



Why Concrete Paving Is A Better Alternative than Asphalt Paving

So you've got more money than you can spend. Does that mean a parking lot made of gold is the best choice for you?

I think we all know that gold is not even a consideration for use in payment. In this country we have two choices for our pavement needs, asphalt and concrete. But which is best for you?

The primary question in choosing between concrete and asphalt pavement is usually one of cost. While cost should be a major factor in a consumer's decision to use either concrete or asphalt pavement, there are other factors, which need to be considered. First of all, you need to know which type of product you are purchasing. Will this product suit all of your needs? Will this product look as good in five years as it does now? The smart consumer will look at all of these factors, become educated and realize that concrete paving is a better alternative than asphalt paving.

In today's market in the United States, you have two types of pavements to choose from. Both pavements are widely used and available in most markets. Let us consider some relative facts about each type of pavement, starting with asphalt:

Asphalt is a petroleum material derived from the refining of crude oil.

The cementing medium for asphalt is a petroleum derivative.

Price is dependent on world oil prices.

The production of asphalt mixtures for paving requires a great deal of petroleum---supplied energy to dry the aggregate and heat the mixture.

Asphalt is applied one layer at a time and needs several layers to reach it's optimal load capacity.

Each layer of asphalt must be compacted by the use of heavy compaction equipment.

Asphalt is flexible, which requires a better sub-grade.

Asphalt pavements normally require resurfacing and major maintenance between 7 and 10 years after placement.

Now lets take a look at some comparable facts about concrete paving:

Concrete is a mixture of rock (mined out of local quarries), sand (from local river beds and Quarries). Portland Cement, the material that binds concrete together, is produced in many parts of the country, using U.S. coal as the sole energy source. It utilizes our plentiful domestic industries. Much of the production cost is injected



into the U.S. economy-not into OPEC pockets. In addition, cement manufacturing processors also use old tires and residuals to conserve fuel and recycle waste.

Concrete paving is applied in one layer with the mix design meeting load capacity, not the number of layers.

No heavy equipment is needed to finish concrete.

Concrete will normally last 50 years with very little maintenance.

The next consideration, which needs to be taken into account, is the site-preparation.

With both types of paving, a sub-grade that is compacted, sturdy, and consistent are needed for best results. Asphalt will require a more rigid sub-grade due to its flexibility. After the sub-grade is up to standard, a layer of crushed rock should be put down and compacted. Compaction tests should be done by certified testing labs and/ or engineers, both of which should be of an outside and independent source.

Now that our site-prep is complete, we need to decide what color our pavement will be.

What do you mean what color? Concrete is light and asphalt is dark, right? Well sort of! Asphalt comes in only one color---black. Due to its main ingredients being of a petroleum base and the problems of coloring a black product, black is your only choice. Unless, you prefer a shade of grey, which with the exposure of sunlight that a parking area will receive, a shade of grey is only a matter of time. The only way to maintain the black color is to use a petroleum based sealer every few months or by adding another layer of asphalt.

On the other hand, with concrete, your choice is limited to light grey, right? Wrong!

Concrete's original color is very light grey, but, with the use of color additives, concrete can be any color possible. As shown with a concrete color chart from Southern Color in Cartersville, there are many stock colors to choose from and any custom color can be produced. All the color choices let your company obtain individually by choosing its own color scheme.

Examples---Checkers restaurants and Racetrack Gas Stations

The most important factor in the placement of pavement is the cost.



CONCRETE VS ASPHALT

LIFE CYCLE COST ANALYSIS

OF A PARKING LOT

The following example was prepared and provided courtesy of the Concrete Council of St. Louis, 1991

PARKING LOT REQUIREMENTS

	CONCRETE	ASPHALT
Size (sq. ft.)	50,000	50,000
Curb (lin. Ft)	2,000	2,000
Paving Thickness (in.)	5	3
Structural Number	0.50x5=2.50*	0.44x3=1.32
Subbase (crushed rock/in.)	---	8
Structural Number		0.14x8=1.12
Structural Number	2.50	2.44
Light Standards Required	4	6

INITIAL COSTS

	CONCRETE	ASPHALT	DIFFERENCE
			Concrete/Asphalt
50,000 Sq. ft. Paving	\$75,000	\$55,000	27%
2000 Lin. ft. Curb	10,000	18,000	-80%
Light Standards (4/6)	10,000	15,000	-50%
Site Preparation	4,000	5,000	-25%
TOTALS	\$99,000	\$93,000	6%



*Caution: Concrete pavement thickness is NOT designed using structural numbers. Structural numbers are used only as a marketing comparison of structural integrity between concrete and asphalt.

