML
Bobolink Circle	755	3	.41	-	ML	942 (2012)	L

Butternut Ct	741	3	.39	111	L	-	L
Button Drive	12	3	.09	26	L	-	L
Cavendish Dr	790	3	.04	NA	NA	-	ML
Cedar St	787	3	.36	NA	NA	-	L
Cedar Ct	788	3	.07	NA	NA	90 (EST)-	L
Cemetery Rd	752	3	.09	97	L	-	L
Chelsea Rd	700	3	.55	-	M	250 (2009)	ML
Cindy Ln	746	3	.20	161	L	130 (EST)	L
Circle Dr	732	3	.11	111	L	80 (EST)	L
Colbert St	8	3	.17	-	L	-	L
The Common	712	3	.07	-	L	-	L
Creek Rd	770	3	.22	-	L	-	L
Cypress Ln	711	3	.14	51	L	60 (EST)	L
Dalton Dr	2	3	.21	-	L	422 (2010)	L
Damon Dr	13	3	.15	-	ML	-	ML
Dartmoor Ct	107	3	.11	101	L	110 (EST)	L
David Dr	120	3	.10	NA	NA	790 (2010)	M
Debra Dr	794	3	.14	-	L	-	L
Deer Crossing Ln	136	3	.47	NA	NA	-	ML
Devon Hill Ct	109	3	.09	71	L	70 (EST)	L
Douglas Rd	39	3	.11	31	L	40 (EST)	L
Essex Highlands	62	3	.47	151	L	140 (EST)	L

Ewing Place	110	3	.17	-	ML	-	M
Fern Hollow Rd	748	3	.04	21	L	20 (EST)	L
Forest Rd	768	3	.65	-	ML	-	ML
Fox Run Rd	785	3	.27	NA	NA	323 (2002)	L
Frederick Rd	720	3	.19	161	L	-	L
Freeman Woods	802	3	.13	NA	NA	582 (2008)	M
Gardenside Ln	133	3	.18	NA	NA	80 (EST)	L
Glenwood Dr	703	3	.27	202	ML	-	ML
Greenfield Road (west of Greenfield Ext)	717	3	.16	-	L	100 (EST)	L
Greenfield Ct	723	3	.06	71	L	60 (EST)	L
Hagan Dr	764	3	.34	NA	NA	-	ML
Hampshire Ct	106	3	.12	222	ML	-	ML
Heatherbush Rd	778	3	.21	252	ML		ML
HIghview Dr.	139	3	.15			20 (EST)	L
Hillside Circle	763	3	.43	-	L	300 (EST)	ML
Ira Allen Dr	15	3	.15	71	L	-	L
Jackson Heights	17	3	.34	-	ML	248 (2011)	ML
Kimberly Dr	85	3	.13	168	ML	200 (EST)	ML
Kurk Dr	782	3	.08	NA	NA	150 (EST)	L

Lamell Ave	722	3	.39	292	ML	-	ML
Landfill Ln	18	3	.07	-	M	-	M
Lang Dr	745	3	.34	NA	NA	708 (2008)	M
Laurel Drive (p)	800	3	.28	NA	NA	200 (EST)	ML
Lavigne Rd	728	3	.11	-	ML	223 (No year)	ML
Leo Dr	713	3	.1	-	L	-	L
Lilac Lane	805	3	.13	NA	NA	70 (EST)	L
Lida Dr	747	3	.24	NA	NA	-	L
Linden Lane	705	3	.18	-	L	130 (EST)	L
Logwood Circle	721	3	.82	-	M	-	M
Maplelawn Dr	734	3	.31	126	L	164 (2012)	L
Margaret St	740	3	.38	275	ML	281(2008)	ML
Marion Avenue	799	3	.22	-	-		L
Market Place	86	3	.12	-	M	1200 (2011)	M
Morse Dr.	4	3	.29	-	M	1845(2008)	M
New England Dr	87	3	.29	-	M	1825 (2011)	M
Oakwood Ln	750	3	.28	232	ML	-	ML
Parizo Dr	92	3	.04	-	M	-	ML
Patricia Place	738	3	.13	121	L	110 (EST)	L
Peacham Ln	759	3	.19	NA	NA	495 (2011)	ML

Peacham Ln Extension	789	3	.12	NA	NA	198 (2008)	ML
Perkins Dr	762	3	.14	NA	NA	-	L
Perry Dr	730	3	.27	NA	ML	227 (2009)	ML
Pomfret Ln	783	3	.12	NA	NA	-	ML
Prescott St	10	3	.33	-	ML	-	ML
Raymond Dr	786	3	.26	NA	NA	142 (No Year)	L
Repa Dr	774	3	.13	NA	NA	-	ML
Ridge Rd	767	3	.23	-	L	-	L
Riverview Dr	761	3	.35	NA	NA	-	M
Ronald Ct	726	3	.05	41	L	-	L
Rosewood Trail	707	3	.10	-	L	50 (EST)	L
Rustic Dr	771	3	.28	280	ML	133 (2012)	ML
Sage Circle	739	3	.18	151	L	-	L
Skyline Dr	766	3	.54	-	M	702 (2008)	M
Southdown Ct	108	3	.16	232	ML	-	ML
Stannard Drive	795	3	.23	-	ML	-	ML
Stearns Ave	14	3	.12	36	L	-	L
Steeplebush Rd	781	3	.17	NA	NA	-	ML
Stonebrook Circle	803	3	.31	NA	NA	30 (EST)	L
Sunset Dr	704 +706	3	.28	282	ML	380 (2012)	ML
Susie Wilson Rd	132	3	.25	NA	NA	490 (2005)	L

Sydney Dr	792 and 731	3	.77	NA	NA	849	M
Tanglewood Drive (p)	744	3	.14	NA	NA	80 (EST)	L
Thistle Ln	791	3	.13	NA	NA	130 (EST)	L
Thomas Ln	773	3	.27	NA	NA	-	L
Timberlane Dr	729	3	.18	91	L	-	L
Turcotte Rd	122	3	.08	-	L	-	L
Walden Woods	32	3	.23	81	L	80 (EST)	L
Weathersfield Bow	784	3	.29	NA	NA	-	ML
Whitcomb ----Meadows Ln	780	3	.26	NA	NA	130	L
Whitetail Ln	137	3	.1	NA	NA	70 (EST)	L
Wildwood Dr	769	3	.49	-	ML	-	ML
Windridge Rd	733	3	.57	-	L	322 (2006)	ML
Winterlane Circle	727	3	.31	-	L		L
Wolff Dr	775	3	.10	NA	NA	210 (EST)	L
Woodlawn Ct	709	3	.05	-	L	50 (EST)	L
Woodlawn Dr	701	3	.22	-	ML	-	ML

Total miles 23.72 miles

Percent of Total Essex Mileage = 23.4%

TABLE 7 - MINOR ROADS

GRAVEL SECTIONS

Road Name	Town Highway Number	State Class	Length	1990 ADT Traffic	1990 Traffic Class	Current ADT Traffic	Current traffic Class
Bixby Hill Rd	714 + 48	3	.90	-	ML	477 (2010)	ML
Brigham Hill Ln	33	3	1.25	-	L	60 (EST)	L
Catella Rd	50	3	1.1	-	ML	210 (EST)	ML
Cilly Hill Rd	54	3	.10	-	L	-	L
Col Page Rd	38	3	.75	-	L	208 (2009)	ML
Fleury Rd	708	3	.16	-	L	30 (EST)	L
Gray Way	57	3	.39	-	L	40 (EST)	L
Hanley Lane	53	3	.30	-	L	80 (EST)	L
Lost Nation Rd	27	3	.40	-	L	100 (EST)	L
McGee Rd	29	3	.08	-	L	50 (EST)	L
Naylor Rd	65	3	.35	-	L	-	L
Sawmill Rd	56	3	.85	-	L	-	L
Saxon Hill	66	3	.56	-	L	-	L
Towers Rd.Ext.	41	3	.25	-	L	-	L

Total miles 7.44 miles

Percent of Total Essex Mileage = 7.4%

Unimproved Roads

This is the only functional category that is consistent with the State Aid Classification System (Class IV). A Class IV Town Highway receives no State aid and the Town is not required to keep it in good and sufficient repair year round. A Class IV Town Highway "…may be maintained to the extent required by the necessity of the Town, the public good and the convenience of the inhabitants."***8**

TABLE 7 - UNIMPROVED ROADS

Road Name	Town Highway Number	State Class	Length (miles)
Extension of Landfill Access Road	18	IV	0.22
Extension of McGee Road	29	IV	0.2
Extension of Brigham Hill Lane	33	IV	0.15
Extension of Hanley Lane	53	IV	0.55
West Sleepy Hollow Road – ADT 2008 = 121	60	IV	1.95
Extension of Saxon Hill Road	66	IV	0.08
Water Tank Road off Bixby Hill	716	IV	0.2
Extension of Fern Hollow	748	IV	0.05

Total miles 3.4

Percent of Essex Mileage = 3.4%

V. BACKGROUND DATA

Defining the functional classes of highways in a community and assigning a specific class to each existing or proposed road is an important step in developing a comprehensive transportation strategy. The second stage in the creation of the plan is to assemble data on the existing road network for analysis.

During the summer of 2013, an inventory was completed on all accepted paved Town roads. This inventory included updating road and traffic data from the prior existing studies and inputting data on all new roads.

Other information, useful in transportation planning, such as path and sidewalk inventories, parking resources and public transportation facilities is contained in the Town Plan, on GIS maps and in other reports.

V. ANALYSIS OF HIGHWAY INVENTORY

The third component needed to develop a prioritization for roadway improvements is an analysis of the inventory data. After the identification has been made of what physically exists today or has been identified as a future need, some level of capability or performance must be assigned to the inventory. If the level of performance of the infrastructure is not adequate, alternative solutions need to be presented and costs assigned to bring the infrastructure to a satisfactory level. There is a correlation between the assigned functional class and what constitutes satisfactory performance. In other words, a gravel road may function at adequate service levels as a minor road serving few homes, but it would not meet the performance standard expected of a secondary arterial road.

The analysis consists of two elements - a computer-aided road surface management program which provides information and analysis of the road surfaces and an in-house evaluation of other highway design and related features of roads, such as seasonal problems, structural barriers (bridges, culverts, horizontal and vertical curves, inadequate road width) and intersections.

The system used to analyze road surfaces is a computer analysis program entitled “APWA Paver” developed by the American Public Works Association and used for many years by communities and

counties across the country. The program used for the 2014 Town Road Management Plan is different from the RSMS Program developed by the University of New Hampshire used in earlier Town road plans. The APWA Paver is a more robust program, is used much more widely and is more universally accepted than the RSMS program. The APWA Paver program provides:

A. An inventory section.
B. A road condition survey, for paved roads which cover such areas as longitudinal / transverse cracking, alligator cracking, extent of patching / potholes, edge cracking severity, drainage and roughness conditions and rutting.
C. For unpaved roads, a similar condition survey is presented covering such areas as condition of the cross section, roadside drainage, corrugations, dust, potholes, rutting and severity of loose aggregate.
D. The field road condition survey leads to the development of a numbered ranking for paved roads based on condition only. The Index is called the PCI - Pavement Condition Index. A score of 100 indicates a road is in 100% acceptable condition; the lower the PCI number, the worse the condition of the road.
E. With the results of the condition survey, a general repair strategy or maintenance scheme is provided for each segment of surveyed road.
F. Using weighting factors which can include traffic, road roughness and the results of the road condition survey, the roadways are then prioritized for improvement and cost estimates provided for a range of solutions. In 1990, the weighting factor was:

40% Condition (PCI)
40% Traffic
20% Roughness

This proportion factor was changed for the 2009 study and the same 2009 factors are used for the 2014 upgrade. The roughness component was eliminated because it is a highly subjective observation that is difficult to accurately quantify and compare. Historically, it has not affected the relative position of roads in a priority list. The condition PCI and traffic volumes are more accurately quantifiable and give a more reliable and consistent result. For the 2014 Road Management Study, the weighting

used for the analysis is:

60% Condition using the PCI

40% Traffic

G. The weighting factor used for traffic is:

Low	.9
Moderate Low	.7
Moderate	.5
Moderate High	.3
High	.1

H. When the condition PCI and the traffic weighting factor are combined into a 40/60 split, the roads (or road segments) fall into a prioritization list. Roads with the lowest overall score reflect those with a generally poor condition and high traffic. A high score would likely be more reflective of a road in good condition with low traffic volumes. The list is not an "absolute" list that drives doing road improvement work only in the order indicated on the list. The weighting scores are not absolute. Throughout the process, judgments are made in evaluating conditions and assigning traffic volumes that will vary depending upon the person or persons conducting the survey.

I. It is not accurate to compare roads close in adjusted ranking; however it is accurate to state that a road with an adjusted score of 15 is more likely to need improvements before a road with an adjusted score of 85.

J. Further, a premise can be made that some very low volume roads that are in need of repair cannot make it to the top of the traffic weighted list because the scores from the high traffic volume roads greatly impact the ranking. Therefore, a second list has been created from the overall priority list. This list provides the ranking of all projects with a PCI at 55 or below as they rank on the overall traffic and PCI combined list. This list gives preference to condition over traffic but still recognizes that traffic is a component in the ranking of even the roads in the worst condition.

K Four lists are included in the Appendix –Appendix A is the overall 40/60 list using both traffic and condition developed in 2014, Appendix B is a derivative of the 2014 priority list with those projects which have a PCI less than or equal to 55,

Appendix C is the list developed in 2009 and Appendix D is the list of remaining high priority projects not constructed from the 2009 analysis.

The ability of a particular road to perform its primary function is often significantly influenced by intersections, where roads of similar or dissimilar functions meet, and by structural or seasonal barriers to through movement.

A detailed evaluation was conducted in 1990 concerning the effect of seasonal barriers - - winter, ice and snow, frost heaves, spring flooding, mud season - - on the transportation network. Also included was an evaluation of structural barriers - - bridges and culverts, horizontal and vertical curves, and narrow road widths. Key intersections were also evaluated.

In the period between 1990 and 2014, the majority of deficiencies outlined in the original Highway Road Management study have been corrected. A brief synopsis is provided of the actions taken:

Seasonal Barriers

The Town has updated its Winter Operations Plan annually and adjusted the Plan for new roads and changed conditions. Frost heaves have generally not been a significant problem, since new road construction and road rehabilitation projects have increased the depth of porous, road sub-base reducing the frost heaving problem.

Flooding occurs to a lesser degree under normal spring runoff conditions but has proven a problem during short duration, high intensity rainfall events. Drainage improvements, including stone-lined ditches, have been made to the gravel roads using FEMA funds from a number of declared disasters and this may lessen the extent of road damage on certain sections of roads in the future.

The increase of traffic volumes and the general increase in weight of vehicles creates degradation of the gravel roads, most noticeably during freeze-thaw cycles. The roads with the most significant impact from this cause continue to be Lost Nation Road, Osgood Hill Road and Brigham Hill Road.

Structural Barriers

Bridges: There are three Essex structures considered bridges by VTRANS They are:

a) Bridge #0008 - North Williston Road Bridge over the Winooski River shared with the Town of Williston. A new bridge was installed in 1993 and its federal sufficiency rating in July of 2012 was 84.3. The approaches to this bridge flood on the order of once per year for a few days a year. This was acknowledged during the design due to the width of the flood plain. During these periods, both Towns close the bridge to traffic. The bridge was resurfaced in 2011.

This bridge and the approaches to it were studied during 2013 as part of the Circumferential Highway alternatives project process. A scoping study was completed by Dubois and King Engineering, Inc. and approved by the Selectboard with the following recommendations:

"1). Replace the existing culvert with a 6 foot concrete box culvert

2). Install intelligent signs along the major approach routes well away from the site to allow display of road closure alerts – potential locations include but are not limited to VT117 east and west, VT15 east of Allen Martin Drive, Williston locations as noted in the presentation slide.

3). Stream gauge at the bridge coordinated with other stream gauges to provide more lead time in decision-making relative to the road closure

4). Installation of more durable and permanent gates to prevent crossing of the roadway during flood events; further, the gates should be lit either through the use of solar panels or direct power so the gates are clearly visible 24/7

5). Reconstruct the road bank at the locations where flood damage has occurred in the past to prevent erosion and allow for more rapid reopening of the roadway after flooding.

6) Changes to the road grade at the approach to VT117 to provide for a flatter grade and better visibility at the intersection where such grade changes do not impact on the floodway.

7) Changes to the farm "curb cuts" to provide for better visibility should also be constructed so the curb cuts are not washed out during storm events."

The next phase of the project will involve design and construction of the referenced improvements. It is anticipated that the work will be completed within the next 3 to 5 years.

b) Bridge #00019 – Pettingill Road Bridge over the Browns River This is a one-lane bridge, many components of which do not meet current federal standards. The bridge was built in 1967. The federal sufficiency rating is 67.9 as of September 21, 2011. The western side of this bridge floods periodically and the road is closed to through traffic when this occurs. There is no current plan to replace or upgrade this bridge. Traffic can get to the other side by using alternative routes in Westford.

c) Bridge # 00020-High bridge over the New England Central Railway tracks at Gentes Road. This bridge has a sufficiency rating of 48.6 in 2007, was re-inspected in 2009 and the sufficiency rating was upgraded to 65.1. No explanation was provided by VTRANS as to the reasons for the increase in rating between 2007 and 2009; no work was done on the bridge duri8ng this time frame. The bridge was built in 1910, upgraded with a new deck in 1990, and the abutments, portions of the deck, drainage and guardrails were reconditioned/repaired/upgraded in 2012. It is estimated that the bridge will not require major work for the next 20 years. The only improvement being contemplated at this time is a change to the north side bridge approach.

Road (and driveway) Culverts: A comprehensive culvert system inspection was conducted in the summer of 2003, in 2009 and again in 2013. The Town's GIS data base has been updated to reflect the 2013 culvert inspections. The inventory covers the location, size, structural condition, inlet and outlet ditch conditions and amount of debris accumulation in the pipes. This study is used by the Public Works Department to identify and

correct problem situations and for normal maintenance. Although many of the actions required are relatively minor and do not require culvert replacement, some do. In general, it will take approximately three full years to make the needed improvements to the piping and ditch systems.

