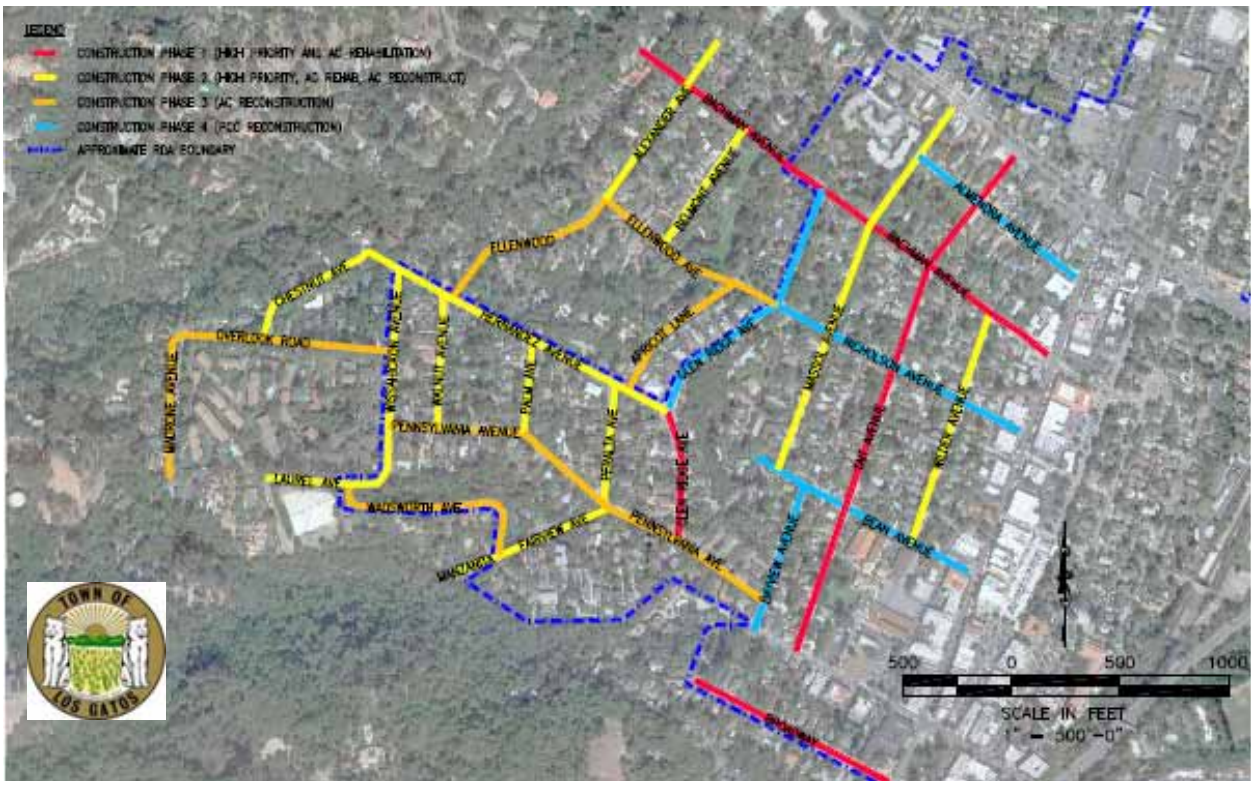
Prepared for the:

Town of Los Gatos

41 Miles Avenue Los Gatos, CA 95030

Conceptual Design Report for Almond Grove District



Submitted by

NICHOLS CONSULTING ENGINEERS, Chtd.

Engineering & Environmental Services

501 Canal Boulevard Suite I Richmond California 94804

March 2011

NCE Project #58.10.20

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1.0 PROJECT UNDERSTANDING AND SCOPE

1.1 PROJECT UNDERSTANDING

The historic Almond Grove District (District) is the oldest residential community in Los Gatos. It was first developed in the late 19th Century and is a vibrant part of the Town's events and activities. The District has predominantly Victorian homes and street parking is necessary due to the preponderance of homes with no garages. The trees are mature and provide an extensive canopy for shade. Unfortunately, there are also areas where tree roots have uplifted sidewalks and curb & gutter creating potential tripping hazards and as such creating distortions in the pavements.

Figure 1.1 PCC Surfaced Streets

In terms of the street infrastructure, there are two distinct areas. There are 10 streets near downtown that are composed of Portland Cement Concrete (PCC), and which are probably more than 80 years old (see Figure 1.1). The slabs are extensively cracked (in many cases, they have broken into four or more pieces and are therefore considered to be "shattered slabs"). This is a definition of failure for PCC pavements, and they have essentially reached the end of their service lives. There are multiple patches and utility cuts from sewer and water line projects, which contribute to the "patchwork quilt" appearance of the pavement.

Figure 1.2 AC Surfaced Streets

In addition, there are 21 asphalt concrete (AC) surfaced streets that are located in the upper portion of the District. Many of these streets are also old, extensively patched/cracked, and not smooth. Some appear to be pavements with little or no underlying aggregate base.

Curbs and gutters, where existing, are partial and in many cases, deteriorated. Most curb ramps are not compliant with current Americans with Disabilities Act (ADA) standards.

There are also drainage and right of way issues that will need to be addressed for curb and gutter and sidewalk repairs, that will need to be considered during development of construction drawings. Figure 1.3 illustrates examples where drainage is a concern. A complete list of these streets as well as map showing their location is provided in Figure 1.4.

Figure 1.3 Drainage Considerations

1.2 STUDY OBJECTIVES

Due to the conditions present, the Town desires to replace and rehabilitate the street infrastructure in the District. The objective of our conceptual design is to consider rehabilitation or reconstruction alternatives for all surface infrastructure elements within the public right of way and to estimate the costs for repairs and replacement. However, underground utilities (water, stormwater, sewer etc) are not included in the scope of work, as we understand that they have been addressed and upgraded sufficiently by previous utility projects.

1.3 SCOPE OF WORK

The scope of work included three primary elements:

1. Field reconnaissance;
2. Analysis and design options; and
3. Cost analysis

Figure 1.5 Damaged Curb and Gutter

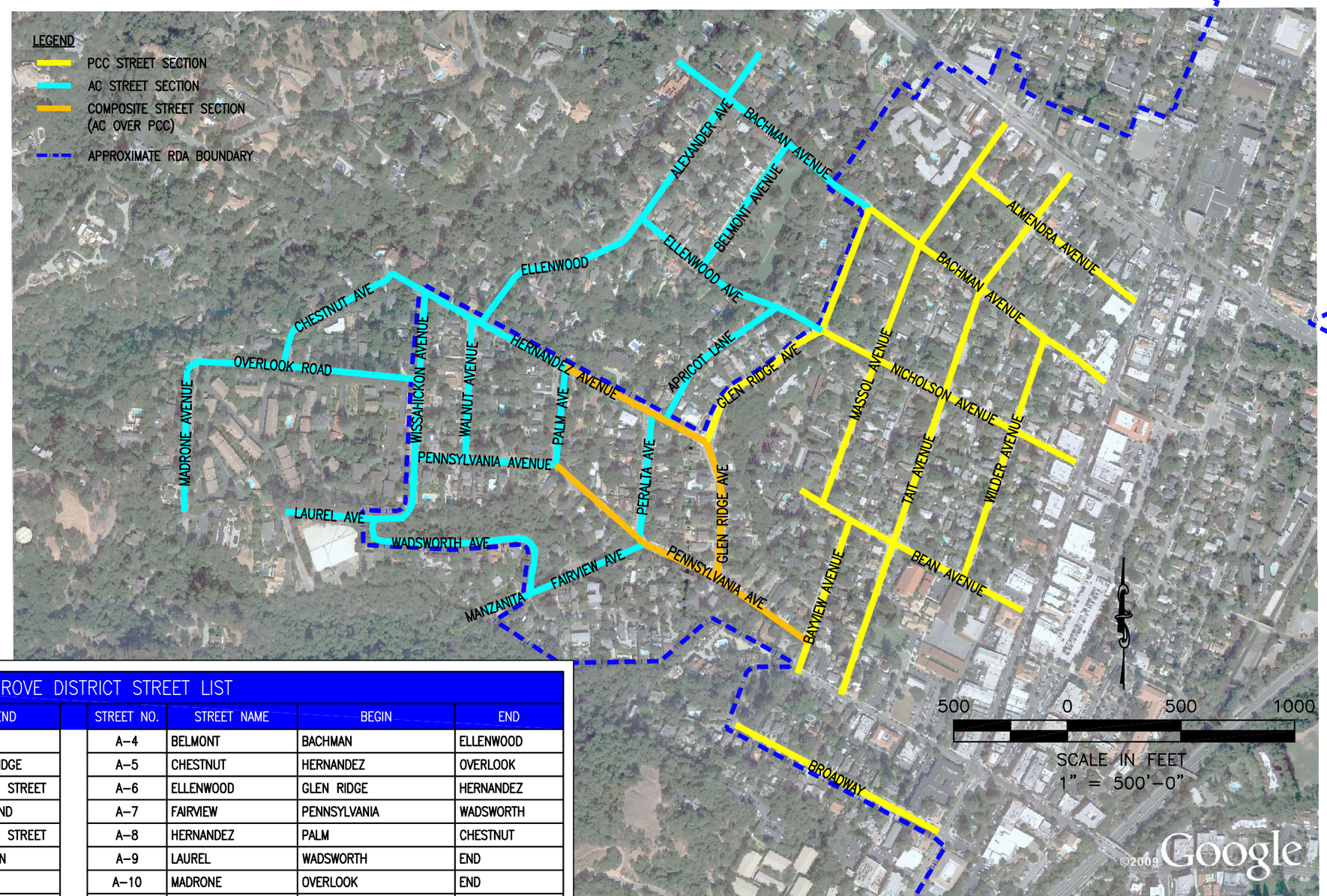
The physical assets considered in this study included:

- Pavements
- Curb and gutters (see Figure 1.5)
- Sidewalks and curb ramps
- Crosswalks
- Trees and other vegetation within the right of way
- Driveways
- Drainage inlets
- Utility poles that may affect ADA compliance
- Sign posts that may affect ADA compliance
- Existing traffic calming devices

The remaining chapters of this report discuss the findings of our study and options that are available to the Town.

NOTES:

1. STREET SECTION TYPE IS BASED ON VISUAL CONDITION SURVEYS AND WIDELY SPACED, LIMITED CORING OF PAVEMENT.
2. LIMITS OF COMPOSITE STREETS SECTIONS ARE APPROXIMATE AND WERE DETERMINED BASED ON PAVEMENT DISTRESS TYPES EXHIBITED.
3. STREET NO. ABBREVIATIONS IN TABLE ARE AS NOTED:
   P = PCC STREET SECTION
   C = COMPOSITE STREET SECTION (AC/PCC)
   A = AC STREET SECTION



AERIAL IMAGE FROM GOOGLE EARTH

ALMOND GROVE DISTRICT STREET LIST

STREET NO.	STREET NAME	BEGIN	END	STREET NO.	STREET NAME	BEGIN	END
P-1	ALMENDRA	N. SANTA CRUZ	MASSOL	A-4	BELMONT	BACHMAN	ELLENWOOD
P-2	BACHMAN	N. SANTA CRUZ	GLEN RIDGE	A-5	CHESTNUT	HERNANDEZ	OVERLOOK
P-3	BAYVIEW	BEAN	W. MAIN STREET	A-6	ELLENWOOD	GLEN RIDGE	HERNANDEZ
P-4	BEAN	N. SANTA CRUZ	WEST END	A-7	FAIRVIEW	PENNSYLVANIA	WADSWORTH
P-5	BROADWAY	N. SANTA CRUZ	W. MAIN STREET	A-8	HERNANDEZ	PALM	CHESTNUT
P-6	GLEN RIDGE	HERNANDEZ	BACHMAN	A-9	LAUREL	WADSWORTH	END
P-7	MASSOL	LOS GATOS SARATOGA	BEAN	A-10	MADRONE	OVERLOOK	END
P-8	NICHOLSON	N. SANTA CRUZ	GLEN RIDGE	A-11	MANZANITA	WADSWORTH	END
P-9	TAIT	LOS GATOS SARATOGA	W. MAIN STREET	A-12	OVERLOOK	WISSAHICKON	MADRONE
P-10	WILDER	BACHMAN	BEAN	A-13	PALM	HERNANDEZ	PENNSYLVANIA
C-1	GLEN RIDGE	HERNANDEZ	PENNSYLVANIA	A-14	PENNSYLVANIA	PALM	WISSAHICKON
C-2	HERNANDEZ	GLEN RIDGE	PALM	A-15	PERALTA	HERNANDEZ	PENNSYLVANIA
C-3	PENNSYLVANIA	BAYVIEW	PALM	A-16	WADSWORTH	LAUREL	FAIRVIEW
A-1	ALEXANDER	NORTH END	ELLENWOOD	A-17	WALNUT	HERNANDEZ	PENNSYLVANIA
A-2	APRICOT LANE	ELLENWOOD	HERNANDEZ	A-18	WISSAHICKON	HERNANDEZ	LAUREL
A-3	BACHMAN	GLEN RIDGE	END				

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PROJECT STREET LIST AND VICINITY MAP
CONCEPTUAL DESIGN REPORT FOR ALMOND GROVE DISTRICT
LOS GATOS, CALIFORNIA

FIGURE 1.4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
C. NG	058.10.20		03/01/11		

2.0 PAVEMENT ANALYSIS & DESIGN OPTIONS

2.1 CRITERIA USED IN ANALYSIS

Since the Almond Grove District is a designated historic district and has a very high visibility with the local community and residents, it was particularly important that the assumptions made for the design criteria, guidelines, and desired deliverables were consistent with the Town's.