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ST. LOUIS LCC ANALYSIS

ASSUMPTIONS

(Current Costs)

	CONCRETE	ASPHALT
Paving Installed (5 on grade) (3 on 8)	\$1.50/sq. ft.	\$1.10/sq. ft.
Integral Curb (24" curb & gutter)	\$5.00/lin. ft.	\$9.00/lin. ft.
Light Standards (30 ft., 400w.)	\$2,500 each	\$2,500 each
Electricity & Maintenance / Standard	\$150/yr.	\$150/yr.
Joint Resealing	\$0.10/sq. ft.	---
Restriping	\$0.02/sq. ft.	\$0.02/sq. ft.
Sealcoat	---	\$0.08/sq. ft.
Spot Repairs	---	\$0.12/sq. ft.
2" Overlay	---	\$0.50/sq. ft.
Restripe Concrete	Every 6 years	---
Reseal Concrete Joints	Every 8 years	---
Asphalt Sealcoat	---	Every 3 years

Restripe Asphalt	---	Every 3 years
Overlay Asphalt	---	Every 8-9 years
Asphalt Spot Repairs	---	Between Overlays

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ST. LOUIS LCC ANALYSIS

CONCRETE CUMULATIVE COSTS

					ADJUSTED *	
				YEARLY	YEARLY	CUMULATIVE
YEAR	RESTRIPE	JOINTS	LIGHTS	TOTAL	TOTAL	TOTAL
0				99,000		99,000
1			600	600	600	99,600
2			600	600	583	100,183
3			600	600	567	100,750
4			600	600	550	101,300
5			600	600	535	101,835
6	1,000		600	1,600	1,386	103,221
7			600	600	505	103,726
8		5,000	600	5,600	4,580	108,306
9			600	600	477	108,783
10			600	600	463	109,247
11			600	600	450	109,697
12	1,000		600	1,600	1,167	110,864

13			600	600	425	111,289
14			600	600	413	111,702
15			600	600	401	112,103
16		5,000	600	5,600	3,640	115,744
17			600	600	379	116,123
18	1,000		600	1,600	982	117,105
19			600	600	358	117,463
20			600	600	348	117,811
21			600	600	338	118,148
22			600	600	328	118,477
23			600	600	319	118,796
24	1,000	5,000	600	6,600	3,410	122,206
25			600	600	301	122,507
26			600	600	293	122,800
27			600	600	284	123,084
28			600	600	276	123,361
29			600	600	269	123,629
30	1,000		600	1,600	696	124,325
TOTALS	\$5,000	\$15,000	\$18,000	\$137,000	\$25,325	\$124,325

*ADJUSTED YEARLY TOTAL = Yearly Total x Adjustment Factor

(See page 3 for Adjustment Factors)

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ASPHALT CUMULATIVE COSTS

							Adjusted*	
				Spot		Yearly	Yearly	Cumulative
Year	Sealcoat	Restripe	Overlay	Repair	Lights	Total	Total	Total
0						93,000		93,000
1					900	900	900	93,900
2	4,000	1,000			900	5,900	5,733	99,633
3					900	900	850	100,483
4				6,000	900	6,900	6,331	106,813
5	4,000	1,000			900	5,900	5,260	112,073
6					900	900	780	112,853
7					900	900	758	113,611
8		1,000	25,000		900	26,900	22,002	135,613
9					900	900	715	136,328
10					900	900	695	137,023
11	4,000	1,000			900	5,900	4,428	141,451
12					900	900	656	142,107
13				6,000	900	6,900	4,889	146,996
14	4,000	1,000			900	5,900	4,062	151,058
15					900	900	602	151,661
16					900	900	585	152,246
17		1,000	25,000		900	26,900	16,992	169,238

18					900	900	552	169,790
19					900	900	537	170,327
20	4,000	1,000			900	5,900	3,419	173,747
21					900	900	507	174,253
22				6,000	900	6,900	3,776	178,029
23	4,000	1,000			900	5,900	3,137	181,166
24					900	900	465	181,631
25					900	900	452	182,083
26		1,000	25,000		900	26,900	13,123	195,206
27					900	900	427	195,633
28					900	900	415	196,048
29	4,000	1,000			900	5,900	2,641	198,688
30					900	900	391	199,080
TOTALS	\$28,000	\$10,000	\$75,000	\$18,000	\$27,000	\$251,000	\$106,080	\$199,080

