TO: SUPPLEMENTAL TAX OVERSIGHT COMMITTEE

FROM: DOUG MONN, PUBLIC WORKS DIRECTOR

SUBJECT: PAVEMENT MANAGEMENT PLAN

DATE: JUNE 26, 2013

NEEDS: For the Committee to receive and file a Pavement Management Plan briefing.

FACTS:

1. Orientation of the Committee to City Planning and Policy as they pertain to City streets concludes with this third and final plan presentation:
   - Factors for a well-designed roadway.
   - Factors for a well-constructed roadway.
   - Factors that cause deterioration of road surface.
   - Best management to extend the useful life of the City's road system.

2. Pavement design is based on theoretical parameters:
   - Traffic Index (TI) is a theoretical number assigned to a street based on the expected loading (over time, the amount of traffic traveling on the road, impacts its ability to bear the loads).
   - R-value (resistivity) is the strength of the native soil to resist the loads expected on the surface.

3. The thickness of the aggregate base and hot mix asphalt needed for a street is determined by balancing the number of cars using the road (traffic index) and the strength of the soil (R-value) needed to support the necessary loading.

4. Once constructed, maintenance and protection of the road surface from sun and water are the major factors in the prevention of deterioration.

ANALYSIS & CONCLUSION: Cost effective pavement preservation requires applying the right treatment at the right time.

POLICY REFERENCE: June 2006 Adopted Pavement Management Program

FISCAL IMPACT: None/information only

OPTIONS:

a. Receive and file reports

b. Amend, modify, or reject the above option.

Attachments: PowerPoint Presentation Slides
2006 Pavement Management Program

Supplemental Tax Oversight Committee

Presentation No. 3
June 26, 2013

Ditas Esperanza, City Capital Projects Engineer
Joe Ririe, Pavement Engineering, Inc.

Recap of Presentation No. 2

Presentation No. 2 was an overview of the:

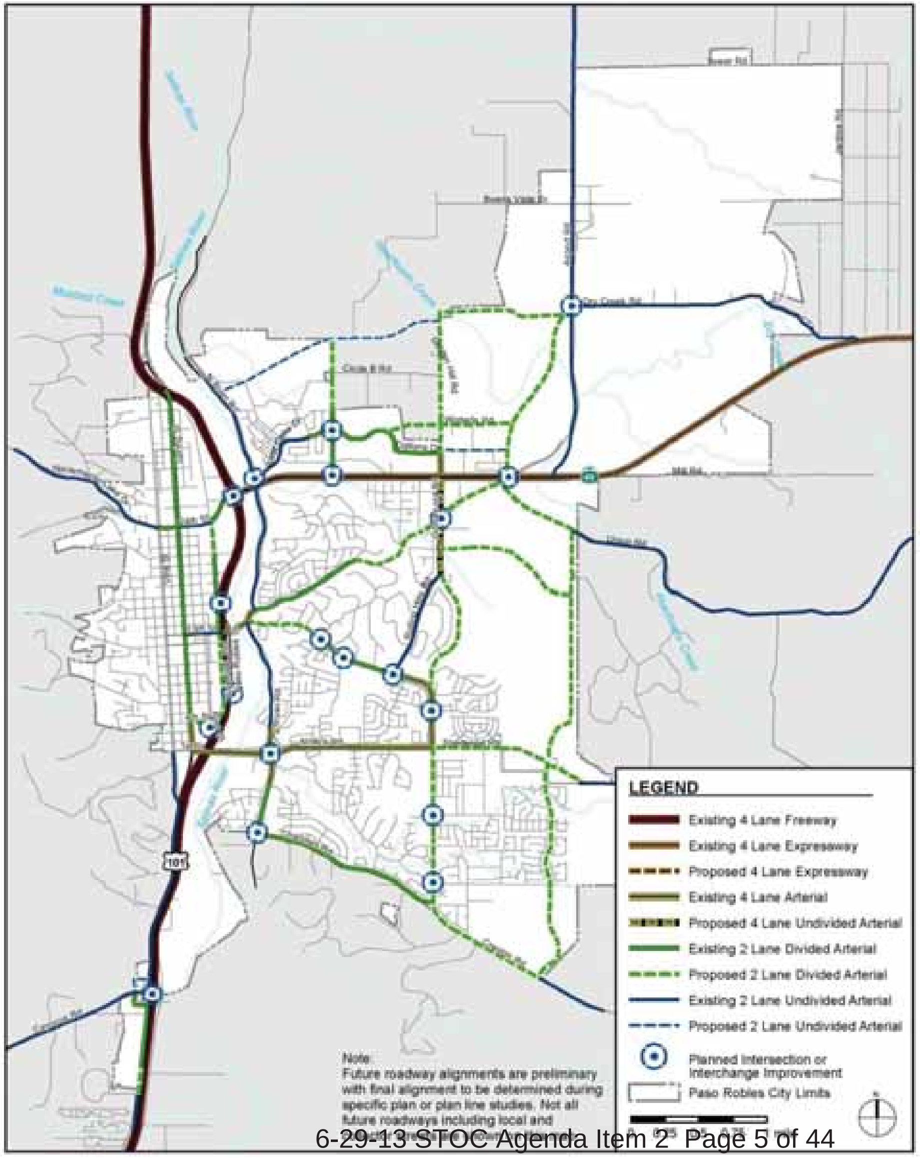
- The City's Circulation Element
- Road design and effects on travel speed, congestion, and traffic volume for arterial roads
- Public Works Contract Code and how projects are advertised and awarded for construction

Pavement Maintenance Management

Tonight's presentation will discuss pavement maintenance/ management, including:

- Factors for a well-designed roadway
- Factors for a well-constructed roadway
- Factors that cause deterioration of road surface
- Best management to extend the useful life of the City's road system

Presentation No. 2 showed the City's Circulation Element, which was an overview of the City's street network system.