Horizontal and Vertical Curves: Although the majority of the problem areas have been addressed, the following areas still need improvement:

1. Gentes Road at the northern approach to the bridge
2. Brigham Hill Road approximately 377 feet east of the Colchester Town line
3. Pinecrest Drive at the high point north of the intersection with Jackson Heights
4. Sleepy Hollow Road at the intersection with Old Pump Road
5. Saxon Hill Road south west of the intersection with Deer Crossing Lane due to its narrow width
6. Sand Hill Road on the 8% vertical curve as it approaches VT 117
7. Skyline Drive
8. Creek Road

It should be noted that most of the eight areas listed are not likely to be improved for many years due the high cost and impractical nature of making the noted improvements.

Inadequate Road Width: Although a list will not be outlined in the study, many of the older Town roads do not meet the minimum width requirements of the Public Works Specifications. The minimum width recommended in the Specifications is 24 feet for a two-lane road.

Intersections: The 1990 study provided an extensive list of the intersections needing improvement. The majority of the problem intersections have been addressed from that report and the intersection situation is significantly

different in 20014. A portion of that report is repeated in this study because of its continued applicability to intersections today:

"Intersections are critical elements in the transportation network and are principally responsible for the breakdown in functional class operations that occur. In designing and improving arterial, at-grade intersections, the Institute of Transportation Engineers (ITE) have promulgated eleven principles that should be followed:

1. Reduce the number of conflict points among vehicular movements.
2. Control the relative speed of vehicles both entering and leaving an intersection.
3. Coordinate the type of traffic control devices used (such as stop signs or traffic signals) with the volume of traffic using the intersection.
4. Select the proper type of intersection to serve the volume of traffic being served. Low volumes can be served with no controls, whereas high levels of traffic may require more expensive and sophisticated treatments, such as turning lanes or even at-grade separation structures.
5. When traffic volumes are high, separate right turn and/or left turn lanes may be required.
6. Avoid multiple and compound merging and diverging maneuvers. Multiple merging or diverging requires complex driver decisions and creates additional conflicts.
7. Separate conflict points. Intersection hazards and delays are increased when intersection maneuver areas are too close together or when they overlap. These conflicts may be separated to provide drivers with sufficient time (and distance) between successive maneuvers for them to cope with the traffic situation.
8. Favor the heaviest and fastest flows. The heaviest and fastest flows should be given preference in intersection design to minimize hazard

and delay.

9. Reduce area of conflict. Excessive intersection area causes driver confusion and inefficient operations. When intersections have excessive areas of conflict, channelization should be employed.

10. Segregate non-homogeneous flows. Separate lanes should be provided at intersections where there are appreciable volumes of traffic traveling at different speeds. For example, separate turning lanes should be provided for turning vehicles.

11. Consider the needs of pedestrians and bicyclists. For example, when there are pedestrians crossing wide streets, refuge islands should be provided so that more than five lanes do not have to be crossed at a time.

Some intersections in the Town of Essex have been studied and improvements are in various stages of planning, design or construction. Others have been identified but not fully studied.

The most significant intersections in 2014 needing improvement are:

1) The Susie Wilson Road/ VT15 intersection and the Susie Wilson Road/Kellogg Rd. intersection: Both intersections and the connecting roadway were studied and a scoping report produced as part of the Circumferential Highway Alternatives planning process. The Selectboard adopted the following position:

> **"Short-term Improvements:** The Selectboard supports the short-term improvements outlined in the Study, with the revised recommendation that includes cross-intersection dashed lane striping at the north bound Susie Wilson Bypass approach to the intersection with Kellogg Road and additional overhead lane signage without any change in lane designation. In addition, the improvements achieved through use of adaptive signal controls in the corridor should be better defined before a commitment is made to fund this improvement over the short-term rather than mid to long-term.
>
> **Mid to Long-term Improvements:** The Selectboard supports the mid-long term improvements identified generally by added lanes at the VT 15/Susie Wilson Road Intersection (Expanded

version and not Reconfigured version), expanded turn lanes at the Kellogg Road/Susie Wilson Road intersection and widening of the road where necessary to provide 4-foot wide bike lanes on each side of Susie Wilson Road along its entire length. The preferred alternative is further defined as:

Kellogg Road Intersection: The improvements include but are not limited to: An additional westbound receiving lane on Kellogg Road, dual northbound and left turn lanes on Susie Wilson Road, 4 foot bike lanes through the intersection, a dedicated southbound right turn lane on Susie Wilson Road Bypass and an additional northbound lane on Susie Wilson Bypass with a taper after 500 feet. Please refer to the attached diagram.

Potential Connectors: The Selectboard supports this concept but the changes would have to be made at the Planning Commission level as sites are redeveloped or the Town would have to purchase the land or easements to make the connections happen. These changes are eligible for Circ Highway funds.

Bike Lanes: The Selectboard conceptually supports adding 4-foot wide bike lanes throughout the project length from the Susie Wilson Road/VT15 intersection to the Susie Wilson Road/Kellogg Drive intersection. However, south of David Drive, this is a major issue and could represent a major unknown cost or impact. The Selectboard will not support reducing the travelled lane width to 10.5 feet on this roadway. The impacts on private property and utilities may be of such a magnitude that 4-foot wide bike lanes are not feasible in this area. This is an issue that will have to be determined during the early stages of conceptual design after more accurate surveys are available for use in the decision-making process.

VT 15/Susie Wilson Road Intersection: The Selectboard supports the Expanded Version (i.e., added lanes) based on costs and very little difference in LOS between the Expanded and Reconfigured version. Issues to be settled during the early stages of conceptual design are: 1) resolution of the slip lane and reverse movements on VT 15 from westbound to eastbound, 2) resolution of the appropriate location for the pedestrian crossing,3) bicycle transition heading east on VT 15."

2) The Susie Wilson/Kellogg Road intersection operates at a poor level of service in the afternoon with long delays for almost all the left turning movements. .
3) The Sand Hill Road/VT15 intersection meets signal warrants and a Scoping Study with a Selectboard recommended alternative has been produced through the MPO. It is on the current regional transportation program (TIP) and was added to the list of project for initiation of design as a component project of the Circumferential Highway Alternatives projects process. It is anticipated that this project will go to construction within the next 3 to 5 years with State and federal funds.
4) The VT15/Allen Martin Parkway intersection will see increased traffic activity as the Saxon Hill Industrial Park is built out. Funds have been set aside by the Town for a "scoping" level study of this intersection and how it could be improved. This study will begin in the spring of 2014.
5) The intersection of VT 289 and the Susie Wilson Road Bypass is being redesigned by VTRANS as part of the Circumferential Highway Alternative projects process. This intersection is characterized by long queues during the peak PM traffic flow period. Lanes will be added and improved signalization. The work is anticipated to be completed by the summer of 2015.
6) All the State traffic signals on VT15 in Essex Center are being studied for full inter-connectivity and coordination by the CCRPC as part of the Circumferential Highway Alternatives planning process.

New Roads: Although not identified in the 1990 Plan, new roads may be needed at some point in time to meet the needs of the community. They are:

1) Completion of Allen Martin Parkway to the Circumferential Highway if segments A and B of the Circumferential Highway

are ever constructed.

2) Completion of the Circumferential Highway both in Williston and Colchester.
3) Creation of interconnecting minor roads or alleys parallel to Susie Wilson Road to provide for local access between lots and for access to the signalized locations in the corridor
4) Creation of interconnections between areas of the community either for emergency access or as permanent, full-use roadway interconnects as deemed appropriate.
5) New development roads accepted by the Town Selectboard as a result of Planning Commission development approval.

Complete Streets: Under legislation passed in 2011, communities have to address the issue of meeting the needs of all transportation users, regardless of their age, ability or preferred mode of transportation. Town projects either have to add features outlined in the complete streets guidance published by VTRANS or annually file a report with the Town clerk as to why these features have not been included in the specific projects. Addition of these features will increase the cost of future projects.

VI. MANAGEMENT GUIDELINES TO IMPROVE TRANSPORTATION IN ESSEX

So far, the definition of functional road classes and the assignment of classes to streets have been identified. An inventory of facilities has been assembled and an identification of needs to bring the infrastructure up to reasonable standards of performance is provided. The most important question still remains unanswered. How can the Town use both the functional class system and support documents to meet longer term transportation objectives and goals? In the following paragraphs, a number of ways to accomplish this are presented (Note that a significant portion of this section remains unchanged from 1990; the guidelines were applicable then and still remain the same):

A. Management plans and financial expenditures for road reconstruction or improvements should be consistent with the functional class system. In effect, the priority for funds to resolve structural infrastructure problems should go first to the higher class of roads, such as a majors or collectors, with lesser priorities for minors. This is not meant to indicate that all efforts should be directed away from minor roads. Some minor roads are insufficient to reasonably accommodate local access and repairs cannot be delayed forever.

Use of functional classes provides not only a basis for determining the relative priority of improvements, but also indicates what the returns of a specific functional improvement will be for a given input of dollars. For example, if two roads are in need of repaving and one is a major road with high traffic volumes and the other a collector with medium traffic volumes, the need to satisfy the movement function will indicate that the monies should go towards paving the major facility. A specific dollar value for the improvement can then be related to the ability to move a given number of vehicles more quickly and safely over the roadway. Travel times can be reduced by enabling vehicles to travel at the proper speed limit, if the roads can physically accommodate the speed limit.

Each class of road also needs to meet certain minimum structural and physical standards to function properly. The higher movement classes, because of loads and speeds, will require greater depths of base and subbase, thicker wearing surfaces, greater curve radii, lesser slopes, greater stopping distances and the like. Through inventory and analysis, existing roads which do not meet the functional class standards can be identified and programmed for upgrade.

The Public Works Specifications need to be updated on a more frequent basis so that the road standards for both new and existing construction are consistent with the functional classes. As an example, a secondary arterial road such as Kellogg Road needs a deeper section of gravel and a thicker course of asphalt than a minor dead-end road such as Blackberry Lane.

B. Guidelines and principles keyed to functional class should be established and

followed in the design and reconstruction of highways. These principles are set forth in a number of documents ***2,1,3** and as outlined in the following sub-paragraphs:

1. Limited Access Roads
    - Grade separated intersections are a high priority.
    - Provisions for under or over cross-movements by pedestrians, bicycles and other forms of non-motorized transport is essential to prevent isolation of sections of the Town and to reduce unnecessary motorized trips.
    - Park and ride, ride-share, car pool, pickup and/or parking lots need to be constructed or made available in close proximity to points of access.
    - High speed travel and high levels of service need to be maintained, limiting travel time delays.
    - Signalized intersections need to be spaced far apart (generally in excess of 1 mile). If signalized intersections are within a half mile of each other, progression/coordination should occur.
    - Land use controls need to be in place adjacent to intersections to preclude intersection access congestion due to concentrated development or development with a high traffic generation.
    - Turning movements at intersections leading to limited access roads need to have designated lanes for left turns and slip lanes for right turns.

2. Major (arterial roads)
    - Priority of design features need to address movement rather than access.
    - Penetration should not be made of identifiable neighborhoods to minimize through traffic movements in residential areas, unless such penetration can be accomplished with speed controls, meandering roadways and green-space separation between residential areas and the through traffic roadway.
    - Access needs to be tightly controlled through effective access

management policies. Such features as curb cut reductions or elimination, medians (where appropriate), parallel service roads and the like are parts of this strategy.

- Pedestrian crossings need to be restricted to specific areas and preferably located at signalized intersections. Any mid-block pedestrian crossings need to be appropriately lighted, signed and clearly marked.
- Speeds of 30 - 35 mph on secondary arterials and 35 - 45 mph on primary arterials need to be maintained.
- On-street parking needs to be prohibited on the major arterial roads.
- Lane width (11-12 ft.) and total pavement widths need to be appropriate to accommodate the higher speed of travel and wider if heavy truck traffic is anticipated (1 ft. to 2 ft.).
- Right-of-way should generally be a minimum of four rods (66 ft.) up to a maximum of 100 ft.
- Signals should be no closer than 1/4 to 1/2 mile apart and should be synchronized for progressive movement of traffic. Priority needs to be established for the highest volume of through traffic.
- Park and ride, ride share, van pool pickup and/or parking lots need to be constructed or made available on the periphery of the community where reduction in trip ends can have the largest impact on reducing internal congestion.
- Intersection operations on major roads, especially the limited access to major, major to major and major to collector have the most significant impact on movement and hence on the performance level of service of major streets.
- Public mass transit services need to have identified bus stops with covered wait areas wherever feasible and the stops need to be properly sighted to allow the opportunity for maximum pick-up and for minimization of disruption of other through traffic. There also needs to

be safe crossing points for pedestrians to access the bus pick-up locations.

3. Collector Roads ***9,10**

- A significant number of collectors function poorly because structurally they have not been designed to perform as collectors. They have not been designed to handle heavy loads of through traffic (especially trucks and buses).
- Access control is best effected by carefully reviewing curb cut locations and where possible, providing access at the maximum feasible distance from intersections (for corner clearance) and via a minor road location (for corner lots).
- Collectors should penetrate developments but where possible avoid through movement.
- Operating speeds should be 25 to 35 mph for level roads.
- Parking when permitted should be restricted so it is away from intersections and away from the entrance throats to developments. The ability to accommodate parking should also be dependent on road width.
- A minimum right-of-way of three rods (49.5 ft.) and a maximum of 60 ft. are recommended.
- Residential neighborhoods should be interconnected but in a manner to reduce through traffic (i.e., circuitous layout) and to prevent the interconnections from being used as alternatives to the major roads.
- Present and future land use adjacent to the collector needs to be compatible with the functional road classification. Plantings and structural screening (fences) can help to alleviate some of the visual and noise conflicts.
- Consideration needs to be made to accommodate pedestrians, cyclists and horses on rural collectors. They generally do not have safe provisions for pedestrians and bicycles as do collectors in many built-up

areas.

- Complete streets considerations must be taken into account on projects or documentation provided as to why these features cannot be incorporated
- Design of collectors may, in many cases, be appropriate using uncurbed but well-drained shoulders. Lane width should be a minimum of 12 ft. without curbs and 30 ft. for two lanes, if curbs are provided. Additional lanes would provide 11 to 12 ft. for every lane in excess of two to the roadway width.
- The distance between a collector-minor intersection and a collector major intersection must be sufficient to avoid interference with vehicles leaving the major road.
- Collectors acting as access points to major subdivisions should be spaced on the order of 1/4 mile apart.
- Medians can be used at entrances to developments to further restrict access and reduce congestion.
- Gravel roads that act as collectors need to be improved through better drainage, deeper subbases, filter fabrics, stone fill and other means so that current high traffic volumes can be accommodated during the majority of the year. Some gravel roads may require paving.
- New developments on gravel roads will, by virtue of more traffic, add to the structural deterioration of these roads, especially in mud season and; therefore, proportionate costs of improving the collector roads needs to be assessed. In addition, development policy and Town Zoning should not encourage increased density or increased sharing of driveway curb cuts for more than two residential housing units on gravel roads to reduce the traffic impact on these roads and to reduce the Town's future need to incur very large costs to rebuild and pave the gravel roads.
- New developments on paved collector roads could accommodate

shared driveways up to a maximum of four living units, providing agreements are in place such that the shared driveways will never become public roads, requiring Town repairs and maintenance.

4. Minor Roads

- Local access roads should primarily serve the function of access, with low volumes and speeds of 25 mph or less.
- Restrictions on the length of loop roads and cul-de-sac streets must be maintained, as well as the number of dwelling units served. Increases in length and dwelling units result in the creation of undesigned and unwanted collectors.
- Minor roads must be designed to accommodate service vehicles, including fire trucks, snow plows, garbage trucks and the like. Inasmuch as on-street parking is permitted, curbs and total lane widths of 15 ft. are essential to the proper functioning of the roadway.
- Residential, local streets should not be subjected to through traffic. Where existing streets have this problem, special physical geometric or administration control features need to be set in place to reduce the thru traffic problems.
- Pedestrian pathways and sidewalks should be provided in every new development and the sidewalks should then interconnect with trails and paths between neighborhoods.
- Minor roads need to be retained as minor roads and development on them must be carefully controlled so that minor roads, especially the gravel surfaced ones, do not inadvertently become collectors.
- New developments on gravel roads will, by virtue of more traffic, add to the structural deterioration of these roads, especially in mud season and; therefore, proportionate costs of improving the minor roads needs to be assessed. In addition, development policy and Town Zoning should not encourage increased density or increased sharing of driveway curb

cuts for more than two residential housing units on gravel roads to reduce the traffic impact on these roads and to reduce the Town's future need to incur very large costs to rebuild and pave the gravel roads.

- New developments on paved minor roads could accommodate shared driveways up to a maximum of four living units, providing agreements are in place such that the shared driveways will never become public roads, requiring Town repairs and maintenance.

5. Unimproved Roads

- The Board of Selectmen have adopted a road policy on the remaining unimproved roads (Class IV) that:
    a). clearly defines maintenance and upgrade responsibilities being that of the adjacent land owners served by the road.
    b). provides the right for general public access (non-exclusivity)
    c). limits development
    d). provides for transfer of ROW to create a minimum three rod width
    e). stipulates the required standards to which the road must be improved to bring it to a functional capability consistent with the traffic volume on the road.

C. Planning for increased use and integration of alternative transportation must recognize the difference between functional road classes and use the difference to create transportation opportunities.

To reduce the reliance on single-occupancy vehicular travel, alternatives should not only be available but also provide a distinct advantage. At present, there is no advantage for most people to use car pools, van pools, ride sharing, bus or rail service. Some ways to enhance their use are:

- increase the movement capability on those routes designated for these services, through intersection improvements, signal optimization, etc.,
- provide adequate new parking facilities at key locations as indicated previously and also make use of unused parking spaces at under-utilized shopping centers for car and van pools,
- provide better pick-up and drop-off facilities, for buses, including improved pedestrian access,
- require new developments where buses are likely to enter/depart to meet turning radius standards which allow for higher speed movement,
- co-locate multi-modal transportation hubs, so bus and possibly rail service meet at a common location, with adequate parking and safe pedestrian access. The location should be adjacent to either a limited access or major roadway with the capability to move high volumes of vehicles to and from the location,
- satellite parking areas on major roads should tie into the common hub and have smaller vans and/or buses to move people along the links,
- provide financial incentives to encourage use
- provide paved or concrete, all-weather walkways and trails as an option for local traffic traveling between schools, homes, recreation facilities, shopping centers and places of employment.