*ADJUSTED YEARLY TOTAL = Yearly Total x Adjustment Factor (See page 3 for Adjustment Factors) 7 – 8

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ST. LOUIS LCC ANALYSIS

CUMULATIVE COST COMPARISON

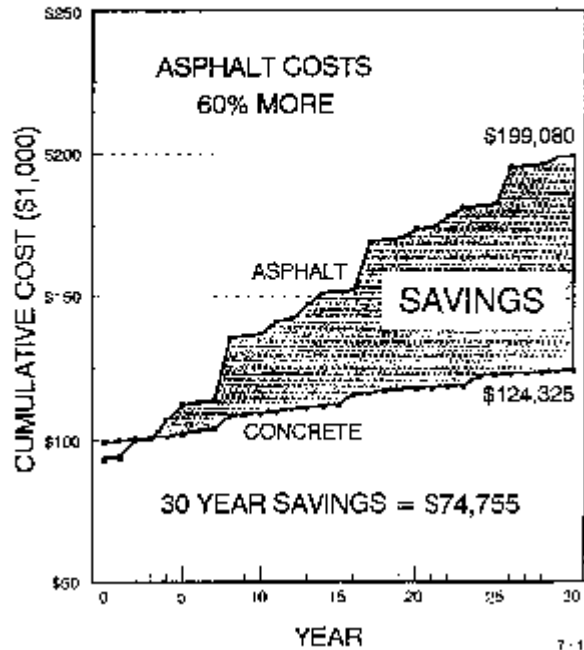
			DIFFERENCE	ASPHALT
	CONCRETE	ASPHALT	ASPHALT	PERCENT

YEAR	COST	COST	Less (more)	Less (more)
0	99,000	93,000	6,000	6%
1	99,600	93,900	5,700	6%
2	100,183	99,633	550	1%
3	100,750	100,483	267	0%
4	101,300	106,813	(5,513)	-5%
5	101,835	112,073	(10,238)	-10%
6	103,221	112,853	(9,632)	-9%
7	103,726	113,611	(9,884)	-10%
8	108,306	135,613	(27,307)	-25%
9	108,783	136,328	(27,545)	-25%
10	109,247	137,023	(27,777)	-25%
11	109,697	141,451	(31,754)	-29%
12	110,864	142,107	(31,244)	-28%
13	111,289	146,996	(35,707)	-32%
14	111,702	151,058	(39,357)	-35%
15	112,103	151,661	(39,557)	-35%
16	115,744	152,246	(36,502)	-32%
17	116,123	169,238	(53,115)	-46%
18	117,105	169,790	(52,686)	-45%
19	117,463	170,327	(52,864)	-45%
20	117,811	173,747	(55,936)	-47%
21	118,148	174,253	(56,105)	-47%
22	118,477	178,029	(59,553)	-50%

23	118,796	181,166	(62,371)	-53%
24	122,206	181,631	(59,426)	-49%
25	122,507	182,083	(59,576)	-49%
26	122,800	195,206	(72,407)	-59%
27	123,084	195,633	(72,549)	-59%
28	123,361	196,048	(72,687)	-59%
29	123,629	198,688	(75,059)	-61%
30	124,325	199,080	(74,755)	-60%
TOTALS	\$124,325	\$199,080	\$74,755	-60%

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CUMULATIVE COST COMPARISON





1992 LIFE – CYCLE COST ANALYSIS

SUNSET TERRACE ELEMENTARY SCHOOL

ROCHESTER, MINNESOTA

(Figures obtained from Rochester Intermediate School District)

CONCRETE

SERVICE LIFE	50 YEARS
Initial Costs	\$28,000
Future Costs (Expressed in Present Value)	
-Miscellaneous Maintenance (\$0.02/sy/yr)	\$3,000
50 YEAR TRUE COST	\$31,000 = \$620 / year

ASPHALT

SERVICE LIFE	25 YEARS
Initial Costs	\$13,000
Future Costs (Expressed in Present Value)	
- Seal Coat (every 3 years) @ \$3,200 / coat	\$19,200
- Overlay (year 15)	\$9,000
25 YEAR TRUE COST	\$41,200 = \$1,650 /year

SAVINGS / YEAR USING CONCRETE \$1,030

Source: "Concrete Solutions", Winter 1992, Quarterly Newsletter of the Aggregate Ready-Mix Association of Minnesota.