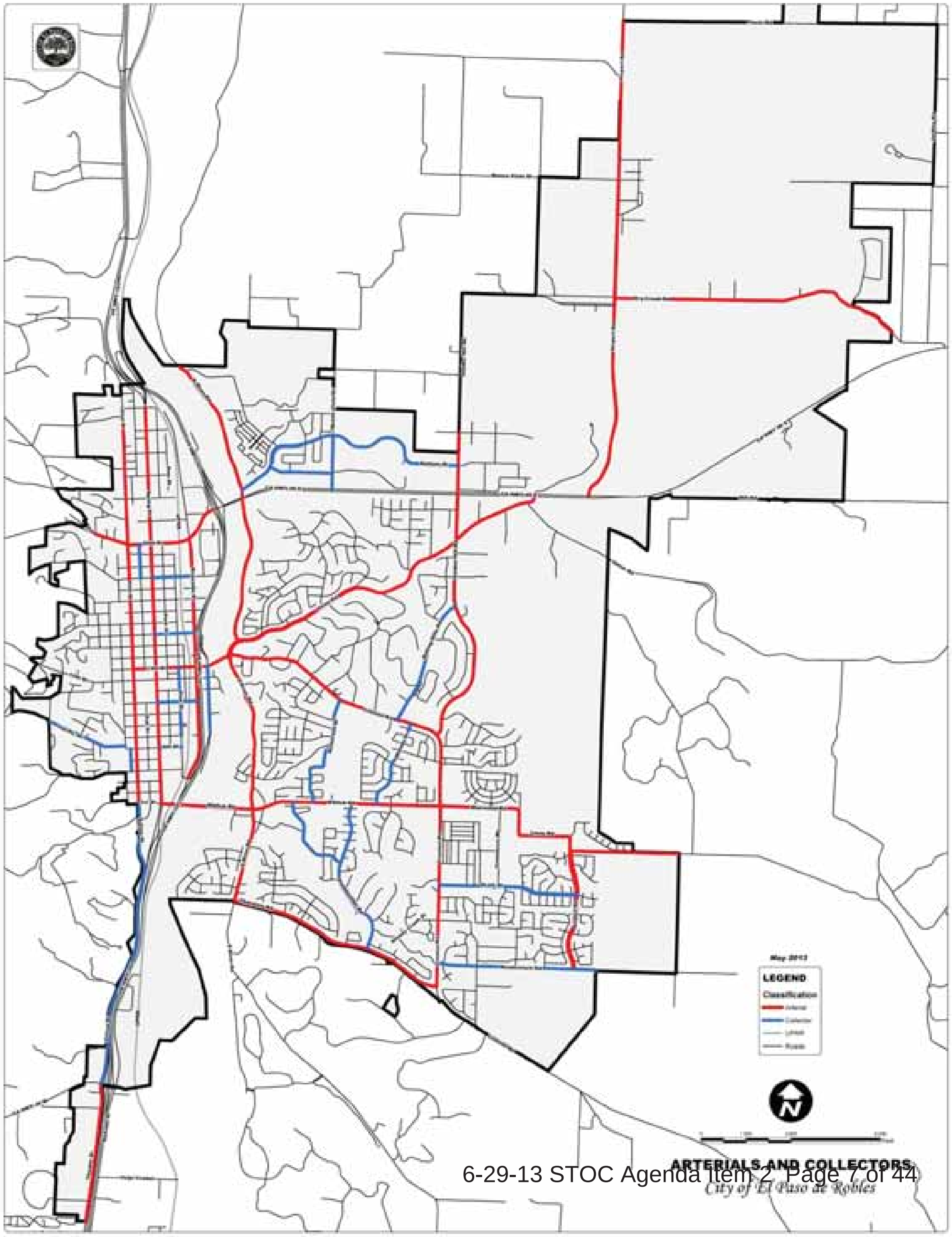


Circulation Element Master Plan Map

Street Classifications

The City's street network system consists of four street classifications that the City maintains:

- Arterials: Niblick, Creston, Spring, Vine, etc.
- Collectors: Rambouillet, Nicklaus, Scott, etc.
- Residential
- Alleys



ARTERIALS & COLLECTORS

— Arterial

— Collector

32 miles of arterials

20 miles of collectors

45 miles of residential

4 miles of alleys

Road Design – Based on Two Factors

- Traffic Index (TI) is the number assigned to the expected loading of a street segment.

    The more volume expected (arterials), the higher the TI

- Recommended TI's

    8.0 for arterials (Niblick, Spring, Creston, etc.)

    7.0 for collectors (Rambouillet, Lana, Scott, etc.)

    6.0 for residential and alleys

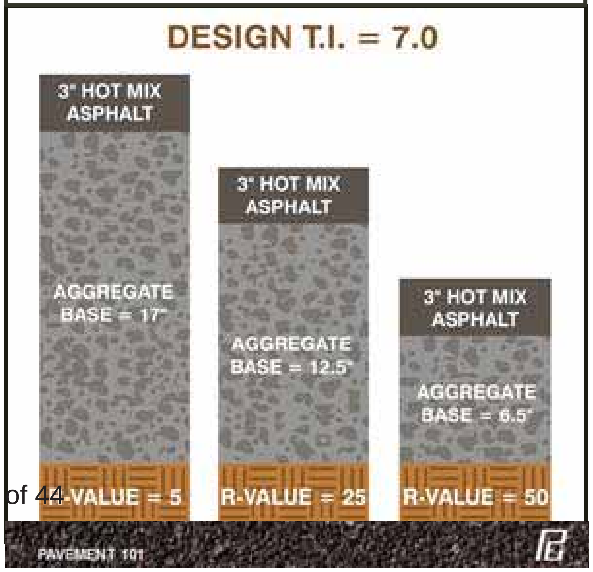
... and by the way, Caltrans uses a TI of 14 for their freeways and highways

Road Design – Based on Two Factors, cont’d

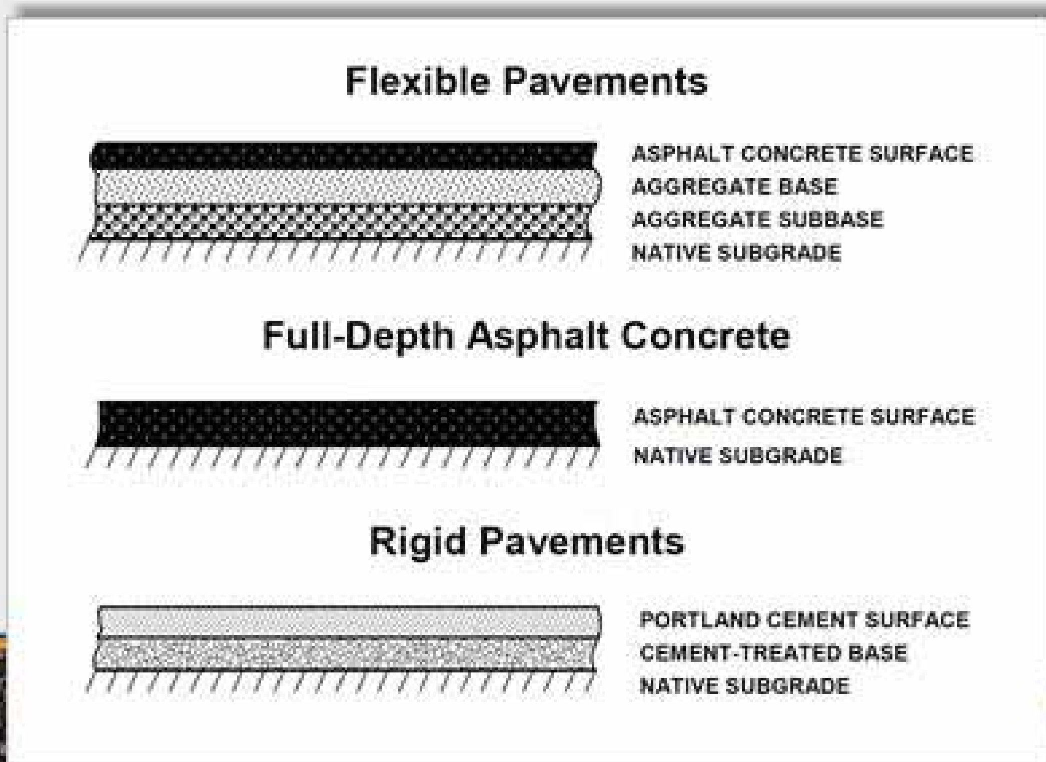
- R-Value is the condition of the native soil.
  - It is the native soil’s existing characteristics that can resist the anticipated long-term weight the street will experience.
  - In San Luis Obispo County, where poor soils are common, this number can be as low as 5 (the lowest possible)
  - Aggregate base, which is an engineered material designed to have certain characteristics, has an R-Value of 78

- In pavement design, the lower the R-Value, the more structural section is needed to ‘bridge’ the soil and provide a well performing section. This is illustrated in the graph on the right for a pavement section with a TI of 7.0