Some of the major criteria and assumptions in this study included:

- The inclusion of both rehabilitation and reconstruction pavement alternatives. In particular, both PCC and AC pavements were considered. The recycling of pavement materials were also considered, as this may be a cost reduction as well as a "greener" alternative. This would be consistent with the goals of California's climate change legislation (AB 32 and SB 375).
- Capability of local contractors.
- Consistency with current ADA requirements.
- Tolerance of community to withstand significant or prolonged construction activities. The impacts of noise and dust during construction, as well as impacts to downtown businesses were also considered.
- Tree trimming/removal and other vegetation within the right of way will be addressed during development of final design documents, but approximate costs were used in the cost analysis.
- Historical features and constraints were indicated to be minimal by the Town and therefore were not considered.
- Needs of non-motorists such as pedestrians and bicyclists were assumed to be the same as existing conditions and therefore no bicycle or pedestrian improvements were considered (i.e. bicycle lanes or new cross-walks).
- Construction phasing to consider the on-street parking required by residents.
- Existing drainage is assumed to be adequate and no significant drainage improvements were included.
- Utilities (water service, stormwater, sewer etc) are not included in the scope of work, as they have been addressed and upgraded sufficiently by previous utility projects.
- Right of way issues are expected for some sidewalk and curb and gutter replacement but are not quantified in this study and should be addressed during the final design documents.

Since this is a conceptual design, no photogrammetric or land surveys were included, so street lengths are considered to be accurate within ±10 feet, and pavement areas within ± 1,000 square feet for purposes of planning and cost estimates.

2.2 FIELD RECONNAISSANCE

During the field reconnaissance, a detailed investigation of the surface infrastructure elements was performed, and data collected for analysis. This included a walking survey of the pavements to identify any issues that affect rehabilitation costs. The following items were also quantified:

- Pavements - lengths, widths, areas, condition assessments
- Sidewalks – condition, material type, compliance with ADA, quantities

- Curb ramps – quantity and compliance with ADA
- Driveways – typical width and quantity and impact on sidewalks
- Curb and gutters – condition and quantities
- Pavement markings – types and quantities
- Potential conflicts of ADA compliance regarding clearance with respect to right of way as well as utility poles
- Trees – general impacts on sidewalks and pavements
- Irrigation and other vegetation between sidewalks and curb and gutters
- Traffic calming elements

In addition, pavement cores were provided by the Town for the PCC streets. AC pavement cores were taken by NCE as part of this analysis. The detailed results of core information (thickness and location) can be found in Figure 2.1.

2.3 EXISTING PAVEMENT INFRASTRUCTURE

As previously mentioned in Chapter 1, there are two distinct pavement types present, PCC and AC. There are 10 streets near downtown that are PCC, and an additional 21 AC streets. Of the AC streets, the coring investigation determined that three were composite pavements i.e. PCC pavements that have been overlaid with AC. These are Glen Ridge Avenue, Hernandez Avenue and Pennsylvania Avenue. The types of pavement distress observed are typical of composite pavements i.e. block cracking which is indicative of PCC joints reflecting through the AC.

Table 2.1 below notes the three different pavement types, and their quantities. Note that the quantities of the composite pavements are approximate based on limited coring and surface expressions of PCC pavement distress observed in the AC. A complete list of the AC streets as well as map showing their locations is provided in Figure 1.4.

Table 2.1 Summary of Pavement Types

Street Pavement Type	Sections	Centerline Feet	Pavement Area (sf)	% of the District (by Pavement Area)
AC	18	10,909	364,311	36.8
PCC	10	14,309	543,090	54.8
Composite	3	2,499	83,358	8.4
Total	**31**	**27,717**	**990,759**	**100**

2.3.1 PCC Street Sections

The general condition for the PCC streets is poor to very poor. The typical distresses observed included patching, spalling, longitudinal and transverse cracking, corner breaks, and map cracking as illustrated in Figures 2.2 through 2.5. These distresses not only create an uneven surface (poor ride quality and potential tripping hazards) and are aesthetically not pleasing but also create pathways to allow water to penetrate into underlying layers that potentially weaken the pavement structure and accelerate the pavement deterioration.

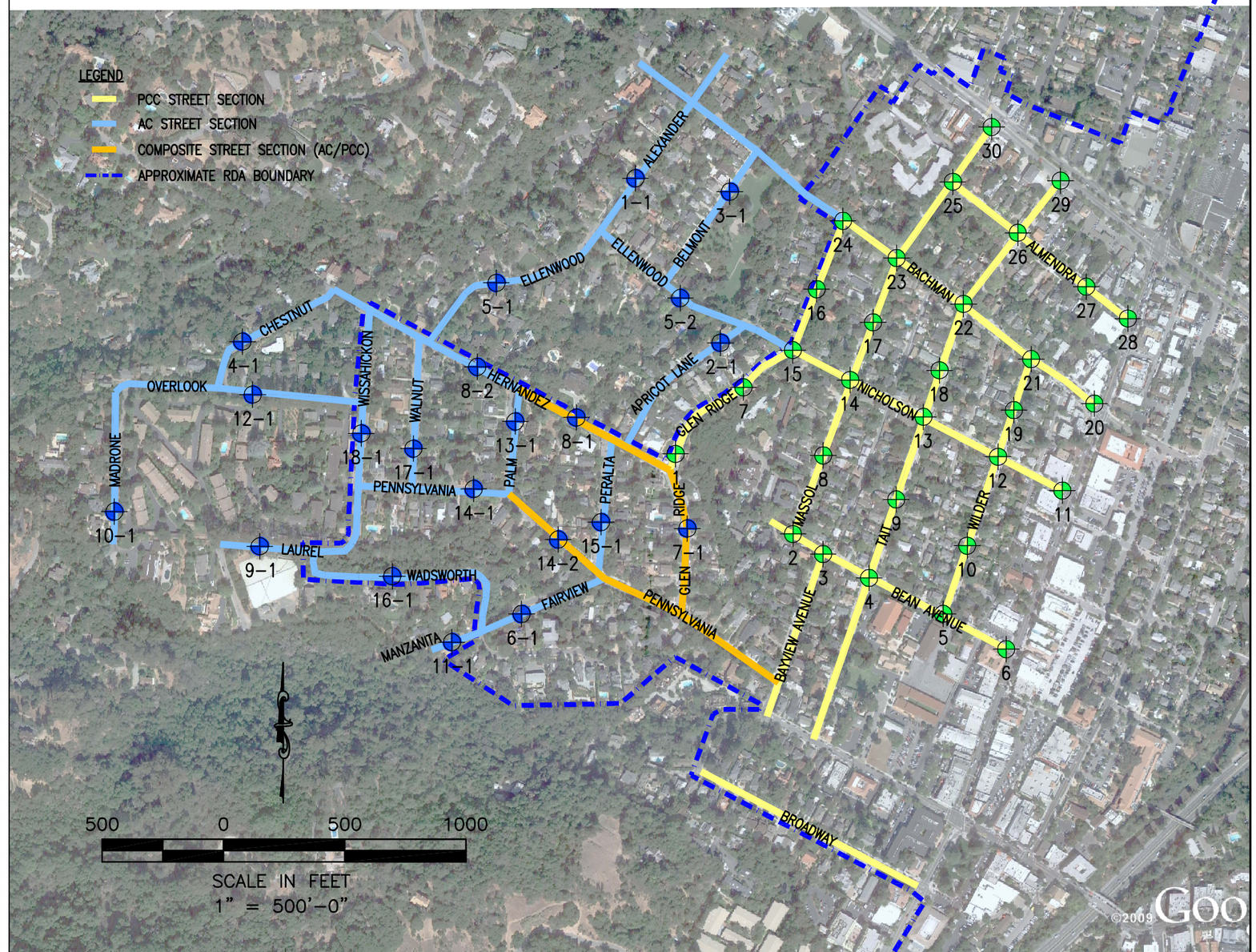
In general, the slab thicknesses vary from 4¼ to 7 inches (based on the core information provided by the Town).

ALMOND GROVE DISTRICT PAVEMENT CORE MEASUREMENT TABLE

TOWN PROVIDED CORES				NCE COLLECTED CORES			
CORE NO	CORE LOCATION	CORE THICKNESS LAYER	CORE THICKNESS INCHES	CORE NO	CORE LOCATION	CORE THICKNESS LAYER	CORE THICKNESS INCHES
1	101 GLEN RIDGE	PCC	6.00	1–1	216 ALEXANDER AVE	AC	0.625
2	INT BEAN & MASSOL	PCC	7.00			ATB	3.375
3	INT BEAN & BAYVIEW	PCC	5.75			AB	7.125
4	INT BEAN & TAIT	PCC	4.75	2–1	192 APRICOT LANE	AC	3.875
5	INT BEAN & WILDER	PCC	5.00			AB	6.375
6	INT BEAN & SANTA CRUZ	PCC	6.00	3–1	255 BELMONT AVE	AC	5.5
7	125 GLEN RIDGE	PCC	6.00			AB	--
8	124 MASSOL	PCC	5.00	4–1	72 CHESTNUT AVE	AC	3.50
9	118 TAIT	PCC	5.25			AB	12.00
10	127 WILDER	PCC	5.50	5–1	1 ELLENWOOD AVENUE	AC	1.00
11	INT NICHOLSON & SANTA CRUZ	PCC	7.00			ATB	3.00
12	INT WILDER & NICHOLSON	PCC	6.00			AB	--
13	INT TAIT & NICHOLSON	PCC	4.50	5–2	15 ELLENWOOD AVENUE	AC	1.50
14	200 MASSOL	PCC	5.50			ATB	2.50
15	INT ELLENWOOD & GLENRIDGE	PCC	6.00			AB	16.875
16	229 GLEN RIDGE	PCC	6.00	6–1	4 FAIRVIEW AVENUE	AC	3.625
17	218 MASSOL	PCC	5.50			AB	--
18	222 TAIT	PCC	4.50	7–1	29 GLEN RIDGE AVENUE	AC	2.00
19	219 WILDER	PCC	6.50			PCC	7.00
20	INT BACHMAN & SANTA CRUZ	PCC	6.50			AB	--
21	INT BACHMAN & WILDER	PCC	6.00	8–1	25 HERNANDEZ AVENUE	AC	2.00
22	INT BACHMAN & TAIT	PCC	4.50			PCC	7.00
23	INT BACHMAN & MASSOL	PCC	4.25			AB	--
24	INT BACHMAN & GLEN RIDGE	PCC	5.50	8–2	57 HERNANDEZ AVENUE	AC	3.25
25	320 MASSOL	PCC	5.00			ATB	5.00
26	INT ALMENDRA & TAIT	PCC	5.00			AB	7.00
27	237 ALMENDRA	PCC	5.00	9–1	101 LAUREL AVENUE	AC	2.375
28	INT ALMENDRA & SANTA CRUZ	PCC	5.00			AB	8.375
29	INT TAIT & LG SARATOGA	PCC	7.00	10–1	16519 MADRONE AVENUE	AC	2.375
30	INT MASSOL & LG SARATOGA	PCC	6.00			AB	10.625
				11–1	30 MANZANITA AVENUE	AC	1.625
						AB	6.625
				12–1	18338 OVERLOOK ROAD	AC	2.330
						AB	11.125
				13–1	80 PALM AVENUE	AC	4.500
						AB	--
				14–1	362 PENNSYLVANIA AVENUE	AC	1.875
						ATB	4.00
						AB	--
				14–2	324 PENNSYLVANIA AVENUE	AC	1.500
						PCC	7.625
						AB	--
				15–1	67 PERALTA AVENUE	AC	2.375
						AB	9.000
				16–1	97 WADSWORTH AVENUE	AC	1.375
						AB	5.875
				17–1	4 WALNUT AVENUE	AC	1.625
						AB	5.375
				18–1	134 WISSAHICKON AVENUE	AC	1.000
						ATB	4.625

NOTES:

1. LOCATIONS OF ALL CORES ARE APPROXIMATE.
2. NCE CORES WERE PERFORMED ON EACH AC STREET SECTION, AS NO PAVEMENT SECTION DATA WAS AVAILABLE FROM THE TOWN
3. IN THE MEASUREMENT TABLE, "--" INDICATE AB THICKNESS THAT WERE NOT OBTAINED DURING CORING DUE TO INABILITY TO ACCESS THE LAYER TO MEASURE THICKNESS.
4. CORE LAYER ABBREVIATIONS ARE AS NOTED:
   AB = AGGREGATE BASE AC = ASPHALT CONCRETE
   ATB = AC TREATED BASE PCC = PORTLAND CEMENT CONCRETE



LEGEND

30 APPROXIMATE TOWN PROVIDED CORE LOCATION

18–1 APPROXIMATE NCE COLLECTED CORE LOCATION

AERIAL PHOTO FROM GOOGLE EARTH

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PAVEMENT CORE LOCATION MAP AND MEASUREMENT TABLE
CONCEPTUAL DESIGN REPORT FOR ALMOND GROVE DISTRICT
LOS GATOS, CALIFORNIA

FIGURE 2.1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
C. NG	058.10.20		03/01/11		

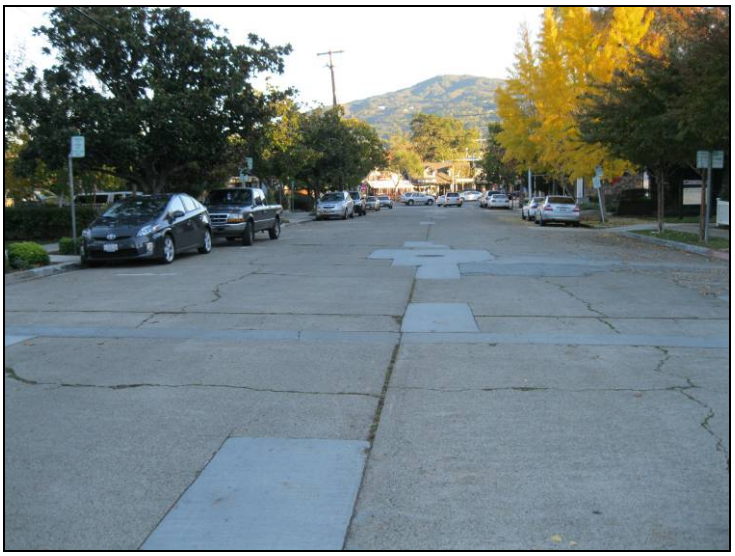


Figure 2.2 Various sizes of patching and longitudinal/ transverse cracks

Figure 2.3 Patching and shattered slabs

Figure 2.4 Patching, spalling, and linear cracks

Figure 2.5 Patching, longitudinal/ transverse cracks and corner cracks

2.3.2 AC Street Sections

Unlike the PCC streets, the current condition of AC pavements can be broadly categorized into three groups: good, fair and poor condition. The individual street sections in each condition group are summarized in Table 2.2.

Table 2.2 Summary of AC Streets by Condition Category

Street No	Street Name	Begin	End
Good Condition			
A-4	Belmont Ave	Bachman Ave	Ellenwood Ave
Fair Condition			
A-1	Alexander Ave	N End	Ellenwood Ave
A-5	Chestnut Ave	Hernandez Ave	Overlook Rd
A-7	Fairview Ave	Pennsylvania Ave	Wadsworth Ave
A-17	Walnut Ave	Hernandez Ave	Pennsylvania Ave
A-3	Bachman Ave	Glen Ridge Ave	End
A-8	Hernandez Ave	Palm Ave	Chestnut Ave
A-13	Palm Ave	Hernandez Ave	Pennsylvania Ave
A-18	Wissahickon Ave	Hernandez Ave	Laurel Ave
Poor Condition			
A-2	Apricot Lane	Ellenwood Ave	Hernandez Ave
A-6	Ellenwood Ave	Glen Ridge Ave	Hernandez Ave
A-9	Laurel Ave	Wadsworth Ave	End
A-10	Madrone Ave	Overlook Rd	End
A-11	Manzanita Ave	Wadsworth Ave	End
A-12	Overlook Rd	Wissahickon Ave	Madrone Ave
A-14	Pennsylvania Ave	Palm Ave	Wissahickon Ave
A-15	Peralta Ave	Hernandez Ave	Pennsylvania Ave
A-16	Wadsworth Ave	Laurel Ave	Fairview Ave

For the AC sections, the AC layer thicknesses varied widely from 1 inch to 5½ inches (with one pavement section exhibiting ⅝ inches AC over 3⅜ inches asphalt treated base) and the aggregate base (AB) thicknesses varied from 4 inches to 19⅜ inches. In addition, some streets did not appear to have any aggregate base. This information is based on the coring performed by NCE for this project. It should be noted only limited coring was performed (in general, one core per street) and thus may not have captured fully the in-situ condition. It is recommended that additional coring be performed as part of preparing street rehabilitation design documents. The coring results are shown in Figure 2.1.

Examples of the street sections in each condition category are shown in Figures 2.6 to 2.8. Figure 2.6 illustrates a pavement in good condition as exhibited by Belmont Avenue. Little or no cracks with minor weathering were observed on Belmont Avenue. A fair pavement section is illustrated in Figure 2.7 for Palm Avenue, which contains moderate quantities of fatigue cracking. The poor pavement section generally contains a larger percentage of fatigue cracks as illustrated in Figure 2.8 for Peralta Avenue.

Figure 2.6 Belmont Avenue (good condition)

Figure 2.7 Palm Avenue (fair condition)

Figure 2.8 Peralta Avenue (poor condition)

2.3.3 Composite Street Sections

For composite pavement sections (AC overlaid on PCC), the AC layer thicknesses varied from 1½ to 2 inches. The underlying PCC slab thicknesses varied from 7 inches to 7⅜ inches. Again, these results are based on limited coring information (generally only one core per street) and may not fully capture in-situ conditions. The coring results are shown in Figure 2.1.

The typical pavement distresses on composite pavements are reflective cracking, where the longitudinal and transverse joints in the PCC reflect upward through the AC layer. This creates a block pattern and is often called block cracking. Figure 2.9 illustrates the reflective cracking.

Figure 2.9 Reflective cracking on Glen Ridge Avenue

2.4 PAVEMENT DESIGN ALTERNATIVES

The pavements are, by far, the single largest cost item in this study. Therefore, much thought was given to what design alternatives to include in the analysis. Although there are many design alternatives available, local conditions may preclude or make impractical specific alternatives. For instance, the experience of local contractors in the Bay Area, availability of plants/equipment for specialized rehabilitation materials or techniques, the tolerance of the local residents and businesses to prolonged construction periods, and compliance with state and federal regulatory standards were all considered in this process.

This section discusses the pavement design alternatives that were considered, and presents the most practical options for the Town. The advantages and disadvantages for each alternative are also included.

2.4.1 Key Design Assumptions

For the designs considered, the following key design assumptions were made:

1. Pavement design life = at least 20 years i.e. all new pavements are expected to be in service for at least for 20 years before any major rehabilitation is required.
2. Traffic Index (TI) for residential Streets = 5.5. The TI is a measure of the types and volumes of traffic expected within the design period.
3. Subgrade strength: R-value= 5 (the Town has predominantly clay subgrades; a more thorough geotechnical investigation should be performed prior to final pavement design.)
4. Existing pavement layer thicknesses as determined by the coring investigations (see Figure 2.1).
5. The design methods used were based on both Caltrans and AASHTO. The latter was used for PCC design since Caltrans assumes a minimum TI of 9, which is typical of major arterials and not residential streets.
    i. Caltrans. Highway Design Manual, Californian Department of Transportation, Sacramento, CA. 2006.
    ii. AASHTO Guide for Design of Pavement Structures, American Association of State and Highway Transportation Officials, Washington, D.C. 1993.

2.4.2 Pavement Design Treatments & Alternatives

Since the pavement conditions for the AC sections varied from good to poor, the design alternatives considered also varies. For instance, it would not be cost effective to consider reconstruction for a pavement that was in good condition.

The following paragraphs first present the different design alternatives available for each condition category (good, fair or poor). The advantages and disadvantages of each are also presented, and finally, the proposed designs are summarized in Table 2.6.

Alternatives for Good Condition Pavements

Pavements in excellent/good condition usually contain minor surface distress or low severity weathering. Therefore, the most cost-effective range of alternatives falls within the “pavement preservation” group of treatments. This includes crack seals, fog seals, slurry seals, scrub seals or microsurfacing. The purpose of applying these crack or surface treatments is to seal the pavement from water penetrating into the

underlying pavement layers, which contributes to further pavement deterioration. A brief description is included in the following paragraphs.

Crack or Joint Sealing

Crack or joint sealing is the placement of polymerized/rubberized asphalt materials into cracks/joints that bond to the crack/joint walls and move as the pavement expands/contracts or bends. This technique is used to fill longitudinal and transverse cracks/joints, including joint reflection cracks from underlying PCC slabs that are ¼ to ½ inch wide. The primary purpose is to prevent surface water infiltration into the substructure of pavement and to prevent the debris from falling into the cracks. It is most cost effective to use this technique as preventative maintenance when the overall pavement condition is in good condition. Sealing cracks on a deteriorated pavement surface is not cost effective and will not provide any structural benefits. This is applicable to both AC and PCC pavements.

Slurry Seals

A slurry seal consists of a graded aggregate, asphalt emulsion, mineral filler, water, and additives. It is a hard wearing surface for pavement preservation. Slurry seals are used primarily on aged and raveled pavements, filling minor cracks, restoring skid resistance and adding aesthetic appeal. It may be used on local or residential streets and parking lots. Larger cracks need to be individually treated before the application of a slurry seal. The surface is smoother than a chip seal treatment and is more "surface friendly". In general, slurry seals can be categorized into three types, depending on the maximum aggregate size in the mix. Type I slurry seals usually contain maximum aggregate size of ⅛ inch; Type II slurry seals usually contain maximum aggregate size of ¼ inch; and Type III slurry seals usually contain maximum aggregate size of ⅜ inch. Type II slurries are most commonly used for cities on residential streets. This is applicable to AC pavements only.

Scrub Seals

A scrub seal is a polymer modified asphalt layer applied to an asphalt pavement surface and scrubbed into the cracks and voids with a broom. A layer of sand or small aggregate is then applied over the asphalt and then scrubbed again, forcing the mix into the cracks and voids to form a seal. It is used to fill and seal small cracks and voids, as well as to enrich hardened/oxidized asphalt. However, many contractors are still unfamiliar with scrub seals, so tests may be needed to determine what emulsion or polymer- modified emulsion will work best with the brooms. This is applicable to AC pavements only.

Microsurfacing

Microsurfacing consists of graded aggregates, asphalt emulsion, mineral filler, water and other additives. Compares to slurry seals, microsurfacing uses better quality aggregates and a fast setting emulsion of higher stiffness allowing thicker layers to be placed. Thus, it is usually used in more specialized situations, such as rut filling, restoring surface profiles, or for streets that sustain heavy traffic. It also has a quicker cure time, but the cost is generally higher than a slurry seal treatment. This is applicable to AC pavements only.

The **advantages** of the treatments described above are generally their low cost and quick construction time. There is minimal disruption to residents and existing traffic flow, and generally the street is opened to traffic within hours.

However, their **disadvantages** include the fact that they are not intended to address structural issues, so their typical service life ranges from 3 to 8 years.

Pavement Rehabilitation Alternatives for Fair Condition Pavements

In this section, pavement rehabilitation techniques are discussed. Again, since there are PCC, AC and composite pavements in the Almond Grove District, the types of rehabilitation considered depend on the existing pavement type.

PCC Overlays on existing PCC Pavement

Rehabilitating existing PCC pavements is less expensive than a complete reconstruction and so are desirable from a cost-effective perspective. Table 2.3 summarizes the three types of rehabilitation alternatives considered. These are PCC overlays with three bonding conditions: fully bonded, partially bonded, and unbonded. The bonding condition is generally selected based on the condition of the existing PCC pavement.

Table 2.3 Summary of PCC Pavement Rehabilitation Strategies

Rehabilitation Technique	Special Preparation Required	Existing Pavement Condition	Pre-overlay Repairs	Applicability
Bonded Overlay	• Surface preparation (e.g., shotblasting) • Bonding agent	Relatively good condition	Most deteriorated cracks, joints, punchouts	Not applicable, due to grade constraints and noise during construction.
Partially Bonded Overlay	• Bonding agent	Moderate condition	Limited repair and surface sweeping	Not applicable, due to grade constraints. Mainly used in airfield applications.
Unbonded Overlay	• Separation layer	Deteriorated condition	Limited repair of deteriorated cracks, joints, punchouts	Not applicable, due to grade constraints.