So we have looked at most of the costs in the placement of pavement but we are not done yet. There



are other costs we need to look at.

The latest "American Standard Practice for Roadway Lighting" now considers light

Reflected from the road surface in the overall lighting system so that the pavement, in effect, becomes part of the lighting system. According to a study by Richard Stark, formerly illuminating engineer for the Illinois Department of Transportation, and now a consulting engineer and chairman of the Transportation Research Boards Visibility Committee, using highly reflective paving materials can save money by requiring fewer light fixtures and reduced energy and maintenance costs.

Quote: "High-reflectance pavements require less illumination than low-reflectance

Surfaces," says Stark. "It's like painting the ceiling white or black in an uplighted room. The white surface will require less light to provide the same room lighting level as the black-surfaced room."

The study groups pavement types into four general categories of reflectance, ranging

from R1 (High Reflectance) to R4 (Low Reflectance). Of these, the 2 pavement types commonly used in this country are Portland Cement concrete (R1) and asphalt with dark aggregate (R3). How does this affect pavement construction? According to Stark, "The same lighting level can be met with a smaller investment in equipment and wattage, resulting in a lower initial investment and lower energy and maintenance costs when using the R-1 pavement."

We've looked at paving materials. We've looked at site-prep. We've looked at color.

We've looked at cost. But what about load distribution? What is load distribution and how will it affect our parking area? Load distribution is how the weight of the vehicle is transferred to the parking surface and its effects.

With asphalt pavement the load is directed in a straight-down fashion. This straight down

load can cause rutting of the surface, which is common on major roads and on parking areas with heavy traffic. This goes back to asphalt being a flexible pavement.

Example---I-85

Concrete pavements distribute the axle load over a wide-shallow area causing minimal wear and damage.

Example--- Highway 316



Parking areas in convenience stores.

There are additional advantages for concrete that should be mentioned. Skid resistance and nighttime light reflectance are both important to driver and pedestrian safety. Concrete's light reflectance also contributes to better-lighted areas, which are so important security in today's society. Clean utility cuts can be made in concrete pavements and the cutout section can be replaced permanently, without the settlement that often occurs in asphalt patches.

As you have seen from different studies, and from experts in the pavement field, concrete is a superior choice over the use of asphalt when used for pavement. Concrete will give you a lower total cost, a wider range of expression with the use of color, a better sense of safety, not to mention a wiser use of natural resources and less maintenance.

You have seen the facts – now it is time to make your decision and choose your pavement. Make the right choice, act now and call your local Thomas Concrete sales representative and place your order.

REFERENCES

National Ready Mixed Concrete Association (1992). Concrete Salesman's Guide to Promoting Concrete Parking Lots.

Publications: MSP 25; Silver Spring, Maryland

Riley R. (July 1986). Concrete Construction.

McIntosh B. (July 1987). Concrete International.

"American National Standard Practice for Roadway Lighting" (ANSI / IES RP-8-83). Engineering Society of North America, New York 1983 58pp.

Stark R. Illinois Dept. of Transportation Study

American Association of State Highway and Transportation Official's (AASHTO) road test conducted in the late 1950's and early 1960's.

CONCRETE



PARKING

AREAS

ADVANTAGES

- Longer Life
- Maintenance Free
- More Economical
- Esthetic Quality
- Non-stick Surface
- Safer
- Resistant to gasoline and oil
- Clean appearance
- All-weather surface
- Better night visibility
- Rut-free surface
- More Prestigious

GEORGIA CONCRETE AND PRODUCTS ASSOCIATION, INC.

SUITE 110 / 100 CRESCENT CENTER PARKWAY / TUCKER, GEORGIA 30084 (404) 621-9324

...concrete is today's best buy in pavements

GENERAL REQUIREMENTS

CONCRETE MIX

Minimum compressive strength-

3,500 psi @ 28 days

Maximum slump-4"

Air entrainment-5% +- 1%

Early consultation with the ready mixed supplier will help in selecting a mix design that is economical as well as appropriate for the area in which the pavement will be used.



CONSTRUCTION

While no special sub base is required, it is important that the soil type, moisture content, and density of the sub grade be uniform. Concrete shall be placed, struck off, consolidated, and finished to plan grade. Cure the concrete with a uniform coverage of curing compound (as per mfrg. recommendations) or other approved curing material. Unless special concrete mixes are used, automobile traffic should be kept off the pavement for three days and truck traffic for about seven days.