Structural Section Based on Native Soil R-Value



Typical Pavement Structures



PAVEMENT 101

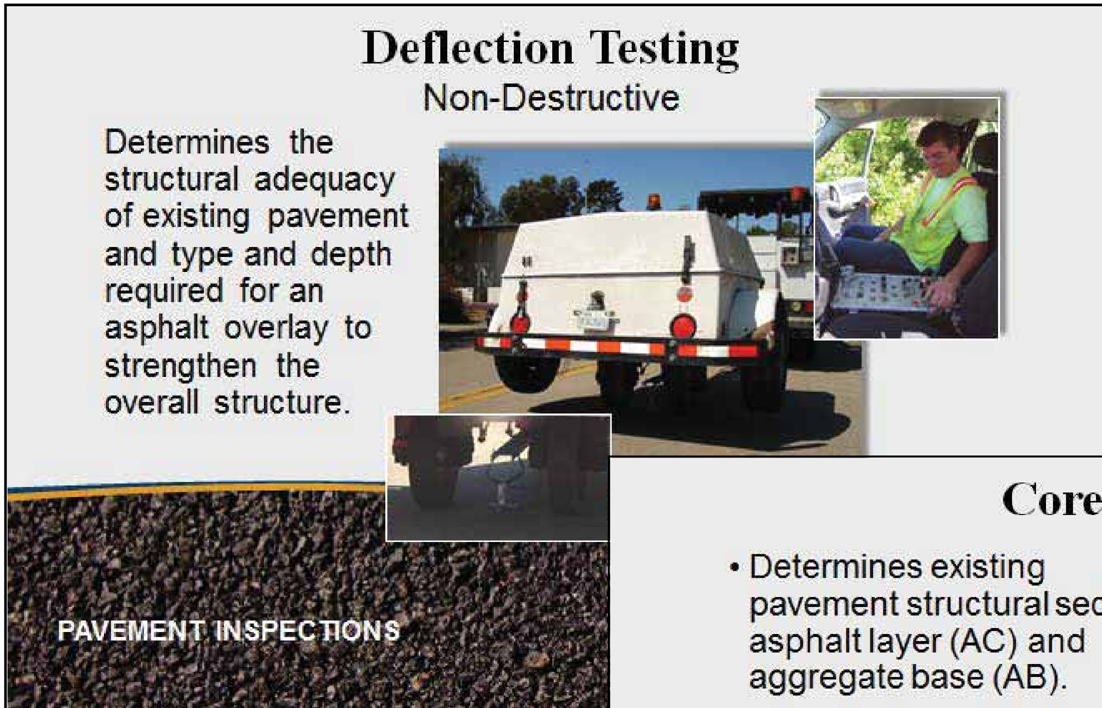
Pavement Investigation & Analysis

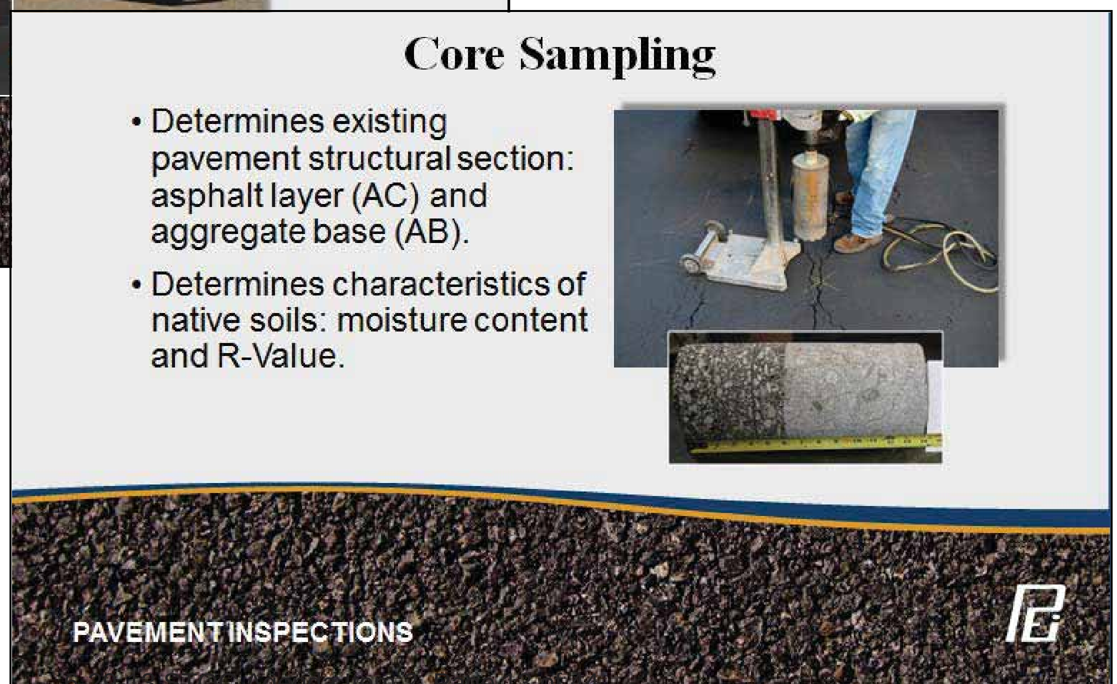
- Pavement rehabilitation requires significant financial investment. Therefore it makes sense to design pavement to last as long as possible and take into consideration all possible factors that impact performance or contribute to premature deterioration.
    - Factors affecting future pavement performance cannot be determined solely by appearance or surface condition.
    - It is the existing pavement structure and underlying soils that are key to designing long-lasting, structurally sound pavement.

Pavement Investigation & Analysis, cont'd

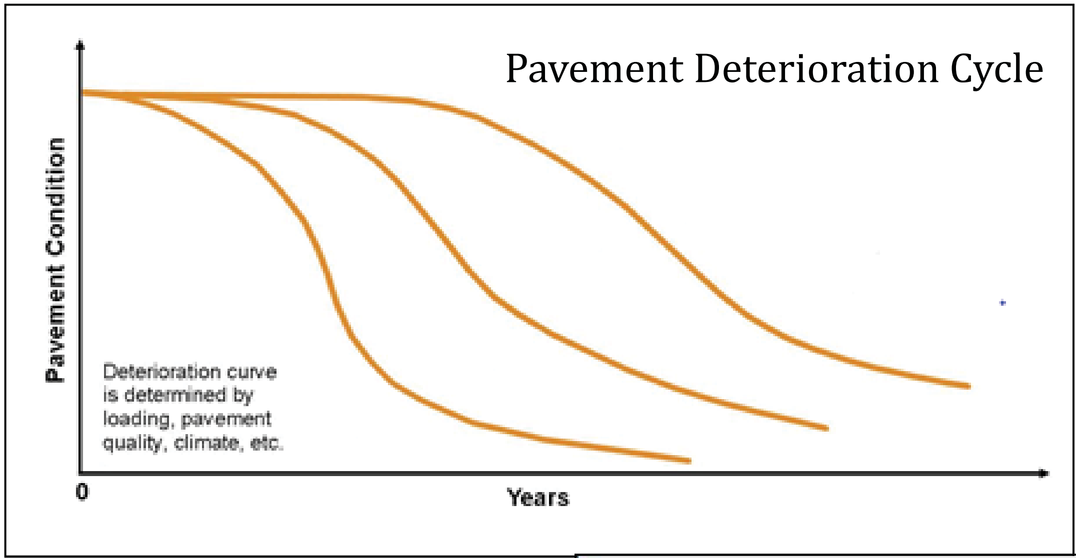
- The existing pavement structure and character of underlying soils cannot be determined solely from historical records.
  - Record drawings show what is supposed to be there.
    - But was it actually constructed that way?
    - And how are the native soils and base materials behaving compared to idealized "R-value" and gravel factors assumptions?
  - The only way to know is to investigate/test.

