MINUTES

CITY OF COCOA
SPECIAL CITY COUNCIL MEETING
PAVING ANALYSIS

May 17, 2016

A Special Meeting of the City Council was held on Tuesday, May 17, 2016, in City Council Chambers, Cocoa City Hall, 65 Stone Street, Cocoa, Florida as publicly noticed.

I. OPENING MATTERS:

Mayor Parrish called the meeting to order at 5:59 p.m.

Councilman Blake provided the invocation and led the assembly in the Pledge of Allegiance to the Flag of the United States of America.

The Assistant City Clerk took the roll.

Present:	Henry Parrish	Mayor
	Don Boisvert	Deputy Mayor
	Brenda Warner	Councilwoman
	Michael Blake	Councilman
	Tyler Furbish	Councilman
	John Titkanich	City Manager
	Matt Fuhrer	Assistant City Manager
	Angela Ferguson	Assistant City Clerk
Absent:	Anthony Garganese	City Attorney

Other Staff Members Present:

Ed Wegerif, Public Works Director; Jack Walsh, Utilities Director; Steve Belden, Community Services Director; Teri Butler, Finance Director; and Ed Wegerif, Public Works Director.

The 2015 Pavement Management Plan Booklet[1] was handed out to staff prior to the start of the meeting.

[1] Exhibit A: 2015 Pavement Management Plan

Mr. Wegerif welcomed Council and advised that the City had hired a consultant to do an analysis of the roadways and sidewalks. He noted that the analysis was a systematic and important approach to identify the condition of the roadways and their maintenance. He further noted that the City's roadways are a large investment.

II. PRESENTATION:

Scott Stevens provided a presentation[2] to Council and staff of the current condition and future outlook of the City of Cocoa's roadway and sidewalks. He highlighted his background and experience with Kisinger Campo and noted some of the company's completed projects such as Melbourne and the County. Mr. Stevens advised of the various goals of the project with the city, which includes looking at every street and sidewalk within the city's inventory to get a firsthand look regarding their condition.

Mr. Stevens explained what Pavement Management was and how it was an ongoing process as roads change, erode, and wear out over time. The process allows for determining future condition of roads and advised that it is a $35 million asset that deserved a lot of attention.

Mr. Stevens explained that the trend of the asphalt and diesel prices are decreasing over time but contractors are not dropping prices and as a result it is still an expensive undertaking.

He noted that Pavement Management tools such as the PAVER software were chosen to perform the analysis and develop the database.

Mr. Stevens explained the large undertaking and detail that it takes for the level and types of work that would need to be addressed. The entire city's network of streets is looked at which includes groups of pavements, entire streets, and individual sections, which are the smallest pieces of road.

He noted that with Cocoa's network there are 314 branches with 953 sections and just under 80 miles of road within the City or 9 million square feet of asphalt.

Councilman Blake asked how much the streets were worth and in response, Mr. Stevens noted $35 million or about $35 a square yard which is a rough estimate and included asphalt, curbs, and striping.

Mr. Wegerif indicated things such as drainage would be extra.

[2] Exhibit B: City of Cocoa Pavement Management Program

Mr. Stevens stated that if you looked at other assets and cost, pavement is a significant asset.

He detailed the base map that was created with a GIS file for the pavement and the sidewalk program using Google Earth which gives a good idea of the presence or absence of sidewalks, which helps build inventory.

Inspection of sidewalks included walking every piece of sidewalk and looking for main defects such as tripping hazards and ramps was done. They then compiled the data into the GIS system for analysis.

Mr. Wegerif reminded all that state and county roads such as S.R. 524 and Clearlake Road are not in the City's network.

Mr. Stevens shared with the Council that when his associate goes out and looks at the pavement condition, twenty (20) different distresses are identified and located and then rated, which is identified as the PCI and then broken down into five (5) categories.

Specifics of the data collection were discussed which included feet on the ground with a trained observer which minimizes errors in recording, and the use of software. He indicated that 1000% automation is not really possible, so the manual recording/observation leads to a very detailed survey of the roads and sidewalks.

Mr. Stevens provided a summary of the pavement condition for the City.

He clarified that five (5) miles of road failed and of those failed roads the average PCI was 18.

Discussion was held on where the failed roads were located.

Mr. Stevens advised when the data was summarized most roads fell in the fair category with an average of 48%, 15% in the good category, and not many miles in the poor category.

An additional element that was looked at is called the Structural Condition Index (SCI) which further defines the distresses, such as potholes. He indicated very few structural problems exist.

Demetrius Waters, 911 School Street, made a comment about tax dollars being used for the Peachtree project and in response. City Manager Titkanich advised that this is a completely different project and that the Peachtree project was in coordination with the Space Coast TPO.

Mr. Waters further mentioned that he is deeply impressed with the contractors working out on Peachtree and wondered why when 20,000 cars pass through, he doesn't see more prosperity.

Mr. Stevens says only about ten miles of roadway are in bad shape which is a small amount structurally speaking, the rest are in pretty good shape. He then reviewed the causes of pavement deterioration and a short discussion was held regarding this matter.

A condition summary of sidewalks was provided that showed defects or issues that were major, highlighting that the information was manually collected data and then categorized.

Mr. Wegerif spoke about the trip hazards, usually caused by trees. There are about approximately 600-700 hazards, of which half have been remedied and the rest will be addressed by the end of the fiscal year.

Mr. Stevens provided a pavement deterioration model to Council showing rates of deterioration based on data that was provided by the city.

Mayor Parrish inquired about the longevity of cement versus asphalt and in response, Mr. Stevens advised concrete can lost longer but that it was typically more expensive in the long run.

Mr. Stevens advised that the current deterioration is 3 points which is typical but noted that he thinks the roads are deteriorating slower than the data seems to show.

When doing the modeling, Mr. Stevens advised that his company develops a decision matrix which helps categorize the types or level of work that needs to be done. Treatment strategy and the associated costs were reviewed and the differentials associated with it.

Mayor Parrish asked Mr. Stevens how many years he has been doing this and in response Mr. Stevens indicated ten years in pavement and 32 years in engineering.

Mayor Parrish asked him in comparison to other cities, had he recognized worse or better overall condition in comparison to Cocoa. Mr. Stevens indicated that Cocoa is in middle of the pack, maybe slightly lower.

Assistant City Fuhrer asked how the City roads compare to Brevard County roads more specifically and in response, Mr. Stevens indicated about the same as far as condition but budget wise Cocoa is in a better position as the County did not have much to spend.

Mr. Stevens advised the efforts all come down to the PCI forecast budget analysis based on current PCI condition which is in the mid 50s. He explained he can then take the city's base budget of $300,000, see what it can it buy, what condition it would be in five years, and what was the trend at the time.

Mr. Stevens advised the PCI forecast is an accurate tool showing current conditions and provided various scenarios.

Councilman Blake asked Mr. Stevens with the data collected was he given a task to see what areas needed prioritizing and if so which areas were they. All Council concurred they would also like to know. In response, Mr. Stevens explained if they took the optimal solution that the analysis provided which would be to break up bits and pieces of the roads and do work on Fiske Blvd as an example, it would not be feasible.

Councilman Blake asked if they took the highly travelled roads near major locations such as Fiske Boulevard and S.R. 520 and U.S. 1 and Clearlake Roads, how many of our roads intersect with branches or sections of those that have a high volume of travel. He reiterated his question on what areas are a priority, most feasible, and which would be more proactive to undertake first.

In response, Mr. Wegerif indicated the most heavily used roads would be prioritized.

Councilman Blake questioned the prioritization of streets without curbs, drainage and gutters. In response, Mr. Wegerif indicated those factors do not weigh in on the report and a short discussion was held among Council and staff regarding the same.

Mr. Stevens indicated that the report looks at the pavement only. He then explained and identified the sidewalk issues such as trip hazards, tree overgrowth, and missing ramps which is an ADA compliant requirement.

Mr. Stevens provided the overall pavement management suggestions to the City, which included the program they are on now to continue, preventative maintenance, and fixing roads that have base failure so they last instead of a quick fix/overlay. An evaluation should be done before having the contractor start work, plus they need to make sure the contractor does the right thing.

Councilwoman Warner asked about cold in place recycling and Mr. Stevens explained that pavement is taken up, chewed up and spit back out on site.

Mr. Stevens explained the custom report that was given to Mr. Wegerif regarding the assessment and thanked all.

City Manager Titkanich advised that the purpose of the study, which was started in 2015, was to manage assets similar to utilities. The City would determine the life cycle, use a ranking system, and then determine what needs to be done. He thanked KCA, who provided a roadmap to follow. City Manager Titkanich stated it may take longer but stressed it was an ongoing process.

Additionally he stated that generally in the past, the City budgeted $200,000 for pavement, which at times dipped to $100,000 but the past two years was increased to $300,000 for and to include specific program projects. City Manager Titkanich added that micro-surfacing was also implemented.

City Manager Titkanich reviewed funding levels and indicated anything over $300,000 would be challenging because it would result in a tax increases to citizens.

Councilwoman Warner asked if a county wide gas tax would help. In response. City Manager Titkanich indicated a Commissioner was pushing that and affirmed that a portion of the proceeds would help the cities with the roadway projects, but it was unknown how much would be given to the City.

City Manager Titkanich advised that another angle that was looked at to garner funding would be if the city front loaded it and borrowed with a line of credit and pay back the debt service with the annual appropriation over a five year period or more, but advised that although fuel prices are going down, prices of asphalt are not so it is not wise to borrow on a line of credit.

City Manager Titkanich's recommendation is to maintain the $300,000 budget and as funds become available, that the City continue to fund the project each year,

City Manager Titkanich shared that the highest SCI scores were for Pineda Street and Fiske Boulevard and went over the phases of construction and cost. He recommended that the City concentrate on the first phase of Fiske Boulevard this fiscal year which is outside the budgeted $300,000.

He added that lights would be added to the corridor deters which deters criminals and Mayor Parrish added that he wants it to look nice like the village.

City Manager Titkanich indicated the right thing to do would also be to start with the school safe routes on Pineda Street.

Mayor Parrish asked how much of Pineda is in the City and City Manager Titkanich confirmed it was about half.

Councilman Blake asked if the County will do their side when the City complete theirs and City Manager Titkanich advised that they would work with the County to attempt to do so in FY 2017.

City Manager Titkanich detailed the funding opportunities that can and will present themselves such as partnerships with other agencies, like CRA's, Utilities, FDOT etc., leveraging stormwater and utility projects, evaluating a public service tax in 2018 (the last projection was $200,000), and consider special assessment districts within the City. He indicated that increasing the millage by 1.5 is not a viable option.

Councilman Blake expressed that he likes the concept of borrowing upfront if we know we are going to allocate a minimum $300,000 each year. He wanted to know how much it will cost and how long would it take to do as many projects as possible.

City Manager stated there is a budget workshop coming up in six weeks and they could include it in the discussion.

City Manager Titkanich said the report is step one in determining how to tackle the management of this asset and commended Mr. Wegerif for going in this direction.

Councilwoman Warner thinks we will see areas improve and show initiative. The Fiske Boulevard corridor needs all the help it can get, and she wants to support citizens that are making a difference in improvements to their neighborhoods.

City Manager Titkanich advised that Assistant City Manager Fuhrer had spoken to the County regarding derelict vessels and worked with Sergeant Delatorre regarding this matter.

City Manager Titkanich advised Council will see agenda item regarding a generator at Dyal that went down which will be declared an emergency.

City Manager Titkanich apprised Council that they are working with the Assistant County Manager and Police Chief regarding the Provost Park incident.

Councilman Blake indicated a phenomenal job was done at Provost Park.

III. PUBLIC INPUT:

None.

IV. ADJOURNMENT:

- **MOTION by Councilman Furbish; Seconded by Deputy Mayor Boisvert, to adjourn the Special Meeting.**

AYES: Parrish, Blake, Warner, Boisvert, Furbish

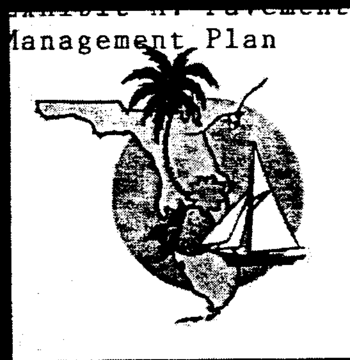
THE MOTION PASSED UNANIMOUSLY (5-0)

The Paving Analysis Special Meeting adjourned at 7:15 pm.

Henry U. Parrish III, Mayor

ATTEST:

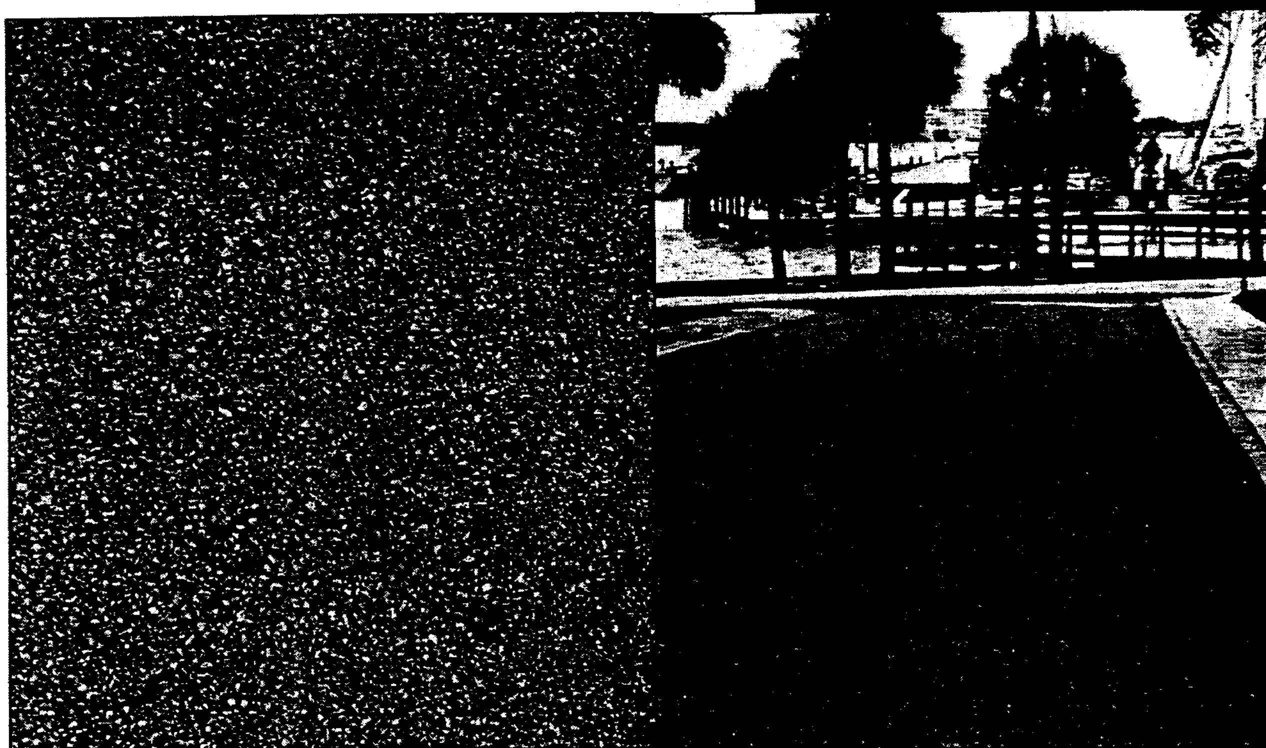
Carle Shealy, City Clerk
(Transcribed by A. Ferguson, Assistant City Clerk)



The

City of Cocoa, Florida

2015 Pavement Management Plan



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KISINGER CAMPO
& ASSOCIATES

First Draft - April 2015

The City of Cocoa, Florida

2015 Pavement Management Program

Final Report
January 2016

Prepared For:
The City of Cocoa, Florida

City Council

Mayor	Henry U. Parrish III
District One	Michael Blake
District Two / Deputy Mayor	Brenda Warner
District Three	Don Boisvert
District Four	Tyler Furbish

City Manager
John Titkanich Jr., AICP

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Florida Authorization Number 0002317

KCA Project Number 006-201402.00

Engineer of Record:	**Scott E. Stevens, P.E.**
Database Management:	**David J. Hubert**
Pavement Inspection:	**Stephen L. Vance**
Report Assistance:	**Thierry Y. Ku**

Scott E. Stevens, P.E.

Florida Registration 39644

Executive Summary

The first step in the development of the PMP was to develop an accurate inventory of the tasked roadway assets owned and maintained by the City of Cocoa. KCA was able to utilize the centerline Geographical Information System (GIS) map maintained by the City as the basis of the PMP network. Each road segment in the GIS file was field checked. As a result, the roadway network tasked by the City consists of 79.1 centerline miles of roadway, 314 individual branches with 953 sections. This is equivalent to over 9 million square feet of pavement.

Existing pavement condition was determined in accordance with ASTM D6433 *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys.* The overall area weighted average Pavement Condition Index (PCI) was determined to be **57.4**. Qualitatively this score is considered fair. Predominant distress types found during inspection were weathering and raveling, rutting, and longitudinal and transverse cracking. Based on length of each road segment and the calculated PCI, 37.2% of the City's asphalt network is in ***Good to Satisfactory*** condition, 48.4% is in ***Fair*** condition, and 14.4% is in a ***Poor or Failed*** condition.