- Bonded overlays require that specific measures be taken to enhance the bonding between the PCC overlay and the existing slab. This usually includes extensive surface preparation of the existing PCC pavement (e.g., shot blasting) and often the placement of a cement grout on the existing rigid pavement just ahead of the paver. The intent of bonding an overlay to the existing pavement is to obtain a pavement system that behaves monolithically. Bonded overlays are used to increase the structural capacity of the pavement, or to improve its overall ride quality. They are typically used where the underlying pavement is in relatively good condition. If distressed pavements are overlaid without substantial pre-overlay repairs, significant reflection cracking will occur in the new overlay because of bonding between the two layers. Typical bonded overlay thicknesses range from about 3 to 6 inches.
- Partially bonded overlays require no real measures be taken to either enhance or prevent bonding from occurring between the rigid overlay and the existing rigid slab. Although used in airport applications, this bonding condition has not seen widespread use in the roads and highways field and, therefore, was not considered further.
- Unbonded overlays require that special actions are taken to prevent bonding between the PCC overlay and the existing PCC pavement, effectively separating them so that they move independently from one another. Various materials may be used as a bondbreaker; a thin (1 to 2 inch) interlayer of AC covered with a membrane curing compound placed on the existing pavement is most commonly used. Unbonded overlays are used when the existing pavement distress is so advanced that it cannot be effectively corrected prior to overlaying. The expectation is that the

placement of the separation layer will prevent the development of reflection cracking in the new overlay. A small amount (if any) of pre-overlay repairs may be required and mismatching of the overlay joints and the existing rigid pavement joints is generally recommended. In some cases, cracking/breaking and seating of the rigid pavement is performed prior to the placement of the unbonded overlay. Typical unbonded overlay thicknesses range from about 6 to 12 inches, depending on conditions.

The **advantages** of these treatments are their much lower cost when compared with reconstruction with new PCC, their shorter construction period and long service life. However, their **disadvantages** are that they require a minimum thickness of 3 to 6 inches, which precludes their consideration due to existing grade constraints. In addition, their construction, if it involves significant pre-overlay repairs, will generate noise. These techniques also require an experienced contractor, and since PCC overlays are not common in cities and counties in the Bay Area, it is doubtful if a qualified contractor is available.

Therefore, these alternatives were not further considered in the final options presented.

Cold In-Place Recycling (AC pavements)

Cold in-place recycling involves cold milling of the AC pavement surface, an addition of emulsified asphalt, cement or other modifiers to improve the properties of the original asphalt concrete mix followed by screeding and compaction of the reprocessed material in one continuous operation. The use of cold in-place recycling can restore old pavements to the desired profile, eliminate existing wheel ruts, restore the crown and cross slope, and eliminate potholes, irregularities and rough areas. It can also eliminate transverse, reflective, and longitudinal cracks. A new wearing surface is then placed as a seal and to restrict moisture intrusion.

The major **advantages** for the cold in- place recycling are the potential cost savings, minimal traffic disruption, ability to retain original profile, environmentally friendly since it minimizes the use of new materials. However, the **disadvantage** is that a certain AC thickness is required to be recycled, and as was described earlier, many of the AC pavements are thin and do not have sufficient thickness. Also there is a high mobilization cost for the equipment, so a large volume of material needs to be recycled to justify the expense. Finally, while there have been improvements in the equipment used, long, straight streets are preferable for construction.

Therefore, this alternative was not further considered in the final options presented.

AC Overlays (Conventional)

This technique involves adding a conventional hot mix asphalt concrete or AC layer to an existing AC or PCC pavement. It is used to correct or improve the structural capacity or functional requirements such as skid resistance and ride quality. The use of an AC overlay is usually more economic when the existing pavement is still in good to fair condition. An overlay may be combined with other techniques such as cold milling, cold recycling, hot recycling, and heater scarification. The thickness of the new surface will be dependent on the type, severity and extent of the pavement surface distresses, the ride quality and the required structural improvement necessary to accommodate the design traffic.

The **advantages** are many – this is a tried and true treatment, and is widely used in the Town and surrounding cities and counties. Contractors are familiar with this process; it is less expensive than reconstruction, quieter than PCC pavements, has a shorter construction period, and is relatively easy to maintain in the future. However, the **disadvantages** are that it will potentially increase the pavement

grade, and reflection cracking is expected.

Therefore, this alternative is applicable for AC pavements but not PCC.

Rubberized Hot-Mix Asphalt (RHMA) Overlay

Rubberized hot-mix asphalt concrete (RHMA) blends ground-up rubber tires with asphalt to produce a binder which is then mixed with conventional aggregate materials. This mix is then placed and compacted into a road surface. There are two primary types of binders for RHMA, asphalt-rubber and terminal blends. Asphalt-Rubber is a blend of paving grade asphalt cement, ground recycled tire rubber and other additives, as needed, for use as binder in pavement construction. The rubber is blended and interacted in the hot asphalt cement sufficiently to cause swelling of the rubber particles prior to use. The asphalt-rubber binder is field blended (at the hot mix plant) and requires specialized mobile mixing.

The **advantages** include better durability and resistance to reflection cracking compare to conventional AC overlays, a lower cost compared to reconstruction, quick construction time, slightly quieter than conventional AC, and is also easy to maintain in the future. The **disadvantage** is that it is more expensive than conventional AC overlays and it will increase the pavement grades.

Therefore, this alternative is applicable for AC pavements but not PCC. It is included in the final options presented.

Pavement Reconstruction Alternatives for Poor Condition Pavements

Reconstruction with PCC

The existing PCC pavements will be removed and replaced by new Jointed Plain Concrete Pavements (JPCP). Based on the AASHTO 1993 Low-Volume Road Design Guide, the pavement thickness required is determined to be 5¼ inches. The assumptions used by this preliminary design are as follows:

1. Design based on 75% reliability;
2. Mean PCC modulus of rupture (S'_c) is 600 psi;
3. Mean PCC elastic modulus (E_c) is 5,000,000 psi;
4. Drainage (moisture) conditions are fair ($C_d = 1.0$);
5. Low traffic level (Traffic Index =6.0): 18-kip ESAL < 300, 000;
6. Very poor subgrade condition: modulus of subgrade reaction (k-value) < 150 pci;
7. Design life: 40 years

The **advantage** is that construction with new JPCP will present the Town with new PCC pavements that preserve the existing "look" of the District. It will be stronger and more durable surface than an AC pavement since it will last as least twice as long as AC. It can be easily grooved to provide a durable skid-resistant surface if required. However, the **disadvantages** are that this alternative will have a higher initial construction cost and the construction period will be longer and therefore more disruptive to local residents. In addition, the removal of the existing PCC pavements will unavoidably generate noise.

This is applicable to both AC and PCC pavements, but was considered only for the existing PCC pavements.

Reconstruction with AC

The old concrete pavements will be removed and replaced by new hot-mix asphalt concrete pavements. The assumptions used in the preliminary design include:

1. Low traffic level (i.e. Traffic Index = 5.5), with approximately 300, 000 equivalent single axle loads (ESALs).
2. Poor subgrade soils, with R-value = 5;
3. Gravel factor for AC = 2.32 and for aggregate base (AB) = 1.1;
4. Design life = 20 years.

Based on the Caltrans Highway Design Manual, the designed pavement structures for a conventional AC pavement (AC over AB over subgrade) and full depth AC pavement (AC placed on top of subgrade) are presented in Table 2.4.

Table 2.4 Pavement Structure for the Reconstructed AC Pavements

Pavement Type/Layer	Conventional AC (in)	Full Depth AC (in)
Asphalt Concrete (AC)	4.5	8.5
Aggregate Base (AB)	8.5	0

The **advantages** of AC reconstruction are (1) its relatively low initial construction cost compared with PCC reconstruction, and (2) its ease of future maintenance and repairs. The **disadvantages** are that it is less durable than PCC pavements. In addition, the removal of the existing PCC pavements will unavoidably generate noise.

This is applicable to both AC and PCC pavements, and was considered for both.

Perpetual Pavements

Perpetual pavements are defined as an asphalt concrete pavement designed and built to last as long as 50 years without requiring major structural rehabilitation or reconstruction, and needing only periodic surface renewal in response to distresses confined to the top of the pavement. This was developed as an alternative to PCC reconstruction, where the design life is usually 40 years.

The basic concept is that AC pavements over a minimum strength are not likely to exhibit structural damage even when subjected to very high traffic flows over long periods of time. Rather, deterioration initiates in the pavement surface as either top-down cracking or rutting. If surface-initiated cracking and rutting can be detected and remedied before they impact the structural integrity of the pavement, the pavement design life could be greatly increased. However, this design concept has been in use primarily on highways.

The assumptions for the preliminary perpetual pavement designs are as follows:

1. Low traffic level (i.e. Traffic Index = 5.5), with approximately 300, 000 equivalent single axle loads (ESALs).
2. AC resilient modulus = 800,000 psi
3. Subgrade condition: R-value = 45 (minimum R-value would require lime treatment of soils and need to be verified with lab testing);
4. Subgrade soil type: AASHTO A-7-6 (silty clays, would need to be verified in a more comprehensive geotechnical investigation)

5. Aggregate base layer of 6 inches;
6. Design life = 50 years.

The major **advantage** of this alternative is that no future reconstruction is required for these pavements. The only maintenance required is typical of those for an AC pavement, together with a replacement of the wearing course as needed. The **disadvantage** is its much higher initial construction cost. In addition, the removal of the existing PCC pavements will unavoidably generate noise.

This is applicable to both AC and PCC pavements, but was not considered for both.

Full Depth Reclamation (FDR)
Full Depth Reclamation (FDR) is a process that rebuilds worn out AC pavements by recycling the existing roadway. Old AC and aggregate base materials are pulverized using a specialized machine called a reclaimer. On top of the pulverized material, water is added to reach the optimal moisture content for compaction and then a variety of materials, such as dry cement, lime, fly ash, or asphalt emulsion are incorporated for stabilization. A reclaimer is used again to mix all the materials. After shaping and grading, the new base is compacted to produce a strong, durable base for a new pavement surface. This method recycles the materials in-situ, and in general, there is no need to haul in aggregate or haul out old material for disposal. The vehicle movements are reduced and there is no need for detours since it can be done under traffic, making this process more convenient for local residents.

The **advantages** are that construction costs are significantly lower than conventional reconstruction. It is also environmental friendly, since much of the existing material is re-used, thus reducing energy costs from hauling and processing of new materials. There is minimal traffic disruption, and existing grades are maintained. However, the **disadvantages** are that due to the small quantities on this project, it is not cost-effective since the equipment mobilization costs are very high. Therefore, this option was not considered further.

2.5 SUMMARY

2.5.1 Final Design Alternatives

From the discussions in Section 2.4, several alternatives were considered to be realistic and practical options for the Town. Table 2.5 below summarizes the options considered for each type of pavement. The detailed designs for each street are in Table 2.6.

Table 2.5 Final Design Alternatives Considered in Cost Analysis

Pavement Condition	Existing Pavement Type	Final Treatments Considered
Good	AC	Crack seals Scrub seals Slurry seals
	PCC & Composite	N/A
Fair	AC & Composite	AC overlay RHMA overlay
	PCC	N/A
Poor	AC	Conventional AC reconstruction Full depth AC reconstruction
	Composite	N/A

	PCC	PCC reconstruction Conventional AC reconstruction Full depth AC reconstruction

2.5.2 Subgrade Stabilization

Our understanding from the Town is that soils underlying the District are mostly clay subgrade with an assumed R-value of 5. This type of soil would indicate a strong potential for instability, that is subject to yielding and "pumping" under equipment and wheel loads. Therefore, for planning purposes, we have assumed that subgrade soils will need to be stabilized to facilitate construction of proposed street reconstruction sections. For the PCC streets the structural design of the PCC includes a cement/lime treated subgrade (CTS), which will also serve to stabilize the soils from a constructability standpoint. For AC streets, we have addressed potential subgrade problems with a combination of geogrid underlying the entire pavement section, and an additional allowance for a percentage of the street with particularly soft subgrade requiring over-excavation and replacement with geogrid and AB. These assumptions will need to be confirmed within the context of a more comprehensive geotechnical investigation for the proposed project. The planning level cost estimate reflects these assumptions.