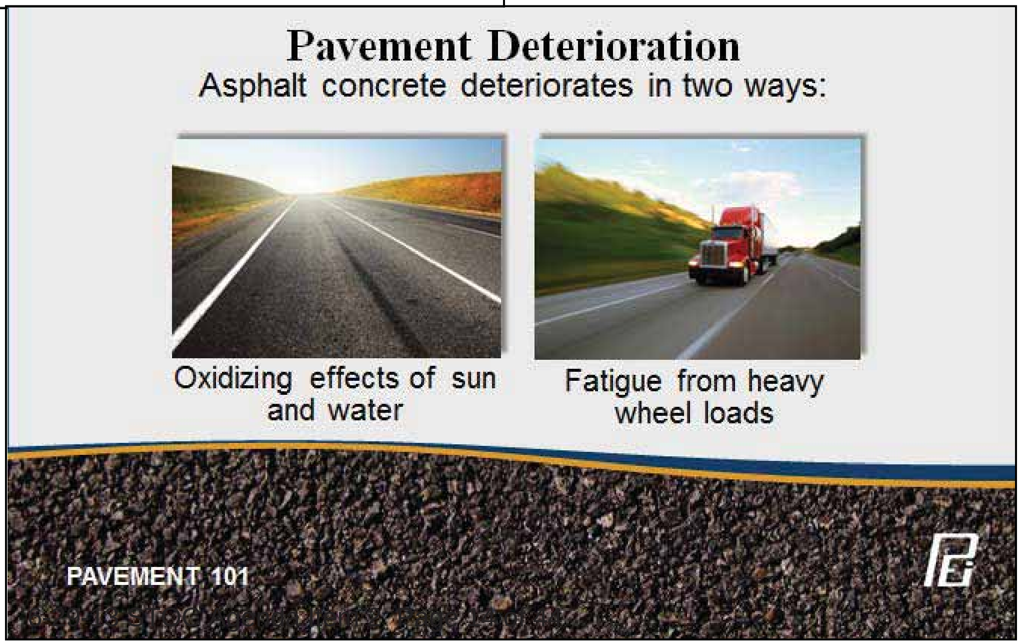
Investigation Methods



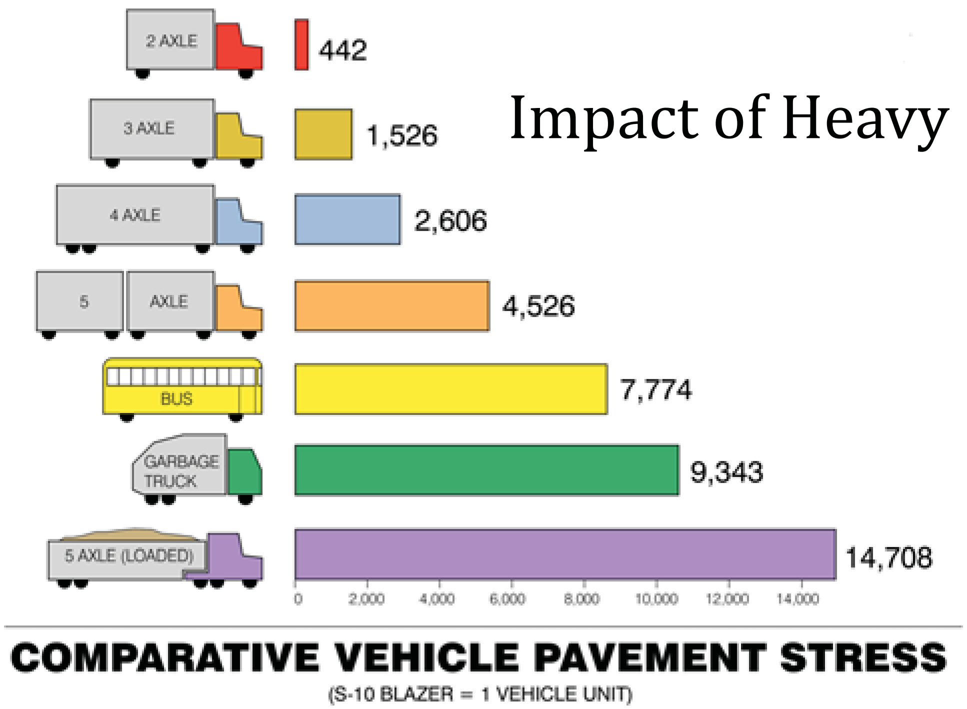


Pavement Deterioration

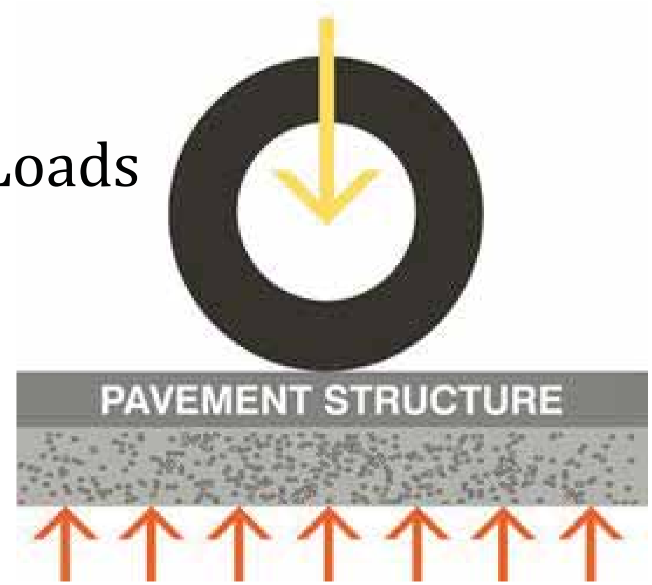




Pavement Deterioration, cont'd



Impact of Heavy Loads



Impact of Sun and Water

Pavement Deterioration, cont'd

Common Pavement Distresses

Weathering or Raveling

Transverse or Longitudinal Cracking

Block Cracking

Alligator Cracking

Pavement Evaluation

Evaluating Common Pavement Distresses

- Alligator cracking
- Block cracking
- Distortions
- Longitudinal / transverse cracking
- Patches
- Rutting / depressions
- Weathering / raveling

Pavement Condition Index

100 – 91 = Excellent
90 – 71 = Good
70 – 51 = Fair
50 – 31 = Poor
30 – 0 = Failed

Developed by the U. S. Army Corp of Engineers during World War II and standardized by ASTM, the PCI is an objective and rational basis for determining pavement condition and establishing maintenance priorities.

Pavement Condition Index Examples

PCI = 100
Excellent 100-91

PCI = 85
Good 90-71

Pavement Condition Index Examples

PCI = 70
Fair 70-51

PCI = 60
Fair 70-51

Pavement Condition Index Examples

PCI = 51
Fair 70-51

PCI = 38
Poor 50-31

Pavement Condition Index Examples

PCI = 28
Failed 30-0

PCI = ?
Enough said

Pavement Preservation

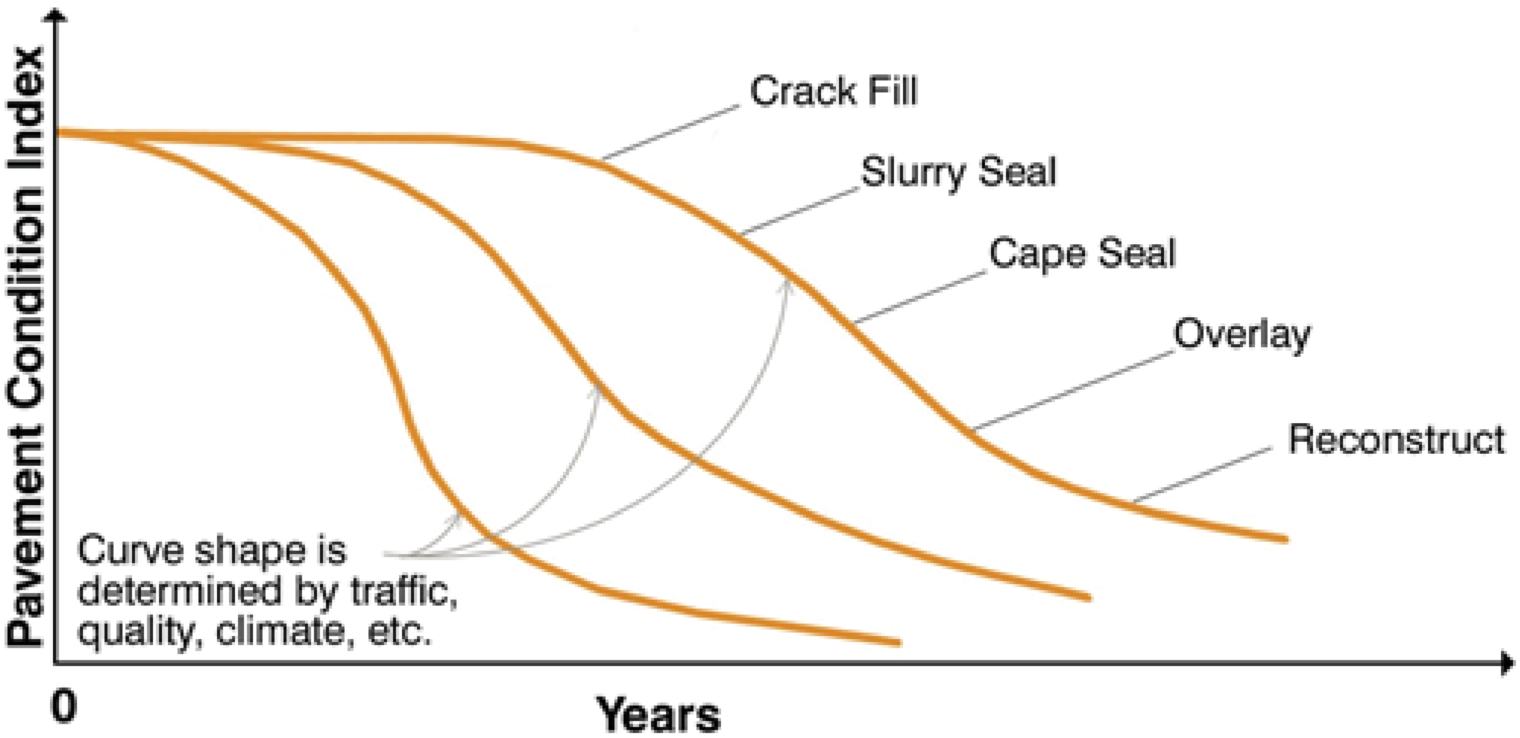
Applying the **RIGHT TREATMENT**

to the **RIGHT PAVEMENT**

at the **RIGHT TIME**

using the **RIGHT MATERIALS**

Pavement Preservation Timing



It makes more sense to spend maintenance money on a "decent road" to extend that road's useful life while other more deteriorated roads are left alone.