Pavement treatment funding scenarios were run on the network to evaluate the effect of budget on future conditions. Treatment costs are based on local construction bid histories, with treatments ranging from crack sealing and rejuvenating, to full depth reclamation. Budget scenarios began with an assumed annual budget of $300,000 per year. Multiples of the assumed budget (0x, 1x, 2x, 4x and 6x) are used to predict the potential future conditions of the pavement network. Based on the analysis, the network condition can be expected to continue to deteriorate if the funding level remains near current levels. A significant increase in the annual funding is necessary in order to stabilize the current deterioration trend.

It is recommended that the City:

- ✓ Evaluate preventive maintenance treatments including crack sealing, rejuvenator application, and rejuvenating fog sealing for pavements that are in good condition.
- ✓ Continue their program of Mill and Overlay on roads that have little or no structural deficiencies.
- ✓ Implement a robust program that would include Mill and Overlay with deep patching, Full Depth Reclamation, Cold In-place Recycling, or complete reconstruction for roads with structural deficiencies.
- ✓ Conduct geotechnical evaluation and design for all roads that have structural deficiencies prior to selection of a final pavement treatment.

Specific suggested projects for Fiscal Years 2016 through 2020 are listed in Appendix B.

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Index of Figures, Tables, and Maps

Introduction

Background

The City of Cocoa, Florida (the City) is located in the middle of the state's east coast between Titusville and Melbourne in Brevard County. From the City's Comprehensive Annual Financial Report for 2014, the City was first incorporated as a village in 1895 and as a city in 1913. The current City Charter was adopted in 1959 and provides for a Council-City Manager for of government. The City is about 1-1/2 hours due east of Disney World near Orlando, Florida. Cocoa is part of Florida's Space Coast, home of Kennedy Space Center, the birthplace of U.S. manned spaceflight. Nearby Port Canaveral is the second-busiest cruise port in the world.

Pavement typically represents the single most valuable physical asset owned and maintained by a municipality. Kisinger Campo & Associates Corp (KCA) was tasked by the City in 2014 to develop a network-level Pavement Management Plan (PMP) for all roadways owned and maintained by the City. Goals of the project include:

- Development of an accurate Geographic Information System (GIS) inventory of the City's owned and maintained centerline-miles of asphalt roadways;
- Assessment of existing observable physical condition in accordance with ASTM D6433-11 *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys;*
- Development of a PAVER^{tm} database including maintenance cost and strategies, and budget analyses;
- Development of a report detailing the recommended Maintenance and Rehabilitation Plan, including the Maintenance Strategy Policy for City roadways;
- Training of City staff on the use of PAVER software;
- Development of a PMP that will provide the basis of a Five Year Capital Improvement Program (CIP) for roadway improvements.

PAVER^{tm} Pavement Management System Overview

Pavement Management, like other Asset Management practices, follows a cyclical process that begins with a basic understanding of system to be evaluated – in this case the pavement network – and proceeds through recommendations. A Pavement Management System (PMS) is a set of defined procedures for collecting, analyzing, maintaining, and reporting pavement data. The intent of a PMS is to assist in finding optimum strategies for maintaining pavements in an acceptable condition over a given period of time for the least cost. In a PMS objective information and data is presented so that decisions made are consistent, cost-effective, and defensible. Many factors beyond the condition assessment can, and do, influence the decisions made as a result of the PMS. These factors may include policy and economic influences internal to the City and the City's primary customers—the citizens who live and work in the City, and who ultimately pay for the pavement assets. Ultimately a PMS provides the basis for an informed understanding of the consequences of alternative decisions.

A Pavement Management Plan (PMP) is the written findings and recommendations supporting the PMS. The primary intent of the PMP is to develop a network-wide understanding of the conditions of all of the paved surfaces within the network. A secondary intent is to develop a prioritization scheme to rate the pavements relative to each other, eventually developing remediation projects.

The City of Cocoa's 2015 PMP has been developed to conform to the methodologies specified in the latest version of ***ASTM D6433 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys.*** This Standard provides the procedural requirements for collecting and categorizing pavement distress data. Data were initially collected utilizing a proprietary data collection application developed by KCA for the sole purpose of providing accurate and cost effective data to our clients. These data were subsequently imported into a **PAVER™ v6.5** software for analysis.

PAVER provides the means to evaluate existing and future budgetary needs against current and projected pavement conditions. The **PAVER** system provides agencies with tools to assist in:

1 Developing an inventory of their pavement network
2 Conducting pavement distress surveys
3 Assessment of pavement conditions
4 Development of models enabling the prediction of future pavement conditions
5 Analysis of funding scenarios
6 Planning of maintenance and rehabilitation activities
7 Reporting of findings

Methodology

Network Definition and Inventory

The initial step in the development of the PMP was to define the extent of the pavement that will be included in the PMP. All roads within the City are subdivided into ***Networks***, ***Branches***, and ***Sections***. Each subdivision is described below:

Network

A pavement ***network*** is simply a logical grouping of pavements to be managed (*Pavement Management for Airports, Roads, and Parking Lots* by M.Y. Shahin, 2005). For the City's PMP, the logical grouping is simply defined as City paved and maintained roads. In other words, the City has one network in PAVER entitled "Roads"; Parking lots, State, County, unpaved rights-of-way, and privately-owned roads are not included in the City's network.

KCA obtained a copy of the City's GIS centerline shapefile to be used as the basis for the PAVER database. Working closely with City staff, the GIS map was reviewed, with operation and maintenance responsibilities identified. Minor adjustments were made to the shapefile to ensure that a one to one relationship would exist once the PAVER database is developed. An atlas was developed by KCA and reviewed by City staff to identify specific roads to be included in the PAVER dataset. All roads included in the inventory are graphically shown in **Map 1 – Paved Road Network** in **Appendix A**.

Network inventory data is information about the roads that generally remains static over time (length, width, surface type, number of lanes, etc.). KCA verified and recorded data provided in GIS (i.e. pavement widths, lanes, etc.) during field inspection activities. Initial Section lengths were determined from the GIS shapefile, with major discrepancies between field conditions and the GIS data noted.

Branches

Each network is separated into ***branches***. Branches are readily-identifiable parts of the pavement network and have a distinct use. For Cocoa, KCA simply defined each named road as a branch. Within the PAVER database, each branch is identified in two ways:

1. By a textual descriptor called the "Branch Name"
   This is the Branch or street name. Most agencies will have this in the centerline file already and GIS can be used to copy data into PAVER. If the names are compiled from multiple sources, consistency between the sources is important.
2. By a textual descriptor called the "Branch ID"
   The BranchID must be unique for each branch in the system. PAVER imposes a 10 character limit and will automatically assign a unique ID. Some agencies prefer to have their own numeric street ID or Asset ID number assigned to each Branch. KCA often will assign a BranchID based in the branch name and ensuring that the BranchID is unique. For Cocoa, KCA assigned a 4-digit numeric identifier as the BranchID.

Sections

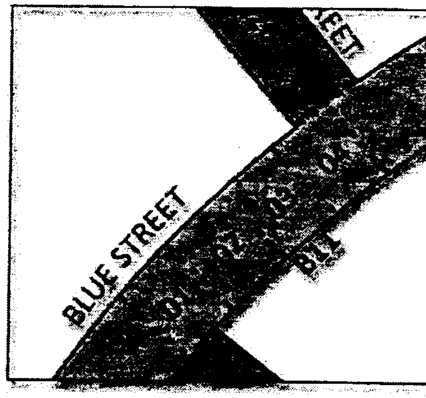
A pavement ***section*** is the smallest management unit for which road resurfacing will be planned. Sections typically share similar characteristics such as pavement structure, construction history, functional classification, and traffic (Shahin, 2005). Sections represent one of the most important elements within the network. Pavement conditions and work planning are aggregated at the section level. Similarly to a branch, each section is uniquely identified. For the City of Cocoa, sections are defined from intersection to intersection, based on the GIS centerline shape file. This ensures consistency between the final PMP and GIS, and that pavements with similar characteristics are grouped as closely together as possible.

Sample Units

The quantity and quality of the ***collected*** data should be matched to the ***intended use*** of the data. If the intended use of the data is for the development of a project-level plan for specific sections of roads, inspecting 100% of the pavement surface along with geotechnical investigations might be the best course of action. On the other hand, if the intended use of the data is for the development of a network-level plan, inspecting 100% of the pavement surface would be an inefficient use of resources.

This plan developed for the City of Cocoa is considered a network-level PMP based on ***ASTM D6433*** methodology. ASTM D6433 is based on the premise that reasonable accuracy (95% confidence) can be achieved without 100% inspection. To accomplish this accuracy, each pavement section is broken into ***sample units*** and inspections are conducted on a specified number of sample units within a section.

Figure 1: Sample Units



Sample units are a conveniently-defined portion of a pavement section designated only for the purpose of pavement inspection (Shahin, 2005). To comply with ASTM D6433 methodology, the size of a sample unit defined as 2,500 ± 1,000 square feet. Figure 1 illustrates how the Branch (***Blue Street***) is conveniently divided into a Section (***B11***) and then sample units (***01, 02, 03, and 04***).

The number of samples per section is determined using Network Level Sampling Criteria. Table 1 specifies the criteria KCA uses to determine the number of sample units to be inspected per section. A minimum of one sample unit per section is inspected.

Table 1: Network Level Sampling Criteria

No. of Sample Units in Section	No. of Units to be Inspected
1 to 5	1
6 to 10	2
11 to 15	3
16 to 40	4
Over 40	10%

Distress Surveys

All field distress information is collected manually. KCA staff utilizes a proprietary software tool for recording and organizing the collected data prior to import into PAVER. This tool integrates the network GIS centerline data with Global Positioning System (GPS) data, enabling staff to quickly and accurately define sample units and collect applicable data. Photographic documentation of the inspected pavement is also integrated into the inspection protocol with the sample location and photographic data geo-referenced and stored in a database distinct from PAVER. Distress data were subsequently imported into PAVER, avoiding manual entry and maximizing database accuracy.

Pavement Condition Index (PCI)

The ASTM D6433 methodology defines 20 different pavement distresses that are used in determining the Pavement Condition Index (PCI). The PCI is a quantitative descriptor of the overall pavement condition based upon the ***type***, ***aerial extent***, and ***severity*** of each observed distresses. Numerically the PCI ranges between 0 and 100. A PCI of 100 represents a pavement completely free of distress whereas a PCI of 0 corresponds to a pavement that has failed completely. Each distress type, extent and severity is assigned a deduct value or weighing factor. A deduct value of 0 indicates that the distress is not present and therefor has no effect on pavement condition, whereas a value of 100 represents serious distress.

A Pavement Condition Rating (PCR) is a qualitative descriptor associated with ranges of PCI and is useful when describing the general condition of pavements. Table 2 shows the range of PCI values to which each rating corresponds.

Structural Condition Index (SCI)

Like the PCI, the SCI is a quantitative descriptor of the pavement condition. The SCI however focuses on distresses that suggest that the roadway may be structurally deficient or that base failures are occurring. Table 3 lists the distress and severity levels that are used in the calculation of SCI for both asphalt and Portland cement pavements.

An analysis of the SCI along with the PCI is a very powerful tool in developing the PMP. Low PCIs and high SCIs suggest that the pavement may not load carrying capacity problems. Conversely, low PCIs and low SCIs indicate that the pavement likely has base-related failures. Each case would have very different repair strategies. The Structural Condition Rating (SCR), the qualitative descriptor associated with ranges of SCI, is shown in Table 4 below.

Table 2: PCI Condition and Range

Good	81-100	Pavement has minor or no distresses and should require only routine maintenance.
Satisfactory	61-80	Pavement has scattered low-severity distresses that should require only routine maintenance.
Fair	41-60	Pavement has a combination of generally low- and medium-severity distresses. Near-term maintenance and repair needs may range from routine to major.
Poor	21-40	Pavement has low-, medium-, and high-severity distresses that probably cause operational problems. Near-term maintenance and repair needs may range from routine up to a requirement for reconstruction.
Failed	0-20	Pavement deterioration has progressed to the point that safe operations are no longer possible; complete reconstruction is required.

Table 3: SCI Distress Types and Severity

	Distresses	Severity
Asphalt Cement	Alligator Cracking	Low, Medium, High
	Patching	Medium, High
	Potholes	Low, Medium, High
	Rutting	Medium, High
Portland Cement	Large Patching	Medium, High
	Corner Break	Low, Medium, High
	Divided Slab	Low, Medium, High
	Punchout	Medium, High

Table 4: SCI Condition and Range

Good	90-100	Pavement has little or no minor distresses that are affected by loads. In general the road base does not show signs of deterioration.
[illegible]	[illegible]	[illegible]
Poor	50-79	Pavement has a combination of generally low- and medium-severity structural distresses. Long-term maintenance and repair needs may range from routine to major.
Serious	0-49	Pavement has mainly high-severity structural distresses. Structural repairs and reconstruction of the road, including the road base, are needed.

Condition Assessment

Both PCI and SCI were determined for each of the 1,209 individual pavement Sample locations and subsequently for the 953 roadway Sections. The more common asphalt distresses found in the City include Weathering/Raveling, Block Cracking, Alligator Cracking, Longitudinal/Transverse Cracking, Edge Cracking, Depressions, Potholes, Patch/Utility Cuts, Bumps/Sags, and Lane/Shoulder Drops.

Network Summary

As mentioned previously, network inventory data generally remains static over time. The pavement network for Cocoa is summarized in Table 5. A single network was defined consisting of 314 individual branches with 953 sections. The total length of the network is 79.1 centerline miles with an area of over 9 million square feet.

Table 5: Network Summary

Number of Branches	314
Number of Sections	953
Total Mileage	79.1
Total Area (sq. ft.)	9,010,259
Average Section Width (ft.)	21.5
Average Section Length (ft.)	438.2
Average Number of Lanes per Section	2.02

Pavement Condition Index (PCI)

After the final importation of distress data, the PCI is calculated within PAVER for each sample. The results are then extrapolated to each section. **Appendix A** shows the geographic distribution of PCI scores across the Roadway Network. The average PCI for all City roads is 56.6 and the area weighted value is 57.4. Based on length of each road segment and the calculated PCI, 37.2% of the City's asphalt network is in ***Good to Satisfactory*** condition, 48.4% is in ***Fair*** condition, and 14.4% is in a ***Poor or Failed*** condition.

Structural Condition Index (SCI)

SCI values for asphalt roads within the network is a numeric average of ***94.8***. This score indicates that while the majority of roads within the network do not appear to have structural issues, there are some with potentially significant base problems causing the deterioration of the pavement surface.

Table 6: Pavement Condition Summary

Pavement Condition Rating	Sections	Length (miles)	Pavement Area (SF)	Average PCI
All City Maintained Roads				
0 - 20 Failed	76	5.0	599,886	18.3
21 - 40 Poor	93	7.8	876,216	30.5
41 - 60 Fair	472	39.3	4,444,045	52.7
61 - 80 Satisfactory	206	17.3	1,983,454	67.0
81 - 100 Good	105	9.7	1,106,658	86.3
	952	79.1	9,010,259	54.6

Figure 2: PCI Distribution

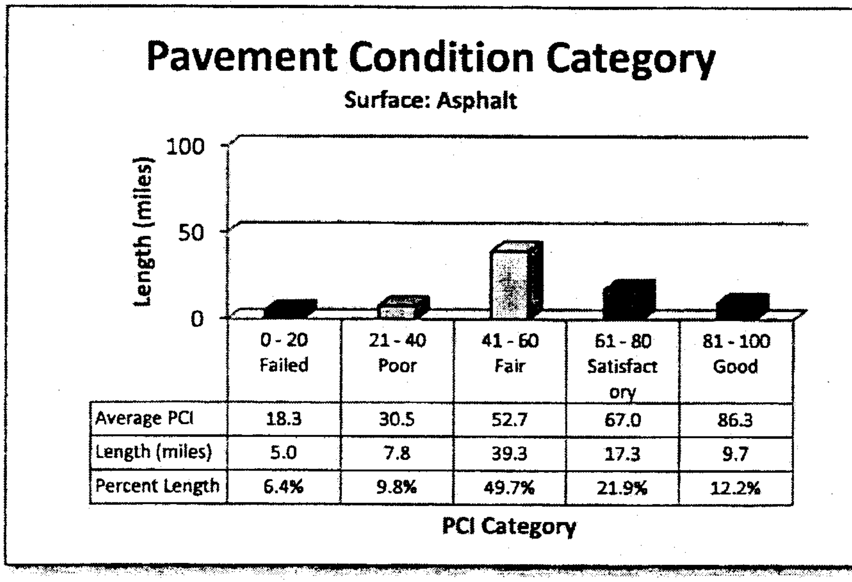
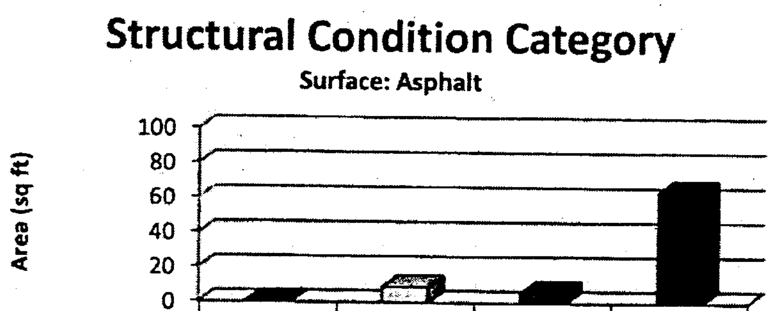


Table 7: Structural Condition Summary

Structural Condition Rating	Sections	Length (miles)	Pavement Area (SF)	Average SCI
All City Maintained Roads				
0 - 49 Serious	8	0.3	7,325,570	99.3
50 - 79 Poor	111	8.9	658,377	84.8
80 - 89 Fair	70	5.8	982,728	67.5
90 - 100 Good	763	64.1	43,584	41.4
	952	79.1	9,010,259	94.0

Figure 3: SCI Distribution



	0 - 49 Serious	50 - 79 Pooir	80 - 89 Fair	90 - 100 Good
Average SCI	41.4	67.5	84.8	99.3
Length (miles)	0.3	8.9	5.8	64.1
Percent Length	0.4%	11.3%	7.3%	81.0%

SCI Category

Cause of Deterioration

The analysis above is per the ASTM D6433 standard. From these index calculations it appears that the overall PCI is fair, but structurally the roads are in good condition. However, additional inferences can be made of the pavement condition based on the underlying causes of pavement distresses: ***Load***, ***Climate and Durability***, or ***Other*** factors.