D. Land use, zoning and the functional classes of road must be correctly coordinated so that permitted development does not overwhelm available or proposed transportation facilities.

Inconsistencies between these elements can cause high traffic demands in areas which cannot accommodate the demands, wasted public monies improving areas in anticipation of development that does not occur, decreased mobility on major

arterials and increased through traffic in developments. Some ways to reduce the inconsistencies are:

- modification of the road classifications and land use at time of adoption of the Town Plan so both elements are consistent
- careful review of all new developments to insure future consistency, including correlation of estimated trip generation numbers with field data on phased developments
- identification of traffic improvements required not only at affected intersections, but on approach roads to the planned development and allocation of costs to provide the improvements to the responsible parties
- review of new developments on basis of alternative transportation enhancements; require actual construction of improvements or payment of an impact fee so that a proportionate portion of the alternative transportation facilities costs are attributed to new development and new traffic generation.

VII. MAINTENANCE AND RECONSTRUCTION PLAN AND FUNDING

There is substantial documentation regarding paved roads and corroborating experience in Essex that expenditure of funds for road maintenance on a timely basis is far less expensive than allowing roads to deteriorate to a point where reconstruction is warranted. The rule of thumb is that one dollar spent on a specific road every 12 to 15 years will in most cases preclude the need to spend four dollars to reconstruct the road after this length of time. Graphical representations of this are included.

Paved Roads - Period 2001 -2005

Prior to 2001, Essex did not allocate sufficient dollars on a consistent yearly basis to maintain its paved roads and many roads deteriorated to a point where a thin to moderate overlay of asphalt (1" to 2" of hot mix) was not sufficient to restore the road's condition. This was outlined in a one page summary entitled...."Highway Resurfacing Needs - A Different Perspective"... provided in

2001to the Selectboard. This document has been updated with current information for 2014 and is included in the Appendix.

With increased paving budgets for highway construction and grant opportunities through VTRANS and FEMA, progress has been made in improving both the gravel and paved roads since 2001. In the period between 2002 and 2005, 25 separate paving and/or reconstruction projects were built encompassing 7.62 miles and costing $951,197. Of this total, $104,078 was obtained from State or federal transportation funds or federal emergency management funds. Funding assistance accounted for 10.9% of the total. This list also does not include the Butler's Corner Reconstruction Project which involved work on VT RT 15 as well as on Old Stage Road. This project cost a total of $1,451,842 with a local Town share of $110,000.

Using the $951,197 figure as a basis for this period, the percentage of funds spent on paved roads within each functional category is as follows:

Functional Class	Miles paved	Cost	% of total cost
Secondary Arterial	2.38 miles	$287,960	30%
Collector Roads	1.96 miles	$183,186	19%
Minor (local) Roads	3.28 miles	$480,051	51%

In the 2001 Highway study, the estimated cost of the referenced projects (excluding Butlers Corners) was $988,059. Not all of the roads identified in the 2001 plan for paving or reconstruction were done. Eleven planned projects totaling $282,537 could not be started due to a lack of available funds.

Also, a number of roads were completed in this period that were not in the 2001 plan. These were Blair Rd, Brigham Hill Lane, Lamell Ave, Maplelawn Drive, Morse Drive, Pioneer Street, Raymond Drive, Saxonhollow Drive. In many cases, either the road deteriorated faster than anticipated or other work was necessary, such as drainage pipe replacements.

Paved Roads -Period 2006- 2009

The 2006 Highway Management Plan identified 40 projects for the four budget years FYE2006 through FYE2009. Thirty-five were accomplished as well as a few additional projects. At the time the Plan was put together in 2005, the total estimated costs of the 35 projects was $951,000.
Of this amount, State/Federal grants were 7.1% of the total. The list also does not include the David Drive intersection improvement project (signalization) at a cost of $359,029 ($229,650 of which was contributed from impact fees), a park-and-ride off the landfill access road ($75,000 state grant), the improvements along Susie Wilson Road completed in connection with the Lowe's project or the Susie Wilson Road/VT15 intersection project in 2009 ($155,073 of which approximately $89,000 was from impact fees).
Using $1,039, 265 as a basis, the percentage of funds spent on paved roads within each functional category was as follows:

Functional Class	Miles Paved	% of Total	Cost	Percent of Total Cost
Secondary Arterial	.78	11.6%	$ 98,543	10%
Collector Roads	3.55	53%	$458,102	44%
Minor (local) Roads	2.37	35.4%	$482,620	46%
Total	6.7	100%	$1,039,265	100%

Per the overall strategy of repaving paved roads every 14 years, the annual amount needed for the overlays in the budget is approximately $300,000 per year. Over the four year period, including all State grants and reconstruction projects, the average amount expended per year was $259,816. In effect, the Town did not budget sufficient funds on an annual basis to maintain its paved roads.

Gravel Roads – Period 2006- 2009

Some gravel roads act as collectors and have traffic volumes that indicate a need to consider rebuilding them as paved roads. The conversion of gravel to paved roads is an expensive undertaking as noted in both the 1990 Road Management Study and in a report produced by the Public Works Department dated January 2007 entitled "Report on Paving of Selected Town Gravel

Roads." On the basis of the 2007 Report, the Selectboard adopted a position that the cost of paving gravel roads was prohibitively expensive and not an action supported by the Selectboard. The Board's specific position on this issue was to:

1) maintain its current position relative to the paving of gravel roads (i.e., no paving) and communicate the positioning writing to those parties who petitioned the Town (i.e., for paving the gravel roads),
2) provide additional funds in FYE08 and future years for the addition of gravel to the roads requiring it and
3) direct the staff to develop a long term maintenance plan for the gravel roads.

To meet the Selectboard's direction regarding the gravel road maintenance plan, detailed inspections were completed in the summer of 2008 on six of the most highly traveled gravel roads – Discovery, Brigham Hill, Indian Brook, Lamore, Lost Nation and Osgood Hill Roads. The collected data was compiled on the air-photo and property line layers of the Town's GIS system. Quantity estimates were then made for each road. Work was done on improving the most critical segments along these roads and is continuing. The collected data and estimates however, can be placed into a summary table which includes quantities, estimated costs and length of roadway. From this table an overall cost per linear foot for upgrading the gravel roads to a higher level of performance can be estimated. The necessary work is a combination of what might be considered by some to be routine maintenance and some actual upgrading of condition. Normal gravel road activities such as grading, liquid chloride application and the like are not considered in the work tasks.

Road	Length	Cost of Work Items	Cost per linear foot
Discovery	2,640 lf	$38,000	$14
Brigham Hill	10,877 lf	$208,000	$19
Indian Brook	6,600 lf	$122,000	$20
Lamore	6,072 lf	$48,000	$8
Lost Nation	14,784 lf	$161,000	$11

Osgood Hill	12,989 lf	$249,000	$19
Totals	53,962 lf	$826,000	$15.31

Using an estimated number of $15.30/ lf and multiplying it by the total length of Class 2 and 3 gravel roads of 23.39 miles (or 123,499 lf), gives an estimated cost of $1,889,534 in 2009 dollars. This cost is only the cost to bring the existing gravel roads to an improved condition – not to pave. If this work were done over a ten year period and assuming an inflation rate of 3% per year, the annual budget need for gravel roads would be $221,453 per year.

Currently the Town is spending on the order of $60,000 in a given budget year for materials (not including manpower and equipment). In general, approximately ½ of a project cost is labor/equipment and the second half is material. Under this assumption, even if one half the cost of the needed $221,453 is from Town labor and equipment, then the gravel road budgets still fall short by about $30,000 to $50,000 a year in meeting this need. Realistically, with the limited number of public works employees and the need to maintain both paved and gravel roads, the deficit per year in spending on maintenance of gravel roads was closer to $100,000 in the 2009 Road Management Plan.

Paved Roads -Period 2009- 2013

The 2009 Highway Management Plan identified 30 projects for the four budget years FYE2010 through FYE2013. Twenty -two were accomplished as well as few additional projects. At the time the Plan was put together in 2009, the total estimated cost of the 30 projects was $1,386,754.
The list also did not include the Gentes Road Bridge reconstruction, costs for routine maintenance, crack-sealing, or costs/reimbursements from FEMA in connection with road damage from declared disasters.

Actual expenditures on paved road reconstruction/paving totaled $1,095,702. This figure includes $113,583 in VTRANS grants for repaving of Class 2 roads. With the state grants subtracted, the local costs were $982,119 or $404,635 less than the plan had set forth in 2009. Reduced Town

budgets did not enable the goals to be met. The percentage of local funds spent on paved roads within each functional category was as follows:

Functional Class	Miles Paved	% of Total	Cost	Percent of Total Cost
Limited Access Expressway	.27	4%	$30,000	3%
Secondary Arterial	.55	9%	$138,844	14%
Collector Roads	2.35	37%	$293,958	30%
Minor (local) Roads	3.14	50%	$519,317	53%
Totals	**6.31**	**100%**	**$982,119**	**100%**

Per the overall strategy of repaving paved roads every 14 years, the annual amount needed for the overlays in the budget is approximately $300,000 per year. Over the four year period, including all State grants , the average amount expended per year was $273,926. Although this number is higher than $259,816 number from the previous road management plan, the miles of road went from 6.7 to 6.3 miles. In effect, the increased costs were most likely due to the increased costs for goods and services. Overall, it can be stated that the Town did not budget sufficient funds on an annual basis to maintain its paved roads. Approximately another $100,000 should have been budgeted and expended to keep up with needed resurfacing costs and needs.

It should be noted that over the four year period, a total of 21 of the top 50 priority projects were completed and 11 of the 51 to 100 priority projects. One project over 100 was done. In addition, significant funds from FEMA were provided to the Town over this period due to a number of declared emergencies. Most of these funds went to the gravel roads, with the exception of work on one paved section of Weed Road.

Strategy for the Future:

It will require a significant commitment to break the current cycle of inadequate road maintenance and long time delays for securing funds for roads requiring reconstruction. The following strategy is a recommended course of action to break this cycle:

(1). Fund the yearly highway paving line item in the General Fund budget at a level to allow re-paving of all existing roads on a 15 year cycle or less. The analysis done in 2009 indicated that to just overlay all existing Town paved roads on a 14 year cycle required an expenditure of $301,162 in 2009 dollars. Some roads may require more than resurfacing and so this "average" estimate of yearly need may be low. However, assuming a 2% increase in costs per year from 2009 until 2013 and a 2.5% increase from 2014 to 2017, the average yearly amount needed between 2014 and 2017 is $346,000.

a) With a reduction in available Capital Funds due to the debt on the Gentes Road Bridge and the Police Station debt, only $145,000 was funded for road construction in the Capital Fund in FYE15. In 2017, when the Gentes Road Bridge debt is paid off, the amount available would be $200,000.

b) To meet the objective of $346,000 per year, a total of $201,000 would be needed from the Operating Account and State Class 2 paving grants. After the Gentes Road bridge debt is retired, the amount needed per year will be $146,000.

c) For FY15, the operating budget has $131,000 set aside for paving. However, a VTRANS Class 2 paving grant is being requested in FYE15 in the amount of $200,000 (+ or -). If this grant is obtained, the amount spent on resurfacing would generally meet the target with gradual annual increases to the operating budget over the next three years. The following table demonstrates this:

FYE	Capital Budget	Operating Budget	State Grants	Total	Needed Funds	Total – Needed Funds	Cumulative Balance
2015	$145,000	$131,000	$200,000	$476,000	$346,000	$130,000	$130,000
2016	$145,000	$145,000	0	$290,000	$346,000	-$56,000	$74,000
2017	$145,000	$155,000	0	$300,000	$346,000	-$46.000	$28,000
2018	$145,000	$170,000	0	$315,000	$346,000	-$31,000	-$3,000

(2). Even with budget difficulties at the State level, the VTRANS Class II paving

program remains viable at this time. In general, funds can be obtained for the Class 2 roads on the basis of a sizeable grant every 3 to 4 years. The funds are project specific.

(3). Insure that the local match for major projects is closely timed for local budgeting in the Capital Fund with the timing for construction by VTRANS and the Federal Highway Administration.

(4). Continue to impose impact fees on developers who add traffic to the existing road network. The fees need to be proportionate to the impact of the new traffic. These fees reduce the overall impact on the tax rate and the level of borrowing required for major projects. These fees can only be set by the Planning Commission during the development review process and it is critical that the Planning Commission set these fees at the appropriate levels. Major projects for which fees have been imposed include:

(1) Susie Wilson Road/Kellogg Signalization and Timing
(2) Essex Way
(3) Sand Hill Road and Allen Martin Parkway Intersection
(4) Sand Hill Road and VT.Rte.117
(5) Allen Martin Parkway and Thompson Drive (due to truck load impacts)
(6) The intersection of Allen Martin Parkway and VT15

(5). The rebuilding of roads generally requires extensive effort, long lead times and a substantial infusion of money to accomplish. In many cases, funds for survey, design and soil testing need to be budgeted a year or more in advance of proposed construction.

(6). Utilize Town forces to the maximum extent possible, especially on repairs/reconstruction of short segments of roadway. Although the Town Highway crew can perform some limited spot reconstruction and has done so in

the past, the number of highway employees (normally 10) is reduced during the summer due to accumulated leave and overtime. There is insufficient Town manpower to perform normal maintenance on Town infrastructure and prepare equipment for winter operations plus construct major projects. Most reconstruction projects will need to be bid out to contractors.

(7). As the number of new houses on gravel roads increase, more work is needed to maintain them at an appropriate level of service, especially during the spring and early summer. Currently, there is an amount equal to $24,000 per year specifically earmarked in the Capital Budget for expenditure on these roads. There are added funds in the Operating Budget for work on these roads. These funds include:

a) $19,000 for liquid application of calcium chloride

b) $10,500 for gravel road ditching

c) $16,400 for gravel road resurfacing

d) Approximately $10,000 in a variety of miscellaneous gravel road materials.

The sum of all the funds spent per year on maintenance of the gravel roads is budgeted at $79,900 excluding Town man-hours and equipment. With man-hours and equipment, the total is estimated to be between $150,000 and $200,000.Coupled with an increase in budget funds, there needs to be a corresponding traffic impact fee officially established for new homes on gravel roads.

(8). In the future (post 2017), it may be necessary to crease the Town highway tax by 1/3-cent to derive an additional $75,000 per year in revenue, specifically earmarked for roadwork.

Funding and Project Planning:

In the previous Highway Management Plan, a project specific listing of each road project to be funded each year over the four years of the Plan was used as the basis for developing the funding

strategy. In this plan, a funding level is proposed based upon the overall level of spending for each year needed to maintain and make gradual improvements to the roads. A listing of potential projects each year is provided, but as in the past, these lists will change as conditions and budgets change. Providing an accurate list four years into the future cannot be reflective of the changes that occur on a shorter term basis. Road conditions can change, priorities can change, costs are likely to increase as inflationary debt occurs on a broader scale and funding levels will change based on the local tax situation. It is also difficult to estimate in 2014 what grant programs will or will not be available into the future. The Priority lists in the Appendix (A, B and D) will serve as a basis for each year's budget decision making.

The following table reflects the budgets that are needed to maintain the existing infrastructure at current levels of repair and to increase the number of paving overlays to prevent future costs from escalating further due to a road migrating from an "overlay" category into a "reconstruction" category. The intent is to correct a limited number of roads that require rebuilding while overlays are placed on the next tier of roads to prevent them from falling into the rebuild category. Funds are also identified to improve the condition of the Town's gravel roads. Again, the logic is that roads overlaid on a timely basis will not need to be fully reconstructed. The table does not include funds for specific high cost projects such as new traffic signals - these projects will have to be budgeted and identified separately. Also, although the Town is in FYE2014, the numbers are provided for reference. Also, the actual summer construction usually in a given fiscal year usually occurs in the summer of the calendar year preceding the FYE Budget (i.e., the construction for FYE14 mostly occurred in the summer of 2013).

PROPOSED FUNDING PLAN

Fund Source	FYE2014	FYE2015	FYE2016	FYE2017	FYE2018
Capital Fund for Paved Roads	$145,000	$145,000	$145,000	$145,000	$145,000
Capital Fund for Gravel Roads	$24,000	$24,000	$24,000	$24,000	$24,000
General Fund for Paving Overlays	$128,000	$131,000	$145,000	$155,000	$170,000
Totals	$297,000	$300,000	$314,000	$324,000	$339,000

SUMMARY:

Under the proposed funding plan through FYE2016, five of the 10 top priority projects ranked in 2014 would be completed plus an additional 5 following the group out of the top 51. This effort will address the most significant road issues over the next two years. Specific road projects beyond that time frame have not been listed although the projects are identified by priority on the master list in the Appendix. It is very difficult to forecast specific project schedules and costs beyond a few years. The project lists for those years will be developed at least two years in

In conclusion, the alternative of not spending money on the Town roads is to drive up the future costs even higher. The proposed plan enables the Town to catch up on a backlog of needed infrastructure repairs without requiring long term debt to pay for the repairs.

Finally, it should be noted that there is no plan to reconstruct or pave any of the Town's gravel roads within the period covered by this Plan (i.e., through FYE 2017).

ROAD PROJECTS/EXPENDITURES FOR FYE 2014

Name of Road/Project	General Fund Share	Capital Fund Share	Cum.Total	Status
Jackson Heights	$0	$7,365	$7,365	Done
Hagan Drive	$0	$56,398	$63,763	Done
Cabot Drive	$0	$22,302	$86,065	Done
Skyline Drive	$25,414	$0	$111,479	Done
Chelsea Road	$25,194	$0	$136,673	Done
Deer Crossing Lane	$47,658	$0	$184,331	Done
Old Stage Road (Partial)	$0	$62,747	$247,078	Done
Unexpended funds	$29,734	$59,188	$336,000	See Note
Class 2 paving grant	$0	$0	$336,000	No grants
Totals	$118,000	$208,000	$336,000	

NOTE: The remaining unexpended funds for FYE14 will be used on projects that will be determined in the spring. Approximately $15,000 of the unexpended Operating Funds will be used for expanded crack-sealing to extend pavement life.