Pavement Maintenance Treatment

Crack Sealing Treatment

- The right treatment for block or transverse cracking
- Inexpensive
- Prevents water from seeping beneath the asphalt to the subgrade where structural damage occurs

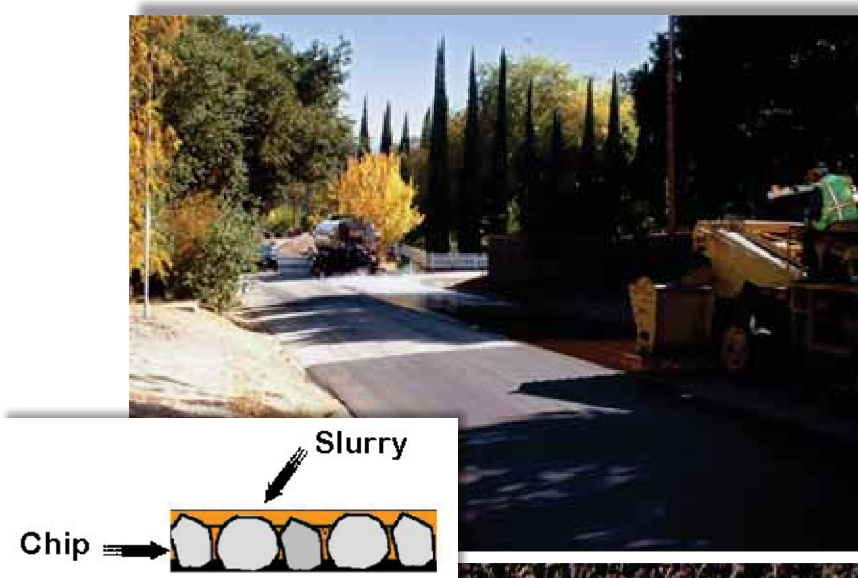
Slurry Seal Treatment

- The right treatment for raveled pavement in traffic areas with speed limits above 15 mph
- Skid resistant
- Fills in minor cracks, creates a uniform finish & provides a weather- and water-tight surface

Pavement Maintenance Treatment

Digout & Patching Treatment

- The right treatment to prevent damage to the subgrade
- Requires precise excavating of damaged areas that are then filled with a new asphalt mix
- Applied on a localized basis



Cape Seal Treatment

- Combines a chip (aggregate) layer followed within a few weeks by a slurry seal for durability
- Prevents water damage to the road bed and provides a new wear surface
- Significantly extends pavement life when combined with crack sealing & surface patching

Pavement Maintenance Treatment

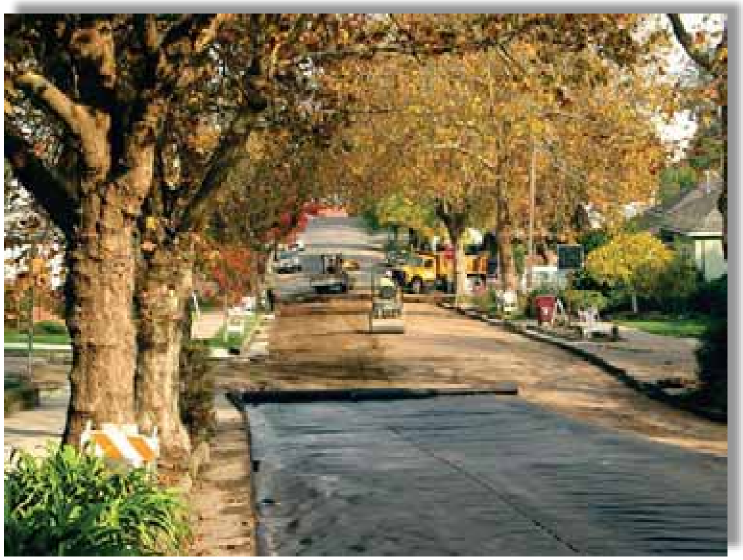
Overlay Treatment

- The right treatment for severely deteriorated pavement
- Overlays existing pavement with a new layer of bituminous asphalt
- Thickness depends on existing pavement condition and traffic
- Strengthens overall pavement structure and improves ride

Mill & Fill Treatment

- Removes existing asphalt to a predetermined depth and replaces with new HMA.
- Extends the life of existing roads.
- Creates a smooth ride by eliminating the effects of tire ruts and any asphalt movement that may occur.

Pavement Maintenance Treatment



Reconstruction

- Required when paved has failed or become functionally obsolete
- Removes and replaces existing pavement structure
- Uses either new or recycled paving materials or a combination of both

Reconstruction Pulverization

- Grinds the existing asphalt surface and mixes it with the aggregate base
- Strengthens the existing base and forms a stronger foundation for reconstruction
- Improves drainage
- Eliminates bumps, humps and rutting

Pavement Preservation Goals

- Good inspections
- Good design
- Good management

Good Pavement Inspections

- **Avoid guesswork** based solely on visual appearance or surface condition, which can be misleading.
- **Provide a complete picture** of the existing pavement and its in-place strength.
- **Determine pavement structure**, underlying soils, why pavement fails and how it will perform with various maintenance or rehabilitation treatments.
- **Employ recognized test methods** such as CTM and ASTM

  - Accurately monitors asphalt concrete mixes to ensure mix designs meet specifications and to measure in-place HMA (Hot Mix Asphalt) density during the laydown phase to ensure sufficient compaction.
  - Mix quality and compaction quality are essential to long-lasting pavements.

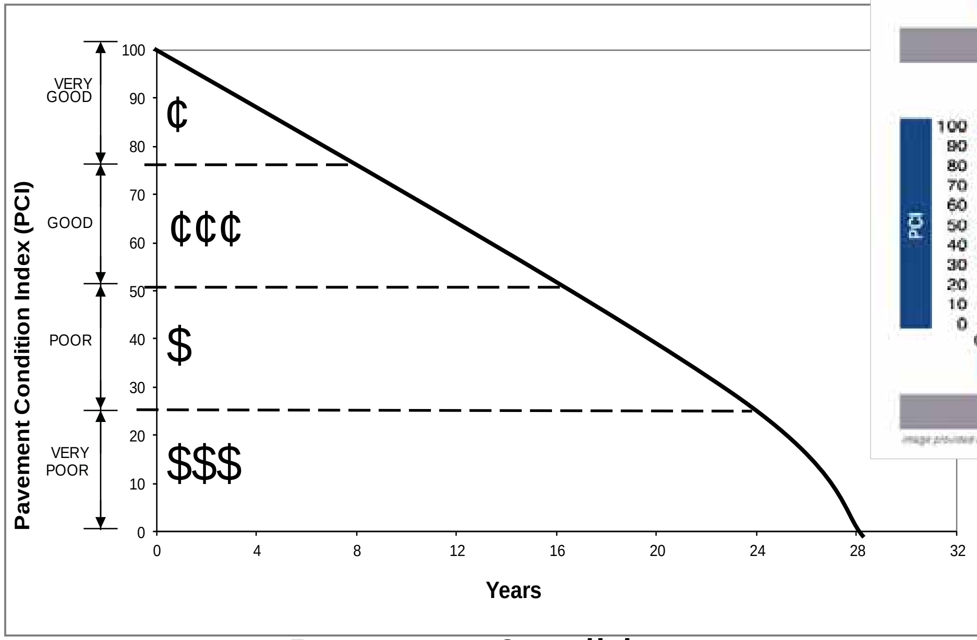
Good Pavement Design

- **Requires knowledge of entire pavement structure**: layer thicknesses, cracking influences, soil characteristics and structural support values of the existing pavement
- **Determines constraints** based on structural support
- **Considers "constructability"** of prospective treatments
- **Develops options** for increasing pavement service life
- **Eliminates guesswork** that results in cost overruns during construction