Load – Alligator Cracking, Edge Cracking, Potholes, Rutting, and Shoving

Climate and Durability – Block Cracking, Joint Reflection, Longitudinal and Transverse Cracking, Weathering, and Raveling

Other – Bleeding, Bumps and Sags, Corrugations, Depressions, Lane/Shoulder drop-off, Patching, Polished Aggregate, Railroad Crossings, Slippage Cracking, and Swelling

For the City roads, 94.4% of the overall condition of the pavement can be attributed to climate and durability issues with the remaining 5.6% attributed to load or other issues. This high percentage of climate related causes, coupled with the fact that the Weathering and Raveling distresses (distress 19 & 20) are known to significantly influence (lower) the PCI score, help in understanding the PCI score.

Condition Prediction

The City of Cocoa has made a major investment on behalf of their citizens in the nearly 80 miles of paved roads. This investment is likely the single largest asset owned by the City in terms of value when considering the cost of the pavement and the associated improvements such as curbs, drainage, signs, signals, and sidewalks.

The ability to forecast pavement conditions based on available funding is a key component of the PMP. This provides the City with the tools necessary to make informed decisions on selecting the correct pavement repair techniques, analyze various funding scenarios, and ultimately develop projects for the preservation or restoration of the paved surfaces.

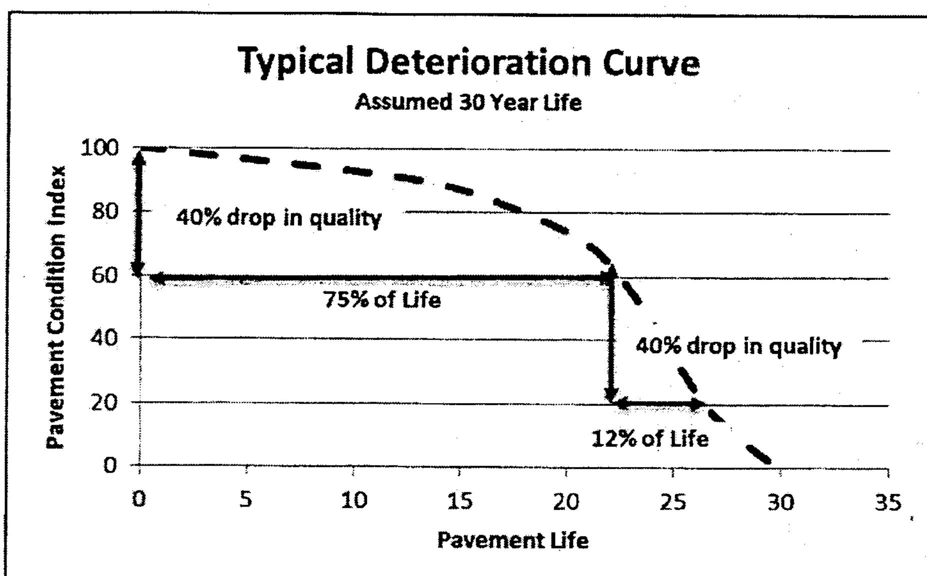
Development of Deterioration Models

Pavement will deteriorate. No matter how well a road is originally constructed, the effects of traffic loads and climate will take a toll on the road surface over time. The age of the pavement and the rate at which the deterioration occurs becomes important considerations when developing asset management strategies for the PMP.

Pavement Life-cycle

Figure 4 depicts a widely published pavement deterioration curve. Several conclusions can be drawn from this curve including the overall life expectancy of the pavement and the relative rate of deterioration based on the age of the pavement. The shape of the curve infers that early in pavement's life the condition remains in good condition for many years before any appreciable maintenance is needed. As a pavement passes the midpoint in its life-cycle, the rate of deterioration can rapidly increase. The curve shown in Figure 4 was derived based on an assumed 30 year life expectancy, and that 40% of a pavement's deterioration occurs within the first 75% of a pavement's expected life. The next 40% of the deterioration occurs very rapidly in only the next 12% of the life. This relationship of deterioration and time has been widely referenced as being typical of pavement deterioration. Additionally, the relationship suggests that conducting *preventative maintenance* early in the pavement's life-cycle can delay significant deterioration and thereby save considerable funds when compared to conducting major maintenance later

Figure 4: Typical Deterioration Curve



in the pavement's life.

Two of the most prominent factors influencing pavement deterioration rates are related to traffic load and climate/durability. The table below includes distresses from *ASTM D6433* by influencing factor or possible cause:

Table 8: Asphalt Concrete Observable Distress by Possible Causes

Traffic Load	Climate/Durability
Alligator Cracking	Bleeding
Depression	Block Cracking
High-severity Longitudinal and Transverse Cracking	Joint Reflection Cracking
Medium and High Severity Patching and Utility Cut Patching	Low and Medium Severity Longitudinal and Transverse Cracking
Potholes	Low Severity Patching and Utility Cut Patching
Rutting	Swell
Slippage Cracking	Weathering

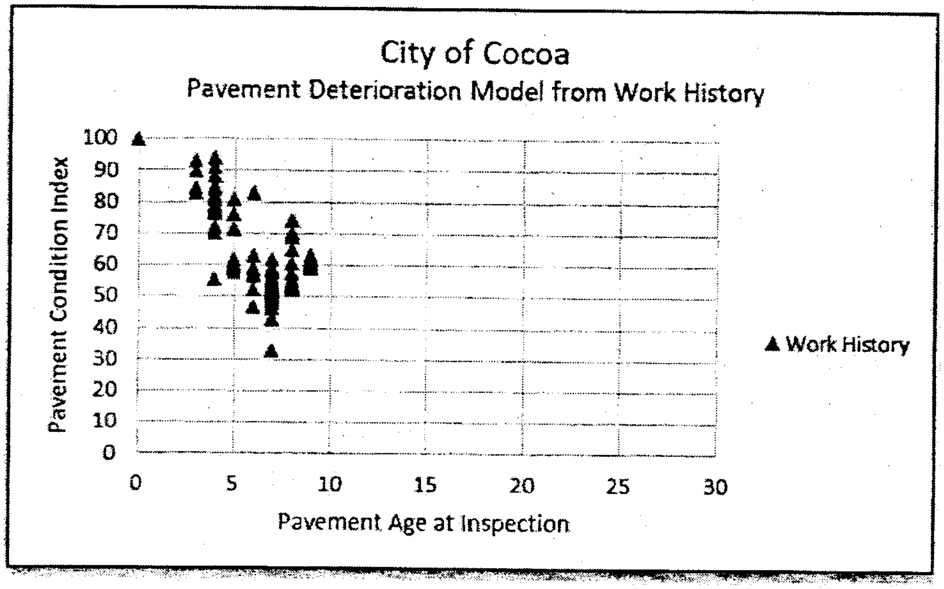
Development of appropriate deterioration curves provide a basis for ***predictive*** condition forecasting. A typical curves such as the one discussed above can be used, but may not accurately represent the specific conditions of the City's network. Deterioration models can be developed specific to a pavement network by evaluating historic PCI values against the age of the pavement. With sufficient data, multiple models may be developed based on the use of the roadway. The expected deterioration of arterial and collector roadways may vary from a model developed for residential roads.

Construction History

Historic construction data helps to define the deterioration curves by establishing the point in time when the pavement was new (time=0, PCI=100). Inspection data establish specific points along the deterioration curve. As additional inspections data is collected and work history added to the Pavement Management System, refinements can be made to the models improving the overall ability of the model to predict future conditions of the road network.

The City provided KCA with available historic asphalt overlay data. An asphalt overlay is considered major maintenance and can be used to establish the point in time when the pavement was new (time=0 and PCI=100). Approximately 9 years of construction information was provided representing 91 individual road sections. These data provide known ages when the PCI was last equal to 100. Plotting these age groups against the average measured PCI for the group at the last inspection provides an indication of how roads with similar history deteriorate with time. Figure 5 is a plot of the average PCI for each of the 91 sections.

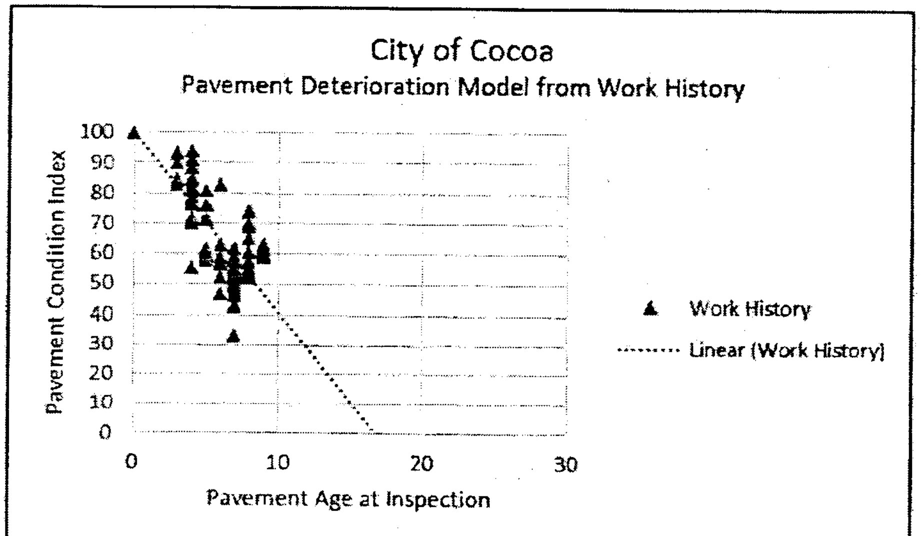
Figure 5: Known Construction Age vs. PCI



Model Review

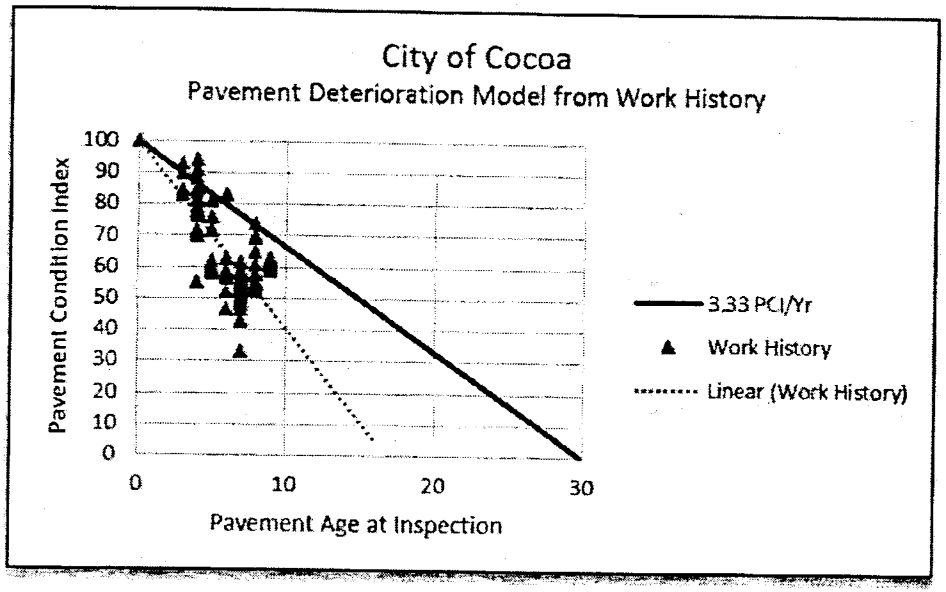
The condition vs. age data presented in Figure 5 was further evaluated in order to develop and acceptable deterioration model. One of the most simplistic deterioration models is to assume that the relationship between PCI and age is linear and has a distinct life expectancy. Figure 6 depicts a linear fit of the construction data which indicates a life of the asphalt of approximately 18 years. While this linear model appears to correlate fairly well to the historic data, the reasonableness of the model must be considered.

Figure 6: Linear Deterioration Model



The second modeling option reviewed is shown in Figure 7. This model is also a straight-line deterioration, but assumes a 3.33 PCI point per year deterioration rate. This rate assumes the life of a pavement in the City to be approximately 30 years.

Figure 7: Linear Deterioration Model at 3.3 points per year



While this model appears to fit the data reasonably well, it may underestimate the actual pavement deterioration. However, consideration should be given known influence of distresses 19 and 20 on the PCI scores. If an assumption is made that the lower PCI scores are an artifact of the influence of distresses 19 and 20, one could reasonably assume slightly higher scores and a longer modeled pavement lifecycle.

Model Recommendation

The model recommended for use by the City is the linear deterioration model shown in Figure 7 assuming 3.33 PCI points per year. This model is relatively simplistic and fits the data well. Additionally, the model extends the overall life of the pavement to a more reasonable age of 30 years. The deterioration model represented in Figure 6 does not appear reasonable given the overriding influence of the Weathering and Raveling distresses on the PCI score. As additional inspection cycles are complete in future years, it is recommended that the deterioration model be re-evaluated.

Pavement Treatment Selection

Selection of specific projects is an iterative process that must incorporate technical and non-technical information. Data collected in this PMP plays a very important role in the decision process, but as pointed out in *Pavement Management for Airports, Roads, and Parking Lots* by M.Y. Shahin, 2005, "the PCI by itself is not sufficient to identify the needed specific M&R type." A single numeric value such as the PCI can indicate a general level of M&R needs, but it is also important to understand the cause (structural, climate, or other) of individual distresses that make up the PCI score. Additionally, factors such as funding, political desires, citizen complaints, etc. often influence project selection.

At the network-level, the goal is to gain and understanding of how pavement conditions can be expected to respond to programmatic funding levels, and to develop optimum combinations of potential pavement M&R treatments and network sections – the right treatment for the right location at the right time.

Short-term Maintenance and Rehabilitation Categories

PAVER uses several categories of M&R in the planning of potential pavement treatments. Specific treatment options can be suggested when the planning horizon, or the length of the planning time period is very short – typically less than one year. In these cases, the change in pavement conditions between distress identification and repair is negligible. Therefor specific repair strategies or proposed actions can be specified with some certainty. M&R categories included as short term include Localized Safety and Localized Preventive. Note that both Localized Safety and Preventive M&R activities are considered part of the City's routine maintenance program, not capital maintenance. Each category is presented below for reference:

Localized Safety M&R

Localized Safety M&R is defined as the localized distress repair needed to keep the pavement operational in a safe condition. This type of maintenance has a very short planning horizon if any at all. It may also be referred to as safety maintenance, stop-gap maintenance, and operational maintenance. Table 9 lists distress severity and type along with proposed remediation actions for Localized Safety M&R.

Table 9: Localized Safety M&R Policy

Severity	Description	Proposed Action
High	*BUMPS/SAGS*	Shallow Patching
High	*CORRUGATION*	Shallow Patching
High	*LANE / SHOULDER DROP*	Shoulder leveling
High	*PATCH/UTILITY CUT*	Shallow Patching
High & Medium	*POTHOLE*	Deep Patching
High	*RUTTING*	Shallow Patching
High	*SHOVING*	Shallow Patching
High	*SLIPPAGE CRACKING*	Shallow Patching

Localized Preventive M&R

Localized Preventive M&R activities are performed with the primary objective of slowing the rate of deterioration, but are applied at the location of individual distresses. For asphalt pavement it can include activities such as deep and shallow patching, and crack sealing. Localized PM differs from Global PM (described below) in that it typically is not applied to pavement outside of the location of the distress. Table 10 lists distress severity and type along with proposed remediation actions for Localized Preventive M&R.

Table 10: Localized Preventive M&R Policy

Severity	Description	Proposed Action
High & Medium	*ALLIGATOR CR*	Deep Patching
High & Medium	*BLOCK CRACKING*	Crack Sealing
Medium	*BUMPS/SAGS*	Shallow Patching
High	*BUMPS/SAGS*	Deep Patching
High	*CORRUGATION*	Deep Patching
Medium	*CORRUGATION*	Shallow Patching
High & Medium	*DEPRESSION*	Deep Patching
Medium	*EDGE CRACKING*	Crack Sealing
High	*EDGE CRACKING*	Shallow Patching
High	*JOINT REFLECTIVE CRACKING*	Shallow Patching
Medium	*JOINT REFLECTIVE CRACKING*	Crack Sealing
High & Medium	*LANE / SHOULDER DROP*	Shoulder leveling
High	*L & T CRACKING*	Shallow Patching
Medium	*L & T CRACKING*	Crack Sealing
High	*PATCH/UTILITY CUT*	Deep Patching
High, Medium & Low	*POTHOLE*	Deep Patching
High	*RUTTING*	Deep Patching
Medium	*RUTTING*	Shallow Patching
High & Medium	*SHOVING*	Grinding (Localized)
High & Medium	*SLIPPAGE CRACKING*	Shallow Patching

Long-term Maintenance and Rehabilitation Categories

Long Term M&R categories include Global Preventive and Major. In these cases, the time between pavement distress identification and repair may be several years. The change in pavement condition, and even the change in identified distresses could be appreciable. Therefore specific repair strategies or proposed actions are suggested as network-level planning guidelines.