ANTICIPATED

ROAD BUDGETS FOR FYE 2015

Name of Road/Project (Priority Number)	General Fund Share	Capital Fund Share	Total
Towers Road (#2)	$42,200	$0	$42,200
Sydney Drive (#4)	$0	$57,300	$99,500
Sand Hill Road (#10)	$0	$22,400	$121,900
Craftsbury Court (#17)	$0	$49,200	$171,100
Willoughby Drive (#23)	$0	$19,700	$190,800
Baker Street (#38)	$26,400	$0	$217,200
Clover Drive (#16)-partial	$39,300	$0	$256,500
Added Crack Sealing	$15,000	$0	$271,000
State Class 2 Grant	$0	$0	$471,000
Gravel Roads	$0	$24,000	$501,000
Contingency	$8,100	-$3,600	$505,500
Totals	$130,000	$169,000	$505,500

ANTICIPATED

ROAD BUDGETS FOR FYE 2016

Name of Road/Project	General Fund Share	Capital Fund Share	Total
Old Stage Road (#1)	$70, 200	$0	$ 70,200
Margaret Street (#19)	$74,800	$0	$145,000
Lida Drive (#51)	$0	$47,300	$192,300
Clover Drive (#16) partial	$0	$72,800	$265,100
Pinecrest Drive (#3) partial	$0	$24,900	$290,000
Prior Year Capital Funds (Pinecrest)		$42,100	$332, 100
Gravel Roads	$0	$24,000	$356,100
Totals	$145,000	$211,100	$356,100

Note: The Capital Fund will have $24,000 set aside for gravel roads and $145,00 for paving, a total of $169,000. To meet the need for $211,100, an amount equal to $42,100 will have to be used from the Capital Road reserve monies.

ANTICIPATED

ROAD BUDGETS FOR FYE 2017

Name of Road/Project	General Fund Share	Capital Fund Share	Total
Specific Projects To Be Determined in FYE15			
Totals	$155,000	$169,000	$324,000

ANTICIPATED

ROAD BUDGETS FOR FYE 2018

Name of Road/Project	General Fund Share	Capital Fund Share	Total
Specific Projects To Be Determined in FYE16			
Totals	$170,000	$169,000	$339,000

REFERENCES

1. Homburger, Wolfgang S., Residential Street Design and Traffic Control. ITE Publication, Prentice-Hall, Pgs 21-36 (1989)

2. American Association of State Highway and Transportation Officials. A Policy on Geometric Design of Highways and Streets. ASHTO Publication, Pgs 1-1 through 1-14, (2001)

3. Stover, Vergil G., Transportation and Land Development, ITE Publication, Prentice-Hall, Pgs 80-93 (1988)

4. Vermont State Statutes, Title 19, Chapter 3

5. Vermont State Statutes, Title 19, Chapter 17

6. Essex, Town Subdivision Regulations, Definitions, (2008)

7. Transportation Research Board, Highway Capacity Manual Special Report #209, National research Council, Pg 11-4

8. Vermont State Statutes, Title 19, Section 310

9. ITE Technical Council Committee 5-5, Guidelines for Major Street Design, (1984)

10. ITE Technical Council Committee 5A-25A, Guidelines for Residential Subdivision Design, ITE.

APPENDIX A

Project #	Branch ID	Name	Section ID	To	From	Length (ft)	Width (ft)	True Area (sq. ft)	Raw PCI	Traffic	Adjusted PCI
1	2 II	Old Stage Road	4	Westford town line	267 Old Stage Road	6336	22	139392	15	30	21
2	710	Towers Road	1	Chapin Road	RT 15	2534	22	55748	4	50	22.4
3	6 III	Pinecrest Drive	2	VT 2A	Jackson Heights	3115	25	77875	19	30	23.4
4	792	Sydney Drive	1	Debra Drive	Essex Way	1539	30	46170	10	50	26
5	710	Towers Road	2	Old Stage Road	Chapin Road	5755	22	126610	15	50	29
6	2 II	Old Stage Road	2	Colonel Page Road	Indian Brook Road	6336	22	139392	34	30	32.4
7	2 II	Old Stage Road	3	267 Old Stage Road	Colonel Page Road	4224	22	92928	38	30	34.8
8	5	Kellogg Road		Colchester town line	Susie Wilson Road	2904	30	87120	57	10	38.2
9	711	Cypress Lane		Cul de sac	Woodlawn Drive	370	30	11100	5	90	39
10	4 II	Sand Hill Road	3	VT 117	Allen Martin Drive	6019	30	180570	47	30	40.2
11	36	Brigham Hill	2	#50	End of Pavement	792	20	15840	34	50	40.4
12	62	Essex Highlands		Cul de sac	Weed Road	2482	22	54604	8	90	40.8
13	3 II	Susie Wilson Road	1	Pinecrest Drive	VT 15	792	52	41184	64	10	42.4
14	6 III	Pinecrest Drive	1	Jackson Heights	Susie Wilson Road	2165	25	54125	52	30	43.2
15	2 II	Old Stage Road	1	Indian Brook Road	VT 15	2112	22	46464	55	30	45
16	754	Clover Drive	2	Cul de sac	Boblink Circle (2nd access)	1954	30	58620	44	50	46.4
17	115	Craftsbury Court	2	Cabot Drive	6 Craftsbury Court	264	30	7920	31	70	46.6
18	95	Essex Way	1	VT 289	VT 15	2429	32	77728	61	30	48.6
19	740	Margaret Street		Cul de sac	Sand Hill Road	2006	30	60180	36	70	49.6
20	774	Repa Drive		Hagan Drive	Sydney Drive	686	30	20580	36	70	49.6
21	789	Peacham Lane	2	Willoughby Drive	Cavendish Drive	317	30	9510	37	70	50.2
22	770	Creek Road		Wildwood Drive	Rustic Drive	1162	30	34860	24	90	50.4
23	758	Willoughby Drive	1	Peacham Lane	Old Stage Road	528	30	15840	51	50	50.6
24	743	Blackberry Road		Cul de sac	Bobolink Circle	792	25	19800	28	90	52.8
25	714	Bixby Hill Road		End of pavement	VT 128	1056	24	25344	55	50	53
26	110	Ewing Place		Cul de sac	Susie Wilson Road	898	24	21552	55	50	53
27	75	Saxonhollow Drive	1	Hillside Cricle (South end)	Greenbriar Drive	634	30	19020	55	50	53
28	766	Skyline Dr	1	13 Skyline Drive	Valleyview Drive	686	30	20580	55	50	53
29	754	Clover Drive	1	Bobolink Circle (2nd access)	Towers Road	1056	30	31680	56	50	53.6
30	744	Tanglewood Drive	1	Rosewood Trail	Sand Hill Road	2693	40	107720	57	50	54.2
31	765	Valleyview Drive	1	Pool	Skyline Drive	1056	30	31680	57	50	54.2
32	24	Gentes Road		Colchester town line	VT 2A	4805	20	96100	59	50	55.4
33	9	Abare Avenue		Damon Drive	Susie Wilson Road	1109	40	44360	46	70	55.6
34	10	Prescott Street		Cul de sac	Abare Avenue	1742	30	52260	46	70	55.6
35	733	Windridge Road	3	Valleyview Drive	7 Windridge Road	528	30	15840	46	70	55.6
36	757	Pinewood Drive		Valleyview Drive	VT117	2323	30	69690	61	50	56.6
37	4 II	Sand Hill Road	1	Maplelawn Drive	VT 15	1954	22	42988	75	30	57
38	725	Baker Street		Greenfield Road	Logwood Circle	1162	30	34860	63	50	57.8
39	3 II	Susie Wilson Road	2	Kellogg Road	Pinecrest Drive	1	52	52	90	10	58
40	115	Craftsbury Court	1	6 Craftsbury Court	Old Stage Road	1056	30	31680	53	70	59.8
41	781	Steeplebush Road		Cedar Street	Bobolink Circle	898	27	24246	53	70	59.8
42	63	Weed Road	1	Sleepy Hollow Road	VT 128	5544	20	110880	67	50	60.2
43	768	Forest Road	2	Cul de sac	Skyline Drive (West)	1320	20	26400	54	70	60.4
44	85	Kimberly Drive		Cul de sac	Pinecrest Drive	686	30	20580	54	70	60.4
45	702	Londonderry Lane		Chelsea Road	VT 15	1056	30	31680	54	70	60.4
46	735	Allen Martin Parkway	1	Hickory Lane	Sand Hill Road	686	30	20580	68	50	60.8

47	772	Billie Butler Drive		Private	VT 15	369	30	11070	82	30	61.2
48	1	North Williston Road		Bridge	VT 117	1795	20	35900	82	30	61.2
49	120	David Dr		End	Susie Wilson	528	30	15840	69	50	61.4
50	761	River View Drive		Pinewood Drive	Pinewood Drive	1848	30	55440	69	50	61.4
51	747	Lida Drive		Repa Drive	Lang Drive	1267	30	38010	43	90	61.8
52	709	Woodlawn Court		Cul de sac	Woodlawn Drive	264	30	7920	57	70	62.2
53	95	Essex Way	2	Freeman Woods	VT 289	2218	30	66540	84	30	62.4
54	20	Old Colchester Road		Essex Junction line	VT 2A	2640	20	52800	84	30	62.4
55	769	Wildwood Drive		Forest Road	Rustic Drive	2587	30	77610	58	70	62.8
56	701	Woodlawn Drive	1	13	Tanglewood Drive	1056	30	31680	58	70	62.8
57	4	Morse Drive		Cul de sac	Kellogg Road	1531	25	38275	72	50	63.2
58	123	Andrew Ave		Gauthier	Turcotte	686	30	20592	46	90	63.6
59	4 II	Sand Hill Road	2	Allen Martin Drive	Maplelawn Drive	2904	30	87120	86	30	63.6
60	75	Saxonhollow Drive	2	Allen Martin Parkway	Hillside Cricle (South end)	1584	30	47520	73	50	63.8
61	753	Saybrook Road		Cul de sac	VT 15	158	24	3792	73	50	63.8
62	758	Willoughby Drive	2	Pomfret Dr	Peacham Ln	475	30	14250	73	50	63.8
63	763	Hillside Circle		Saxon Hollow Road	Saxon Hollow Road	2270	30	68100	47	90	64.2
64	86	Market Place		Cul de sac	Susie Wilson Road	634	30	19020	74	50	64.4
65	778	Heatherbush Road	2	Timberlane Drive	9 Heatherbush Road	528	30	15840	61	70	64.6
66	783	Pomfret Lane		Fox Run Road	Willoughby Drive	634	30	19020	61	70	64.6
67	784	Weathersfield Bow	1	Fox Run Road	Willoughby Drive	739	30	22170	61	70	64.6
68	741	Butternut Ct	2	End	Pointe Dr	1056	25	26400	48	90	64.8
69	2	Dalton Drive		Colchester town line	Ethan Allen Avenue	1109	26	28834	62	70	65.2
70	721	Logwood Circle		Logwood Circle	Greenbriar Drive	4330	30	129900	76	50	65.6
71	789	Peacham Lane	1	Cavendish Drive	Old Stage Road	1320	30	39600	63	70	65.8
72	773	Thomas Lane		Cul de sac	VT 128	1426	30	42780	50	90	66
73	36	Brigham Hill Road	1	50 Brigham Hill Road	Old Stage Road	2640	20	52800	77	50	66.2
74	792	Sydney Drive	2	Hagan Drive	Debra Drive	2693	30	80790	77	50	66.2
75	767	Ridge Road		Valleyview Drive	Skyline Drive	1214	22	26708	51	90	66.6
76	121	Gauthier Drive	2	Cull de sac	New England Drive	739	30	22170	78	50	66.8
77	765	Valleyview Drive	3	Windridge Road	Skyline Drive	1901	30	57030	78	50	66.8
78	775	Wolff Drive		Cul de sac	Riverview Drive	528	30	15840	52	90	67.2
79	717	Greenfield Road	1	Greenfield Ext	VT 117	3696	30	110880	53	90	67.8
80	87	New England Drive		Gauthier Drive	Kellogg Road	1531	30	45930	80	50	68
81	717	Greenfield Road	2	Cul de sac	Greenfield Ext	845	30	25350	81	50	68.6
82	11	Pioneer Street	1	Blair Road	Pinecrest Drive	1267	20	25340	81	50	68.6
83	733	Windridge Road	2	Wildwood Drive	Valleyview Drive	1901	30	57030	68	70	68.8
84	755	Bobolink Circle		Clover Drive (north end)	Clover Drive (south end)	2165	25	54125	55	90	69
85	15	Ira Allen Drive		Jackson Heights	Pioneer Street	792	20	15840	95	30	69
86	18	Landfill Lane		Drop-ff center	VT 2A	370	24	8880	82	50	69.2
87	106	Hampshire Court		Cul de sac	Suffolk Lane	634	25	15850	69	70	69.4
88	776	Greenbriar Drive	1	Saxon Hollow Road	Sand Hill Road	1954	40	78160	83	50	69.8
89	701	Woodlawn Drive	2	Cypress	13	999	30	29970	57	90	70.2
90	735	Allen Martin Parkway	2	End	Hickory Lane	1267	30	38010	84	50	70.4
91	790	Cavendish Drive	1	Weathersfield Bow	Peacham Lane	211	30	6330	71	70	70.6
92	66	Saxon Hill Rd		End of Pavement	VT 15	3854	26	100214	72	70	71.2
93	777	Thompson Drive		Dead end	Allen Martin Drive	1531	30	45930	72	70	71.2

94	742	Foster Road		Cul de sac	Sand Hill Road	2904	28	81312	86	50	71.6
95	722	Lamell Avenue	2	Cul de sac	Ronald Court	1373	25	34325	73	70	71.8
96	736	Lasalle Drive		Margaret Street	Sand Hill Road	317	30	9510	73	70	71.8
97	95	Essex Way	3	Syndney Drive	Freeman Woods	637	30	19110	100	30	72
98	11	Pioneer Street	2	Abare Avenue	Blair Road	686	20	13720	87	50	72.2
99	718	Alder Lane		VT 128	VT 15	792	20	15840	88	50	72.8
100	796	Carmichael Street		Billie Butler Drive	Essex Way	1373	30	41190	88	50	72.8
101	23	Lamore Road		End of pavement	VT 2A	370	22	8140	88	50	72.8
102	733	Windridge Road	1	7 Windridge Road	Timberlane Circle	528	30	15840	75	70	73
103	782	Kurk Drive		Cul de sac	Pinewood Drive	422	30	12660	63	90	73.8
104	729	Timberlane Drive		Winterlane Circle	Windridge Road	950	30	28500	63	90	73.8
105	727	Winterlane Circle		Timberlane Drive	Timberland Drive	1637	30	49110	63	90	73.8
106	121	Gauthier Drive	1	New England Drive	Kellogg Road	2429	30	72870	90	50	74
107	13	Damon Drive		Cul de sac	Prescott Street	792	30	23760	77	70	74.2
108	723	Greenfield Court		Cul de sac	Greenfield Road	317	30	9510	64	90	74.4
109	776	Greenbriar Drive	2	Alderbrook Road	Saxon Hollow Road	1848	40	73920	91	50	74.6
110	778	Heatherbush Road	1	9 Heatherbush Road	Valleyview Drive	369	30	11070	78	70	74.8
111	8	Colbert Street		Abare Avenue	Blair Road	898	30	26940	65	90	75
112	109	Devon Hill Court		Cul de sac	Southdown Court	475	25	11875	65	90	75
113	745	Lang Drive		Hagan Drive	Essex Way	1795	30	53850	92	50	75.2
114	744	Tanglewood Drive	2	Dead end	Rosewood Trail	2693	40	107720	92	50	75.2
115	779	Greenfield Road Ext		Greenfield Road	Greenbriar Drive	779	30	23370	79	70	75.4
116	715	Iris Street		Bobolink Circle	Bixby Hill Road	422	30	12660	79	70	75.4
117	706	Sunset Drive		Cul de sac	Cul de sac	1109	34	37706	79	70	75.4
118	787	Cedar Street		Cul de sac	Clover Drive	1901	26	49426	66	90	75.6
119	798	Irene Avenue		Marion Avenue	VT 128	2270	25	56750	80	70	76
120	730	Lavigne Road		Sand Hill Road	Perry Drive	1426	20	28520	80	70	76
121	107	Dartmoor Court		Cul de sac	Hampshire Drive	581	25	14525	67	90	76.2
122	791	Thistle Lane		Cul de sac	Fox Run Road	686	26	17836	67	90	76.2
123	83	Allen Martin Drive		Sand Hill Road	VT 15	4910	24	117840	100	41	76.4
124	700	Chelsea Road	3	Cul de sac	35 Chelsea Road	1320	30	39600	81	70	76.6
125	700	Chelsea Road	2	End (Cabot Drive)	Cabot Drive	1162	30	34848	81	70	76.6
126	738	Patricia Place		Cul de sac	Margaret Street	686	30	20580	68	90	76.8
127	105	Suffolk Lane		Pinecrest Drive	Pinecrest Drive	1214	30	36420	68	90	76.8
128	780	Whitcomb Meadows Lane		Cul de sac	VT 15	1373	24	32952	68	90	76.8
129	138	Joshua Way		Pinecrest Drive	Susie Wilson Road	422	30	12660	95	50	77
130	719	Alderbook Road		Greenbriar Drive	Greenbriar Drive	1848	30	55440	82	70	77.2
131	722	Lamell Avenue	1	East end	Ronald Court	686	25	17150	82	70	77.2
132	750	Oakwood Lane		Cul de sac	Tanglewood Drive	1478	30	44340	82	70	77.2
133	704	Sunset Road		Sunset Drive	VT 15	211	25	5275	82	70	77.2
134	734	Maplelawn Drive		Sand Hill Road	Sand Hill Road	1637	30	49110	69	90	77.4
135	728	Perry Drive		Lavigne Road	VT 15	1426	20	28520	83	70	77.8
136	784	Weathersfield Bow	2	Cul de sac	Fox Run Road	792	30	23760	83	70	77.8
137	132	Old Susie Wilson Road	1	Abare	Susie Wilson Road	1162	22	25555	70	90	78
138	760	Bluestem Road		Cedar Street	Clover Drive	1003	26	26078	84	70	78.4
139	801	Corporate Drive		Dead end	Allen Martin Drive	1109	30	33270	84	70	78.4
140	799	Marion Ave		Cul de sac	Frederick Road	1162	30	34860	84	70	78.4