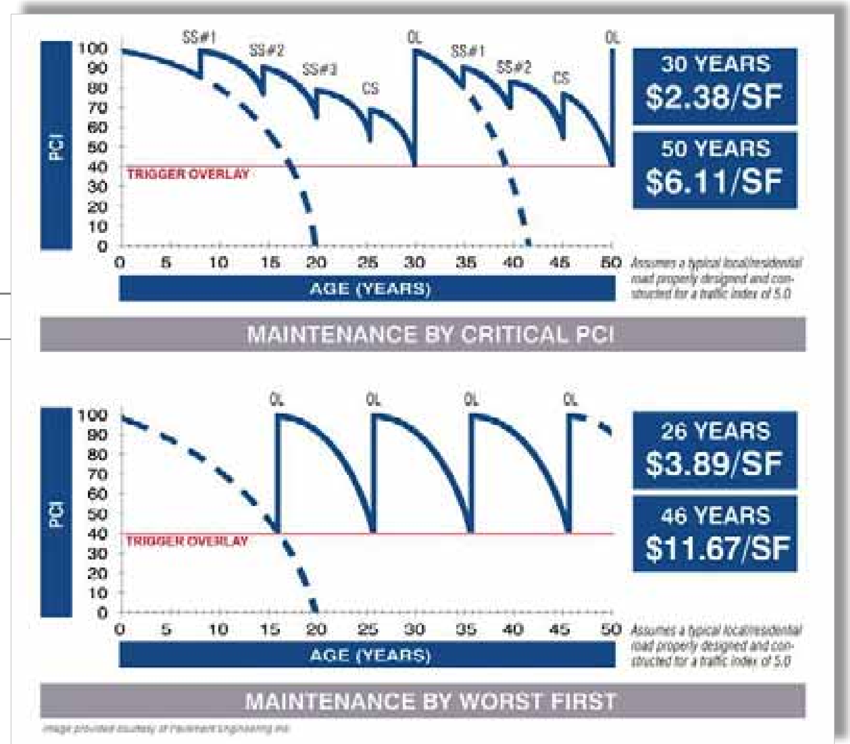
Good Pavement Management

- **Best-First "Top Down" Management:** focuses maintenance and rehabilitation on the best streets in the system.
  - Interim procedure
- **Worst-First "Bottom Up" Management:** focuses maintenance and rehabilitation on the worst streets in the system.
  - Interim procedure
- **Critical-Point Management:** focuses maintenance and rehabilitation on streets above rather than below a critical PCI.
  - Most economical in the long run

Good Pavement Management



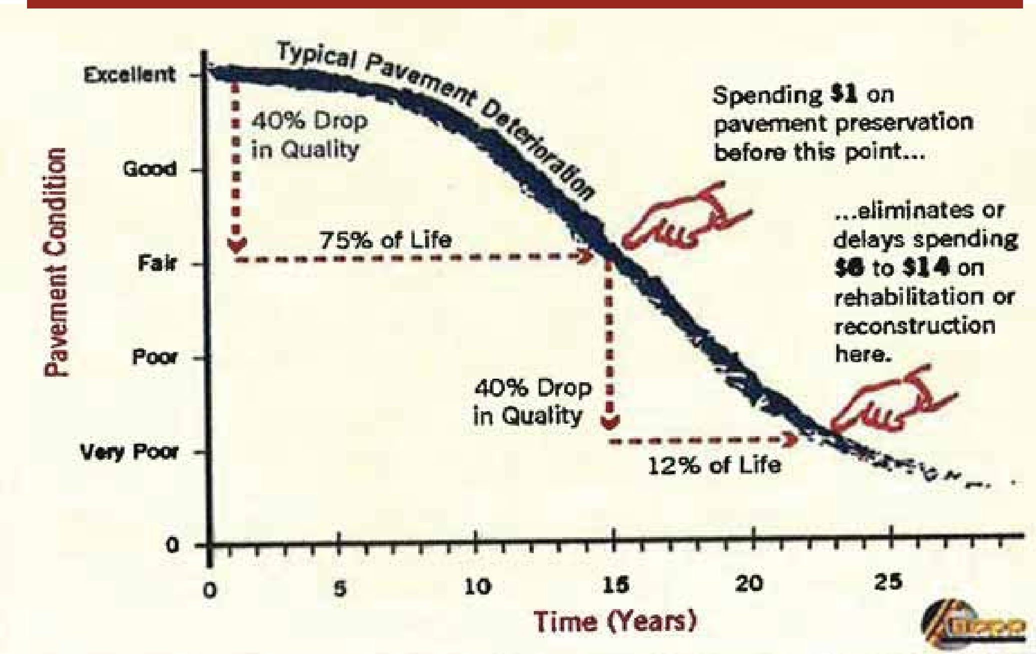
Pavement Condition vs.
Maintenance / Rehabilitation Cost



Critical Pavement Management

Good Pavement Management

PAVEMENT PRESERVATION IS COST EFFECTIVE



Source: National Center for Pavement Preservation

This table shows that for every $1 spent early on pavement preservation, the need to spend $6 to $14 on future repair or replacement can be avoided.

With the Pavement Preservation Graph in mind, in 2006 City Council adopted the following policies in a **Pavement Management Program**:

- Repair streets to maintain an average PCI of 80 or greater.
- Use the annual street maintenance budget for preventive maintenance and the remainder for heavy maintenance or reconstruction.

Good Pavement Management

- In 2008, staff developed a list of streets for maintenance using the policies adopted by City Council. The list included residential, collector, and arterial streets. However, the State discontinued its gas tax transfers to cities and no substantial progress was made.

- The Street Maintenance Plan that was presented to City Council on March 5, 2013 provided two (2) plan options.
  - **Plan A** is a variant of the 2008 Plan focusing on a mix of residential, collector and arterial streets.
  - **Plan B** focuses on arterial and collector streets along with certain residential streets that function as "collectors" as they serve adjacent businesses and schools.

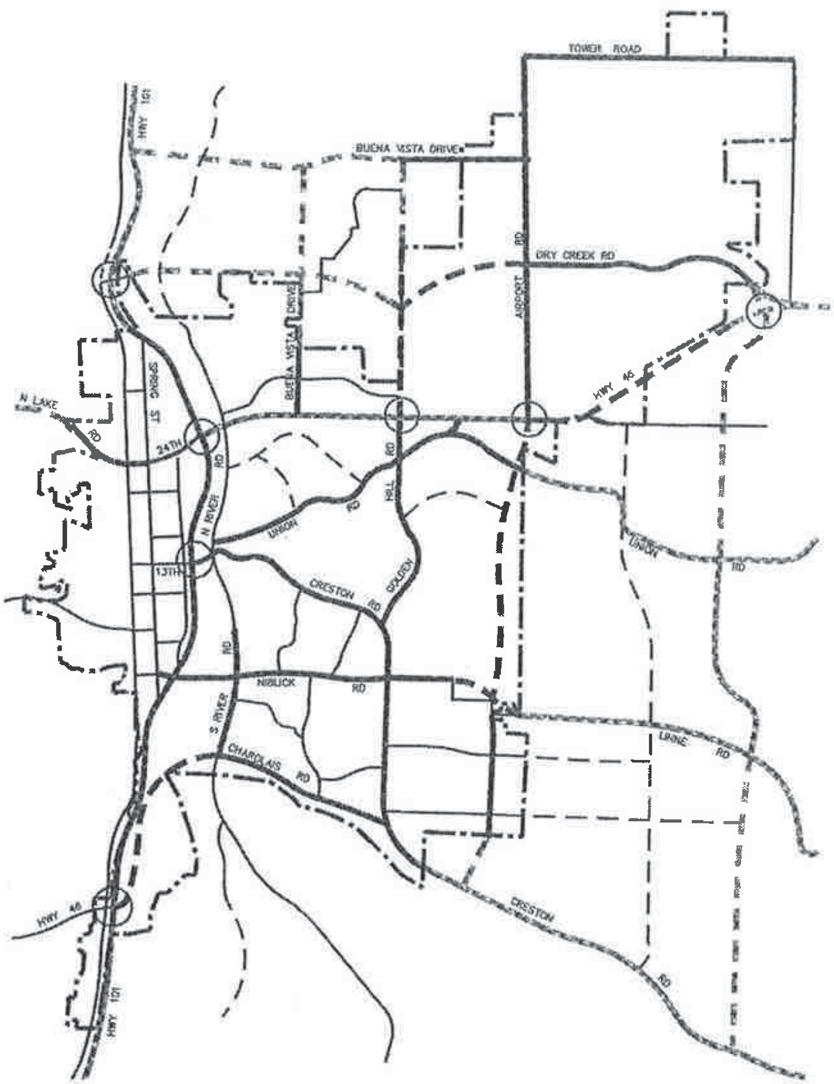
Good Pavement Management

- **Plan A** addresses 12 miles of roadways (combination residential, collectors and arterials.
- **Plan B** addresses 15 miles of roadways (arterials and collectors).

- The philosophy behind **Plan B** is that arterials and collectors are the most traveled streets and therefore Paso Robles citizens would see their sales tax contributions at work sooner.