Global Preventive M&R

Global Preventive M&R are maintenance activities applied to the entire section of pavement with the primary objective of slowing the rate of deterioration. Global PM is a program of activities that preserves the investment in pavements, reduces the rate of degradation due to specific distresses, and extends the life of the pavement. Currently the City does not include Global Preventive M&R in their pavement management program. Therefore, a specific allocation of funding has not been considered in this report.

Table 11: Global Preventive M&R Policy

Severity	Description	Proposed Action
High, Medium & Low	*POLISHED AGGREGATE*	Microsurface, Sealcoat or thin overlay
High, Medium & Low	*BLEEDING*	Microsurface, Sealcoat or thin overlay
High, Medium & Low	*BLOCK CRACKING*	Microsurface, Sealcoat, Crack seal, or Rejuvenation
High, Medium & Low	*WEATHERING / RAVELING*	Microsurface, Sealcoat or Rejuvenation
High, Medium & Low	*L & T CRACKING*	Microsurface, Sealcoat, Crack seal, or Rejuvenation

Major M&R

Major M&R are maintenance activities applied to the entire section and are intended to correct or improve existing structural or functional requirements of the paved surface. It is important to note that Major M&R are the only type of maintenance activities for which the PCI values are returned to 100 after the treatment is applied.

M&R Approach

PAVER allows the user to select different approaches to identify potential projects. The **Minimum PCI** approach is basically a worst-first approach. This approach does not optimize budget spending but rather determines the funding needed to maintain the pavement condition at or above a specified minimum PCI value. The minimum value can vary based on road type or can vary in time. For example, the targeted PCI value may rise over several years in order to fund the program. In this approach the Major M&R costs are applied to each road section when the PCI is projected to reach the specified minimum value. Once this point is reach and Major M&R is applied, the PCI score is reset to 100 and no further treatment is applied until the minimum PCI is once again reached.

The **Critical PCI** approach is based on the concept that it is more cost-effective to maintain pavements above the ***critical*** PCI rather than below. The critical PCI is the point in the life of the pavement where the condition begins to rapidly deteriorate. The critical PCI and also be viewed as the point where the cost of local preventive maintenance starts to significantly increase. Typically the critical PCI ranges from 50 to 75. Using this approach, PAVER is attempting to optimize the M&R budget using the following priority of M&R categories:

1. Localized safety measures (Considered part of Cocoa's <u>routine</u> operating budget)
2. Localized Preventive (Considered part of Cocoa's <u>routine</u> operating budget)

3. Global preventive
4. Major above critical PCI
5. Major below critical PCI

After checking a section's PCI score in relation to the critical PCI, PAVER checks for structural deficiency. Structural deficiency is defined for asphalt pavement in the critical PCI approach as:

- Alligator Cracking (L, M & H) >0.5%
- Patching (M & H) >10%
- Potholes (L, M & H) >0.1%
- Rutting (M & H) >1.0%

For concrete pavement, structural deficiency is defined as

- Large Patching (M & H) >10%
- Corner Break (L, M & H) >5%
- Divided (shattered slabs) (L, M & H)
- Punchout (M & H)

Pavement Treatment Matrix

Many agencies have developed simplified decision trees or decision matrices relating the general type of pavement M&R with distress conditions. These decision matrices can be used to assist in the project planning phase of pavement management. A decision matrix developed for the City is depicted below and consists of the five PCR Groups including a consideration of structural deterioration. The proposed treatment types are those currently used by the City.

Table 12: Decision Matrix for Asphalt

Treatment Type	Structural Deterioration	PCR Condition Group
No Work	No	100-81 (**Good**)
Localized Safety measures considered part of routine operating budget	Yes	
Localized Preventive measures considered part of routine operating budget	No	80-61 (**Satisfactory**)
Localized Preventive Maintenance - Localized Repairs, Full Depth Patching, Crack Seal	Yes	
Major Maintenance (above Critical PCI) – Overlay, Mill and Overlay	No	60-41 (**Fair**)
Major Maintenance (below Critical PCI) – Structural Overlay or Mill and Structural Overlay with Localized Base Repairs	Yes	
Major Maintenance (below Critical PCI) – Structural Overlay or Mill and Structural Overlay	No	40-21 (**Poor**)
Major Maintenance (below Critical PCI) – Structural Overlay or Mill and Structural Overlay with Localized Base Repairs	Yes	
Major Maintenance (below Critical PCI) – Mill and Overlay	No	20-0 (**Failed**)
Major Maintenance (below Critical PCI) – Mill and Overlay with Extensive Base Repairs, Full Depth Reclamation, Complete Reconstruction	Yes	

Funding Scenarios

PAVER uses cost per work type for project level and short term planning. Cost per condition is used for long term planning and to estimate budget needs. These costs are entered in PAVER in policy tables. The cost data used in this report are based on historic bid data provided by City staff, and the Brevard County Cooperative bid for asphalt products.

Table 13 below is a summary of the unit costs used in this report and provide the foundation for conducting the budget analysis. This table represents "cost by condition" where the condition of a section of pavement is known, but the exact treatment is not known.

Table 13: Major M&R Unit Costs and PCI

PCI	Typical M&R Strategy	Unit Cost per Sq. Ft. (Collector)	Unit Cost per Sq. Ft. (Residential)
100	No Work	$0.00	$0.00
90	Preventive / Localized Repairs / Patching (crack seal, rejuvenation)	$0.10	$0.10
80		$0.21	$0.21
70	Overlay or Mill and Overlay with Localized Base Repairs	$1.00	$1.00
60		$1.68	$1.68
50		$2.06	$2.06
40	Mill and Overlay with Extensive Base Repairs or Reconstruction	$3.00	$3.00
30		$3.36	$3.36
20		$3.36	$3.36
10		$4.00	$4.00
0		$4.50	$4.50

Table 14 below is a summary of the "cost by work type." These costs are used for project concepts for specific roadways and a specific implementation year.

Table 14: M&R Unit Costs and PCI

Treatment Strategy	Unit Cost per Sq. Ft. (Collector)	Unit Cost per Sq. Ft. (Residential)
1-inch Overlay	$0.69	$0.69
2-inch Overlay	$1.37	$1.37
3-inch Overlay	$2.06	$2.06
1-inch Mill and Overlay	$1.00	$1.00
2-inch Mill and Overlay	$1.68	$1.68
3-inch Mill and Overlay	$2.37	$2.37
Full Depth Reclamation	$3.36	$3.36
ADA and Sidewalks	$0.55	$0.55

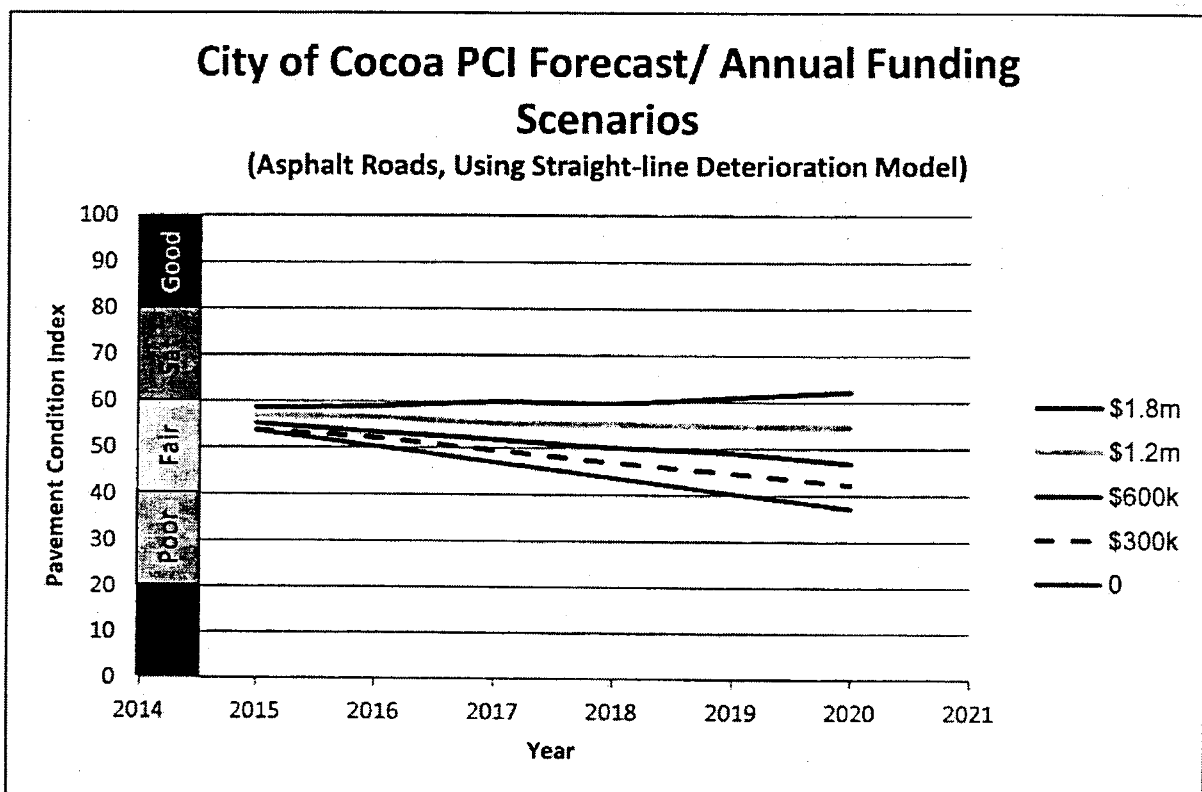
Note that while these cost estimates are based on the best available information, they do not include additional expense items which may be necessary such as drainage improvements. A line item has been added to reflect the cost of improvements as may be required by the US Dept. of Justice to meet the Americans with Disabilities Act (ADA). This cost was based on an approximate cost of $6.00 per linear foot of sidewalk. This value was then converted to an equivalent cost per square foot of pavement area.

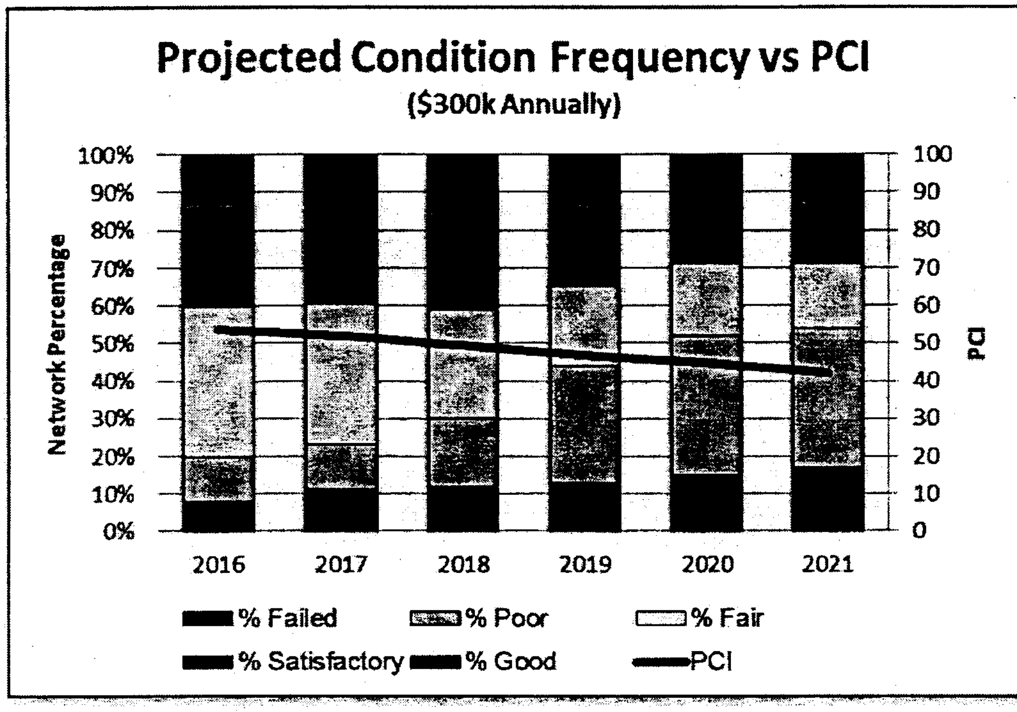
Budget Findings

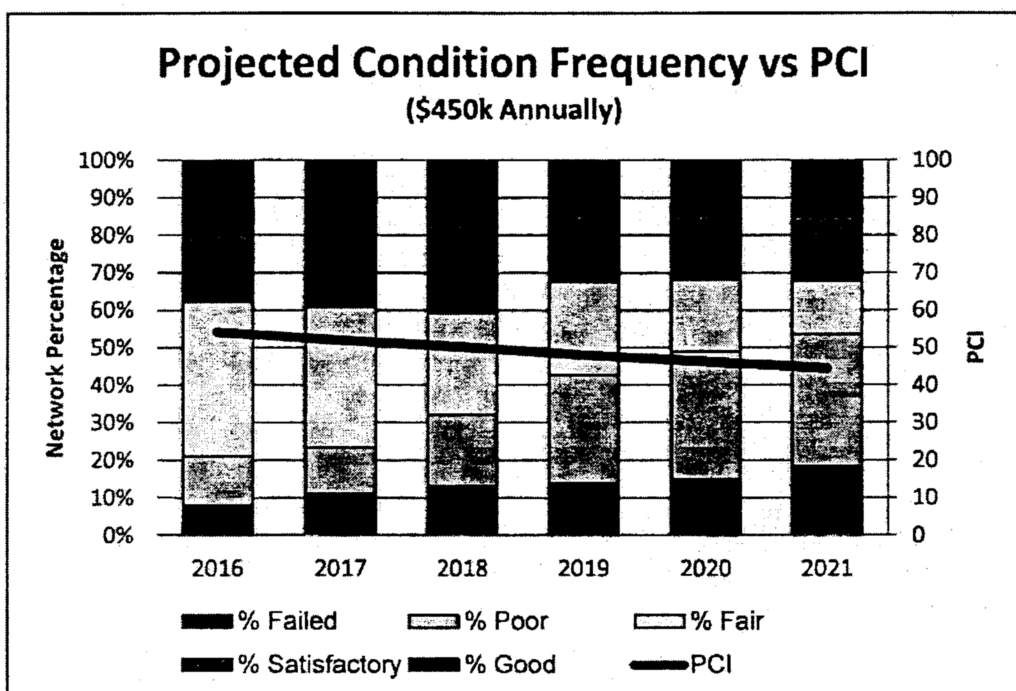
Five different funding scenarios are presents below. An anticipated annual budget of $300,000 was used as the base scenario. The remaining scenarios are multiples (0x, 2x, 4x, and 6x) of the anticipated $300,000 base. The 0x scenario represents a "do nothing" option. Additionally, each scenario assumes the annual funding is available for both Global and Major Maintenance & Rehabilitation (M&R).

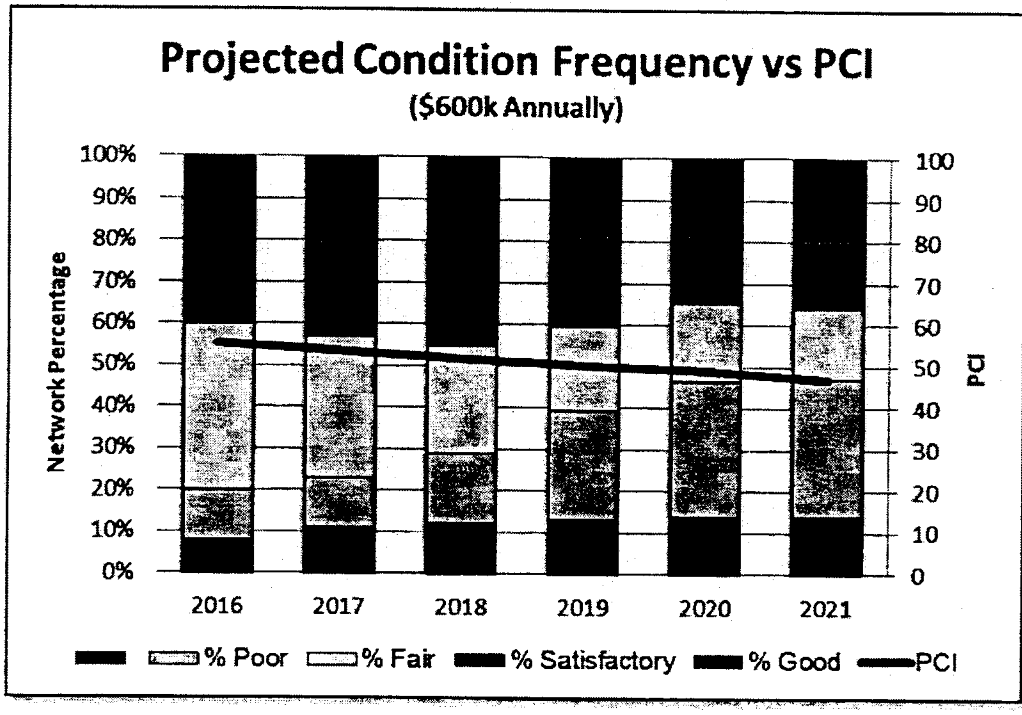
For each scenario and each time period (2016 through 2020), available scenario funding is allocated to roadway sections following the Critical PCI approach described previously. Sections selected for Global M&R have the PCI adjusted based on the anticipated pavement life extension of the Global treatment, and for road sections selected for Major Maintenance & Rehabilitation (M&R), the PCI is reset to 100. In addition, the deterioration model assigned to each road section is applied for each time step in the scenarios to simulate the continued deterioration of the pavement network.