JOINTING

Unless shown on the project drawings, a jointing plan shall be prepared by the contractor and approved before paving begins. Longitudinal and transverse joint spacings should be at regular intervals of 10'-15'. All longitudinal and transverse contraction joints should have a depth approximately equal to 1/4 of the pavement thickness. Expansion (isolation) joints must be full depth, and should only be used to isolate fixed objects abutting or within the paved area. When approved, the contractor shall be permitted to make minor adjustments in joint location to make them coincide with drainage or other structures.

For heavy loads and detailed design information, refer to reference material listed on page four (4).

THICKNESS DESIGN

There are several different but well recommended design procedures for both flexible and rigid pavements, and it is difficult to make a comparison that will be acceptable to everyone. However, the \$27 million National Road Test made during the 1960's and the designs developed by the American Association of State Highway Officials (AASHTO) from these road tests offer an excellent basis for comparison. The design information has been published in the AASHTO "Interim Guide for Design of Pavement Structures".

The AASHTO procedure assigns a layer coefficient to each paving material based on its performance in the road test. The Georgia Department of Transportation has assigned the following layer coefficients to the local flexible paving materials below.

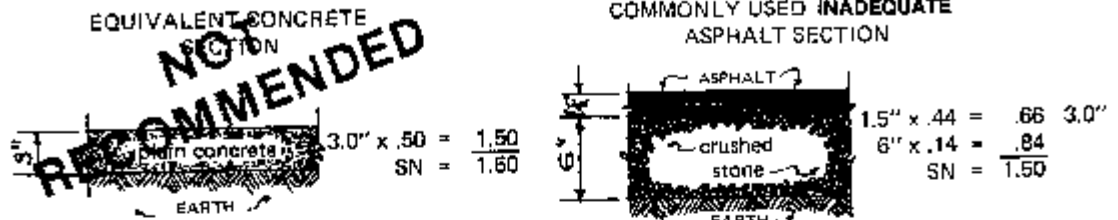
To obtain the equivalent thickness of concrete and asphalt, the designer can use these coefficients to determine the structural strength, called the structural number (SN). SN equals the sum of the various layer thicknesses multiplied by the layer coefficient as shown below.

	Layer
Paving Material in Georgia	Coeff.
Asphaltic Concrete surfacing and binder	.44
Asphaltic Concrete Base	.30

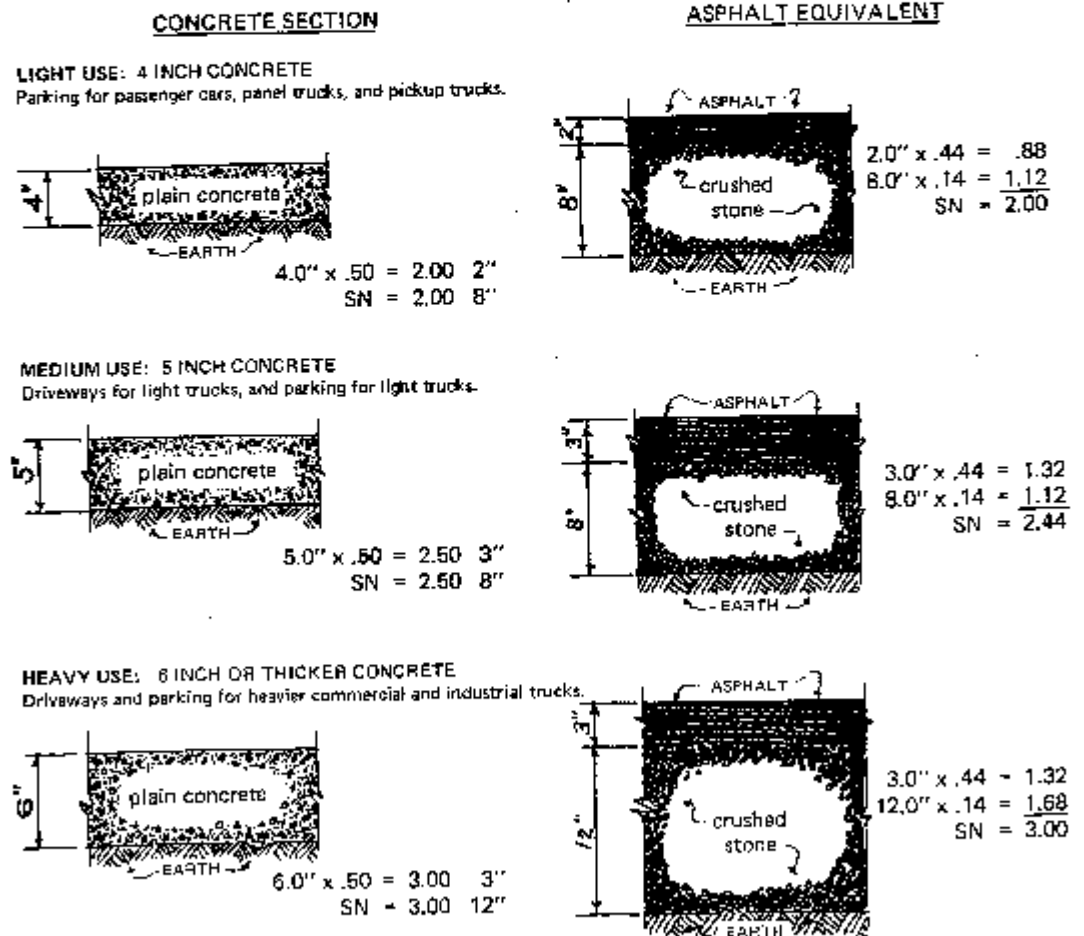
Crushed Stone	.14
Sand-Clay	.10
Soil-Cement	.20
Sand Asphalt	.18
Limerock	.15
Concrete*	.50
Example Problem:	
Determine SN for 1"asphalt on 6" soil-cement base and concrete equivalent	
Asphalt	$A^* \times D^{**} = .44 \times 1.0" = .44$
Soil-Cement	$A^*D = .20 \times 6.0" = 1.20$
	SN= 1.64
Concrete equivalent	$.50 \times 3.28" = 1.64$
A* = pavement layer coefficient	
D** = thickness of pavement layer	