2013 Proposed Street Maintenance Plan B

CLASSIFICATION	STREET	FROM	TO	2005 PCI
Residential	Walnut	Union	Creston	21
Residential	Shannon Hill	Jackson	Creston	27
Collector	21st	Vine	Spring	28
Collector	6th	Spring	Olive	30
Collector	Oak	24th	23rd	34
Residential	Lana	Creston	Melody	34
Collector	Olive	1st	6th	36
Residential	12th	Vine	Fresno	37
Residential	Jackson	Union	Shannon Hill	39
Residential	Country Club	Niblick	Golf Course Parking Lot	42
Collector	Meadowlark	Creston	East end	81
Arterial	Vine	1st	36th	75
Arterial	So River	Niblick	Navajo	44
Arterial	Sherwood	Creston	Fontana	45
Arterial	13th	Vine	Chestnut	53
Arterial	Spring	1st	24th	60
Arterial	Rolling Hills	Creston	Golden Hill	40
Collector	Scott	Creston	Via Ramona	37
Collector	Scott	Via Ramona	Airport	47
Arterial	Spring	24th	36th	61
Arterial	Creston	Oak Meadow	Golden Hill	63
Arterial	Creston	Sherwood	Scott	67
Arterial	Airport	Scott	Pioneer Trail	40
Arterial	24th	US 101	Nacimiento Lake Dr.	77
Arterial	Creston	South River	Rolling Hills	44
Arterial	Union	w/o Hwy 46	Golden Hill	46



Pavement Management Program

June 2006

City of El Paso de Robles

Public Works Department

ADOPTED BY THE CITY COUNCIL
DECEMBER 19, 2006

NOTE: THE CITY COUNCIL EXEMPTED THE GAS COMPANY FROM THE REQUIREMENTS OF EXHIBIT "A"

ANALYSIS OF THE CITY'S STREET SYSTEM

The City of Paso Robles currently maintains approximately 148.3 centerline miles of roadways. Of the 148.3 centerline miles, 31.8 are arterials and 18.8 are collectors. This represents 7,428,956 square feet of arterial pavement, 3,638,702 square feet of collector pavement, 16,818,281 square feet of residential pavement, and 461,178 square feet of alleys in the Business District, for a total system of 28,347,117 square feet.

The City engaged the services of Pavement Engineering Inc. to perform evaluation of all the streets in the City's system to establish a Pavement Condition Index (PCI) for each road segment and is summarized below:

	Area (SF)	Centerline Miles	Weighted PCI
Arterials	7,428,956	31.8	69.2
Collectors	3,638,702	18.8	55.4
Residentials	16,818,281	93.5	63.8
Alleys	461,178	4.3	48.6
	28,347,117	148.3	63.9

The overall current weighted average PCI for the City's streets is **63.9**. Most cities in California try to maintain an average PCI of 70 or above. It is recommended that the City adopt a policy to maintain its residential streets at a PCI level of 70, its alleys at a PCI level of 65, and its arterials and collectors at 80.

RECOMMENDED PROGRAM

Staff recommends a Pavement Maintenance Program to address the City's street system in three categories: Design of New Streets, Construction of New Streets, and Maintenance and Protection of Existing Streets.

A. Design of New Streets

It is critical that streets are designed adequately for the volume of traffic and type of vehicle that is expected to use the roads. In other words, the street structure for arterials and collectors should be designed to accommodate heavy trucks and large volumes of traffic. Residential street design standards can be a little less stringent since these streets typically are limited only to neighborhood traffic.

The structural section (aggregate base and asphalt concrete) required to be installed for new streets is contingent on two factors: traffic index (TI) which is an indication of future truck loading and is a function of the volume and type of traffic that will be using the street, and soils resistivity (R-value) which is the in situ soils characteristic that can withstand the anticipated long-term weight that the street will experience.

1. Traffic Index

Traffic Index (TI) is based on the expected number of vehicles and the type of vehicles to travel the streets in the design life. Heavier vehicles have more impact on pavement. Currently, the City's standards are as follows:

Arterial streets	TI = 7.0
Collector and west side streets	TI = 6.0
Local and rural streets	TI = 5.0
Cul-de-sac and hillside streets	TI = 4.0

Staff proposes that the City's streets be designed with the following Traffic Index:

Arterials (which would also serve as truck routes)	TI = 8.0
Commercial streets and collectors	TI = 7.0
All other streets including alleys	TI = 6.0

2. Soil Resistivity (R-value)

Soil strength is measured in the lab and a number (the R-value) that represents the soil strength is established. In San Luis Obispo County, where poor soils are common, this number can be as low as 5 (the lowest possible). The roadway designer shall have soil samples tested for actual value and the measured R-value shall be used in the calculation of the pavement design. However, if no test is performed, the R-value can be assumed to be 5 and the structural section can be calculated accordingly to include a minimum of 12 inches of aggregate base material. The lower 6 inches may be a Class III sub-base material in accordance with Caltrans Standards.

B. Construction of New Streets

Two policies are proposed for consideration with regards to the construction and acceptance of new streets as part of the City's network of streets as outlined below.

1. Developers to Install Full Street Structure

In a multiphased subdivision or during the initial stages of construction, residential roads are used by concrete trucks and construction vehicles which accelerate the deterioration of these roads and decrease their life expectancy as these roads were neither designed nor constructed to receive this type of traffic. Therefore, the life expectancy of roads in these tracts, which would normally be 20 years, is drastically reduced.

It is proposed that the City adopt a policy to require developers to install **the full structure section prior to acceptance** of public improvements.

In addition, it is also proposed that the aggregate base below the curb be at the same depth as the roadbed.

2. Compaction of New Streets

It has been proven that proper compaction of asphalt concrete has a direct relation to the construction life of a street. Currently the City requires that asphalt concrete be compacted at 95% minimum. It is proposed that the City require that the compaction after rolling shall have an average of 96.5% with no one test below 96%. All testing shall conform to Caltrans Testing Methods and Specifications.

C. Maintenance and Protection of Existing Streets

The following policies are proposed to address the maintenance and protection of the City's existing streets: adopt utility trench repair standards, establish a truck route street system, and establish a specific budget to maintain the City streets.

1. Utility Repair Standards

The trench repair standards proposed are designed to mitigate the impact of utility trenches on the life and durability of streets. The implementation of these standards will result in longer paving life of streets and therefore neutralize the costs driven by premature repair of asphalt that has been trenched and patched inadequately.

Nearly all complaints regarding rough patches in streets are in reference to temporary repairs. Temporary repairs are typically comprised of cutting back the asphalt or a cold patch. Cold asphalt has lower stability and is compacted by on-going traffic and therefore is left a little higher than adjacent grade. Cold asphalt may compact below adjacent grade resulting in annoying bumps. Temporary repairs need to be monitored in order to be effective and to limit disruption and traffic comfort. A temporary trench repair standard is also included for consideration in addition to a monitoring program to assign responsibility for on-going maintenance and timely permanent pavement replacement.

Research by the University of Cincinnati indicates that the area of impact to an existing street extends to three feet outside the edge of the trench. A trench repair standard that accounts for these impacts is proposed.

Appendix A attached includes exhibits and details which are proposed to address utility trench repairs.

2. Truck Route

The wear factor to a road's surface caused by a single large truck is equal to 15,000 automobiles traveling over the same road surface. Arterial road structures are designed to accommodate large volumes of traffic and large, heavy trucks. Street structure in residential areas are designed much less in comparison. It is recommended that the City adopt a Traffic Index of 8.0 for all arterials. With this change, the arterial roads will become the City's designated "Truck Routes."

3. *Protection of Existing Streets*

Good pavement management means that the cost to maintain pavement in a good or excellent condition is relatively low, as long as work is done before the condition of rapid deterioration begins. Once pavement has begun to deteriorate rapidly, the cost to restore the pavement to excellent condition increases rapidly to the point where it may not make economic sense to spend money on routine maintenance. It is proposed that the City adopt a policy to use its annual street maintenance budget towards preventive maintenance and the remainder towards heavy maintenance or reconstruction. These policies that are proposed would allow the citizens of Paso Robles to have streets that are well maintained and last a long time.

The attached chart illustrates that the City should appropriate 2.5 million dollars annually in order to maintain its street system at a level that will extend the life of the streets. Two scenarios are proposed on how this annual budget should be used.