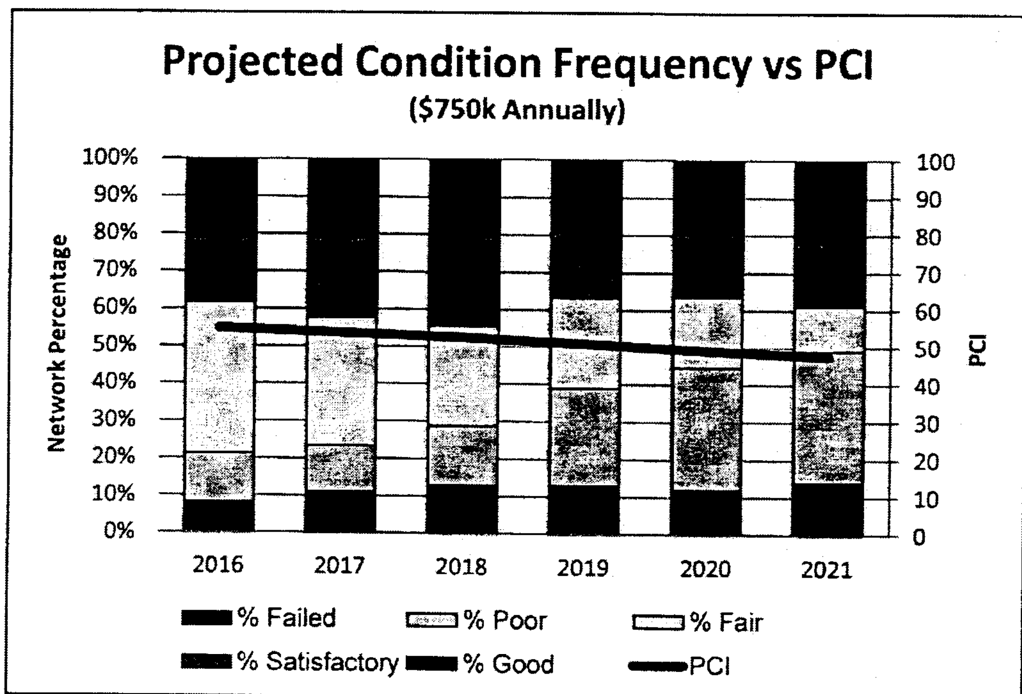
Based on the analysis, network condition deterioration is expected to continue if the funding level remains near $300,000 annually. An increase in annual funding to approximately $1.2m is necessary in order to stabilize the network at the current condition. Results of the funding evaluations are presented in the figures below.

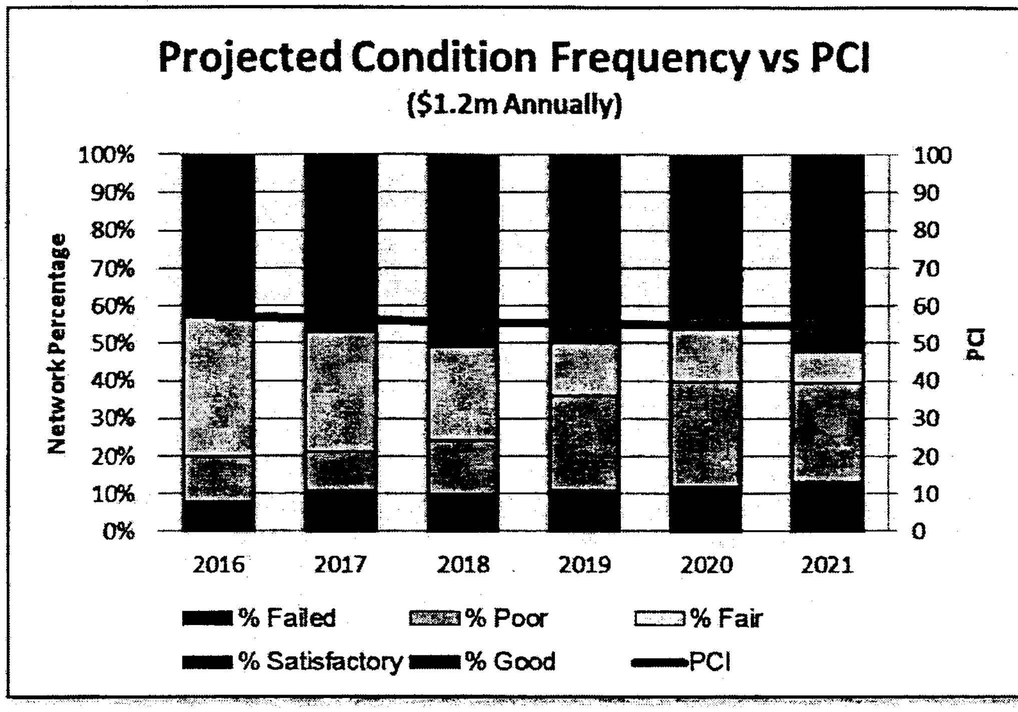


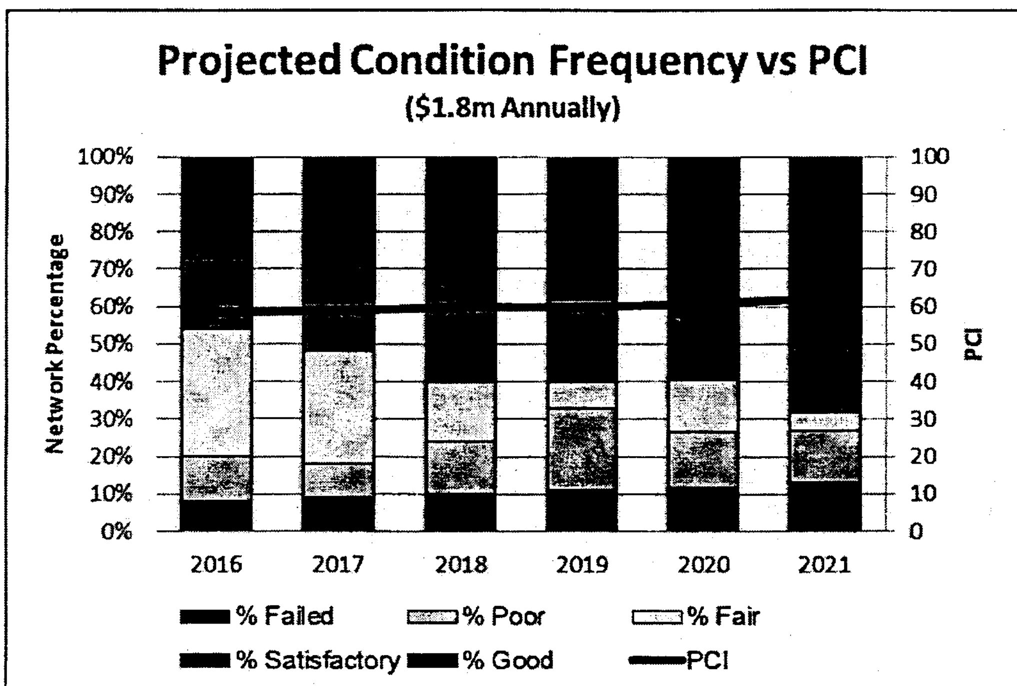

Projected Condition Frequency vs PCI
($300k Annually)
Network Percentage
PCI
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
2021
% Failed
% Poor
% Fair
% Satisfactory
% Good
PCI


Projected Condition Frequency vs PCI
($450k Annually)
Network Percentage
PCI
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
2021
% Failed
% Poor
% Fair
% Satisfactory
% Good
PCI


Projected Condition Frequency vs PCI
($600k Annually)
Network Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PCI
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
2021
% Poor
% Fair
% Satisfactory
% Good
PCI


Projected Condition Frequency vs PCI
($750k Annually)
Network Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PCI
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
2021
% Failed
% Poor
% Fair
% Satisfactory
% Good
PCI


Projected Condition Frequency vs PCI
($1.2m Annually)
Network Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PCI
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
2021
% Failed
% Poor
% Fair
% Satisfactory
% Good
PCI


Projected Condition Frequency vs PCI
($1.8m Annually)
Network Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PCI
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
2021
% Failed
% Poor
% Fair
% Satisfactory
% Good
PCI

Maintenance and Rehabilitation Plan

Pavement Treatment Suggestions

The following treatments are suggest to be included in the City's pavement program and are presented in very general terms.

Overlay / Mill and Overlay

This pavement treatment application is a process where a new layer of asphalt pavement is added to an existing surface, or the surface is milled, and replaced by a new layer of asphalt pavement. The pavement service life extension of this process is normally considered to be 12 to 14 years. Typically, a Florida Department of Transportation asphalt specified pavement is applied in this process. The amount of time needed to perform an asphalt overlay process will vary depending on the size of the project. Once the surface area is milled away, the area is swept or cleaned with a pavement broom or surface vacuum truck. Then the area to be resurfaced is prepared to receive the new surface by applying a thin asphalt emulsion tack coat. In the next step, the new surface is placed with an asphalt paver. Finally, the placed pavement is then immediately compacted with a steel wheeled roller and followed by a pneumatic tire roller to compact the asphalt per the pavement specification being used on the project. Testing and field inspection is normally performed in the treatment process to ensure the contractor has provided a product and pavement that was satisfactorily in accordance with the pavement specification. This process is considered Major M&R because it provides replaced or additional structural capacity. As a result, the PCI of the roads is reset to 100.

Full-Depth Reclamation and Cold In-place Recycling

Full-Depth Reclamation (FDR) and Cold In-place Recycling (CIR) are very similar processes. In both cases a portion of the base material is uniformly crushed, pulverized and blended with the existing surface asphalt to form a new composite base material. The new composite material can be mixed with an asphalt emulsion or calcium chloride to increase the stability of the new base. This process completely rehabilitates and reinforces the structural strength of the underlying base of the road. The new road base is then surfaced with conventional asphalt equipment. The major benefits in these methods are that the road base is rehabilitated and existing material are recycled on-site negating the expense of removing and disposing of the material off-site.

Polymer Modified Slurry Seal (Microsurface)

Microsurfacing involves laying a mixture of dense-graded aggregate, asphalt emulsion, water, polymer additive, and mineral fillers to correct or prevent certain deficiencies in pavement conditions. Microsurfacing is in the same category of pavement treatments as seal coating and thin hot mix asphalt (HMA) overlays. The treatment may be as thin as 3/8 inch and can fill wheel ruts up to 2 inches deep using multiple passes.

Microsurfacing is similar to slurry seals, however, slurry seals cure through a thermal process while microsurfacing uses a chemically process. The use of a polymer-modified binder results in more stability allowing microsurfacing to be placed in multiple lifts. Microsurfacing is generally classified as a preventative maintenance treatment as opposed to a corrective maintenance treatment [5]. Due to this classification by agencies involved in road repair and maintenance, microsurfacing is most often used as a surface treatment to correct rutting, improve surface friction, and extend pavement life by sealing any cracks in the pavement surface.

Rejuvenation

As asphalt ages, the asphalt binder starts to oxidize and becomes brittle. This is the weathering process. The brittleness of the asphalt can cause the aggregate to dislodge. This is raveling. The purpose of a rejuvenator is to soften the stiffness of the oxidized pavement surface to extend the life of the pavement. The rejuvenator product must be able to soften the upper 3/8-inch to ½-inch and add maltenes into the pavement. Rejuvenators should be allied to relatively new asphalt and then re-applied periodically (every 5 to 10 years). Rejuvenators should not be applied to roads that have had polymer modified slurry seal applied.

Project Suggestions

Selection of specific projects is an iterative process that most incorporate technical and non-technical information. Data collected in this PMP plays a very important role in the decision process, but as pointed out in *Pavement Management for Airports, Roads, and Parking Lots* by M.Y. Shahin, 2005, "the PCI by itself is not sufficient to identify the needed specific M&R type." A single numeric value such as the PCI can indicate a general level of M&R needs, but it is also important to understand the cause (structural, climate, or other) of individual distresses that make up the PCI score. Additional factors such as funding, political desires, citizen complaints, etc. often influence project selection.

The historic treatments used by the City are sound and cost effective practices. The City has used asphalt overlays with and without milling for major rehabilitation along with Microsurfacing as a preventive measure. Mill and overlays can provide a very good and long lasting treatment, although it typically is not designed to resolve structural deficiencies. It is recommended that the City:

- ✓ Continue their program of Mill and Overlay on roads that have little or no structural deficiencies.
- ✓ Expand preventive maintenance treatments including crack sealing, microsurfacing, rejuvenator application, and rejuvenating fog sealing for pavements that are in good condition.
- ✓ Implement a robust program that would include Mill and Overlay with deep patching, Full Depth Reclamation, Cold In-place Recycling, or complete reconstruction for roads with structural deficiencies.
- ✓ Conduct geotechnical evaluation and design for all roads that have structural deficiencies prior to selection of a final pavement treatment.

Appendix B contains a list of specific road sections that were selected as potential projects. The selection of these sections started with the Critical PCI project selection methodology used in PAVER and the assumed annual budget target of $300,000. Roadway sections were subsequently grouped into logical conceptual projects that considered available budget and anticipated treatments. The majority of conceptual project pavement treatments are a 2-inch mill and overlay. Where necessary, consideration was given for base repairs or sidewalk improvements. City staff provided invaluable input into project concept development and prioritization.

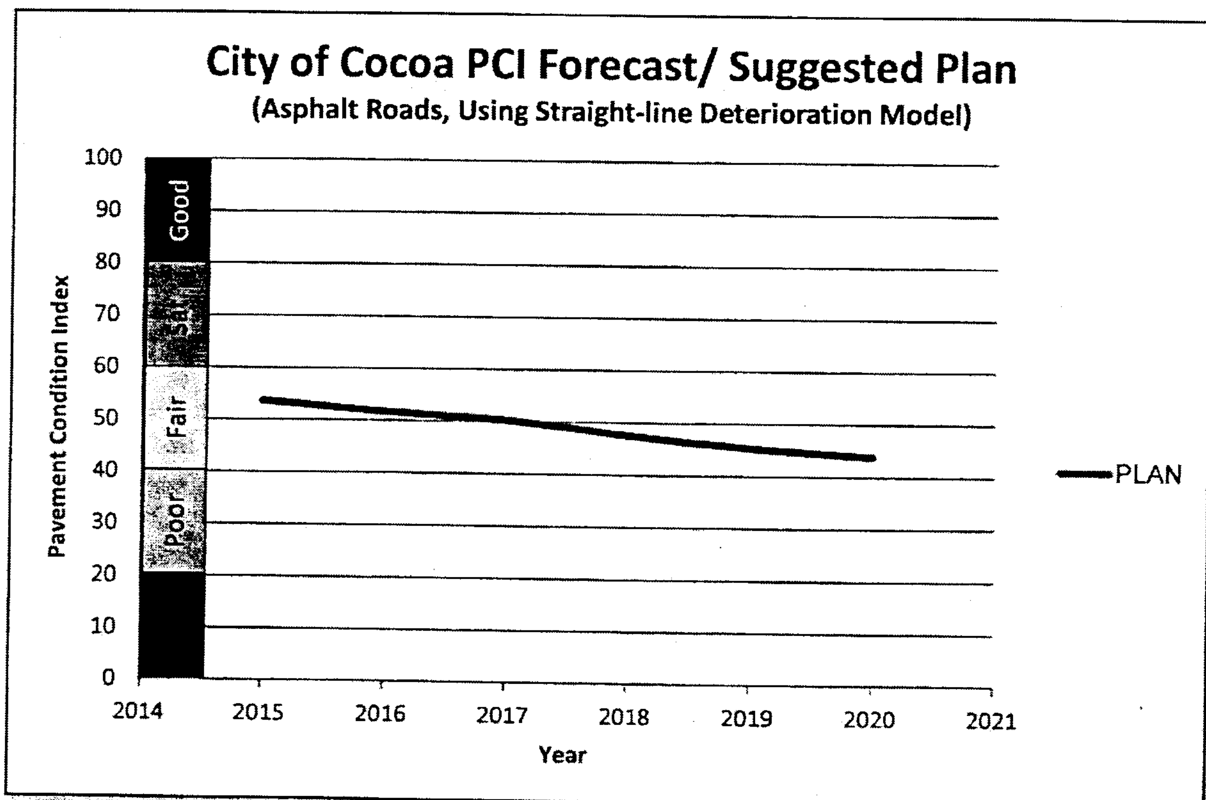
The PLAN budget was based on a *target* of $300,000 per year. The PLAN budget inevitably varied slightly due to the grouping of project concepts. Table 15 shows the total amount of the identified projects versus the budget used in PAVER.