Table 2.6 Pavement Design Summary

Street No	Street Name	Beg Location	End Location	Length ft	Width ft	Area sf	Core Thickness Layer	Core Thickness inches	Recommendation Alternatives	Recommendation Option A	Recommendation Option B	Recommendation Option C
P-1	Almendra Ave	N Santa Cruz Ave	Massol Ave	934	44	40,629	PCC	5.000	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	5.000				
							PCC	5.000				
							PCC	5.000				
P-2	Bachman Ave	N Santa Cruz Ave	Glen Ridge Ave	2,443	39	95,277	PCC	6.500	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	6.000				
							PCC	4.500				
							PCC	4.250				
							PCC	5.500				
P-3	Bayview Ave	Bean Ave	W Main St	690	31	21,390	N/A	N/A	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
P-4	Bean Ave	N Santa Cruz Ave	W End	1,195	30	35,850	PCC	7.000	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	5.750				
							PCC	4.750				
							PCC	5.000				
							PCC	6.000				
P-5	Braodway	N Santa Cruz Ave	W Main St	1,002	35	35,070	N/A	N/A	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
P-6	Glen Ridge Ave	Hernandez Ave	Bachman Ave	1,312	44	57,728	PCC	6.000	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	6.000				
							PCC	6.000				
							PCC	6.000				
							PCC	5.500				
P-7	Massol Ave	Los Gatos Saratoga Rd	Bean Ave	1,901	42	79,842	PCC	7.000	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	5.000				
							PCC	5.500				
							PCC	5.500				
							PCC	4.250				
							PCC	5.000				
							PCC	6.000				
P-8	Nicholson Ave	N Santa Cruz Ave	Glen Ridge Ave	1,260	26	32,760	PCC	7.000	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	6.000				
							PCC	4.500				
							PCC	5.500				
							PCC	6.000				
P-9	Tait Ave	Los Gatos Saratoga Rd	W Main St	2,476	42	103,992	PCC	4.750	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	5.250				
							PCC	4.500				
							PCC	4.500				
							PCC	4.500				
							PCC	5.000				
							PCC	7.000				
P-10	Wilder Ave	Bachman Ave	Bean Ave	1,096	37	40,552	PCC	5.000	Reconstruction	5.25" (PCC)	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA
							PCC	5.500				
							PCC	6.000				
							PCC	6.500				
							PCC	6.000				
C-1	Glen Ridge Ave	Hernandez Ave	Pennsylvania Ave	580	40	23,200	AC	2.000	Mill & Overlay	Mill 2" (HMA) OL 2.5" (RHMA)	N/A	N/A
							PCC	7.000				
C-2	Hernandez Ave	Glen Ridge Ave	Palm Ave	647	34	21,998	AC	2.000	Mill & Overlay	Mill 2" (HMA) OL 2.5" (RHMA)	N/A	N/A
							PCC	7.000				
C-3	Pennsylvania Ave	Bayview	Palm Ave	1,272	30	38,160	AC	1.500	Mill & Overlay	Mill 2" (HMA) OL 2.5" (RHMA)	N/A	N/A
							PCC	7.625				
A-1	Alexander Ave	N End	Ellenwood Ave	287	39	30,485	AC	0.625	Scrub Seal & Overlay	2.5" (HMA)	N/A	N/A
				689	28		ATB	3.375				
							AB	7.125				
A-2	Apricot Lane	Ellenwood Ave	Hernandez Ave	700	21	14,700	AC	3.875	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							AB	6.375				
A-3	Bachman Ave	Glen Ridge Ave	End	1,143	39		AC	N/A	Mill & Overlay	Mill 2" (HMA) OL 2.5" (RHMA)	N/A	N/A
A-4	Belmont Ave	Bachman Ave	Ellenwood Ave	650	32	20,800	AC	5.500	Surface Seal	Slurry Seal	N/A	N/A

Table 2.6 Pavement Design Summary

Street No	Street Name	Beg Location	End Location	Length ft	Width ft	Area sf	Core Thickness		Recommendation			
							Layer	inches	Alternatives	Option A	Option B	Option C
A-5	Chestnut Ave	Hernandez Ave	Overlook Rd	660	27	17,820	AC	3.500	Scrub Seal & Overlay	OL 2.5" (HMA)	N/A	N/A
							AB	12.000				
A-6	Ellenwood Ave	Glen Ridge Ave	Hernandez Ave	1,839	25	45,975	AC	1.000	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							ATB	3.000				
							AC	1.500				
							ATB	2.500				
							AB	19.375				
A-7	Fairview Ave	Pennsylvania Ave	Wadsworth Ave	555	25	13,875	AC	3.625	Scrub Seal & Overlay	OL 2.5" (HMA)	N/A	N/A
A-8	Hernandez Ave	Palm Ave	Chestnut Ave	906	34	30,804	AC	3.250	Mill & Overlay	Mill 2" (HMA) OL 3.5" (RHMA)	N/A	N/A
							ATB	5.000				
							AB	7.000				
A-9	Laurel Ave	Wadsworth Ave	End	573	22	12,606	AC	2.375	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							AB	8.375				
A-10	Madrone Ave	Overlook Rd	End	710	22	15,620	AC	2.375	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							AB	10.625				
A-11	Manzanita Ave	Wadsworth Ave	End	373	20	7,460	AC	1.625	Restruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							AB	6.625				
A-12	Overlook Rd	Wissahickon Ave	Madrone Ave	977	33	32,241	AC	2.330	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							AB	11.125				
A-13	Palm Ave	Hernandez Ave	Pennsylvania Ave	411	32	13,152	AC	4.500	Mill & Overlay	Mill 2" (HMA) OL 3.5" (RHMA)		
A-14	Pennsylvania Ave	Palm Ave	Wissahickon Ave	700	30	21,000	AC	1.875	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							ATB	4.000				
A-15	Peralta Ave	Hernandez Ave	Pennsylvania Ave	528	36	19,008	AC	2.375	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							AB	9.000				
A-16	Wadsworth Ave	Laurel Ave	Fairview Ave	1,025	15	15,375	AC	1.375	Reconstruction	4.5" (HMA) on 10.5" (AB)	8.5" Full Depth HMA	N/A
							AB	5.875				
A-17	Walnut Ave	Hernandez Ave	Pennsylvania Ave	570	32	18,240	AC	1.625	Scrub Seal & Overlay	OL 2.5" (HMA)	N/A	N/A
							AB	5.375				
A-18	Wissahickon Ave	Hernandez Ave	Laurel Ave	950	37	35,150	AC	1.000	Mill & Overlay	Mill 2" (HMA) OL 2.5" (RHMA)	N/A	N/A
							ATB	4.625				

3.0 NON-PAVEMENT DESIGN OPTIONS

3.1 EXISTING CONDITION

Since rehabilitation of pavement infrastructure affects other non-pavement features, the following elements were also considered for planning and cost purposes:

- Sidewalks
- Curb ramps
- Driveways
- Curb and gutters
- Pavement surface features, including underground utility covers within the roadway, pavement striping, and pavement markings
- Storm water drainage features including minor drainage pipes and swales
- Trees and existing vegetation/landscaping
- Other traffic elements, including speed bumps and raised medians

Table 3.1 below summarizes the presence of these non pavement features by street. For purposes of the street inventory, tallies were identified by street and were not separated between PCC, AC, and composite pavements. As indicated in the table, all of the streets are impacted by at least two or more non-pavement infrastructures.

Table 3.1 Summary of Street Inventory

Street Name	Sidewalk	Ramps	Driveway	Curb & Gutter	Storm Water	Utilities	Striping	Marking
Almendra	✓	✓	✓	✓		✓	✓	✓
Alexander	✓	✓	✓	✓		✓	✓	✓
Apricot						✓		✓
Bachman	✓	✓	✓	✓		✓	✓	✓
Bayview	✓	✓	✓	✓		✓	✓	✓
Bean	✓	✓	✓	✓		✓	✓	✓
Belmont		✓	✓	✓		✓	✓	✓
Broadway	✓	✓	✓	✓		✓	✓	✓
Chestnut					✓	✓	✓	✓
Ellenwood	✓	✓	✓	✓		✓	✓	✓
Fairview			✓	✓	✓	✓	✓	✓
Glen Ridge*	✓	✓	✓	✓		✓	✓	✓
Hernandez*	✓	✓	✓	✓	✓	✓	✓	✓
Laurel	✓		✓	✓	✓	✓		✓
Madrone			✓	✓	✓	✓	✓	✓
Manzanita			✓	✓		✓		
Massol	✓	✓	✓	✓		✓	✓	✓
Nicholson	✓	✓	✓	✓		✓	✓	✓
Overlook	✓	✓	✓	✓		✓	✓	✓
Palm						✓	✓	✓
Pennsylvania*	✓	✓	✓	✓	✓	✓	✓	✓
Peralta	✓		✓	✓		✓	✓	✓
Tait	✓	✓	✓	✓		✓	✓	✓

Wadsworth						✓		✓
Walnut						✓	✓	✓
Wilder	✓	✓	✓	✓		✓	✓	✓
Wissahickon	✓	✓	✓	✓	✓	✓	✓	✓

*indicates streets where street inventory includes composite pavement

Note: Trees and existing vegetation were not identified in detail during the field reconnaissance per the Town's preference to address this non pavement infrastructure more specifically during final design documents.

3.1.1 Sidewalks

Streets within the study area had both AC and PCC sidewalks that varied in condition, width and length. Overall the sidewalks are in poor to fair condition, with a few exceptions where it appears the sidewalks were recently replaced and are therefore in good condition. Sidewalk conditions were evaluated based on visual observation. In addition, since the Town is considering road rehabilitation and/or reconstruction, ADA requirements including sidewalk width and identifying tripping hazards (see Figure 3.1), were considered. During the field reconnaissance, data was collected on sidewalk length and width for purposes of calculating surface area (in case of replacement) and comparing width to ADA's requirement of a minimum 4 foot width.

Figure 3.1 Sidewalk Tripping Hazard

Approximately two-thirds of the streets had either AC or PCC sidewalk features. These non pavement features met ADA width requirements in most cases, but had noticeable cracking, some uplift, and in some instances, presented tripping hazards. There were also many localized panel repairs and numerous utilities, specifically water meters and sewer cleanouts, similar to the ones shown on Figures 3.2 and 3.3, that will be impacted by any reconstruction.

Figure 3.2 Sanitary Clean Out within Sidewalk

Figure 3.3 Water Meter within Sidewalk

It was also noted that the sidewalks near Santa Cruz Avenue were distinctly wider than other portions of the same sidewalk, and had bricks inlaid with the concrete to a length of approximately 150 feet beyond the street intersection (see Figure 3.4). It was assumed that this was the standard design for this specific portion of the Town.

Figure 3.4 Sidewalk toward Santa Cruz Avenue

3.1.2 Curb Ramps

Each street corner was inspected to determine whether a curb ramp would be necessary and if so, whether or not the existing curb ramp was ADA compliant. In most cases, street corners requiring curb ramps had non-ADA compliant ramps installed that did not have a detectable warning surface and were too steep (see Figure 3.5). At each of these street corners, measurements on curb height and available diagonal space were made to determine whether the replacement curb ramp could be a standard Caltrans case or if customization would be necessary to avoid utility and/or other conflicts. Many locations had multiple obstructions, most commonly power poles, street signs, and planters, and would require the Town to construct customized curb ramps.

Other street corners had limitations, such as right of way or lack of sidewalks, which would not allow the Town to add a curb ramp, similar to the corner illustrated in Figure 3.6.

Figure 3.5 Typical Existing Curb Ramp

Figure 3.6 Street Corner with No Ramp Availability

Similar to the sidewalks, the curb ramps at Santa Cruz Avenue had bricks inlaid along the perimeter of the curb ramp (see Figure 3.7) that would need to be preserved during replacement of these curb ramps.

Figure 3.7 Santa Cruz Avenue Curb Ramp

3.1.3 Driveways

A majority of the streets within the study area had driveways that will be affected by sidewalk and/or curb and gutter replacement. Length and width measurements were taken to calculate a replacement area for each driveway. The condition of each driveway was determined by visual inspection and the extent of defects (i.e. cracking, breakage, or distortion) to the material, which was typically either AC or PCC.

The condition of the driveways varied from very poor to excellent, most likely due to the care and usage of the resident for each specific driveway and some recent replacement. Also, the driveways were made of a variety of different materials, depending on whether the driveway area was in the Town's or resident's right of way. For purposes of this study, the focus was placed on driveways that are within the Town's likely right of way, and thus the Town would be responsible for its replacement.

In general, driveways within the study area connected to the flowline in one of three ways (illustrated in Figure 3.8a through 3.8c):

1. The driveway remained flush with the sidewalk and then sloped toward the flowline.
2. The driveway was integrated into the sidewalk
3. The driveway fed directly into the flowline since there was no sidewalk present

Figure 3.8a Typical driveway connection

Figure 3.8b Driveway connection integrated with sidewalk

Figure 3.8c Driveway connection with no sidewalk

In addition to the design of the driveway connections, it was noted that some of the driveways had utilities within the PCC portions that would require adjustment, most commonly water meters and sanitary sewer cleanouts.

3.1.4 Curb and Gutter

A significant portion of curb and gutter is in poor condition within the study area. The condition of the curb and gutter was determined by visual observation and consideration of the structural integrity of the material, which was mostly concrete, but the study area had some AC dikes for drainage that was considered as part of this study. During the field assessment, the amount of cracking, material distortion or broken material observed was used to gage curb and gutter condition and measured in linear feet for purposes of data collection. Examples of broken and cracked PCC curbs are shown in Figures 3.9a and 3.9b.

Figure 3.9a Broken Curb

Figure 3.9b Cracking along curb

Field observations noted for this non pavement feature included significant cracking, material distortion (in the form of uplift or depressions caused by vegetation or age), and broken material. These deficiencies were noted along both PCC and AC streets where curb and gutter is installed, but in general were worse along PCC streets than AC streets. In some cases, the curbs were deteriorated to a point where it was indistinguishable from the gutter. Also, there are locations where a broken gutter poses a safety hazard to pedestrians and bike riders along the road (see Figure 3.10).