141	724	Richard Street		Lamell Avenue	VT 15	528	30	15840	84	70	78.4
142	802	Freeman Woods		End	Essex Way	686	30	20580	85	70	79
143	92	Parizo Drive		Cul de sac	Pinecrest Drive	211	25	5275	85	70	79
144	712	The Commons		VT 15	VT 15	370	30	11100	86	70	79.6
145	788	Cedar Court		Cul de sac	Cedar Street	370	30	11100	73	90	79.8
146	3	Ethan Allen Avenue		Colchester town line	VT 15	1320	30	39600	100	50	80
147	766	Skyline Dr	3	Forest Road	24 Skyline Drive	1056	22	23232	100	50	80
148	766	Skyline Dr	2	24 Skyline Drive	13 Skyline Drive	686	30	20580	100	50	80
149	765	Valleyview Drive	2	VT 117	Pool	369	30	11070	100	50	80
150	63	Weed Road	2	RT 15	Sleepy Hollow Road	1	22	22	100	50	80
151	42	Chapin Road		Colonel Page Road	Towers Road	5280	20	105600	87	70	80.2
152	768	Forest Road	1	Skyline Drive (West)	Skyline Drive (East)	2112	20	42240	87	70	80.2
153	741	Butternut Ct	1	Pointe Dr	Margaret St	1214	25	30360	74	90	80.4
154	137	Whitetail Lane		Cul de sac	Deer Crossing	528	30	15840	74	90	80.4
155	6	Blair Road		Pioneer Street	Susie Wilson Road	792	30	23760	89	70	81.4
156	794	Debra Drive		Sydney Drive	Sydney Drive	739	30	22170	76	90	81.6
157	795	Stannard Drive		Essex Way	Essex Way	1214	30	36420	90	70	82
158	793	Bashaw Drive		Sydney Drive	Sydney Drive	686	30	20580	78	90	82.8
159	752	Cemetary Road		Dead end	Sand Hill Road	475	20	9500	78	90	82.8
160	785	Fox Run Road	2	Cul de sac	Pomfret Road	1003	30	30090	78	90	82.8
161	762	Perkins Drive		Riverview Drive	Riverview Drive	739	30	22170	78	90	82.8
162	786	Raymond Drive		Winterlane Circle	Riverview Drive	1373	30	41190	79	90	83.4
163	122	Turcotte Dr		Gauthier	Gauthier	422	30	12660	79	90	83.4
164	732	Circle Drive		Cul de sac	VT 15	581	30	17430	80	90	84
165	748	Fernhollow Road		Cul de sac	Tanglewood Drive	264	30	7920	81	90	84.6
166	797	Partridge Drive		Private	Allen Martin Parkway	211	22	4642	95	70	85
167	39	Douglas Road		Cul de sac	Towers Road	581	24	13944	82	90	85.2
168	785	Fox Run Road	1	Pomfret Road	Weathersfield Bow	422	30	12660	82	90	85.2
169	713	Leo Drive		Dead end	VT 15	528	30	15840	82	90	85.2
170	766	Southdown Court		Cul de sac	Suffolk Lane	845	24	20280	96	70	85.6
171	720	Frederick Road		Cul de sac	Lamell Avenue	1003	30	30090	84	90	86.4
172	705	Linden Lane		Dead end	Glenwood Drive	950	30	28500	84	90	86.4
173	79	Marion Ave		End	Fredrick	1162	30	34860	84	90	86.4
174	726	Ronald Court		Cul de sac	Lamell Avenue	264	25	6600	84	90	86.4
175	17	Jackson Heights	1	Button Drive	Pinecrest Drive	845	20	16900	98	70	86.8
176	14	Stearns Avenue		Jackson Heights	Pioneer Street	634	30	19020	85	90	87
177	771	Rustic Drive		Forest Road	Wildwood Drive	1478	30	44340	99	70	87.4
178	749	Cabot Drive	2	Chelsea Road	Chelsea Road	634	30	19020	100	70	88
179	749	Cabot Drive	1	Chelsea Road	Old Stage Road	369	30	11070	100	70	88
180	700	Chelsea Road	1	Cabot Drive	35 Chelsea Road	369	30	11070	100	70	88
181	136	Deer Crossing		Cul de sac	Saxon Hill Road	2482	30	74460	100	70	88
182	703	Glenwood Drive		Tanglewood Drive	Tanglewood Drive	1426	30	42780	100	70	88
183	764	Hagan Drive	1	Repa	Lang Drive	1531	30	45930	100	70	88
184	737	Hickory Lane		Sage Circle	Allen Martin Parkway	370	25	9250	100	70	88
185	17	Jackson Heights	2	Pioneer Street	Button Drive	475	20	9500	100	70	88
186	132	Old Susie Wilson Road	2	End	Abare	1320	22	29040	100	70	88
187	12	Button Dr		Jackson Hts	Pioneer	475	30	14256	87	90	88.2

188	707	Rosewood Trail		Dead end	Tanglewood Drive	528	30	15840	93	90	91.8
189	803	Stonebrook Circle		Dead end	Windridge Road	1637	30	49110	93	90	91.8
190	800	Laurel Drive		Cul de sac	Allen Martin Parkway	1795	30	53850	95	90	93
191	33	Brigham Hill Lane	2	End of pavement	Brigham Hill Road	1637	18	29466	100	90	96
192	746	Cindy Lane		Cul de sac	Tanglewood Drive	1056	30	31680	100	90	96
193	739	Sage Circle		Cul de sac	Butternut Court	950	30	28500	100	90	96

APPENDIX B

Road Segments with a Pavement Condition Index Equal To or Less than 55

Road Name/Segment	PCI	Road Priority Number Including Traffic
Towers Road Segment 1	4	#2
Cypress Lane	5	#9
Essex Highlands	8	#8
Sydney Drive	10	#4
Old Stage Road Segment 4	15	#1
Towers Road Segment 2	15	#5
Pinecrest Drive Segment 2	19	#3
Creek Road	24	#22
Blackberry Road	28	#23
Craftsbury Court	31	#17
Old Stage Road Segment 2	34	#6
Brigham Hill Road	34	#11
Margaret Street	36	#19
Repa Drive	36	#20
Peacham Lane	37	#21
Old Stage Road Segment 3	38	#7
Lida Drive	43	#51
Clover Drive	44	#16
Abare Avenue	46	#33
Prescott Street	46	#34
Windridge Road	46	#35
Andrew Avenue	46	#58
Sand Hill Road Segment 3	47	#10
Hillside Circle	47	#63
Butternut Court	48	#68
Thomas Lane	50	#72
Willoughby Drive	51	#23
Ridge Road	51	#75
Pinecrest Drive Segment 1	52	#14
Wolff Drive	52	#78
Craftsbury Court	53	#40
Steeplebush Road	53	#41
Greenfield Road Segment 2	53	#79
Forest Road Segment 2	54	#43
Kimberly Drive	54	#44
Londonderry Lane	54	#45

Old Stage Road Segment 1	55	#15
Bixby Hill Road	55	#25
Ewing Place	55	#26
Saxonhollow Drive	55	#27
Skyline Drive	55	#28
Bobolink Circle	55	#85

NOTE #1: The PCI data was collected by summer interns during the summer of 2013 and field verified by Public Works staff for relative accuracy in condition assignment numbers.

NOTE#2: The PCI information is based on the derivation of the PCI using the APWA Paver program. This PCI may differ in formulation of a PCI number from the earlier studies done using the RSMS program.

NOTE# 3: In the 2009 Town Highway Plan, 20 roads were on this list with a PCI of 55 or less.. In the 2014 Plan, there are 42 roads with a PCI of 55 or less. This increase could be caused by using a different program, the judgment of the evaluation team, or it may be that a Town funding has not kept up with the deterioration of the roads.

Note #4: The highlighted roads are those programmed for work in FYE 2014 , 2015 or FYE2016.

APPENDIX C

Town of Essex Public Works

2009 Adjusted PCI

Rank	Road	From st	To st	mile post	end post	length	Traffic Class	PCI	TRAFFIC	ADJUSTED PCI TRAFFIC=40% PCI=60%
1	Skyline Drive 2	FOREST RD INTSCTN	FOREST RD	0.24	0.54	0.3	M	33	50	39.8
2	Foster Road	SANDHILL	CUL DE SAC	0	0.55	0.55	M	36	50	41.6
3	Old Stage Road 3	BRIGHAM HILL RD	#267 OLD STAGE	1.7	2.7	1	MH	51	30	42.6
4	Allen Martin Drive	SANDHILL	VT 15	0	0.93	0.93	MH	54	30	44.4
5	Forest Road	SKYLINE	CUL DE SAC	0	0.65	0.65	M	42	50	45.2
6	Towers Road 1	VT 15	CLOVER	0	0.14	0.14	M	45	50	47
7	Ethan Allen Ave	VT 15	COLCHESTER LINE	0	0.25	0.25	M	48	50	48.8
8	Tanglewood Drive 1	SAND HILL	ROSEWOOD TRAIL	0	0.51	0.51	M	48	50	48.8
9	Sand Hill Road 1	VT. 15 (Jericho Rd)	ALLEN MARTIN DRIVE	0	1.15	1.15	MH	63	30	49.8
10	Skyline Drive 1	VALLEYVIEW	FOREST RD INTSCTN	0	0.24	0.24	M	51	50	50.6
11	Old Stage Road 2	INDIAN BROOK RD	BRIGHAM HILL RD	0.4	1.7	1.3	MH	66	30	51.6
12	Alder Lane	VT 15	VT 128	0	0.15	0.15	M	54	50	52.4
13	Ewing Place	SUSIE WILSON	CUL DE SAC	0	0.17	0.17	M	54	50	52.4
14	Lang Drive	ESSEX WAY	HAGAN (South End)	0	0.34	0.34	M	54	50	52.4
15	Towers Road 3	CHAPIN	OLD STAGE	0.48	1.57	1.09	M	54	50	52.4
16	North Williston Road	VT 117	BRIDGE	0	0.34	0.34	MH	68	30	52.8
17	Glenwood Drive	TANGLEWOOD	TANGLEWOOD	0	0.27	0.27	ML	42	70	53.2
18	Rustic Drive	FOREST	WILDWOOD	0	0.28	0.28	ML	42	70	53.2
19	Sand Hill Road 2	ALLEN MARTIN DRIVE	TOP OF HILL	1.15	1.89	0.74	MH	69	30	53.4
20	Cypress Lane 2	WOODLAWN	END	0.07	0.14	0.07	L	30	90	54
21	Valleyview Drive 1	VT 117	5 VALLEYVIEW DR	0	0.1	0.1	M	57	50	54.2
22	Jackson Heights	PINECREST	PIONEER	0	0.34	0.34	ML	44	70	54.4
23	Kellogg Road	SUSIE WILSON	COLCHESTER LINE	0	0.55	0.55	H	85	10	55
24	Brigham Hill Rd 2	# 50	END PAVEMENT	0.5	0.89	0.39	M	60	50	56
25	Gentes Road	VT 2A	COLCHESTER LINE	0	0.91	0.91	M	60	50	56
26	Pinecrest Drive 1	SUSIE WILSON	JACKSON HEIGHTS	0	0.41	0.41	MH	74	30	56.4
27	Pinecrest Drive 2	JACKSON HEIGHTS	VT. 2A	0.41	1	0.59	MH	74	30	56.4
28	Brigham Hill Lane	BRIGHAM HILL RD	END PAVEMENT	0	0.31	0.31	L	36	90	57.6
29	Clover Drive 2	BOBOLINK (2nd ACC)	CUL DE SAC	0.19	0.57	0.38	M	63	50	57.8
30	Riverview Drive	PINEWOOD	PINEWOOD	0	0.35	0.35	M	63	50	57.8
31	Southdown Court	SUFFOLK	CUL DE SAC	0	0.16	0.16	ML	50	70	58
32	Deer Crossing Lane	SAXON HILL	CUL DE SAC	0	0.47	0.47	ML	51	70	58.6
33	Sand Hill Road 3	TOP OF HILL	VT 117 RIVER RD	1.89	2.29	0.4	MH	78	30	58.8
34	Gauthier Drive	KELLOGG	CUL DE SAC	0	0.6	0.6	M	65	50	59

35	Pinewood Drive	VT 117	VALLEYVIEW DR	0	0.44	0.44	M	65	50	59
36	Pioneer Street 1	PINECREST	BLAIR	0	0.24	0.24	M	65	50	59
37	Susie Wilson Bypass	KELLOGG	VT 2A	0.49	1.26	0.77	H	92	10	59.2
38	Susie Wilson Road 1	VT 15	PINECREST	0	0.15	0.15	H	92	10	59.2
39	Susie Wilson Road 2	PINECREST	KELLOGG	0.15	0.49	0.34	H	92	10	59.2
40	Greenfield Road	VT 117	CUL-DE-SAC	0	0.7	0.7	M	66	50	59.6
41	New England Dr	KELLOGG	GAUTHIER	0	0.29	0.29	M	66	50	59.6
42	Ira Allen Drive	PIONEER	JACKSON HEIGHTS	0	0.15	0.15	MH	80	30	60
43	Hagan Drive	LANG	SYDNEY	0	0.29	0.29	ML	54	70	60.4
44	Repa Drive	ESSEX WAY	SYDNEY	0	0.13	0.13	ML	54	70	60.4
45	Thompson Drive	ALLEN MARTIN DRIVE	DEAD END	0	0.29	0.29	ML	54	70	60.4
46	Greenbriar Drive 1	SANDHILL	W END ALDERBROOK	0	0.43	0.43	M	68	50	60.8
47	Morse Drive	KELLOGG	CUL DE SAC	0	0.29	0.29	M	68	50	60.8
48	Cemetary Road	SANDHILL	DEAD END	0	0.09	0.09	L	42	90	61.2
49	Essex Highlands	WEED	CUL DE SAC	0	0.47	0.47	L	42	90	61.2
50	Stearns Ave	PIONEER	JACKSON HEIGHTS	0	0.12	0.12	L	42	90	61.2
51	Baker Street	GREENFIELD	LOGWOOD	0	0.22	0.22	M	69	50	61.4
52	Towers Road 2	CLOVER	CHAPIN	0.14	0.48	0.34	M	69	50	61.4
53	Prescott Street	ABARE	CUL DE SAC	0	0.33	0.33	ML	56	70	61.6
54	Billie Butler Drive	VT 15	PRIVATE DRIVE	0	0.07	0.07	MH	83	30	61.8
55	Chelsea Road 2	CABOT	END (CABOT)	0.34	0.55	0.21	ML	57	70	62.2
56	Margaret Street	SAND HILL	CUL DE SAC	0	0.38	0.38	ML	57	70	62.2
57	Wildwood Drive	FOREST	RUSTIC	0	0.49	0.49	ML	57	70	62.2
58	Ridge Road	SKYLINE	VALLEYVIEW DR	0	0.23	0.23	L	45	90	63
59	Landfill Lane	VT 2A	DROP OFF CENTER	0	0.07	0.07	M	72	50	63.2
60	Essex Way 1	VT15	CIRC	0	0.46	0.46	MH	86	30	63.6
61	Old Colchester Road	VT 2A	ESSEX JNCTN LINE	0	0.5	0.5	MH	86	30	63.6
62	Craftsbury Court	OLD STAGE	CABOT	0	0.29	0.29	ML	60	70	64
63	Saxon Hollow Drive 1	GREENBRIAR	HILLSIDE South End	0	0.3	0.3	M	74	50	64.4
64	Lida Drive	LANG	REPA	0	0.24	0.24	L	48	90	64.8
65	Market Place	SUSIE WILSON	CUL DE SAC	0	0.12	0.12	M	75	50	65
66	Willoughby Drive	OLD STAGE	POMFRET	0	0.19	0.19	M	75	50	65
67	Abare Avenue	SUSIE WILSON	DAMON	0	0.21	0.21	ML	62	70	65.2
68	Bixby Hill Road	VT 128	END PAVEMENT	0	0.2	0.2	M	76	50	65.6
69	Weed Road 1	VT 128	NAYLOR ROAD	0	0.9	0.9	M	76	50	65.6
70	Cabot Drive	OLD STAGE	CHELSEA	0	0.27	0.27	ML	63	70	65.8
71	Windridge Road	TIMBERLANE	WILDWOOD	0	0.57	0.57	ML	63	70	65.8
72	Brigham Hill Rd 1	OLD STAGE	# 50	0	0.5	0.5	M	77	50	66.2
73	Old Stage Road 1	VT 15 (Center Rd)	INDIAN BROOK	0	0.4	0.4	MH	91	30	66.6
74	Cindy Lane	TANGLEWOOD	CUL DE SAC	0	0.2	0.2	L	51	90	66.6
75	Saxon Hill Road	VT 15 (Jericho Rd)	END OF PAVEMENT	0	0.17	0.17	ML	65	70	67
76	Saybrook Road	VT 15 (Center Rd)	CUL DE SAC	0	0.31	0.31	M	79	50	67.4
77	Heatherbush Road	VALLEYVIEW	TIMBERLANE	0	0.21	0.21	ML	66	70	67.6
78	Woodlawn Drive	TANGLEWOOD	CYPRESS LANE	0	0.2	0.2	ML	66	70	67.6