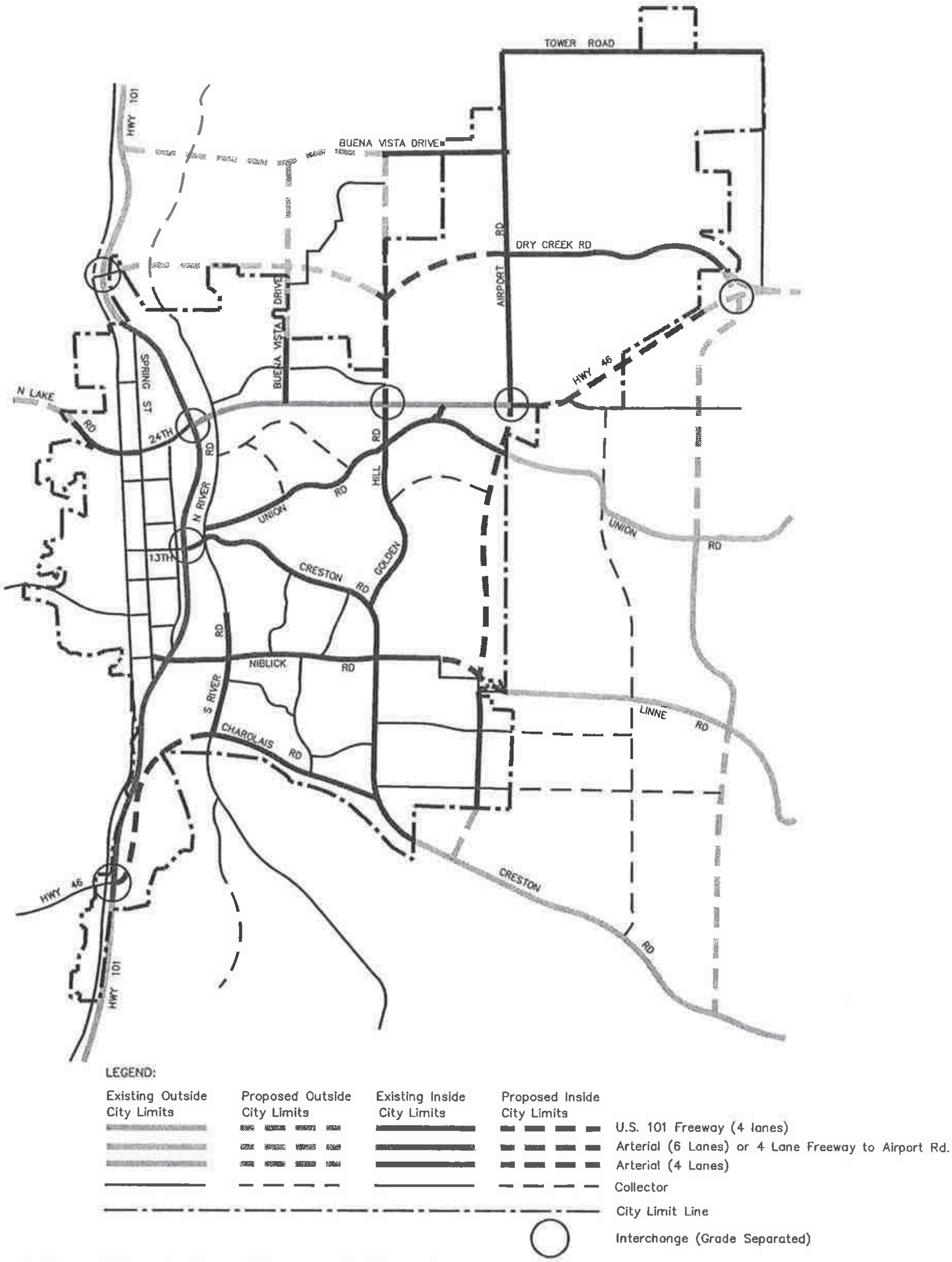
a) Worst case first

As has been past practice, the City could continue to fund major rehabilitation of its streets by performing work on its worst streets first. However, as has been noted, this is costly and while the worst streets are being repaired, other streets which are in fairly good condition could deteriorate rapidly beyond the point where it is possible to extend their design life.

b) Expenditure by categories

A second scenario that could be implemented is to apply certain percentages of its annual budget as follows:

20%	towards slurry seal or light overlay to maintain arterials and collectors at a PCI level of 80 and residential streets at 70
70%	towards major reconstruction of streets
10%	towards maintenance of the City's downtown alleys



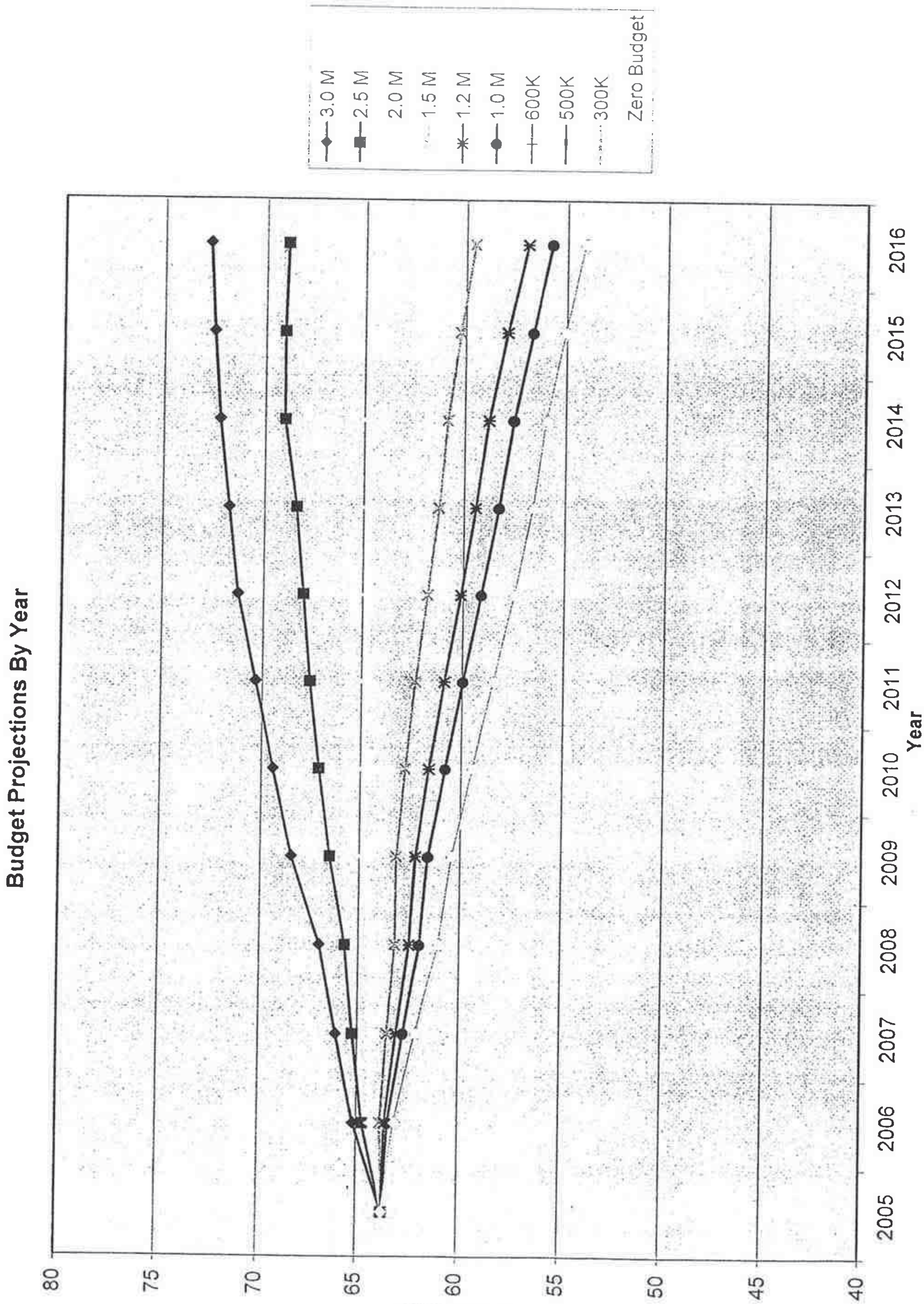
Paso Robles Circulation Element Update

Figure CE–1

Circulation Element Map

As amended by Resolution NO. 02–50 on April 2nd, 2002

File: 337EX06.DWG(12DEC03)25–5307–01


Budget Projections By Year
PCI Ranges
80
75
70
65
60
55
50
45
40
Year
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
3.0 M
2.5 M
2.0 M
1.5 M
1.2 M
1.0 M
600K
500K
300K
Zero Budget