Figure 3.10 Broken gutter on Glen Ridge Avenue.

3.1.5 Pavement Surface Features

As part of the pavement rehabilitation and/or reconstruction recommendations features within the roadway, including utilities, pavement marking, and pavement striping, were identified to be included in the planning and cost estimate for each street. Utility covers, typically manholes, drain inlets, or water valve boxes, which were visible on the road surface were counted. Pavement striping was measured by length and identified by the most similar Caltrans Standard Detail striping detail number. Pavement markings such as words, parking "T," blue fire hydrant markers, crosswalks, and stop bars were also identified and quantified by street. It was noted that almost all of the utility covers were in good condition, with one or two exceptions.

3.1.6 Storm Water Drainage Features

Most of the streets had curb and gutter or some form of flow line along edge of pavement which was related to one of the non pavement infrastructure features identified above. These features included curbs, dikes, gutters, drain inlet, curb inlets, catch basins, and storm water manholes. Along some of the streets, additional drainage features were identified, but not quantified, during field reconnaissance that will require additional design consideration. For the purposes of this study no significant drainage improvements were included. These drainage features included:

- A PCC drainage channel along the east-bound side of Pennsylvania Avenue between Fairview and Bayview (see Figure 3.11)
- Drainage pipes that area installed below driveways along Chestnut Avenue
- AC swales and corrugated metal pipes on Fairview, Madrone, and Wissahickon (see Figure 3.12)
- AC ditches along portions of Hernandez

Figure 3.11 Drainage channel along Pennsylvania

Figure 3.12 Drainage pipe along roadway

3.1.7 Trees and existing vegetation/landscaping

As specified by the Town, individual trees were not counted for trimming and removal, which will be completed during final design documents. However, it was noted that most of these elements were in planters located between sidewalks and gutters. With the exception of the shorter AC pavement streets, this non-pavement infrastructure affected every street to some degree. Some of these features appear to belong to the Town and others appear to belong to the resident based on the right of way observed in the field. This differentiation will need to be clear before final design begins.

3.1.8 Other traffic elements

In addition to the typical non pavement infrastructure presented above, there were additional traffic elements that included, but are not limited to, medians, islands, and speed bumps. These features were identified and measured for length, width, and height during field reconnaissance. These features were found on Massol Avenue and Bachman Avenue. Figures 3.13 through 3.14 show these features in fair to good condition.

Figure 3.13 PCC dike median in fair condition

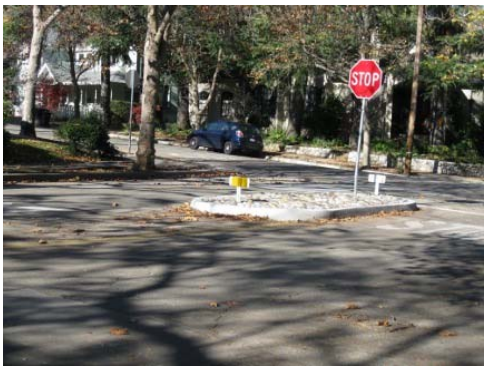


Figure 3.14 Rock median in good condition

3.2 CONCEPTUAL DESIGN

Using the existing non-pavement infrastructure conditions discussed above, this section presents recommendations for each feature. It should be noted that this design is based on field observations and

should be adjusted accordingly should any of the elements change between the time of this report and design and/or construction.

3.2.1 Sidewalks

The sidewalks are in poor to fair condition overall, all sidewalks will be replaced per the Town's Standard Details and Specifications – this is based on direction received from the Town. Since there are portions of sidewalk that appear to be new, the Town should revisit locations and determine whether or not replacement is necessary during the design phase. As discussed under field observations, the sidewalks have many utilities embedded in the concrete, which will need to be addressed during replacement.

As part of the sidewalk replacement, the Town should also consider redesigning the planters located between the sidewalk and gutter, as appropriate, to repair aged planters and to accommodate aging vegetation, particularly mature trees with large roots. This work would be an opportunity for the Town to improve, and possibly standardize, the preservation of these planters in this historical district during this time.

3.2.2 Curb Ramps

Most of the existing curb ramps inspected are non-ADA compliant, and therefore, will need to be replaced per Caltrans Standard Details for curb ramps. A majority of these ramps will need customization to accommodate sign posts, utilities, and/or planters. At locations where there are currently no curb ramps, it is recommended that these locations be left as-is due to design limitations such as lack of sidewalk and right of way.

3.2.3 Driveways

All driveways that will be impacted by the proposed sidewalk and/or curb and gutter repairs noted above were assumed to be replaced per the Town's Standard Details and Specifications. Due to the nature of this feature, it was difficult to generalize an average area of repair per driveway over the entire study area. Therefore, a typical driveway area was assumed for each street based on field measurements.

Driveways impacted by the sidewalk and/or curb and gutter repairs should be replaced depending on how the driveway connects to the flowline. In these cases, only portions of the driveway that are within the Town's right of way should be replaced, whether it is the curb and/or the entire driveway, which should be determined during final design.

3.2.4 Curb and Gutter

All curb and gutter elements in this study area were assumed to be replaced in like kind (i.e. replace PCC curb with PCC curb and AC dike with AC dike) to preserve the existing look of the District per the Town's Standard Details and Specifications. Using the same reasoning, for street sections that currently do not have curb and gutter, no curb and gutter will be installed.

The construction level design of these curb and gutter replacements will need to address construction limitations caused by planters and trees that are located along the back of curb along most of the streets within the study area. Special care should be taken during design to minimize impacts to mature trees, tree roots, and landscaping that might be present in these planters as some of these elements had been

provided by residents. In addition, this consideration is important as the Town has expressed interest in preserving the historical aspect of this district as much as possible and some of the trees and/or landscaping are a part of this preservation.

3.2.5 Pavement Surface Features

Each of the surface features (utility covers and boxes and pavement markings) will be removed and replaced based on the chosen pavement treatment. The general guidelines are listed in Table 3.1.

Table 3.1 Pavement surface feature design guidelines

Surface Feature Design	Surface Seal	Milling	Overlay	Reconstruction
Adjust Utility Covers / Boxes		✓	✓	✓
Remove Pavement Markings*	✓	✓	✓	✓
Replace Pavement Markings*	✓	✓	✓	✓

* Pavement markings include words, striping, and markers

3.2.6 Storm Water Drainage Features

Since storm water drainage features convey water from one place to another, the existing features need to be protected in place or replaced in a way to maintain the flowline. It is recommended that existing drainage features within the roadway, such as storm water manholes and drain inlets, are protected in place. Other drainage features will need to be addressed individually during final design, when topography survey should be completed to provide information about existing grades.

Based on the limited information collected during the field reconnaissance, locations with curb and gutter will have improved drainage if curb and gutters are replaced. For areas where there is no curb and gutter, the Town should verify grades and determine how each individual feature should be handled. Some design options would include remove and replace, changing grades to remove certain features, or designing an alternate means of handling the flow (i.e. replacing a channel with an underground pipe). However, for the purposed of this study no drainage improvements were included.

3.2.7 Trees and Existing Vegetation / Landscaping

As mentioned above, the Town indicated that this feature will need to be addressed during final design. For purposes of the cost analysis, assumptions were made to estimate tree removal quantities. These assumptions include an order of magnitude that this feature would impact road rehabilitation and/or reconstruction based on field reconnaissance.

3.2.8 Other Traffic Elements

Ideally, since the traffic elements that were identified are in fair to good condition, these features can be preserved in place. However, the streets that these elements are located on are recommended for PCC reconstruction, so these traffic elements will need to be removed and replaced in like kind unless the Town has a different preference.

4.0 COST ANALYIS AND OTHER CONSIDERATIONS

4.1 Cost Analysis

The construction costs included in this study are for planning purposes only and do not represent final design costs. It also includes estimated design, construction management, and construction administration costs. All costs are presented in 2011 dollars and assume construction to begin in 2011. Because the largest single asset and cost item is for pavements, the costs are split according to PCC and AC surfaced pavements (composite pavements are included in AC surfaced pavements since they are currently surfaced with AC and will receive similar treatments) as summarized in Table 4.1 for PCC Streets and Table 4.2 for AC Streets. It should be noted that costs will be sensitive to significant increases in material and labor costs (i.e. oil prices) and therefore may need to be updated to reflect any significant changes.

Three options (Options 1 through 3) were determined for PCC Streets based on three reconstruction alternatives i.e.

- Reconstruct with PCC
- Reconstruct with conventional AC
- Reconstruct with full-depth AC

Two options are provided for AC Streets based on two reconstruction alternatives i.e.

- Reconstruct with conventional AC
- Reconstruct with full-depth AC

In addition, we have included future maintenance costs (analysis period of 50 years) for all options. This allows a more balanced comparison between the PCC and AC options, as PCC reconstruction generally has a higher construction cost but lower maintenance cost over its life cycle. Conversely, AC pavements have a lower construction cost, but significantly more maintenance and rehabilitation costs over the analysis period.

The following life cycle cost assumptions were made in this study:

- Streets reconstructed with PCC – Future maintenance costs include replacement of the joint sealant every seven years (3% inflation annually)
- Streets reconstructed/rehabilitated with AC – Future maintenance based on seven year cycles with generally two to three cycles of surface seals followed by one AC overlay. This is repeated within a 50 year period (3% inflation annually).
- Non-Pavement Infrastructure – 50 year design life with all construction complete in 2011 (and no projected future maintenance costs)

In reviewing the total construction costs presented in Tables 4.1 and 4.2, it is apparent PCC construction costs are slightly higher than AC reconstruction options with modest cost differences between the two AC reconstruction options (Full Depth AC and Conventional AC over AB). In addition, future maintenance costs are substantially less for reconstruction with PCC streets than AC streets. In light of the modest cost differences between PCC and AC reconstruction costs and PCC having significantly less future maintenance costs, PCC reconstruction methods would be very attractive for the Town to consider.

4.2 Construction Phasing

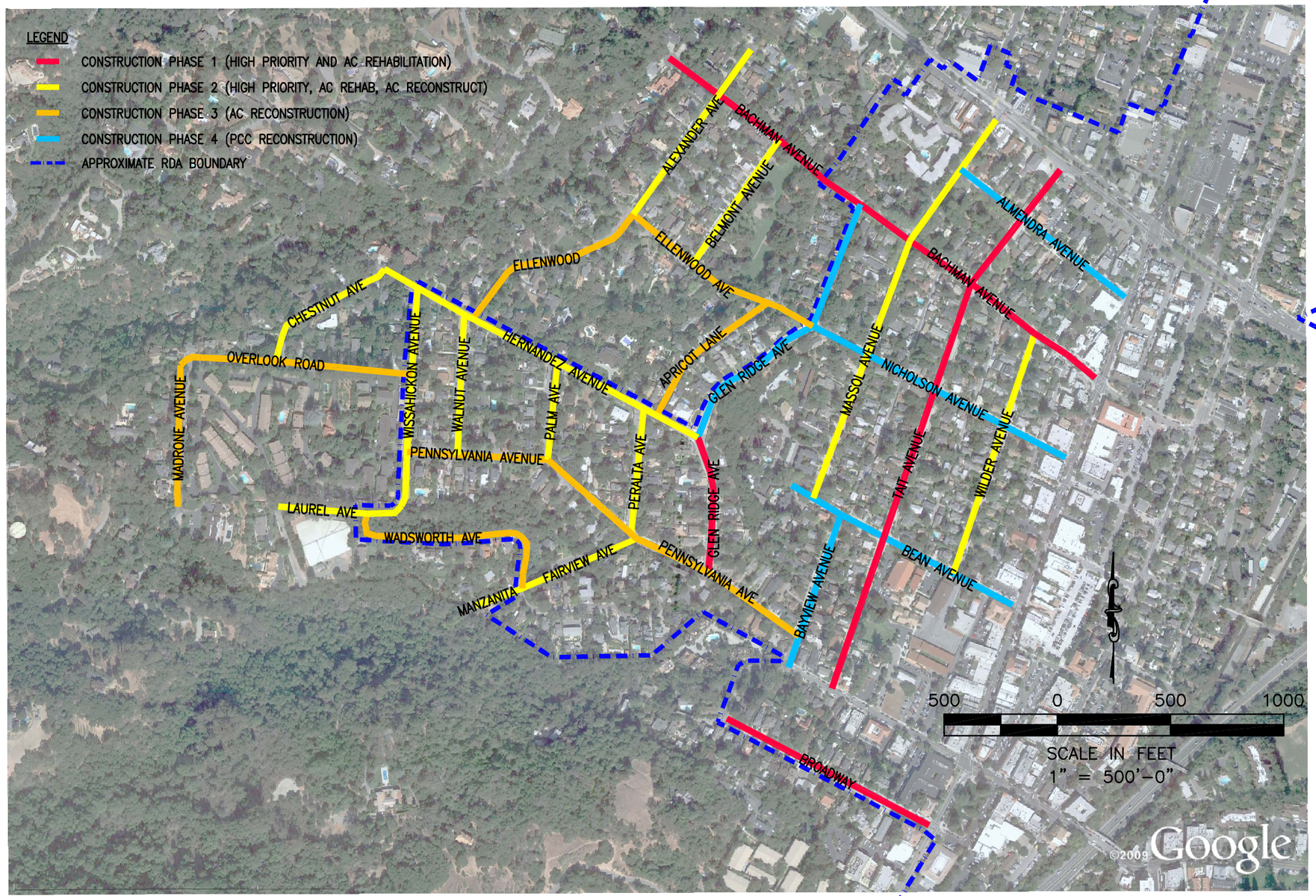
Also for planning purposes, we have included a four-phase construction plan for construction of the planned project. Construction phasing was generally developed based on street condition, surface type, impacts to the local community especially on-street parking, and maintaining through traffic and access for residents during construction. The Phases can be generalized as follows:

Phase I – Construction of a portion of PCC reconstruction streets and AC rehabilitation streets
Phase II – Construction of a portion of PCC reconstruction streets, AC reconstruction streets, and remaining AC rehabilitation streets
Phase III – Construction of remaining AC reconstruct streets
Phase IV – Construction of remaining PCC reconstruct streets

The conceptual level construction phasing plan is provided on Figure 4.1 showing which streets are constructed during each phase and initial construction procedures for maintaining traffic and access. In addition, Tables 4.4 through 4.7 detail the estimated costs associated with each phase.