79	Carmichael Street	BILLIE BUTLER	END	0	0.12	0.12	M	80	50	68
80	Clover Drive 1	TOWERS	BOBOLINK (2nd ACCESS)	0	0.19	0.19	M	80	50	68
81	Sydney Drive 1	ESSEX WAY	DEBRA DRIVE	0	0.25	0.25	M	80	50	68
82	Whitcomb Meadows	VT 15	CUL DE SAC	0	0.26	0.26	L	54	90	68.4
83	Greenfield Court	GREENFIELD	CUL DE SAC	0	0.06	0.06	L	56	90	69.6
84	Allen Martin Parkway 1	SANDHILL	HICKORY	0	0.13	0.13	M	83	50	69.8
85	Greenbriar Drive 2	LOGWOOD CIRCLE	ALDERBROOK RD	0.43	0.72	0.29	M	83	50	69.8
86	Valleyview Drive 2	5 VALLEYVIEW DR	RIDGE	0.1	0.4	0.3	M	83	50	69.8
87	Cedar Street	CLOVER	BLUESTEM	0	0.27	0.27	L	57	90	70.2
88	Creek Road	RUSTIC	WILDWOOD	0	0.22	0.22	L	57	90	70.2
89	Whitetail Lane	DEER CROSSING	CUL DE SAC	0	0.1	0.1	L	57	90	70.2
90	Steeplebush Drive	BOBOLINK	CEDAR	0	0.17	0.17	ML	72	70	71.2
91	Essex Way 2	CIRC	LANG	0.46	1	0.54	M	86	50	71.6
92	Logwood Circle	GREENBRIAR	LOGWOOD	0	0.82	0.82	M	86	50	71.6
93	Dalton Drive	EATHAN ALLEN	COLCHESTER LINE	0	0.21	0.21	ML	73	70	71.8
94	Butternut Court 1	MARGARET ST	SAGE			0	L	60	90	72
95	Butternut Court 2	SAGE	CUL DE SAC	0	0.39	0.39	L	60	90	72
96	Sage Circle	BUTTERNUT COURT	CUL DE SAC	0	0.18	0.18	L	60	90	72
97	Thomas Lane	VT 128	CUL-DE-SAC	0	0.27	0.27	L	60	90	72
98	David Drive	SUSIE WILSON	CUL DE SAC	0	0.1	0.1	M	89	50	73.4
99	Saxon Hollow Drive 2	HILLSIDE South End	GREENBRIAR	0.3	0.42	0.12	M	89	50	73.4
100	Hickory Lane	ALLEN MARTIN PKWY	SAGE CIRCLE	0	0.07	0.07	ML	76	70	73.6
101	Lasalle Road	SAND HILL	MARGARET	0	0.06	0.06	ML	76	70	73.6
102	Cedar Court	CEDAR ST	CUL DE SAC	0	0.07	0.07	L	63	90	73.8
103	Frederick Road	LAMELL	CUL DE SAC	0	0.19	0.19	L	63	90	73.8
104	Hillside Circle	NO ENTRANCE	SO ENTRANCE	0	0.43	0.43	L	63	90	73.8
105	Raymond Drive	RIVERVIEW	WINTERLANE	0	0.26	0.26	L	63	90	73.8
106	Timeberlane Drive	WINTERLANE CIRCLE	WINDRIDGE	0	0.18	0.18	L	63	90	73.8
107	Woodlawn Court	WOODLAWN	CUL DE SAC	0	0.05	0.05	L	63	90	73.8
108	Sunset Road	VT 15 (Center Rd)	SUNSET DRIVE	0	0.04	0.04	ML	77	70	74.2
109	Valleyview Drive 3	RIDGE	WINDRIDGE	0.4	0.65	0.25	M	91	50	74.6
110	Weed Road 2	NAYLOR RD	VT 15 (Jericho Rd)	0.9	1.5	0.6	M	91	50	74.6
111	Devon Hill Court	SOUTHDOWN	CUL DE SAC	0	0.09	0.09	L	65	90	75
112	Allen Martin Parkway 2	HICKORY	PARTRIDGE	0.13	0.37	0.24	M	92	50	75.2
113	Hampshire Court	SUFFOLK	CUL DE SAC	0	0.12	0.12	ML	80	70	76
114	Iris Street	BIXBY HILL	BOBOLINK	0	0.08	0.08	ML	80	70	76
115	Peacham Lane	WILLOUGHBY DR	PEACHAM LN EXT	0	0.19	0.19	ML	80	70	76
116	Stannard Drive	ESSEX WAY	ESSEX WAY	0	0.23	0.23	ML	80	70	76
117	Alderbrook Road	GREENBRIAR	GREENBRIAR	0	0.35	0.35	ML	82	70	77.2
118	Greenfield Road Ext	GREENFIELD	GREENBRIAR	0	0.05	0.05	ML	82	70	77.2
119	Suffolk Lane	PINECREST W	PINECREST E	0	0.23	0.23	ML	82	70	77.2
120	Bashaw Drive	SYDNEY	SYDNEY	0	0.13	0.13	L	69	90	77.4
121	Patricia Place	MARGARET ST	CUL DE SAC	0	0.13	0.13	L	69	90	77.4
122	Londonderry Lane	VT 15 (Center Rd)	CHELSEA	0	0.2	0.2	ML	83	70	77.8

123	Dartmoor Court	HAMPSHIRE	CUL DE SAC	0	0.11	0.11	L	71	90	78.6
124	Turcotte Road	GAUTHIER	ANDREW	0	0.08	0.08	L	71	90	78.6
125	Tanglewood Drive 2	ROSEWOOD TRAIL	END	0.51	0.58	0.07	M	98	50	78.8
126	Kimberly Drive	PINECREST	CUL DE SAC	0	0.13	0.13	ML	85	70	79
127	Bobolink Circle	SO END CLOVER	NO END CLOVER	0	0.41	0.41	L	72	90	79.2
128	Colbert Street	BLAIR	ABARE	0	0.17	0.17	L	72	90	79.2
129	Chelsea Road 1	CUL-DE-SAC	CABOT	0	0.34	0.34	ML	86	70	79.6
130	Irene Avenue	MARION AVE	VT. 128	0	0.43	0.43	ML	86	70	79.6
131	Lamell Ave	CUL-DE-SAC (WestEnd)	DEAD END (East End)	0	0.35	0.35	ML	86	70	79.6
132	Sydney Drive 2	DEBRA DRIVE	HAGAN	0.25	0.76	0.51	ML	86	70	79.6
133	Pioneer Street 2	BLAIR	ABARE	0.24	0.43	0.19	M	100	50	80
134	Andrew Ave	TURCOTTE ?	GAUTHIER	0	0.13	0.13	L	74	90	80.4
135	Circle Drive	JERICHO RD (VT15)	CUL DE SAC	0	0.11	0.11	L	74	90	80.4
136	Winterlane Circle	TIMBERLANE	DEAD END	0	0.31	0.31	L	74	90	80.4
137	Parizo Drive	PINECREST	DEAD END	0	0.04	0.04	ML	88	70	80.8
138	Sunset Drive	CUL-DE-SAC	CUL-DE-SAC	0	0.21	0.21	ML	89	70	81.4
139	Kurk Drive	PINEWOOD	CUL DE SAC	0	0.08	0.08	L	77	90	82.2
140	Corporate Drive	ALLEN MARTIN DRIVE	END	0	0.21	0.21	ML	91	70	82.6
141	Lavigne Road	PERRY DRIVE	SAND HILL ROAD	0	0.27	0.27	ML	91	70	82.6
142	Perry Drive	VT 15 (Jericho Rd)	LAVIGNE ROAD	0	0.27	0.27	ML	91	70	82.6
143	Pomfret Lane	FOX RUN ROAD	WILLOUGHBY	0	0.12	0.12	ML	92	70	83.2
144	Blair Road	SUSIE WILSON	PIONEER	0	0.15	0.15	ML	93	70	83.8
145	Weathersfield Bow	WILLOUGHBY DR	CUL-DE-SAC	0	0.29	0.29	ML	93	70	83.8
146	Blackberry Road	BOBOLINK	DEAD END	0	0.15	0.15	L	80	90	84
147	Cavendish Drive	PEACHAM	POMFRET	0	0.04	0.04	ML	94	70	84.4
148	Oakwood Lane 1	TANGLEWOOD	CUL DE SAC	0	0.27	0.27	ML	94	70	84.4
149	Richard Street	VT 15 (Jericho Rd)	LAMELL AVE	0	0.1	0.1	ML	94	70	84.4
150	Perkins Drive	RIVERVIEW NO	RIVERVIEW SO	0	0.14	0.14	L	81	90	84.6
151	Chapin Road	TOWERS	COL PAGE ROAD	0	1	1	ML	95	70	85
152	Bluestem Road	CLOVER	CEDAR	0	0.19	0.19	ML	96	70	85.6
153	Debera Drive	SYDNEY	SYDNEY	0	0.14	0.14	L	83	90	85.8
154	Old Susie Wilson 1	KELLOGG	ABARE	0	0.2	0.2	L	83	90	85.8
155	Douglas Road	TOWERS	CUL DE SAC	0	0.11	0.11	L	85	90	87
156	Gardenside Lane	VT 2A	CUL DE SAC	0	0.18	0.18	L	85	90	87
157	Leo Drive	VT 15	END PAVEMENT	0	0.1	0.1	L	85	90	87
158	Marion Avenue	FREDERICK	CUL DE SAC	0	0.22	0.22	L	85	90	87
159	Maplelawn Drive	SAND HILL (NorthEnd)	SAND HILL (SouthEnd)	0	0.31	0.31	L	86	90	87.6
160	Damon Drive	PRESCOTT	END	0	0.15	0.15	ML	100	70	88
161	Walden Woods	INDIAN BROOK RD	DEAD END	0	0.23	0.23	L	88	90	88.8
162	Wolff Drive	RIVER VIEW	DEAD END	0	0.1	0.1	L	89	90	89.4
163	Linden Lane	GLENWOOD	DEAD END	0	0.18	0.18	L	90	90	90
164	Fox Run Road	WEATHERSFIELD	CUL-DE-SAC	0	0.27	0.27	L	92	90	91.2
165	Thistle Lane	FOX RUN ROAD	CUL DE SAC	0	0.13	0.13	L	92	90	91.2
166	Laurel Drive	ALLEN MARTIN PKWY	END	0	0.34	0.34	L	94	90	92.4

167	Old Susie Wilson 2	ABARE	END	0.2	0.47	0.27	L	94	90	92.4
168	Ronald Court	LAMELL	CUL DE SAC	0	0.05	0.05	L	94	90	92.4
~~169~~	Button Drive	PIONEER ST	JACKSON HEIGHTS	0	0.09	0.09	L	98	90	94.8
170	Fern Hollow Road	TANGLEWOOD	DEAD END	0	0.04	0.04	L	98	90	94.8
171	Rosewood Trail	TANGLEWOOD	DEAD END	0	0.09	0.09	L	98	90	94.8
~~172~~	Common (The)	VT 15	VT 15	0	0.07	0.07	L	100	90	96
~~173~~	Cypress Lane 1	WOODLAWN	END	0	0.07	0.07	L	100	90	96
	Old Stage Road 4	#267 OLD STAGE	#370 OLD STAGE	2.7	3.55	0.85	MH		30	12
	Old Stage Road 5	#370 OLD STAGE	ESSEX TOWN LINE	3.55	4	0.45	MH		30	12
	~~X~~Lamore Road	VT. 2A	END OF PAVEMENT	0	0.07	0.07	M		50	20
	Oakwood Lane 2	CUL DE SAC	CUL DE SAC	0.27	0.28	0.01	ML		70	28
	Partridge Drive	ALLEN MARTIN PRKWY	CROSS ST/PRV ROAD	0	0.04	0.04	ML		70	28
	Peacham Lane Ext	PEACHAM LN	OLD STAGE	0	0.12	0.12	ML		70	28

Traffic Volume Weighting Factors		
High	H	10
Moderate - High	MH	30
Moderate	M	50
Moderate - Low	ML	70
Low	L	90

APPENDIX D

HIGHWAY RESURFACING NEEDS – A DIFFERENT PERSPECTIVE

Facts

1. A dollar spent on overlaying a road at approximately the 10 to 12 year point will cost the Town $4 to $5 in reconstruction costs if delayed to year 16.
2. The Town has 51.2 miles of paved roadway including 10.83 miles of Class 2 which are eligible for resurfacing grants from the State. The Town has been successful in getting these grants over time. Adjusting the 51.2 miles for the gravel roads and adding for the Class 2 wider roads yields 42.6 miles which the Town will need to fund for overlays.
3. A typical paved Town road varies from 22 feet in width (similar to Weed Rd) to 52 feet in width (Susie Wilson Road) with the average width close to 30 feet.
4. The minimum structural pavement overlay should be 1.5 inches thick.
5. Asphalt cost $37 per ton in 2000. The current bid price is $66.26 per ton.

Calculation

42.6 miles x 5,280 ft/mile x 30 ft width ÷ 9 sf/sy x .0850 tons/sy x $66.26/ton = $4,222,723

$4,222,723 ÷ 14 years = $301,162 per year *1

*1 assumes no price increases over the 14 years

Result

The current highway budget for FYE10 has an account for overlays of $112,754. At this level of budget expenditure, a road resurfaced in 2009 will wait 37 years for repaving. With the paving portion of reconstruction projects included in the Capital Budget, the total overlay expenditure for FYE10 increases to $228,000 and the resurfacing schedule increases to 18.5 years. This is still too long to wait for repaving a roadway..

Conclusion

The Town is not funding the paved road overlays at a high enough budget value to avoid higher future costs. Roads will deteriorate to the point where reconstruction will be the only remedy.

APPENDIX E

Report on Paving of Selected Town Gravel Roads

January 2007

Report on Paving of Selected Town Gravel Roads

Background:

General: The Town has a total of 23.39 miles of Class III gravel roads, as noted in the "Highway Transportation Management Plan" dated January 2005. The Class III gravel roads are categorized by function into two general classifications – Collector Roads and Minor Roads. The Town also has 3.4 miles of gravel Class IV roads, but these roads are not the responsibility of the Town to maintain.

A "collector" road has the primary function of distributing traffic between minor roads and the major arterial system. A secondary function is land access and a tertiary function is to handle inter-neighborhood traffic movement. In the case of the gravel collector roads, they primarily function as interconnections with neighboring communities. A table of the gravel collector roads is located in Appendix Table 1.

The minor roads are those roads used primarily to provide access to adjacent properties and are not generally used for through traffic. In general, traffic volumes are low. A table of the gravel minor roads is located in Appendix Table 2.

The Class IV roads are listed in Appendix Table 3 and noted as being Unimproved Roads.

In the 1991 comprehensive study on all Town roads, a section was dedicated to gravel roads and three roads were identified as being potential candidates for future paving. These roads were Osgood Hill, Indian Brook and Brigham Hill. An excerpt from this report is included as Appendix 4. The cost in 1991 dollars was significant ($1.3M) to reconstruct and pave all three roads. The paving of gravel roads was included in the Town Capital Plan up through FYE2000 and then discontinued in FYE2001. No funding had been included for many years and there was a concern raised by Village residents over Village residents potentially paying for paving of the Town's gravel roads through the Capital tax.

Traffic: Gravel roads function adequately in low volume traffic situations. As the traffic volume and number of heavy vehicles increase on a gravel road, the load carrying capability of the road surface decreases, especially during periods of spring runoff, fall to winter transition and wet weather. The Town collects limited traffic volume information on the gravel roads but the most recent data that is available is provided in Appendix Table 5.

Analysis of the data reveals the following:

1) Traffic volume on Lost Nation Road and Lamore Road (where hard data was obtained) has decreased over time due to the construction of the Circ Highway. This particular road group (including Discovery Road) functioned as a bypass to the Five Corners traffic until the Circ Highway was built. The overall drop is approximately 40%.
2) Indian Brook has a high traffic count for a gravel road but this generally occurs only during the late spring, summer and early fall due to the Park use.

3) As a comparison, paved roads with similar daily traffic counts to the higher traffic volume gravel roads include Willoughby Drive (616), Towers Road -north of Chapin (638), Sydney Drive (729) and Gentes Road (558). For further comparison, other selected paved roads have the following counts: Pinewood Drive (1311), Greenfield Road (1563), Susie Wilson Road Bypass (14,000).
4) Traffic which has been measured has remained relatively level on the remaining gravel roads over the last six years (i.e., no major increase).

Technical Issues:

Current gravel roads will not support a paving overlay without a significant reconstruction of the road. There are a number of issues/reasons for this, including:

1) Inadequate vertical and horizontal alignment of the road. Because the speeds on gravel roads are slower and the gravel roads generally tend to provide better traction (rougher surface friction factor than a paved road), some vertical and horizontal curves may have to be lessened in slope and curves lengthened to provide for safe vehicle travel when paved. A paved road will have to be wider, mainly to provide for adequate shoulders off the pavement.

2) Lack of adequate drainage. Many of the gravel roads have ditches with a combination of steep slopes, undersized culverts, "soft" soils and poor drainage leading away from the culverts. A gravel road can be replaced quickly, cheaply and easily in the event of a drainage system failure. Prior to paving of a gravel road, the drainage system must in many cases be rebuilt at least in part to preclude the early failure of the paved road. In addition, the paving of the road increases the rate of runoff from the road surface and drainage facilities that may have been adequate for a gravel road may not be adequate for a paved road. Ditches that consisted of natural soil (soft) will likely have to be stabilized with some stone.

3) Improper surface characteristics. The surface of a gravel road is designed with a road gravel that contains a significant portion of fine material – material passing the #200 sieve as silt or clay. It is not uncommon to have this material contain on the order of 9 % to 11 % "fines". This material acts as the binder on gravel roads, holding the coarser sand and gravel material in place. It is designed to shed water to the greatest extent that the surface can without creating a quagmire in the spring. Conversely, a paved road requires that the underlying material be coarse and open to act as a natural drain to enable the water to seep through and not collect directly below the paved zone. If fine grained materials are used or a gravel with more than 6 % fines, the result is a rapid break-up of the pavement, starting with cracking, potholes and finally break-up of the surface. To convert a gravel road to a paved road, a minimum depth of new coarse gravel sub-base of 24 inches is needed, topped by a 6 inch lift of clean finer gravel. Filter fabric should also be installed between the old base and the clean gravel.