Table 15: PLAN Budget

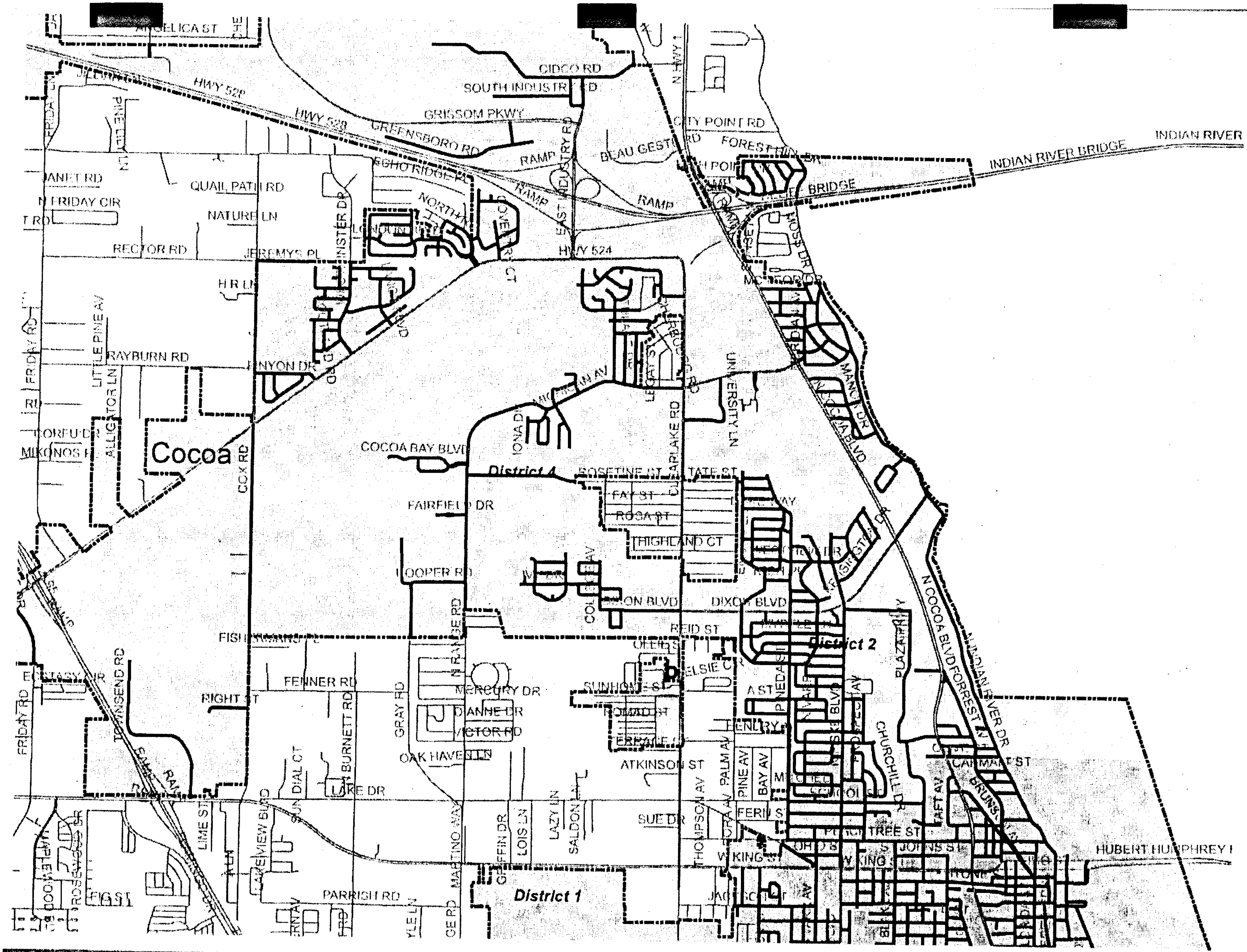
Year	Identified Project Amount	Budget Amount
FY 16	$295,030	$300,000
FY 17	$302,314	$303,000
FY 18	$311,359	$312,000
FY 19	$309,624	$310,000
FY 20	$230,035	$300,000

The resulting projected PCI based on this set of projects and PLAN budget is depicted in Figure 8 below. As can be seen in the figure, the City's PCI can be expected to continue to deteriorate from the mid-50s to the mid to low-40

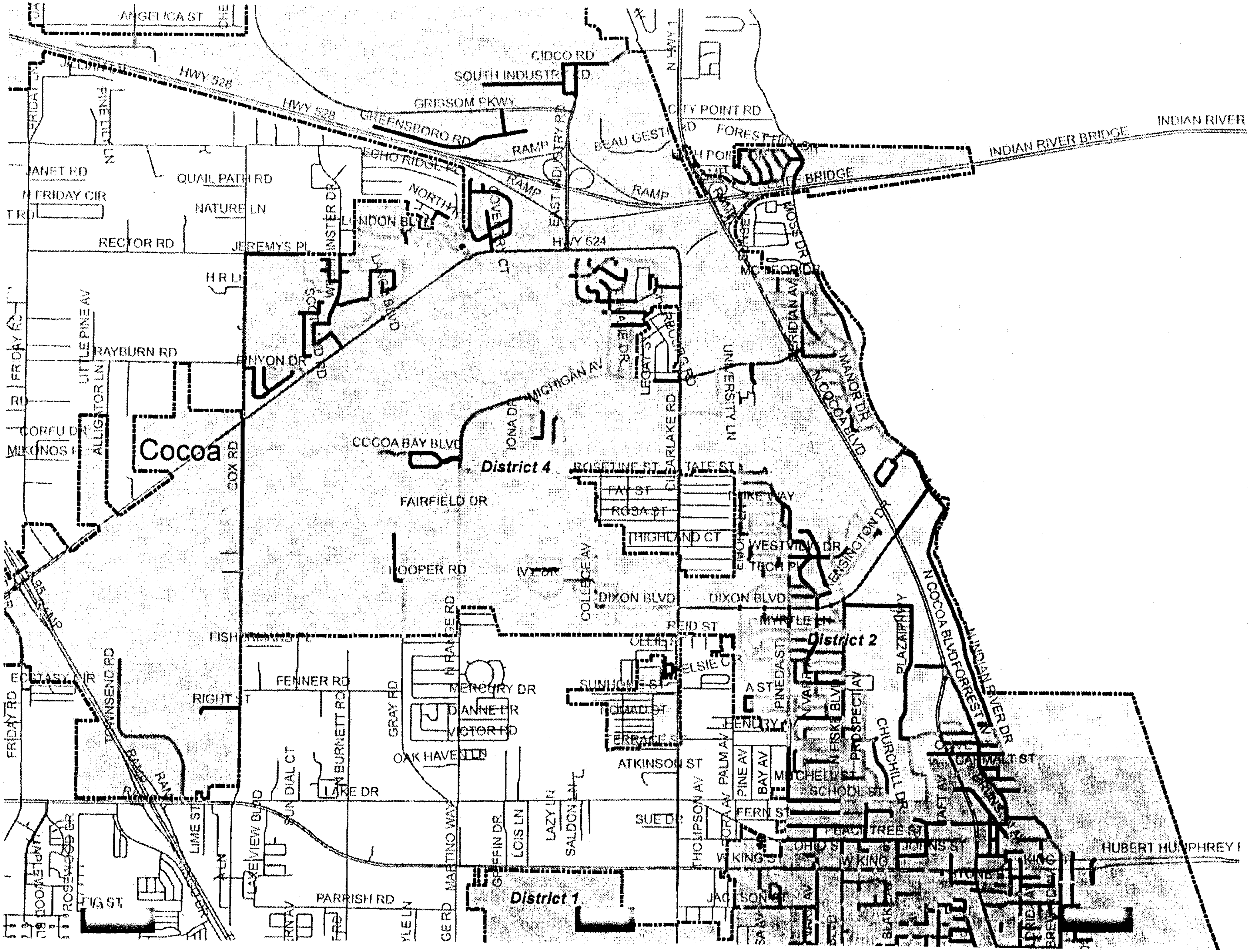
Figure 8: Proposed Projects / PCI Forecast



Appendix A - Maps



Cocoa
District 1
District 2
District 4
INDIAN RIVER
INDIAN RIVER BRIDGE
HWY 528
HWY 524
N HWY 1
N COCOA BLVD
N INDIAN RIVER DR
HUBERT HUMPHREY
CIDCO RD
GRISSOM PKWY
GREENSBORO RD
CITY POINT RD
ANGELICA ST
QUAIL PATH RD
NATURE LN
RECTOR RD
JEREMYS PL
JANET RD
N FRIDAY CIR
RAYBURN RD
LITTLE PINE AV
ALLIGATOR LN
MIKONOS PL
COX RD
COCOA BAY BLVD
FAIRFIELD DR
COOPER RD
CLEARLAKE RD
UNIVERSITY LN
TATE ST
FAY ST
ROSA ST
HIGHLAND CT
DIXON BLVD
REID ST
ELSIE CT
MERCURY DR
DIANNE DR
VICTOR RD
FENNER RD
RIGHT ST
TOWNSEND RD
GRAY RD
BURNETT RD
SUN DIAL CT
LAKE DR
OAK HAVEN LN
MARTINO WAY
GRIFFIN DR
LOIS LN
LAZY LN
SALDON LN
ATKINSON ST
SUE DR
THOMPSON AV
PALM AV
PINE AV
BAY AV
CHURCHILL DR
PEACH TREE ST
LIME ST
LAKEVIEW BLVD
PARRISH RD
FIG ST
MAPLEWOOD DR



Cocoa
District 1
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INDIAN RIVER
INDIAN RIVER BRIDGE
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CIDCO RD
SOUTH INDUSTRY RD
GRISSOM PKWY
GREENSBORO RD
CITY POINT RD
QUAIL PATH RD
NATURE LN
RECTOR RD
JEREMYS PL
RAYBURN RD
ALLIGATOR LN
LITTLE PINE AV
COX RD
COCOA BAY BLVD
MICHIGAN AV
FAIRFIELD DR
HOOPER RD
COLLEGE AV
DIXON BLVD
UNIVERSITY LN
N COCOA BLVD
MANOR DR
N INDIAN RIVER DR
KENSINGTON DR
WESTVIEW DR
REID ST
PLAZA PKWY
CHURCHILL DR
PROSPECT AV
PINEDA ST
N FISKE BLVD
ATKINSON ST
PALM AV
PINE AV
BAY AV
THOMPSON AV
FERN ST
PEACHTREE ST
OHIO ST
W KING ST
SCHOOL ST
TAFT AV
HUBERT HUMPHREY
MERCURY DR
DIANNE DR
VICTOR RD
OAK HAVEN LN
GRAY RD
N RANGE RD
FENNER RD
N BURNETT RD
LAKE DR
SUN DIAL CT
LAKEVIEW BLVD
MARTINO WAY
GRIFFIN DR
LOIS LN
LAZY LN
SALDON LN
SUE DR
PARRISH RD
TOWNSEND RD
RIGHT ST
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FRIDAY RD
LIME ST
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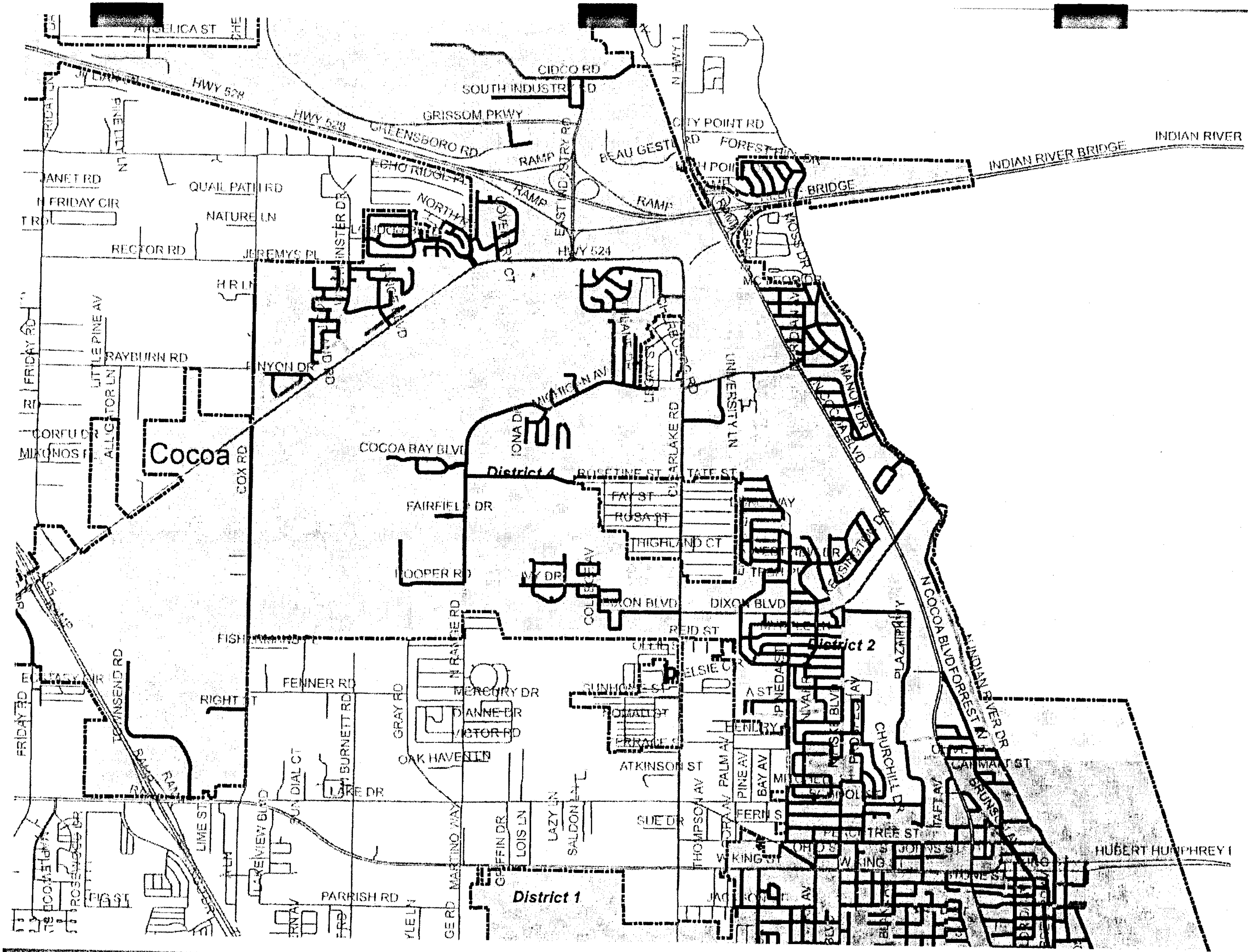
MIKONOS
CORFU DR
JANET RD
N FRIDAY CIR
PINE LILY LN
ANGELICA ST
RAMP



Cocoa
District 1
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INDIAN RIVER
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SOUTH INDUSTRY RD
GRISSOM PKWY
GREENSBORO RD
CITY POINT RD
BEAU GESTE RD
FOREST HILL DR
MOSS DR
MANOR DR
UNIVERSITY LN
CLEARLAKE RD
MICHIGAN AV
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COCOA BAY BLVD
FAIRFIELD DR
HOOPER RD
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FAY ST
ROSA ST
HIGHLAND CT
DIXON BLVD
REID ST
ELSIE CT
SUNHOME ST
TERRACE ST
ATKINSON ST
SUE DR
THOMPSON AV
PALM AV
PINE AV
BAY AV
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PLAZA PKWY
TAFT AV
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TOWNSEND RD
COX RD
RAYBURN RD
LITTLE PINE AV
ALLIGATOR LN
CORFU DR
FRIDAY RD
JANET RD
FRIDAY CIR
QUAIL PATH RD
NATURE LN
RECTOR RD
JEREMYS PL
ANGELICA ST
PINE LILY LN
RAMP

Appendix B – Suggested Project Sections

FY 16

PROJECT ID	Branch Name	UNIQUE ID	Section From	Section To	Length, Miles
2016 Florida S (Utilities) (2016)	FORREST AV	0585-035	KING	WILLARD	0.05
		0585-025	OLEANDER	KING	0.05
		0575-015	LEMON	STONE	0.04
		0575-040	ROSA L JONES	TRAVIS	0.05
		0575-035	TRAVIS	ST CHARLES	0.05
		0575-030	ST CHARLES	FACTORY	0.05
		0575-025	FACTORY	ORANGE	0.07
		0575-045	OAK PARK MHP	ROSA L JONES	0.04
		0575-050	ALLISON	OAK PARK MHP	0.02
		0585-030	KING	WILLARD	0.05
		0575-010	STONE	OLEANDER	0.04
		0575-020	ORANGE	LEMON	0.04
					0.54
2016 Peachtree E (Utilities) (2016)	PEACHTREE ST	1095-010	INDIAN RIVER	FLORIDA	0.04
		1095-030	LEGION	FIRST	0.03
		1095-025	RIDGEWAY	LEGION	0.04
		1095-015	FLORIDA	FORREST	0.13
		1095-035	FIRST	COCOA	0.06
		1095-020	FORREST	RIDGEWAY	0.03
					0.32
2016 IRD - Willard to 1025 (Utilities) (2016)	N INDIAN RIVER DR	0975-025	PARKWAY	CARMALT	0.06
		0975-042	SUNRISE	ADDR 1025	0.68
		0975-015	MULBERRY	MITCHELL	0.14
		0975-010	PEACHTREE	MULBERRY	0.12
		0975-005	WILLARD	PEACHTREE	0.11
		0975-020	MITCHELL	PARKWAY	0.06
		0975-030	CARMALT	OLIVE	0.08
		0975-035	OLIVE	HIGHLAND	0.04
		0975-040	HIGHLAND	SUNRISE	0.10
					1.38
2016 IRD 1025 to Dixon (2016)	N INDIAN RIVER DR	0975-045	ADDR 1025	DIXON	0.50
					0.50
2016 IRD IR Circle to McLeod (2016)	N INDIAN RIVER DR	0975-075	CARLETON	MACFARLAND	0.18