NOTES:

1. CONSTRUCTION PHASING PRESENTED IS FOR PLANNING PURPOSES ONLY. THIS PROPOSED CONSTRUCTION PHASING SHOULD BE FURTHER EVALUATED PRIOR TO DESIGN.
2. CONSTRUCTION PHASING WAS GENERALLY DEVELOPED BASED ON STREET CONDITION, SURFACE TYPE, IMPACTS TO THE LOCAL COMMUNITY ESPECIALLY ON-STREET PARKING, AND MAINTAINING THROUGH TRAFFIC AND ACCESS FOR RESIDENTS DURING CONSTRUCTION.
3. CONSTRUCTION PHASE 3 AND 4 WERE IDENTIFIED TO SEPARATE PROJECTS FOR REMAINING AC (PHASE 3) AND PCC (PHASE 4) STREETS.
4. PCC RECONSTRUCTION SHOULD BE COMPLETED USING THE FOLLOWING PROCEDURE:
   - 4.1. ONE HALF OF THE STREET WIDTH SHOULD BE REMOVED WHILE LEAVING THE SECOND HALF INTACT.
   - 4.2. NEW PCC SHOULD BE POURED AND ALLOWED TO CURE FOR SEVEN (7) DAYS. DURING THIS TIME, THE CONTRACTOR SHALL PROVIDE A METHOD OF ACCESS FOR RESIDENTS ALONG THE REPAVED PORTION OF ROAD WITHOUT DISTURBING THE NEW PAVEMENT (I.E. BRIDGES AT DRIVEWAYS).
   - 4.3. AFTER THE NEW PAVEMENT HAS BEEN COMPLETELY CURED, THE PROCESS SHOULD BE REPEATED ON THE OPPOSITE SIDE OF THE ROAD.



AERIAL IMAGE FROM GOOGLE EARTH

Nichols Consulting Engineers, Chtd.
501 Canal Blvd, Suite I
Point Richmond, CA 94804
(510) 215-3620

PROPOSED CONSTRUCTION PHASING
CONCEPTUAL DESIGN REPORT FOR ALMOND GROVE DISTRICT
LOS GATOS, CALIFORNIA

FIGURE 4.1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
C. NG	058.10.20		03/01/11		

TABLES

Table 4.1. Estimated Pavement Rehabilitation and Reconstruction Capital Costs for PCC Streets[1]

ITEM DESCRIPTION	PCC REPLACEMENT[2]	AC / AB REPLACEMENT[3]	FULL DEPTH AC REPLACEMENT[4]
Maintaining Traffic / Traffic Control	$ 75,000	$ 75,000	$ 75,000
Mobilization / Demobolization	$ 434,300	$ 401,000	$ 420,400
Tree Removal	$ 55,000	$ 55,000	$ 55,000
Asphalt Concrete Reconstruction (5" AC over 11" AB)	$ -	$ 3,876,800	$ -
Asphalt Concrete Reconstruction (8.5" Full Depth AC)	$ -	$ -	$ 4,264,500
PCC Reconstruction (6" JPCP)	$ 4,541,400	$ -	$ -
Curb and Gutter Repair (AC and PCC)[5]	$ 1,920,300	$ 1,920,300	$ 1,920,300
Driveway Repair	$ 531,600	$ 531,600	$ 531,600
Sidewalk Repairs (AC and PCC)	$ 1,219,900	$ 1,219,900	$ 1,219,900
Curb Ramp Repairs	$ 208,000	$ 208,000	$ 208,000
Utility Adjustments[6]	$ 96,000	$ 96,000	$ 96,000
Striping and Pavement Markings	$ 38,400	$ 38,400	$ 38,400
Subtotal	$ 9,119,900	$ 8,422,000	$ 8,829,100
20% Contingency	$ 1,824,000	$ 1,684,400	$ 1,765,800
Construction Total	$ 10,943,900	$ 10,106,400	$ 10,594,900
Design Fees (10%)	$ 1,094,400	$ 1,010,600	$ 1,059,500
Construction Management (5%)	$ 547,200	$ 505,300	$ 529,700
Construction Administration (3%)	$ 328,300	$ 303,200	$ 317,800
Grand Total	$ 12,913,800	$ 11,925,500	$ 12,501,900

Projected Future Maintenance Cost for 50 Years	$ 4,958,800	$ 23,639,600	$ 23,639,600

Notes:

(1) Costs are based on 2011 Construction Costs.

(2) PCC Replacement assumed that reconstructed PCC pavements are replaced with 5.25" JPCP.

(3) AC / AB Replacement assumed that reconstructed PCC pavements are replaced with 4.5" AC over 10.5" AB.

(4) Full Depth AC Replacement assumed that reconstructed PCC pavements are replaced with 8.5" full depth AC.

(5) Cost includes valley gutters.

(6) Cost includes manholes, drain inlets, valve boxes, vaults, and meters as visually identified in the field.

Table 4.2. Estimated Pavement Rehabilitation and Reconstruction Capital Costs for AC Streets[1,2]

ITEM DESCRIPTION	AC / AB REPLACEMENT[3]	FULL DEPTH AC REPLACEMENT[4]
Maintaining Traffic / Traffic Control	$ 89,500	$ 89,500
Mobilization / Demobolization	$ 221,700	$ 228,900
Tree Removal	$ 90,000	$ 90,000
Asphalt Concrete Rehabilitation - RHMA Overlay[5,6]	$ 922,500	$ 922,500
Asphalt Concrete Rehabilitation - Surface Seal[7]	$ 56,100	$ 56,100
Asphalt Concrete Rehabilitation - AC Milling	$ 92,100	$ 92,100
Asphalt Concrete Reconstruction (5" AC over 11" AB)	$ 1,428,500	$ -
Asphalt Concrete Reconstruction (8.5" Full Depth AC)	$ -	$ 1,571,400
Curb and Gutter Repair (AC and PCC)[8]	$ 974,600	$ 974,600
Driveway Repair	$ 282,600	$ 282,600
Sidewalk Repairs (AC and PCC)	$ 325,400	$ 325,400
Curb Ramp Repairs	$ 76,500	$ 76,500
Utility Adjustments[9]	$ 79,400	$ 79,400
Striping and Pavement Markings	$ 17,000	$ 17,000
Subtotal	$ 4,655,900	$ 4,806,000
20% Contingency	$ 931,200	$ 961,200
Construction Total	$ 5,587,100	$ 5,767,200
Design Fees (10%)	$ 558,700	$ 576,700
Construction Management (5%)	$ 279,400	$ 288,400
Construction Administration (3%)	$ 167,600	$ 173,000
Grand Total	$ 6,592,800	$ 6,805,300

Projected Future Maintenance Cost for 50 Years	$ 11,250,900	$ 11,250,900

Notes:

(1) Costs based on 2011 Construction Costs.

(2) Includes costs for AC pavement rehabilitation that include slurry seal, scrub seal, mill and fills, and/or RHMA overlays.

(3) AC / AB Replacement assumed that reconstructed AC pavements are replaced with 4.5" AC over 10.5" AB.

(4) Full Depth AC Replacement assumed that reconstructed AC pavements are replaced with 8.5" full depth AC.

(5) Base repair quantities assumed to be 15% of non-reconstruction pavement area.

(6) Cost includes crack sealing, base repairs, overlay, wedge and conform grinding.

(7) Cost includes scrub and slurry seals.

(8) Cost includes valley gutters.

(9) Cost includes manholes, drain inlets, valve boxes, vaults, and meters as visually identified in the field.

Table 4.3. Estimated Pavement Rehabilitation and Reconstruction Capital Costs by Street Name[1]

STREET ID	STREET NAME	PAVEMENT TYPE	RECOMMENDED TREATMENT	PCC RECONSTRUCTION OPTIONS			AC RECONSTRUCTION OPTIONS		AC REHABILITATION
				PCC REPLACEMENT[2]	AC / AB REPLACEMENT[3]	FULL DEPTH AC REPLACEMENT[4]	AC / AB REPLACEMENT[5]	FULL DEPTH AC REPLACEMENT[6]	
P-1	Almendra Avenue	PCC	Reconstruction	$ 734,600	$ 677,900	$ 711,000	NA	NA	NA
P-2	Bachman Avenue	PCC	Reconstruction	$ 958,000	$ 887,000	$ 928,400	NA	NA	NA
P-3	Bayview Avenue	PCC	Reconstruction	$ 453,100	$ 423,200	$ 440,600	NA	NA	NA
P-4	Bean Avenue	PCC	Reconstruction	$ 704,900	$ 654,700	$ 683,900	NA	NA	NA
P-5	Broadway	PCC	Reconstruction	$ 753,000	$ 703,900	$ 732,500	NA	NA	NA
P-6	Glen Ridge Avenue	PCC	Reconstruction	$ 888,500	$ 807,700	$ 854,800	NA	NA	NA
P-7	Massol Avenue	PCC	Reconstruction	$ 1,406,200	$ 1,294,400	$ 1,359,600	NA	NA	NA
P-8	Nicholson Avenue	PCC	Reconstruction	$ 776,500	$ 730,600	$ 757,400	NA	NA	NA
P-9	Tait Avenue	PCC	Reconstruction	$ 1,751,600	$ 1,606,000	$ 1,690,900	NA	NA	NA
P-10	Wilder Avenue	PCC	Reconstruction	$ 693,500	$ 636,700	$ 669,900	NA	NA	NA
C-1	Glen Ridge Avenue	AC / PCC	Mill & Overlay	NA	NA	NA	NA	NA	$ 293,900
C-2	Hernandez Avenue[7]	AC / PCC	Mill & Overlay	NA	NA	NA	NA	NA	$ - [7]
C-3	Pennsylvania Avenue[8]	AC / PCC	Mill & Overlay	NA	NA	NA	NA	NA	$ - [8]
A-1	Alexander Avenue	AC	Scrub Seal & Overlay	NA	NA	NA	NA	NA	$ 301,000
A-2	Apricot Lane	AC	Reconstruction	NA	NA	NA	$ 130,800	$ 142,800	NA
A-3	Bachman Avenue	AC	Mill & Overlay	NA	NA	NA	NA	NA	$ 271,900
A-4	Belmont Avenue	AC	Slurry Seal	NA	NA	NA	NA	NA	$ 178,200
A-5	Chestnut Avenue	AC	Scrub Seal & Overlay	NA	NA	NA	NA	NA	$ 88,800
A-6	Ellenwood Avenue	AC	Reconstruction	NA	NA	NA	$ 484,800	$ 522,400	NA
A-7	Fairview Avenue	AC	Scrub Seal & Overlay	NA	NA	NA	NA	NA	$ 102,300
A-8	Hernandez Avenue	AC	Mill & Overlay	NA	NA	NA	NA	NA	$ 556,900
A-9	Laurel Avenue	AC	Reconstruction	NA	NA	NA	$ 166,400	$ 176,700	NA
A-10	Madrone Avenue	AC	Reconstruction	NA	NA	NA	$ 198,600	$ 211,400	NA
A-11	Manzanita Avenue	AC	Reconstruction	NA	NA	NA	$ 69,700	$ 75,800	NA
A-12	Overlook Road	AC	Reconstruction	NA	NA	NA	$ 378,800	$ 405,200	NA
A-13	Palm Avenue	AC	Mill & Overlay	NA	NA	NA	NA	NA	$ 57,400
A-14	Pennsylvania Avenue	AC	Reconstruction	NA	NA	NA	$ 618,100	$ 635,300	NA
A-15	Peralta Avenue	AC	Reconstruction	NA	NA	NA	$ 282,000	$ 297,300	NA
A-16	Wadsworth Avenue	AC	Reconstruction	NA	NA	NA	$ 138,700	$ 151,200	NA
A-17	Walnut Avenue	AC	Scrub Seal & Overlay	NA	NA	NA	NA	NA	$ 89,200
A-18	Wissahickon Avenue	AC	Mill & Overlay	NA	NA	NA	NA	NA	$ 248,200
			Subtotal	$ 9,119,900	$ 8,422,100	$ 8,829,000	$ 2,467,900	$ 2,618,100	$ 2,187,800
			Contingency	$ 1,824,000	$ 1,684,400	$ 1,765,800	$ 493,600	$ 523,600	$ 437,600
			Construction Total	$ 10,943,900	$ 10,106,500	$ 10,594,800	$ 2,961,500	$ 3,141,700	$ 2,625,400
			Design Fees (10%)	$ 1,094,400	$ 1,010,700	$ 1,059,500	$ 296,200	$ 314,200	$ 262,500
			Construction Management (5%)	$ 547,200	$ 505,300	$ 529,700	$ 148,100	$ 157,100	$ 131,300
			Construction Administration (3%)	$ 328,300	$ 303,200	$ 317,800	$ 88,800	$ 94,300	$ 78,800
			Grand Total	$ 12,913,800	$ 11,925,700	$ 12,501,800	$ 3,494,600	$ 3,707,300	$ 3,098,000
			Projected Future Maintenance Cost for 50 Years	$ 4,958,800	$ 23,639,600	$ 23,639,600			

Notes:

[1] Costs are based on projected 2011 Construction Costs.