Design/Construction Issues:

To estimate the approximate costs for paving a specific section of a gravel road, the following steps need to be considered before estimating for the actual pavement cost:

1) Survey the road to identify needed changes in vertical or horizontal alignment
2) Inspect all existing drainage structures for condition and adequacy
3) Calculate the drainage requirements for the new road and identify the drainage improvements that must be made
4) Establish a limit for clearing based on the new width, drainage considerations and horizontal/vertical alignment
5) Determine whether the existing road base needs to be cut the full 24 inches (+) or whether some combination of cuts and fills could be used
6) Class III gravel and Class III paved roads have different design specifications as provided in the Town specifications. If the Town is to upgrade a Class III Gravel road to a Paved Class III, Town standards must be adhered to. The Town Standards are reasonable and appropriate for the climate and soil conditions in Essex.
7) Determine if ledge is present in the road bed that will impact the excavation or drainage
8) Build the resolution of these issues into a final design

Basis of Estimate for the Study:

Using the information outlined previously, a very general cost estimate has been developed using a standard length of non-specific road. The estimate is based on the following:

1. Typical Class III paved road cross section, see Appendix item 6.
2. Typical Class III gravel road cross section, see Appendix item 7.
3. Reclaim existing gravel on the road when excavating for new subbase, and stockpile at the landfill. All excess material shall be placed at the landfill as well.

Estimated Costs for Paving 1,000 L.F.

Of Class III Gravel Road

Item No.	Item Description		Cost
1	Clearing and Grubbing	$	2,320.00
2	Drainage Swale Excavation	$	17,455.00
3	Excavation of Subgrade	$	65,300.00
4	Road Fabric	$	6,500.00
5	Swale Stone (5" minus)	$	5,235.00
6	Road Subbase (VAOT 704.05A)	$	44,490.00
7	Paving	$	29,330.00
8	Storm Drain Crossings	$	5,160.00
	Subtotal	$	175,790.00
	Contingency (10%)	$	17,579.00
	Engineering (15%)	$	26,368.50
	Total	**$**	**219,737.50**

4. Although this cost appears very high, it is based on current prices as noted in the Mean's Estimating Guide as well as current project costs of other Town projects.

Costs and Impacts of Paving Selected Gravel Roads or Sections Thereof:

1. If the three roads (Brigham Hill, Osgood hill and Indian Brook) identified in 1991 were reconstructed properly as outlined in this memorandum, and paved today in their entirety, the total cost would be on the order of 6.7 million dollars.
2. In comparison to the funds spent on paved roads within the Town, the Town has budgeted the following sums the last few years for overlay/ reconstruction of the existing paved roads and related construction:

Year	Operating Funds	Capital Funds
FYE02	$ 86,850	$175,000
FYE03	$133,270	$135,500
FYE04	$128,441	$ 60,000
FYE05	$124,600	$110,000
FYE06	$116,300	$128,000
FYE07	$133,000	$142,200
FYE08	$134,400	$124,921

(Note: The above numbers do not reflect the fact that some large site specific projects were also funded during this period. Most of these projects were funded with State and Federal Aid equal to 90% of the project cost).

3. In a study done in 2001, it was noted that to maintain an overlay program that would resurface a paved road every 12 years, the annual sum of $190,000 would be needed. That amount does not reflect the extra cost to reconstruct roads that have gone beyond their life-span. It is unfortunate but true that the Town has not been adequately funding its pavement overlay program on its existing paved roads.
4. If the costs to upgrade 1000 ft of a gravel road to a paved road ($219,737) were used instead to bring the existing paved roads up to standard, the funds would pave 12,930 feet of a 30 foot wide paved road (2.45 miles of paved road). Diverting the limited available funds from the maintenance of existing paved roads to paving the gravel roads would cause the paved roads to deteriorate beyond the overlay stage and into the more expensive reconstruction stage.

Alternatives:

There are interim steps that can be taken to improve the gravel roads short of paving them. Some of these are:

1. Provide more funds for the addition of gravel to the existing roads. Currently, approximately $15,000 per year is budgeted which provides a thin overlay on about 1.5 miles of gravel road. This is insufficient to replace the gravel that is lost each year to grading , spring mud season, washouts and the like. Many of the gravel roads have lost much of the traveled surface creating a road without the capability to handle the traffic

load. If 6 inches of gravel were added to 1 mile of gravel road, the cost would be on the order of $26,500 for materials. If hauled by outside contractors, the cost would increase to approximately $35,000/mile. If the construction materials budget were increased by $50,000 per year, the Town could overlay the three highest traveled gravel roads over a two to three year period.

2. In the worst areas of gravel roads, fabric could be placed under the gravel to help distribute the traffic load to the subbase and reduce the extent of spring thaw problems. For a mile of road, this would cost on the order of $30,000.

3. Another option, which has limited use due to the availability of material is to utilize the stockpile of recycled asphalt at the landfill and replace some of the top gravel with a thick layer (6 inches) of the recycled asphalt. This could be done in limited areas as a transition between the paved sections and the gravel sections. Some of the underlying base would have to be removed and replaced with coarse gravel before placing the recycled material.

Conclusions:

1. The cost to pave an existing gravel road is extremely expensive and cannot be accomplished within the normal budget process.
2. The need to continue maintenance on the paved roads is of greater importance than placing new pavement on the gravel roads, given traffic levels, accident history and other factors.
3. The traffic levels on the gravel roads have not increased significantly over the past five to six years ; safety issues are likely to increase to a higher level than exists today if the gravel roads are paved due to increased speed, road configuration and decreased surface friction.
4. An increase in the operating budget to provide for a better gravel road surface, incremental improvements to the drainage (increased culvert replacement, stoning of ditches), partial use of filter fabric and selected use of recycled asphalt will enable the gravel roads to better handle the traffic loads and reduce the level of complaints. It will improve the situation but not provide an end product equivalent to a paved road. However, this level of intermediate improvement would cost on the order of 7% of the paved gravel road cost.

APPENDIX

TABLE 1 - COLLECTOR ROADS

GRAVEL SECTIONS

Road Name	Highway Number	Class	Length (miles)	1990 Traffic Count	Traffic level	2005 Traffic count	Traffic Level
Brigham Hill Rd	36	3	2.06	715	MH	904	H
Curve Hill Road	26	3	.20	-	ML	-	ML
Chapin Road	26	3	2.53	-	ML	-	ML
Discovery Road	21	3	.50	-	M	-	M
Indian Brook Rd	30	3	1.25	-	M	935	H
Lost Nation Rd	27	3	2.80	-	M	482	M
Lamore Rd	23	3	1.15	-	ML	-	ML
Old Pump Rd	59	3	1.04	-	L	-	L
Osgood Hill Rd	51	3	2.46	-	M	691	MH
Pettingill Rd	44	3	.76	-	ML	-	ML
Sleepy Hollow Rd	60	3	1.20	-	ML	-	ML

Total Miles: 15.95 miles

Percent of Total Essex Mileage = 16.2%

TABLE 2 - MINOR ROADS

GRAVEL SECTIONS

Road Name	Highway Number	Class	Length Miles		1990 Traffic Level	2005 Traffic Count	Traffic Level
Bixby Hill Rd	714 + 48	3	.90	-	ML	-	ML
Brigham Hill Ln	33	3	1.25	-	L	-	L
Catella Rd	50	3	1.1	-	ML	-	ML
Cilly Hill Rd	54	3	.10	-	L	-	L
Col Page Rd	38	3	.75	-	L	-	L
Fleury Rd	708	3	.16	-	L	-	L
Gray Way	57	3	.39	-	L	-	L
Hanley Lane	53	3	.30	-	L	-	L
Lost Nation Rd	27	3	.40	-	L	-	L
McGee Rd	29	3	.08	-	L	-	L
Naylor Rd	65	3	.35	-	L	-	L
Sawmill Rd	56	3	.85	-	L	-	L
Saxon Hill	66	3	.56	-	L	-	L
Towers Rd.Ext.	41	3	.25	-	L	-	L

Total miles 7.44 miles

Percent of Total Essex Mileage = 7.5%

TABLE 3 - UNIMPROVED ROADS

Road Name	Town Highway Number	State Class	Length (miles)
Extension of Landfill Access Road	18	IV	0.22
Extension of McGee Road	29	IV	0.2
Extension of Brigham Hill Lane	33	IV	0.15
Extension of Hanley Lane	53	IV	0.55
West Sleepy Hollow Road	60	IV	1.95
Extension of Saxon Hill Road	66	IV	0.08
Water Tank Road off Bixby Hill	716	IV	0.2
Extension of Fern Hollow	748	IV	0.05

Total miles 3.4

Percent of Essex Mileage = 3.4%

Unpaved Roads

Unpaved roads are currently able to function most of the year in a satisfactory condition due to their relatively low volume of traffic.

Some residents have expressed a desire to pave the gravel roads to reduce dust, potholes, rutting as well as mud season in the early spring. However, pavement cannot be placed on the existing gravel surfaces without extensive reconstruction of the roads. In most cases, the existing gravel roads are narrow, have inadequate base material, poor drainage, proximity of ledge to the surface and travelled surfaces that are designed to have 8% passing the #200 sieve (silts and clays). In a gravel road, the top course is meant to be relatively impervious and the fine-graded gravel performs this task. Pavement cannot be placed on this material because the subbase for pavement needs to be porous and open for vertical and horizontal movement of water.

Table 12 lists all the gravel roads by priority of repair.

APPENDIX 4-1

TABLE 12

Page No. 1 — ROAD SURFACE MANAGEMENT SYSTEM — Date: 10/16/91

UNPAVED ROADS - PRIORITIZED LISTING

REPAIR SUMMARY

WEIGHTING FACTORS - TRAFFIC = 34 % ROUGHNESS = 33 % ROAD CONDITION = 33 %

RANK	ROAD NAME	INVEN NUMBER	DIRECTION OF TRAVEL FROM STREET	TO STREET	V O L	SECT START (Mi.)	SECT END (Mi.)	SECT LENGTH (Mi.)	GENERAL REPAIR STRATEGY	COMMENTS
1	LOST NATION ROAD-1	0027-001	OLD STAGE ROAD	DISCOVERY ROAD	5	0.930	1.860	0.930	REGRADE	FAIR DRAIN
2	OSGOOD HILL ROAD	0051-001	BROWN'S RIVER ROAD	WESTFORD LINE	4	0.950	2.460	1.510	REGRADE	
3	LAMORE ROAD	0023-001	LOST NATION ROAD	GENTES ROAD	5	0.540	1.220	0.680	RESHAPE	
4	OSGOOD HILL ROAD	0051-001	BROWN'S RIVER ROAD	WESTFORD LINE	4	0.000	0.950	0.950	RESHAPE	
5	DISCOVERY ROAD	0021-001	LOST NATION ROAD	LAMORE ROAD	4	0.000	0.500	0.500	RESHAPE	
6	INDIAN BROOK ROAD	0030-001	OLD STAGE ROAD	DEAD END	4	0.000	1.250	1.250	RESHAPE	
7	LAMORE ROAD	0023-001	LOST NATION ROAD	GENTES ROAD	5	0.000	0.540	0.540	RESHAPE	FAIR DRAIN
8	LOST NATION ROAD-1	0027-001	OLD STAGE ROAD	DISCOVERY ROAD	5	0.000	0.930	0.930	? REGRAD	
9	BRIGHAM HILL ROAD-	0036-002	END OF PAVEMENT	COLCHESTER LINE	4	0.890	1.900	1.010	RESHAPE	
10	BRIGHAM HILL ROAD-	0036-002	END OF PAVEMENT	COLCHESTER LINE	4	1.900	2.950	1.050	RESHAPE	
11	HANLEY LANE	0053-001	OSGOOD HILL ROAD	TURN AROUND	1	0.000	0.300	0.300	REGRADE	POOR DRAIN
12	BIXBY HILL ROAD-2	0048-002	END OF PAVEMENT	CUL DE SAC	2	0.220	1.100	0.880	RESHAPE	
13	CATELLA ROAD	0050-001	OSGOOD HILL ROAD	CUL DE SAC	2	0.000	1.100	1.100	RESHAPE	
14	CHAPIN ROAD-2	0042-002	END OF PAVEMENT	WESTFORD LINE	2	0.940	3.530	2.590	RESHAPE	FAIR DRAIN
15	CURVE HILL ROAD	0026-001	LOST NATION ROAD	COLCHESTER LINE	2	0.000	0.200	0.200	RESHAPE	
16	PETTINGILL ROAD	0044-001	BROWN'S RIVER ROAD	WESTFORD LINE	2	0.000	0.760	0.760	RESHAPE	FAIR DRAIN
17	SAWMILL ROAD	0056-001	JERICHO LINE	CUL DE SAC	2	0.000	0.850	0.850	RESHAPE	
18	SLEEPY HOLLOW ROAD	0060-001	WEED ROAD	OLD PUMP ROAD	2	0.000	1.200	1.200	RESHAPE	
19	SAWMILL ROAD EXTEN	0056-001	SAWMILL ROAD	DEAD END	1	0.000	0.130	0.130	RESHAPE	
20	CILLEY HILL ROAD	0054-001	JERICHO TOWN LINE	WESTFORD TOWN LINE	1	0.000	0.100	0.100	RESHAPE	
21	BRIGHAM HILL LANE-	0033-002	END OF PAVEMENT	DEAD END	1	0.310	1.200	0.890	RESHAPE	POOR DRAIN
22	CLARA HILL LANE-2	0903-002	END OF PAVEMENT	CUL DE SAC	1	0.050	0.250	0.200	RESHAPE	
23	COLONEL PAGE ROAD	003B-001	OLD STAGE ROAD	CHAPIN ROAD	1	0.000	0.750	0.750	RESHAPE	FAIR DRAIN
24	FLEURY ROAD	0708-001	TOWERS ROAD	DEAD END	1	0.000	0.160	0.160	RESHAPE	POOR DRAIN
25	LOST NATION ROAD-2	0027-002	DISCOVERY ROAD	DEAD END	1	1.860	3.200	1.340	RESHAPE	FAIR DRAIN
26	MCGEE ROAD	0029-001	LOST NATION ROAD	DEAD END	1	0.000	0.080	0.080	RESHAPE	
27	TOWERS ROAD EXTENS	0041-001	OLD STAGE ROAD	DEAD END	1	0.000	0.250	0.250	RESHAPE	
28	OLD PUMP ROAD	0059-001	SLEEPY HOLLOW ROAD	JERICHO LINE	2	0.000	1.040	1.040	SPOTMATL	
29	NAYLOR ROAD	0065-001	JERICHO ROAD	WEED ROAD	1	0.000	0.350	0.350	SPOTMATL	
30	OLD PUMP ROAD EXTE	0057-001	OLD PUMP ROAD	DEAD END	1	0.000	0.390	0.390	SPOTMATL	
31	SAXON HILL ROAD	0066-001	JERICHO ROAD	DEAD END	1	0.000	0.810	0.810	SPOTMATL	FAIR DRAIN

Total Mileage ### 23.720

Gravel roads first need to be brought to an appropriate standard before consideration is given to pave. Also, not all gravel roads should be considered for future paving because of changes that are likely to take place as a result of construction of the Circumferential Highway or because the traffic load is relatively small. It is recommended that only those roads with a high or moderately high traffic level be considered for paving and only those which are not impacted by the Circumferential Highway. From Table 12, the only roads that meet this criteria are:

Osgood Hill Road
Indian Brook Road
Brigham Hill Road

The costs to pave each of these roads is approximately $13.60/lf above the reconstruction cost (in 1991 dollars) to bring the roads to a reasonable cross-section, with adequate drainage, improved gravel surface, etc. Table 13 provides the total cost to bring these three roads to a paved condition.

TABLE 13

Road	Reconstruction Cost	Paving Cost	Total
Osgood Hill Road	$381,000	$177,000	$ 558,000
Indian Brook	194,000	90,000	284,000
Brigham Hill Road	319,000	148,000	467,000
	$894,000	$415,000	$1,309,000

Comparing this cost to the five-year paved road capital program cost of $2,750,000 shows that reconstruction and paving of gravel roads is extremely expensive (48% of the paved improvement costs), would correct only 5.77 miles of road versus 27.31 miles of paved road fixed and would benefit a very small traffic volume (a few hundred trip ends versus hundreds of thousands of trip ends). In tight economic times, the extra costs to pave gravel roads cannot be justified and it may be difficult to justify paving gravel roads in good economic times.

The strategy for gravel roads should be to continue their upgrade, but over a longer and more protracted time frame, and limit as much as possible the increase in traffic.

Using the highest cost repair strategy available under the Road Surface Management Plan, and including costs for Lost Nation Road which were omitted, the total cost to bring gravel roads up to a proper functional level is approximately $1,700,000. Using the lowest cost repair strategy, a dollar value of $169,973 is needed. Comparing these two extremes over a ten year repair period yields:

	ANNUAL AMORTIZED OVER 10 yrs & 5%
high cost repair strategy[1]	$220,150/year
low cost repair strategy	$ 22,011/year

Currently, the Town budgets approximately $45,000/year for gravel road maintenance. At this level, the effort includes minor spot reconstruction, regrading, application of liquid calcium chloride and selected areas of aggregate overlay. In effect, it provides for a higher degree of maintenance than routine upkeep, but does not provide sufficient dollars for reconstruction or large-scale reshaping.

Because of the traffic on the top priority gravel roads, it is recommended that these roads be gradually upgraded over a ten-year period. This cost would be $714,177 (in 1991 dollars). The ten year plan for upgrading of the most traveled graveled roads is as shown in Table 14 and is based on an annual expenditure of an additional $72,000(±) per year.