*Based on the AASHTO National Road Test results and other performance records, it has been conservatively estimated that the layer coefficient of concrete is .50.

Do you know what is equal?



RECOMMENDED CONCRETE PAVEMENT SECTIONS AND THEIR ASPHALT EQUIVALENTS



When concrete and asphalt pavements are compared on an equal structural strength basis, current-day initial costs are very close. In total costs, due to concrete's longer service life, concrete pavements are always the best selection.

TWENTY-YEAR PAVEMENT COST ANALYSIS

CONCRETE PAVEMENT

CONCRETE MATERIAL COST PER SQ.YD.	= \$ (A)
FORMING, PLACING & FINISHING cost per sq. yd.	= \$ (B)
CURING cost per sq. yd.	= \$ (C)
CONCRETE PAVEMENT CONSTRUCTION cost per sq. yd.=(A+B+C)	= \$ (D)
INTEGRAL CURB CONSTRUCTION cost per sq. yd. -----x \$ -----/-----sq. yds. of pavement Lineal ft. Cost/lin.ft.	= \$ (E)
TOTAL CONSTRUCTION cost per sq. yd.=(D+E)	= \$ (F)
MAINTENANCE cost per sq. yd.	= \$ (G)
TOTAL COST per sq. yd. for 20 years service=(F+G)	= \$

ASPHALT PAVEMENT

PLANT MIX ASPHALT (Material, Equipment, & Labor) cost per sq. yd.	= \$ (A)
BASE (Material, Equipment, & Labor) cost per sq. yd.	= \$ (B)
SUBGRADE STABILIZATION (Material, Equip. & Labor) cost per sq. yd.	= \$ (C)
ASPHALT PAVEMENT CONSTRUCTION cost per sq. yd. = (A+B+C)	= \$ (D)
CURB & GUTTER CONSTRUCTION cost per sq. yd. -----x \$ -----/-----sq. yd. of pavement Lineal ft. Cost/lin. ft.	= \$ (E)
TOTAL CONSTRUCTION cost per sq. yd.= (D+E)	= \$ (F)
RESURFACING 3 TIMES IN 20 YEARS cost (every 7	= \$ (G)



yrs.) 3x \$_____ cost per sq. yd.	
TOTAL COST FOR 20 YEARS SERVICE= (F+G)	= \$

REFERENCES

1. Suggested Specification for Concrete Parking Area, PCA, IS213.01B
2. Concrete Streets, PCA, PL086.02P
3. Municipal Concrete Pavement Manual, American Concrete Pavement Assn.
4. Guide for Design and Construction of Concrete Parking Lots, ACI 330R-87

The publication is intended for the use of professional personnel competent to evaluate the significance and limitations of its contents and who will accept responsibility for the application of the material it contains.