[2] PCC Replacement assumed that reconstructed PCC pavements are replaced with 5.25" JPCP.

[3] AC / AB Replacement assumed that reconstructed PCC pavements are replaced with 4.5" AC over 10.5" AB.

[4] Full Depth AC Replacement assumed that reconstructed PCC pavements are replaced with 8.5" full depth AC.

[5] AC / AB Replacement assumed that reconstructed AC pavements are replaced with 4.5" AC over 10.5" AB.

[6] Full Depth AC Replacement assumed that reconstructed AC pavements are replaced with 8.5" full depth AC.

[7] Cost for Hernandez Avenue AC Rehabilitation included under Street ID A-8.

[8] Cost for Pennsylvania AC Rehabilitation included under Street ID A-14.

Table 4.4. Estimated Pavement Rehabilitation and Reconstruction Capital Costs - Phase I Construction[1]

STREET ID	STREET NAME	PAVEMENT TYPE	RECOMMENDED TREATMENT	PCC RECONSTRUCTION OPTIONS		
				OPTION A[2]	OPTION B[3]	OPTION C[4]
PCC Reconstruction Streets						
P-2	Bachman Avenue	PCC	Reconstruction	$ 958,000	$ 887,000	$ 928,400
P-5	Broadway	PCC	Reconstruction	$ 753,000	$ 703,900	$ 732,500
P-9	Tait Avenue	PCC	Reconstruction	$ 1,751,600	$ 1,606,000	$ 1,690,900
AC Rehabilitation Streets						
C-1	Glen Ridge Avenue	AC / PCC	Mill & Overlay	$ 293,900	$ 293,900	$ 293,900
A-3	Bachman Avenue	AC	Mill & Overlay	$ 271,900	$ 271,900	$ 271,900
			Phase I Subtotal	$ 4,028,400	$ 3,762,700	$ 3,917,600
			20% Contingency	$ 805,700	$ 752,500	$ 783,500
			Phase I Construction Total	$ 4,834,100	$ 4,515,200	$ 4,701,100
			Design Fees (10%)	$ 483,400	$ 451,500	$ 470,100
			Construction Management (5%)	$ 241,700	$ 225,800	$ 235,100
			Construction Administration (3%)	$ 145,000	$ 135,500	$ 141,000
			Phase I Grand Total	$ 5,704,200	$ 5,328,000	$ 5,547,300

Notes:

[1] Costs are based on projected 2011 Construction Costs.

[2] Option A assumed that reconstructed PCC pavements are replaced with 5.25" JPCP and includes AC rehabilitation.

[3] Option B assumed that reconstructed PCC pavements are replaced with 4.5" AC over 10.5" AB and includes AC rehabilitation.

[4] Option C assumed that reconstructed PCC pavements are replaced with 8.5" full depth AC and includes AC rehabilitation.

Table 4.5. Estimated Pavement Rehabilitation and Reconstruction Capital Costs - Phase II Construction[1]

STREET ID	STREET NAME	PAVEMENT TYPE	RECOMMENDED TREATMENT	PAVEMENT RECONSTRUCTION OPTIONS					
				OPTION A[2]	OPTION B[3]	OPTION C[4]	OPTION D[5]	OPTION E[6]	OPTION F[7]
PCC Reconstruction Streets									
P-7	Massol Avenue	PCC	Reconstruction	$ 1,406,200	$ 1,294,400	$ 1,359,600	$ 1,406,200	$ 1,294,400	$ 1,359,600
P-10	Wilder Avenue	PCC	Reconstruction	$ 693,500	$ 636,700	$ 669,900	$ 693,500	$ 636,700	$ 669,900
AC Reconstruction Streets									
A-9	Laurel Avenue	AC	Reconstruction	$ 166,400	$ 166,400	$ 166,400	$ 176,700	$ 176,700	$ 176,700
A-11	Manzanita Avenue	AC	Reconstruction	$ 69,700	$ 69,700	$ 69,700	$ 75,800	$ 75,800	$ 75,800
A-15	Peralta Avenue	AC	Reconstruction	$ 282,000	$ 282,000	$ 282,000	$ 297,300	$ 297,300	$ 297,300
AC Rehabilitation Streets									
A-1	Alexander Avenue	AC	Scrub Seal & Overlay	$ 301,000	$ 301,000	$ 301,000	$ 301,000	$ 301,000	$ 301,000
A-4	Belmont Avenue	AC	Slurry Seal	$ 178,200	$ 178,200	$ 178,200	$ 178,200	$ 178,200	$ 178,200
A-5	Chestnut Avenue	AC	Scrub Seal & Overlay	$ 88,800	$ 88,800	$ 88,800	$ 88,800	$ 88,800	$ 88,800
A-7	Fairview Avenue	AC	Scrub Seal & Overlay	$ 102,300	$ 102,300	$ 102,300	$ 102,300	$ 102,300	$ 102,300
A-8	Hernandez Avenue	AC	Mill & Overlay	$ 556,900	$ 556,900	$ 556,900	$ 556,900	$ 556,900	$ 556,900
A-13	Palm Avenue	AC	Mill & Overlay	$ 57,400	$ 57,400	$ 57,400	$ 57,400	$ 57,400	$ 57,400
A-17	Walnut Avenue	AC	Scrub Seal & Overlay	$ 89,200	$ 89,200	$ 89,200	$ 89,200	$ 89,200	$ 89,200
A-18	Wissahickon Avenue	AC	Mill & Overlay	$ 248,200	$ 248,200	$ 248,200	$ 248,200	$ 248,200	$ 248,200
			Phase II Subtotal	$ 4,239,800	$ 4,071,200	$ 4,169,600	$ 4,271,500	$ 4,102,900	$ 4,201,300
			20% Contingency	$ 848,000	$ 814,200	$ 833,900	$ 854,300	$ 820,600	$ 840,300
			Phase II Construction Total	$ 5,087,800	$ 4,885,400	$ 5,003,500	$ 5,125,800	$ 4,923,500	$ 5,041,600
			Design Fees (10%)	$ 508,800	$ 488,500	$ 500,400	$ 512,600	$ 492,400	$ 504,200
			Construction Management (5%)	$ 254,400	$ 244,300	$ 250,200	$ 256,300	$ 246,200	$ 252,100
			Construction Administration (3%)	$ 152,600	$ 146,600	$ 150,100	$ 153,800	$ 147,700	$ 151,200
			Phase II Grand Total	$ 6,003,600	$ 5,764,800	$ 5,904,200	$ 6,048,500	$ 5,809,800	$ 5,949,100

Notes:

(1) Costs are based on projected 2011 Construction Costs.

(2) Option A assumed that reconstructed PCC pavements are replaced with 5.25" JPCP, reconstructed AC pavements are replaced with 4.5" AC over 10.5" AB, and includes AC rehabilitation.

(3) Option B assumed that reconstructed PCC pavements are replaced with 4.5" AC over 10.5" AB, reconstructed AC pavements are replaced with 4.5" AC over 10.5" AB, and includes AC rehabilitation.

(4) Option C assumed that reconstructed PCC pavements are replaced with 8.5" full depth AC, reconstructed AC pavements are replaced with 4.5" AC over 10.5" AB, and includes AC rehabilitation.

(5) Option D assumed that reconstructed PCC pavements are replaced with 5.25" JPCP, reconstructed AC pavements are replaced with 8.5" full depth AC, and includes AC rehabilitation.

(6) Option E assumed that reconstructed PCC pavements are replaced with 4.5" AC over 10.5" AB, reconstructed AC pavements are replaced with 8.5" full depth AC, and includes AC rehabilitation.

(7) Option F assumed that reconstructed PCC pavements are replaced with 8.5" full depth AC, reconstructed AC pavements are replaced with 8.5" full depth AC, and includes AC rehabilitation.

Table 4.6. Estimated Pavement Rehabilitation and Reconstruction Capital Costs - Phase III Construction[1]

STREET ID	STREET NAME	PAVEMENT TYPE	RECOMMENDED TREATMENT	AC RECONSTRUCTION OPTIONS	
				OPTION A[2]	OPTION B[3]
AC Reconstruction Streets					
A-2	Apricot Lane	AC	Reconstruction	$ 130,800	$ 142,800
A-6	Ellenwood Avenue	AC	Reconstruction	$ 484,800	$ 522,400
A-10	Madrone Avenue	AC	Reconstruction	$ 198,600	$ 211,400
A-12	Overlook Road	AC	Reconstruction	$ 378,800	$ 405,200
A-14	Pennsylvania Avenue	AC	Reconstruction	$ 618,100	$ 635,300
A-16	Wadsworth Avenue	AC	Reconstruction	$ 138,700	$ 151,200
			Phase III Subtotal	$ 1,949,800	$ 2,068,300
			20% Contingency	$ 390,000	$ 413,700
			Phase III Construction Total	$ 2,339,800	$ 2,482,000
			Design Fees (10%)	$ 234,000	$ 248,200
			Construction Management (5%)	$ 117,000	$ 124,100
			Construction Administration (3%)	$ 70,200	$ 74,500
			Phase III Grand Total	$ 2,761,000	$ 2,928,800

Notes:

[1] Costs are based on projected 2011 Construction Costs.

[2] Option A assumed that reconstructed AC pavements are replaced with 4.5" AC over 10.5" AB.

[3] Option B assumed that reconstructed PCC pavements are replaced with 8.5" full depth AC.

Table 4.7. Estimated Pavement Rehabilitation and Reconstruction Capital Costs - Phase IV Construction[1]

STREET ID	STREET NAME	PAVEMENT TYPE	RECOMMENDED TREATMENT	PCC RECONSTRUCTION OPTIONS		
				OPTION A[2]	OPTION B[3]	OPTION C[4]
PCC Reconstruction Streets						
P-1	Almendra Avenue	PCC	Reconstruction	$ 734,600	$ 677,900	$ 711,000
P-3	Bayview Avenue	PCC	Reconstruction	$ 453,100	$ 423,200	$ 440,600
P-4	Bean Avenue	PCC	Reconstruction	$ 704,900	$ 654,700	$ 683,900
P-6	Glen Ridge Avenue	PCC	Reconstruction	$ 888,500	$ 807,700	$ 854,800
P-8	Nicholson Avenue	PCC	Reconstruction	$ 776,500	$ 730,600	$ 757,400
			Phase IV Subtotal	$ 3,557,600	$ 3,294,100	$ 3,447,700
			20% Contingency	$ 711,500	$ 658,800	$ 689,500
			Phase IV Construction Total	$ 4,269,100	$ 3,952,900	$ 4,137,200
			Design Fees (10%)	$ 426,900	$ 395,300	$ 413,700
			Construction Management (5%)	$ 213,500	$ 197,600	$ 206,900
			Construction Administration (3%)	$ 128,100	$ 118,600	$ 124,100
			Phase IV Grand Total	$ 5,037,600	$ 4,664,400	$ 4,881,900

Notes:

[1] Costs are based on projected 2011 Construction Costs.

[2] Option A assumed that reconstructed PCC pavements are replaced with 5.25" JPCP and includes AC rehabilitation.

[3] Option B assumed that reconstructed PCC pavements are replaced with 4.5" AC over 10.5" AB and includes AC rehabilitation.

[4] Option C assumed that reconstructed PCC pavements are replaced with 8.5" full depth AC and includes AC rehabilitation.