TABLE 14 - UNPAVED ROAD IMPROVEMENTS
(1991 DOLLARS)

	Name of Road/ Priority No.	Location	Length (Miles)	Repair	Cost
Year 1	1) Lost Nation-1	.93 to 1.86	.93	add gravel, regrade & compact	$35,000
Year 1	2) Osgood Hill	.95 to 2.46	1.51	add gravel, regrade & compact	$57,404
Year 2	3) Lamore	.54 to 1.22	.68	add gravel, regrade & compact	$53,856
Year 3	4) Osgood Hill	0.00 to .95	.95	reshape with minor add'l material	$85,272
Year 4	5) Discovery	0.00 to .50	.5	Reshape with minor add'l material	$55,440
Year 5	6) Indian Brook	0.00 to 1.75	1.25	reshape with minor add'l material	$112,700
Year 6	7) Lamore	0.00 to .54	.54	reshape with minor add'l material	$42,768
Year 7	8) Lost Nation	0.00 to .93	.93	reshape with minor add'l material	$98,208
Year 8	9) Brigham Hill	.89 to 1.9	1.01	reshape with minor add'l material	$42,663
Year 9	9) Brigham Hill (Phase 2)	.89 to 1.9	1.01	reshape with minor add'l material	$42,662
Year 10	10) Brigham Hill	1.9 to 2.95	1.05	reshape with minor add'l material	$88,704

Summary

It is recommended that the Town of Essex fund a highway reconstruction plan which provides the following revenues over the period indicated.

1) for paved roads and key intersections, a total of $550,000 per year for 5 years (FY 1992 to FY 1997).

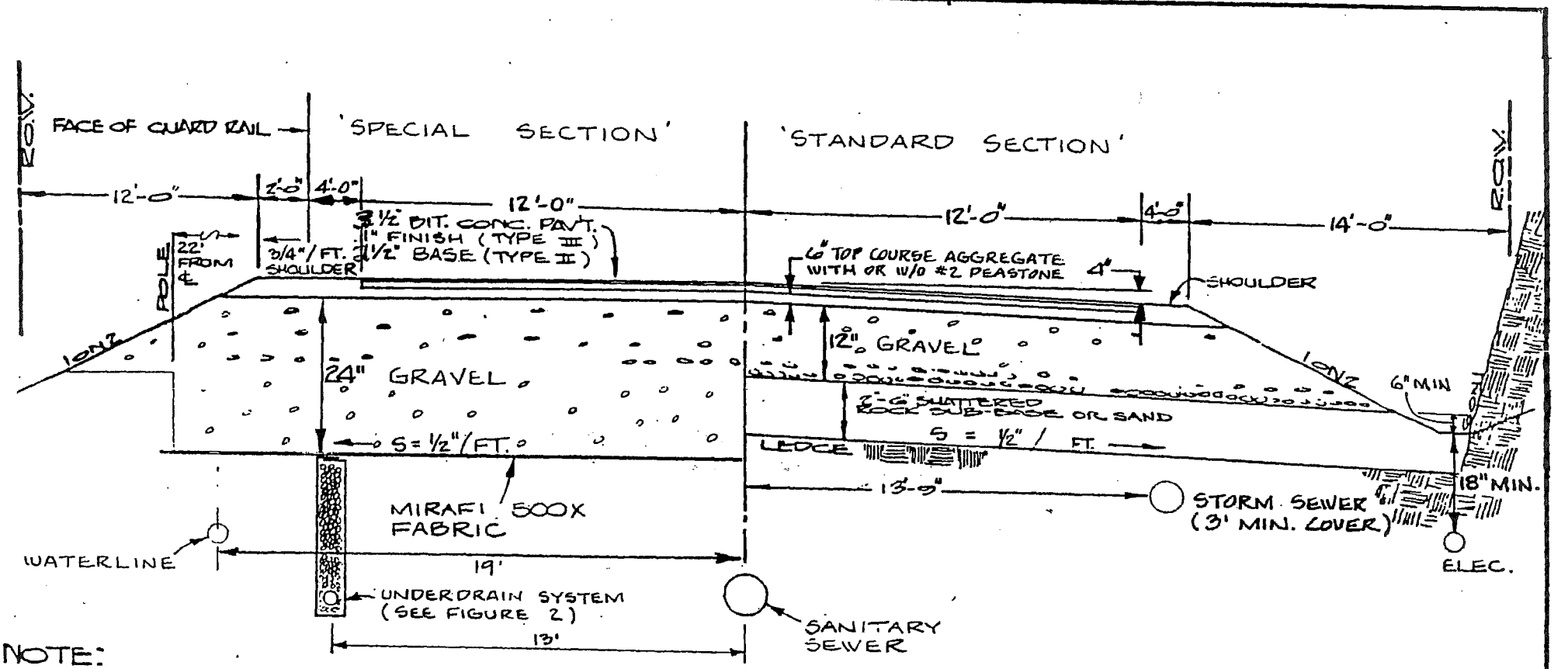
2) for unpaved roads, a total of $72,000 per year for 10 years (FY 1992 to FY 2002).

Table 5

Average Daily Traffic on Selected Unpaved Roads

Road	2005 count	2003 count	1999 Count	1991 Count/Estimate
Bixby Hill Road				172
Brigham Hill Road *	873		904	715
Brigham Hill Lane				101
Catella Road				182
Chapin Road *	457	377	454	371
Curve Hill Road *				
Discovery Road *				700 (pre-Circ)
Fleury Lane				21
Hanley Lane				41
Indian Brook Road *	649		935	
Lamore Road *	550	533	522	871 (pre Circ)
Lost Nation Road	471		482	798 (pre-Circ)
Mcgee Road				41
Old Pump Road Ext				21
Old Pump Road *		91		
Osgood Hill Road *	641	598	691	691
Pettingill Road *				
Sawmill Road				182
Sawmill Road Ext				31
Sleepy Hollow Road *	255	225	289	245

* Designated by the Town as a gravel "collector road"; all undesignated gravel roads are considered minor roads



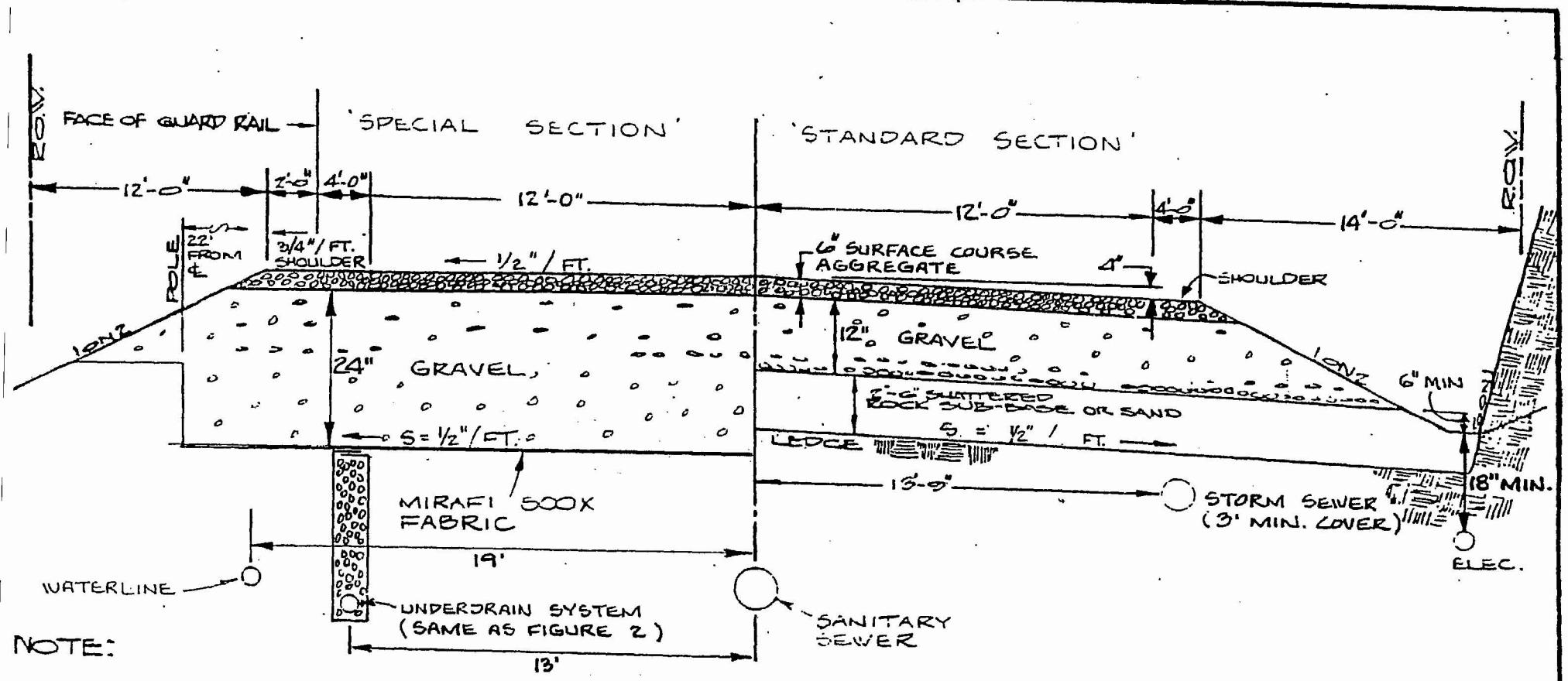
NOTE:

1. ALL MATERIALS AND CONSTRUCTION TO BE ACCORDING TO SPECIFICATIONS.
2. USE GUARD RAIL WHEN HEIGHT OF FILL AT SHOULDER POINT IS MORE THAN 10'FT.
3. MIN. SLOPE FOR DRAINAGE PIPES TO BE 0.2%.
4. MIN. ROW. TO BE 60 FT. GREATER IF SO ORDERED BY THE BOARD OF SELECTMEN.
5. NOTES 1, 2 & 3 OF PREVIOUS DETAIL FOR "PAVED STREET W/ CURBS AND SIDEWALKS" SHALL APPLY TO THIS DETAIL
6. SHALLOW DITCHES MAY BE USED ONLY WHEN A CLOSED STORM DRAINAGE SYSTEM IS USED WITH CATCH BASIN.

STREET DETAILS – Type II Rural Road

CROSS-SECTION PAVED STREET WITHOUT CURB

FIGURE



NOTE:

1. ALL MATERIALS AND CONSTRUCTION TO BE ACCORDING TO SPECIFICATIONS.
2. USE GUARD RAIL WHEN HEIGHT OF FILL AT SHOULDER POINT IS MORE THAN 10 FT.
3. MIN. SLOPE FOR DRAINAGE PIPES TO BE 0.2%.
4. MIN. RADII TO BE 60 FT. GREATER IF SO ORDERED BY THE BOARD OF SELECTMEN.
5. NOTES 2, 3 & 4 OF FIGURE 2 FOR "PAVED STREET W/ CURBS AND SIDEWALKS" SHALL APPLY TO THIS DETAIL
6. SHALLOW DITCHES MAY BE USED ONLY WHEN A CLOSED STORM DRAINAGE SYSTEM IS USED WITH CATCH BASIN.

STREET DETAILS – Type III Rural Road

CROSS-SECTION UNPAVED ROAD

FIGURE

APPENDIX F

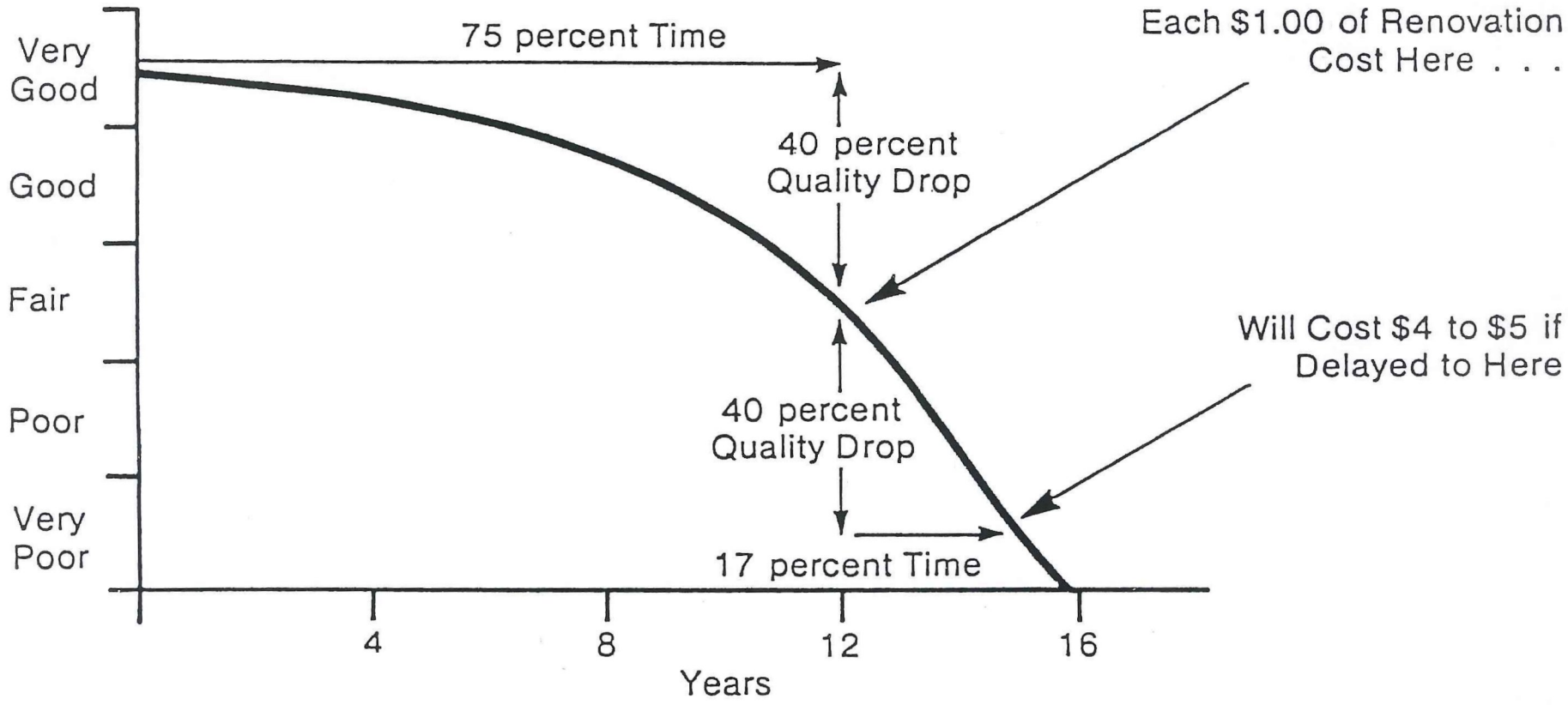
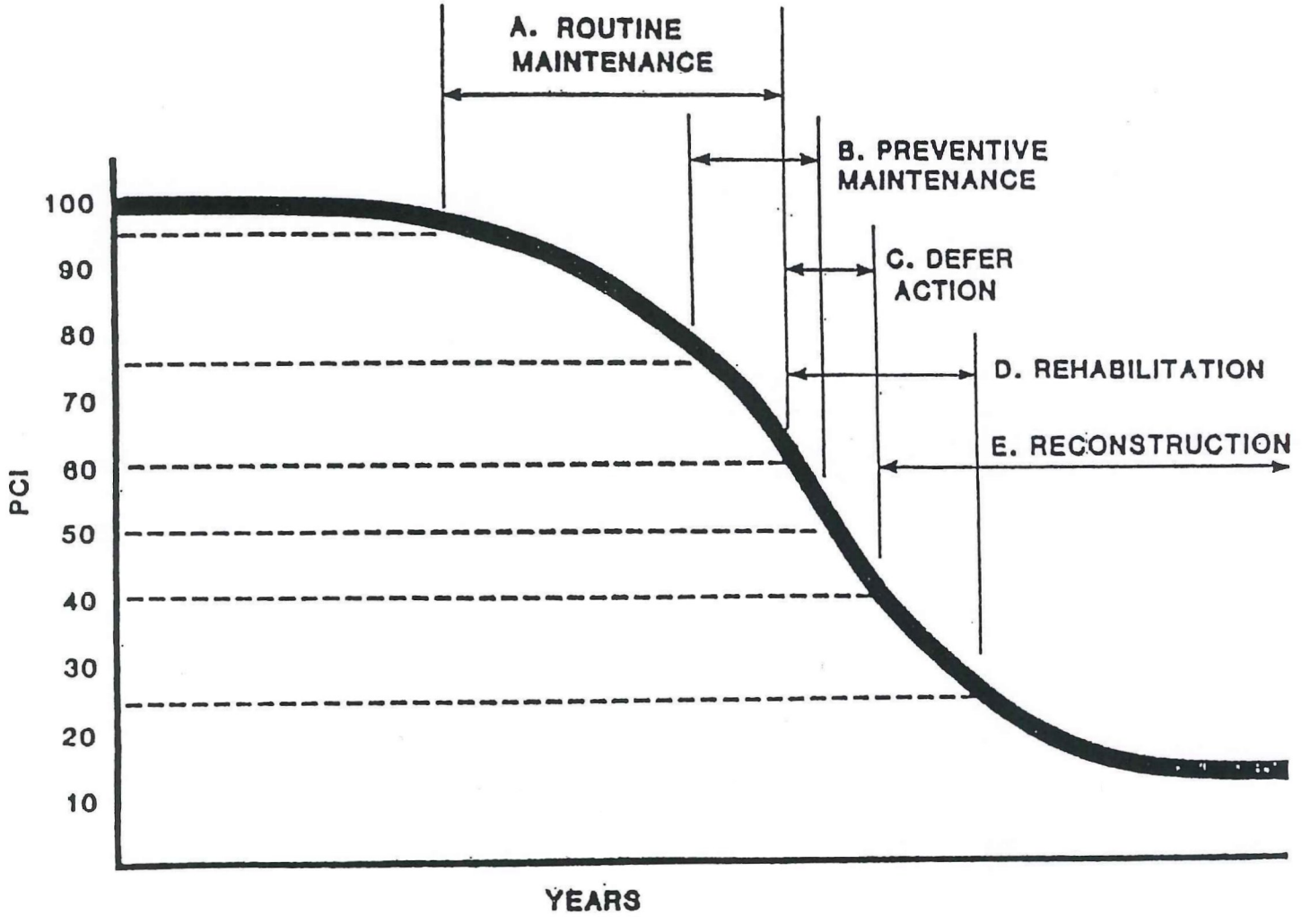


Figure 1-1. Pavement Deterioration/ Rehabilitation Relationship

32-A

Figure IV-8 Maintenance Strategies and Timing



Source: Road Surface Management for Local Communities: Course Workbook (U.S. Department of Transportation & Federal Highway Administration, May 1985).