		0975-065	BEVERLY	COQUINA	0.24
		0975-055	INDIAN	CIRCLE	0.17
		0975-070	COQUINA	CARLETON	0.14
		0975-080	MACFARLAND	CITY LIMIT	0.03
		0975-060	CIRCLE	BEVERLY	0.16
					0.94

2016 Riverside (2016)	RIVERSIDE DR	1215-015	OAK	CITY LIMIT	0.06
		1215-010	OAK	DERBY	0.06
		1215-005	DERBY	CHURCH	0.17
					0.29

FY 17

PROJECT ID	Branch Name	UNIQUEID	Section From	Section To	Length Miles
2017 Fiske N, Phase 1 (2017)	N FISKE BLVD	0965-005	CRESTVIEW	AZALEA	0.03
		0965-050	HIGHLAND	AVON	0.05
		0965-055	AVON	HILLCREST	0.05
		0965-060	HILLCREST	BRISTOL	0.10
		0965-065	CRESTVIEW	HICKORY	0.02
		0965-070	HICKORY	CRESTVIEW	0.02
		0965-075	BRISTOL	CRESVIEW	0.04
		0965-080	CYPRESS	ALAMANDA	0.05
		0965-085	ALAMANDA	WILLOW	0.05
		0965-090	WILLOW	MYRTLE	0.05
		0965-095	AZALEA	CYPRESS	0.05
		0965-100	MYRTLE	JAPONICA	0.05
		0965-105	JAPONICA	CRESTVIEW	0.08
		0965-110	CRESVIEW	DIXON	0.02
					0.64

2017 Forest Hills Global (2017)	BUCKINGHAM LN	0190-005	WESTCHESTER	FOREST HILL	0.16
	FAIRFAX LN	0540-005	WESTCHESTER	FOREST HILL	0.11
	FOREST HILL DR	0580-005	RIVER POINT	FAIRFAX	0.10
		0580-010	FAIRFAX	BUCKINGHAM	0.06
		0580-015	BUCKINGHAM	NOTTINGHAM	0.05
		0580-020	NOTTINGHAM	HIGH POINT	0.12
	NOTTINGHAM LN	1030-005	WESTCHESTER	FOREST HILL	0.17
					0.77

2017 Rosa Jones (2017)	ROSA L JONES DR	1230-085	WASHINGTON	PAW PAW	0.06
		1230-100	JOHNSON	BLAKE	0.06
		1230-095	WILSON	JOHNSON	0.07
		1230-040	JOHNSON	JOHNSON	0.00
		1230-110	HOWARD	FISKE	0.19
		1230-090	PAW PAW	WILSON	0.06
		1230-005	RAILROAD	G	0.01
		1230-075	COCOA	RAILROAD	0.09

		1230-080	G	WASHINGTON	0.15
		1230-105	BLAKE	HOWARD	0.06
					0.75

FY 18

PROJECT ID	Branch Name	UNIQUEID	Section From	Section To	Length Miles
2018 Cocoa North (2018)	ARCHER CT	0045-005	PARAPET	NORWOOD	0.05
		0045-010	NORWOOD	END	0.08
	ARNOT ST	0050-005	ARROWSMITH	STONEMONT	0.05
	ARROWSMITH DR	0055-005	WESTMINSTER	ARNOT	0.05
		0055-010	ARNOT	SCOTLAND	0.07
		0055-015	SCOTLAND	END	0.02
	BARD CT	0095-005	WESTMINSTER	END	0.03
	CROSSBOW DR	0370-005	LONGBOW	END	0.15
		0370-010	PIKE	LONGBOW	0.07
		0370-015	PIKE	LANCE	0.06
		0370-020	LANCE	WESTMINSTER	0.17
	DARA ST	0395-005	STONEMONT	PARAPET	0.05
	E MALORY CT	0470-005	LANCE	END	0.11
	HIGHTOWER CT	0670-005	LONGBOW	END	0.13
		0670-010	LONGBOW	WESTMINSTER	0.09
	LANCE BLVD	0805-010	524	MALORY	0.03
		0805-015	MALORY	CROSSBOW	0.07
		0805-020	CROSSBOW	LONGBOW	0.13
	LONGBOW RD	0845-005	CROSSBOW	LANCE	0.18
		0845-010	LANCE	HIGHTOWER	0.09
	NORWOOD CT	1025-005	ARCHER	END	0.03
	PARAPET DR	1075-005	WESTMINSTER	ARCHER	0.05
		1075-010	ARCHER	DARA	0.07
		1075-015	DARA	END	0.14
	PIKE CT	1100-005	CROSSBOW	END	0.06
	SCOTLAND RD	1315-005	SENTRY	END	0.08
		1315-010	SENTRY	ARROWSMITH	0.15
	SENTRY DR	1320-005	WESTMINSTER	SPRING	0.10
		1320-010	SPRING	SCOTLAND	0.05
	SPRING CIR	1375-005	SENTRY	WESTMINSTER	0.16
	STONEMONT DR	1410-005	WESTMINSTER	DARA	0.11
		1410-010	DARA	ARNOT	0.16
		1410-015	ARNOT	END	0.02
	W MALORY CT	1535-005	LANCE	END	0.12
					2.97

2018 Cocoa Pines (2018)	LONGLEAF RD	0850-005	PONDEROSA	PINYON	0.16
		0850-010	LONGLEAF	PINYON	0.20
	PINYON DR	1130-005	524	LONGLEAF	0.07
		1130-010	LONGLEAF	PONDEROSA	0.13
		1130-015	PONDEROSA	LONGLEAF	0.05
		1130-020	LONGLEAF	COX	0.05
	PONDEROSA ST	1150-005	LONGLEAF	PINYON	0.11
					0.78

2018 Washington (2018)	WASHINGTON ST	1555-010	STONE	W KING	0.05
		1555-015	LEMON	STONE	0.03
		1555-020	POMOLO	LEMON	0.05
		1555-025	BARBARA JENKINS	POMOLO	0.02
		1555-030	LUCAS	BARBARA JENKINS	0.02
		1555-035	D	LUCAS	0.04
		1555-040	BERNARD	D	0.03
		1555-045	E	BERNARD	0.03
		1555-050	WHALEY	E	0.03
		1555-055	F	WHALEY	0.02
		1555-060	G	F	0.05
		1555-065	ROSA L JONES	G	0.05
					0.43

2018 Westminster (2018)	WESTMINSTER DR	1585-005	HIGHTOWER	CITY LIMIT	0.03
		1585-010	524	SENTRY	0.08
		1585-015	SENTRY	SPRING	0.05
		1585-020	SPRING	ARROWSMITH	0.04
		1585-025	ARROWSMITH	CROSSBOW	0.05
		1585-030	CROSSBOW	STONEMONT	0.05
		1585-035	STONEMONT	PARAPET	0.05
		1585-040	PARAPET	BARD	0.04
		1585-045	BARD	HIGHTOWER	0.05
					0.46

FY 19

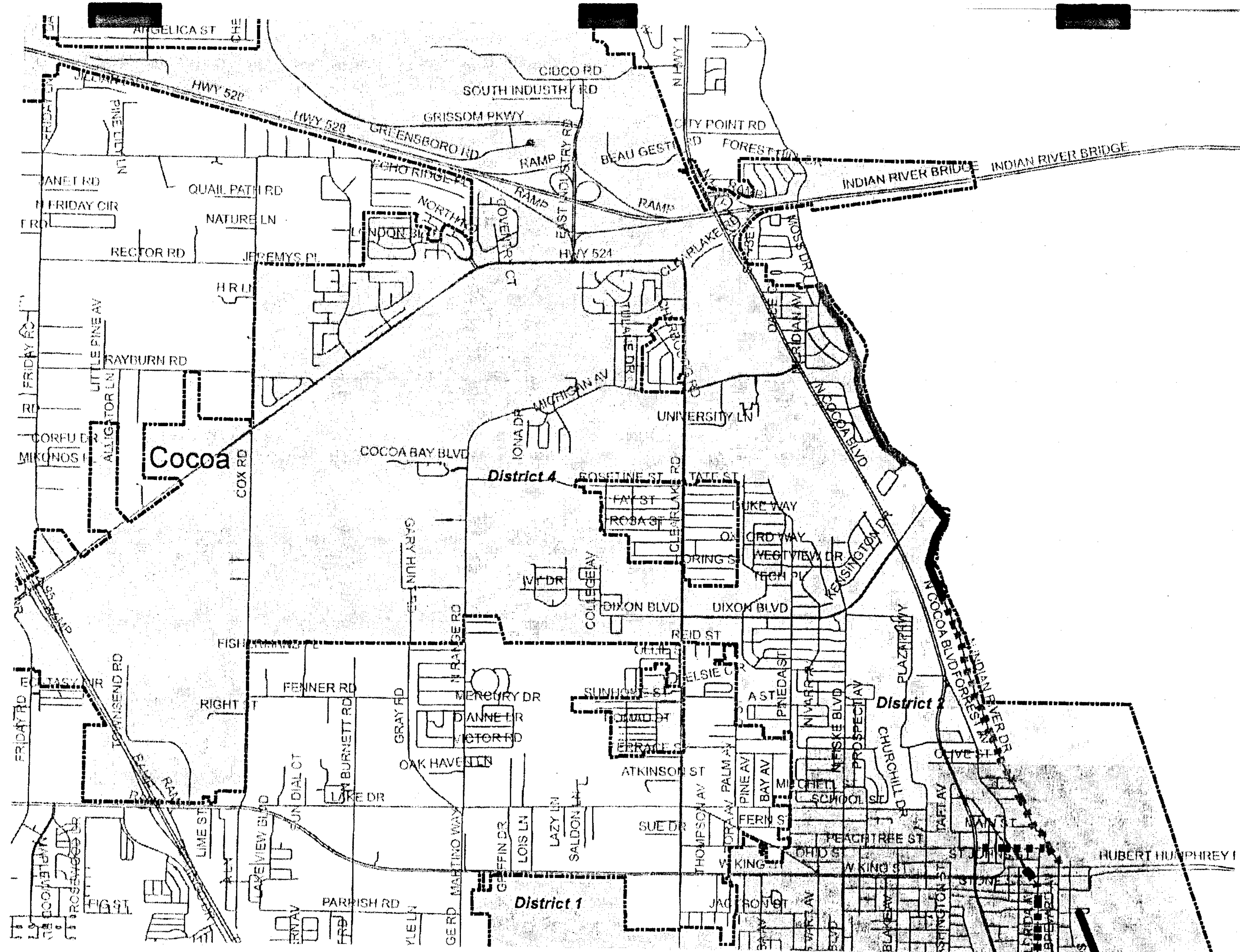
PROJECT ID	Branch Name	UNIQUEID	Section From	Section To	Length Miles
2019 Michigan Ave W (2019)	MICHIGAN AV	0925-005	CLEARLAKE	LEGAY	0.11
		0925-015	LEGAY	STANFORD	0.12
		0925-020	STANFORD	AUBURN	0.05
		0925-025	AUBURN	TULANE	0.05
		0925-030	TULANE	CLEMSON	0.17
		0925-035	MERCER	RANGE	0.04
		0925-040	CLEMSON	MERCER	0.13
					0.67

2019 Range (2019)	N RANGE RD	0980-010	HOOPER	CITY LIMIT	0.13
		0980-015	HOOPER	FAIRFIELD	0.32
		0980-020	FAIRFIELD	ROSETINE	0.19
					0.63

FY 20

PROJECT ID	Branch Name	UNIQUE ID	Section From	Section To	Length Miles
2020 Peachtree Central (2020)	PEACHTREE ST	1095-040	COCOA	THIRD	0.07
		1095-045	THIRD	WILSON	0.15
		1095-050	WILSON	BLAKE	0.13
					0.36

2020 Pineda, Phase 1 (2020)	PINEDA ST	1120-045	HENDRY	C	0.10
		1120-050	C	BRISTOL	0.07
		1120-055	BRISTOL	CYPRESS	0.16
		1120-065	CYPRESS	ALAMANDA	0.04
		1120-075	ALAMANDA	WILLOW	0.04
		1120-080	WILLOW	MYRTLE	0.05
		1120-085	MYRTLE	JAPONICA	0.05
		1120-090	JAPONICA	DIXON	0.05
					0.56



Cocoa
District 1
District 2
District 4
INDIAN RIVER BRIDGE
HWY 520
HWY 524
N HWY 1
N COCOA BLVD
INDIAN RIVER DR
HUBERT HUMPHREY
CIDCO RD
SOUTH INDUSTRY RD
GRISSOM PKWY
GREENSBORO RD
CITY POINT RD
BEAU GESTE RD
RAMP
QUAIL PATH RD
NATURE LN
RECTOR RD
JANET RD
N FRIDAY CIR
FRIDAY RD
ANGELICA ST
JEREMYS PL
RAYBURN RD
LITTLE PINE AV
ALLIGATOR LN
CORFU DR
COX RD
COCOA BAY BLVD
MICHIGAN AV
IONA DR
UNIVERSITY LN
CLEARLAKE RD
TULANE DR
DIXON BLVD
COLLEGE AV
REID ST
N RANGE RD
GARY HUNT RD
GRAY RD
FENNER RD
N BURNETT RD
RIGHT ST
TOWNSEND RD
MERCURY DR
VICTOR RD
OAK HAVEN LN
ATKINSON ST
SUE DR
LOIS LN
LAZY LN
SALDON LN
GRIFFIN DR
MARTINO WAY
PARRISH RD
LAKEVIEW BLVD
LIME ST
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LAKE DR
DUKE WAY
WESTVIEW DR
KENSINGTON DR
PINEDA ST
N FISKE BLVD
PROSPECT AV
CHURCHILL DR
PLAZA PKWY
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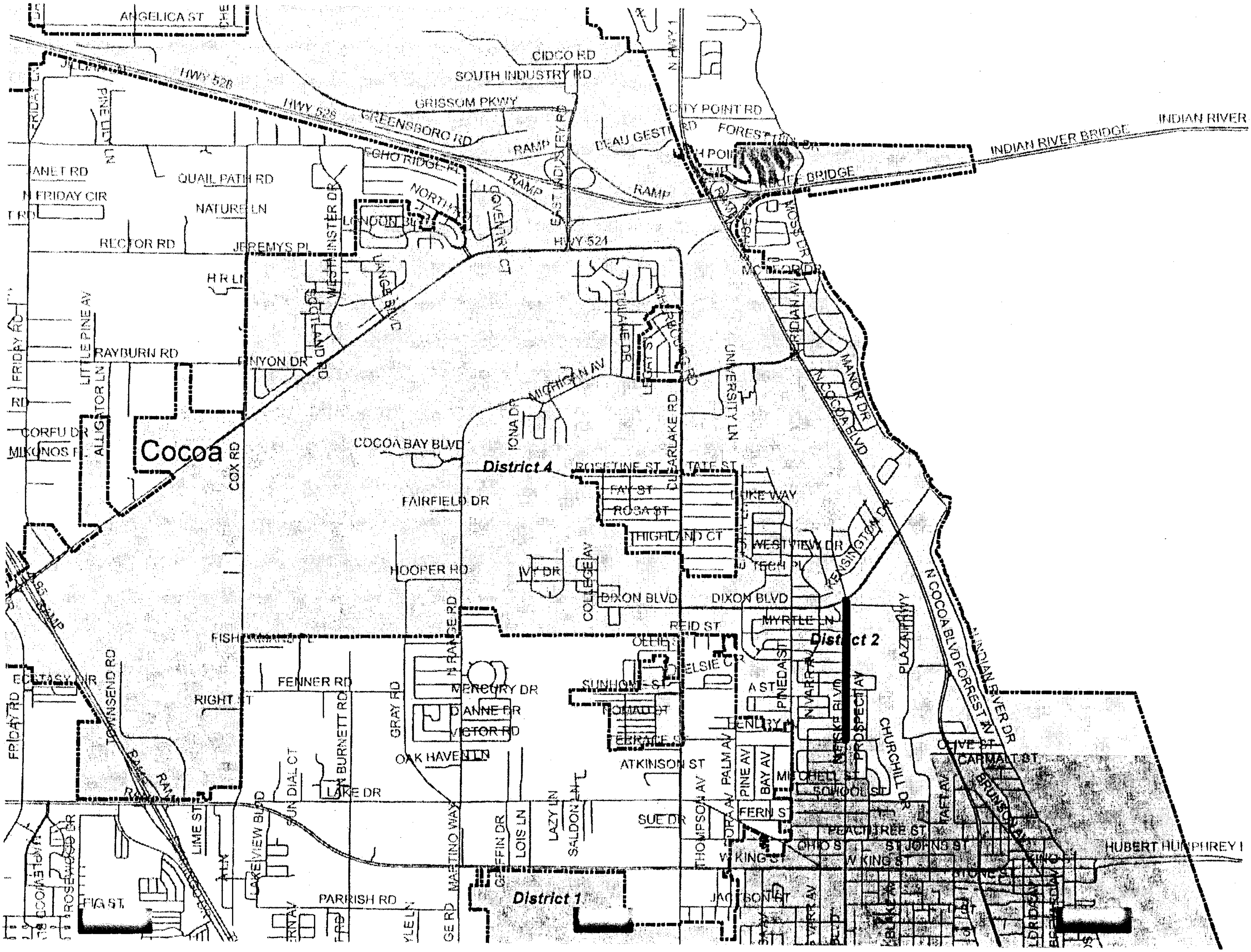
TAFT AV
PALM AV



INDIAN RIVER
INDIAN RIVER BRIDGE
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N COCOA BLVD
N COCOA BLVD FORREST AV
HUBERT HUMPHREY
CHURCHILL DR
PROSPECT AV
PLAZA HWY
MYRTLE LN
UNIVERSITY LN
CLEARLAKE RD
DIXON BLVD
REID ST
TULANE DR
MICHIGAN AV
COLLEGE AV
IONA DR
FAIRFIELD DR
HOOPER RD
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GRAY RD
FENNER RD
BURNETT RD
LAKE DR
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LAKEVIEW BLVD
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COX RD
TOWNSEND RD
FRIDAY RD
RAYBURN RD
ALLIGATOR LN
LITTLE PINE AV
RECTOR RD
NATURE LN
QUAIL PATH RD
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HWY 524
GRISSOM PKWY
GREENSBORO RD
SOUTH INDUSTRY RD
CIDCO RD
CITY POINT RD
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PINYON DR
CORFU DR
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THOMPSON AV
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PINE AV
BAY AV
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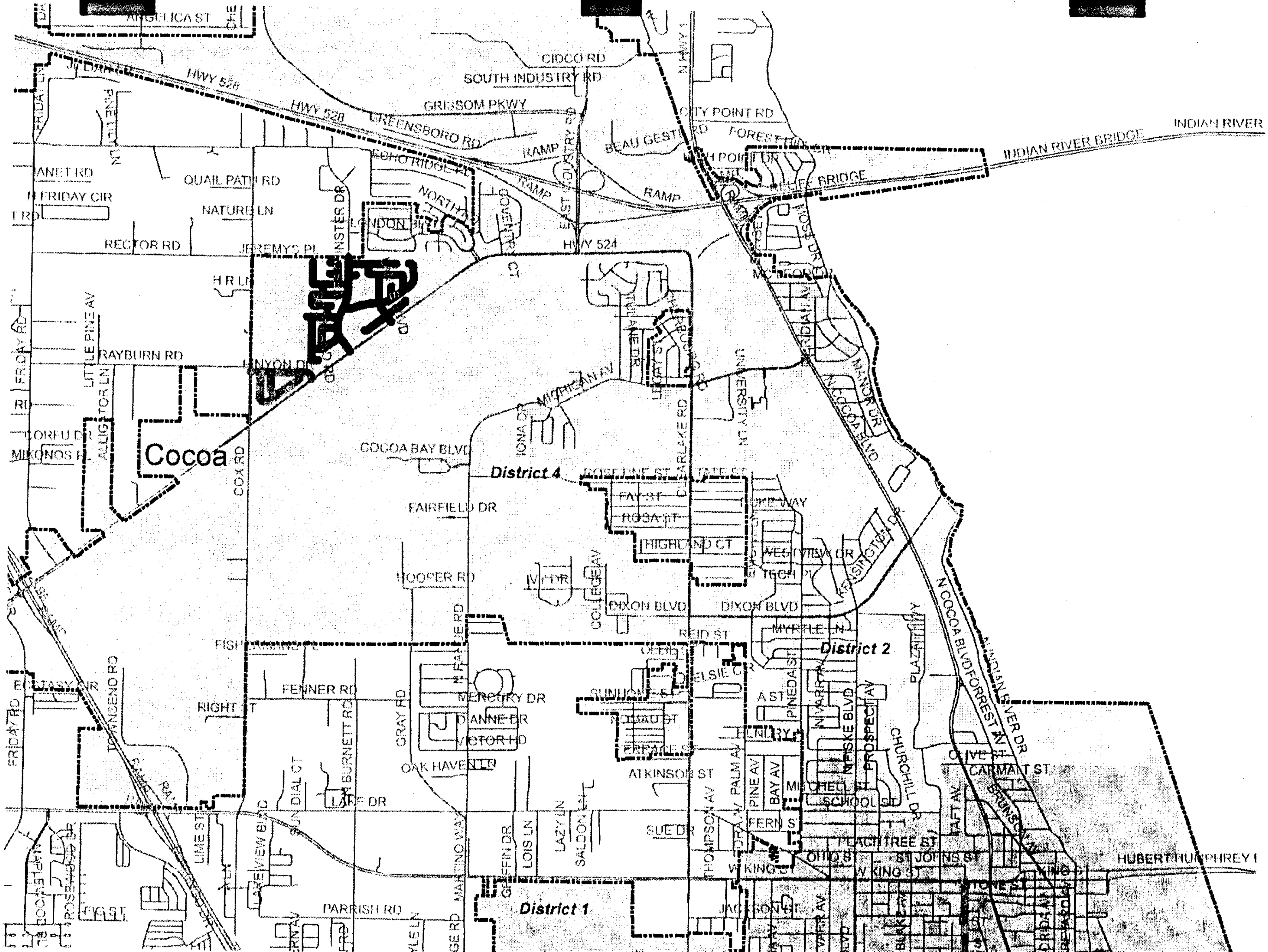
LOIS LN
LAZY LN
GRIFFIN DR
MARTINO WAY
PEACHTREE ST
ST JOHNS ST
W KING ST
CARMALT ST
SCHOOL ST
FIG ST
District 1
District 2
District 4
Cocoa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INDIAN RIVER
INDIAN RIVER BRIDGE
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CIDCO RD
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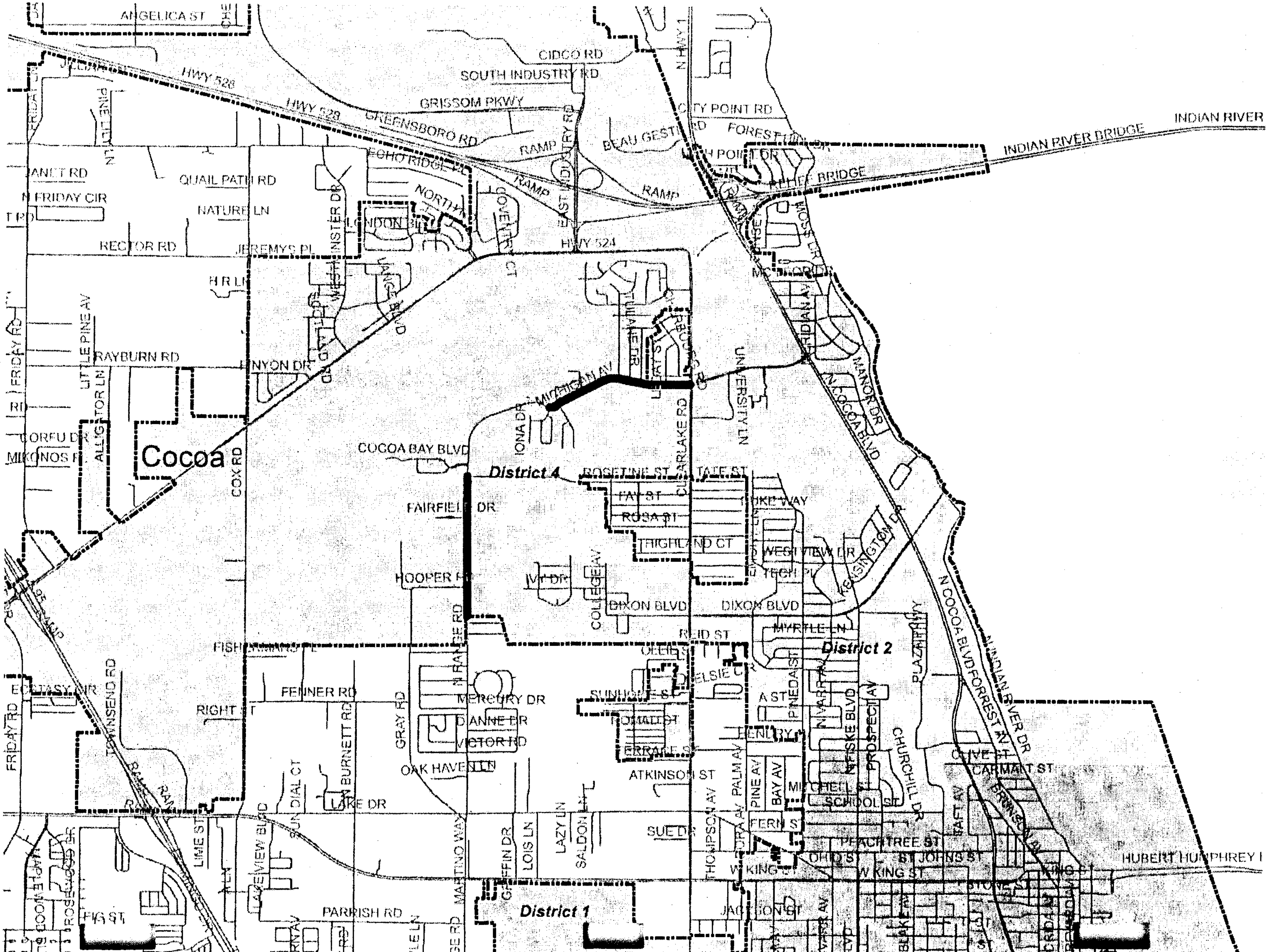
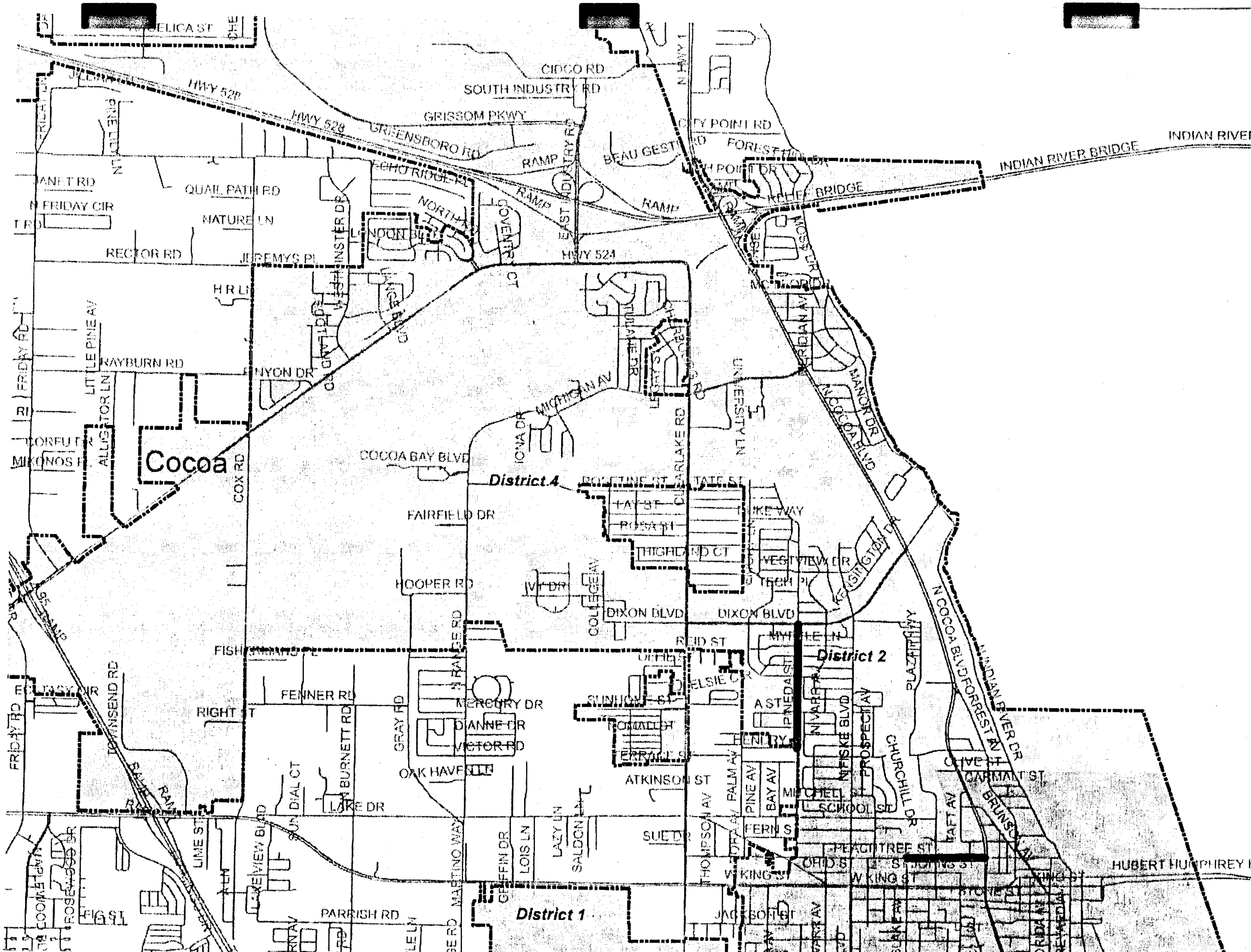
LOIS LN
LAZY LN
SALOON LN
MARTINO WAY
N FISKE BLVD
PROSPECT AV
CHURCHILL DR
MITCHELL ST
SCHOOL ST
PINEDA ST
MYRTLE LN
REID ST
DIXON BLVD
HIGHLAND CT
ROSA ST
FAY ST
COLLEGE AV
IONA DR
TULANE DR
PLAZA
N INDIAN RIVER DR
N COCOA BLVD/FORREST AV
TAFT AV
CARMAN ST
PARRISH RD
FIG ST
LAKE DR
N BURNETT RD
FRIDAY RD
RIGHT ST


Cocoa
District 1
District 2
District 4
INDIAN RIVER
INDIAN RIVER BRIDGE
N HWY 1
HWY 528
HWY 524
CIDCO RD
SOUTH INDUSTRY RD
GRISSOM PKWY
GREENSBORO RD
CITY POINT RD
COCOA BAY BLVD
FAIRFIELD DR
HOOPER RD
N COCOA BLVD
N INDIAN RIVER DR
CLEARLAKE RD
UNIVERSITY LN
MICHIGAN AV
DIXON BLVD
COLLEGE AV
REID ST
MERCURY DR
ATKINSON ST
THOMPSON AV
PEACHTREE ST
ST JOHNS ST
W KING ST
HUBERT HUMPHREY
COX RD
RAYBURN RD
TOWNSEND RD
FRIDAY RD
PARRISH RD
MARTINO WAY
N RANGE RD
LAKEVIEW BLVD
FIG ST
ANGELICA ST
QUAIL PATH RD
NATURE LN
RECTOR RD
JEREMYS PL
WESTMINSTER DR
COVENTRY CT
ALLIGATOR LN
LITTLE PINE AV
CHURCHILL DR
PROSPECT AV
SCHOOL ST
ROSETINE ST
TATE ST
FAY ST
ROSA ST
HIGHLAND CT
TULANE DR
IONA DR
MANOR DR
FORREST AV
CARMALT ST
TAFT AV
BLAKE AV
DIXON BLVD
GRAY RD
N BURNETT RD
OAK HAVEN LN
LAKE DR
SUE DR
LOIS LN
LAZY LN
SALDON LN
GRIFFIN DR
JACKSON ST
FENNER RD
RIGHT ST
LIME ST
VICTOR RD
ANNE DR
PINE AV
BAY AV
PALM AV
FERN ST
A ST
PINEDA ST
MYRTLE LN
CORFU DR
MIKONOS PL
JANET RD
N FRIDAY CIR
H R LN
CANYON DR
ECHO RIDGE PL
RAMP



District 1
District 2
District 4
Cocoa
INDIAN RIVER
INDIAN RIVER BRIDGE
N INDIAN RIVER DR
N COCOA BLVD
HUBERT HUMPHREY
CHURCHILL DR
PROSPECT AV
N FISKE BLVD
UNIVERSITY LN
CLEARLAKE RD
DIXON BLVD
REID ST
THOMPSON AV
ATKINSON ST
TULANE DR
COLLEGE AV
SALDON LN
LAZY LN
LOIS LN
GRIFFIN DR
MICHIGAN AV
IONA DR
FAIRFIELD DR
HOOPER RD
MERCURY DR
DIANNE DR
VICTOR RD
GRAY RD
MARTINO WAY
COCOA BAY BLVD
N RANGE RD
FENNER RD
N BURNETT RD
LAKE DR
PARRISH RD
SUN DIAL CT
LAKEVIEW BLVD
COX RD
LIME ST
RIGHT ST
TOWNSEND RD
RAYBURN RD
ALLIGATOR LN
LITTLE PINE AV
RECTOR RD
NATURE LN
QUAIL PATH RD
N FRIDAY CIR
FRIDAY RD
HWY 528
HWY 524
GRISSOM PKWY
GREENSBORO RD
SOUTH INDUSTRY RD
CIDCO RD
CITY POINT RD
N HWY 1
BEAU GESTE
RAMP
JEREMYS PL
H R LN
COCOA BAY BLVD
HIGHLAND CT
MANOR DR
MOSS DR
FIG ST
A ST
PINE AV
BAY AV
PALM AV
SUE DR
W KING ST
PEACHTREE ST
JACKSON ST
CARMAN ST
TAFT AV
SCHOOL ST