

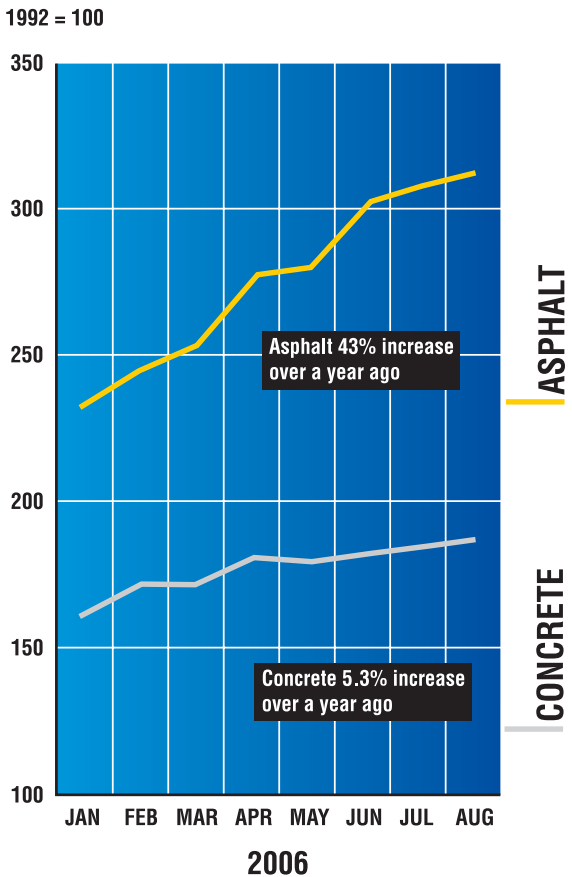
Equivalent Designs: Concrete vs. Asphalt

This summary publication outlines recommended designs for the three most common road classifications, including life cycle cost analysis.

One key component of comparing pavements is developing equivalent designs. In this analysis the equivalent designs were developed using design procedures from each pavement industry. The concrete thickness was based on ACPA's new state-of-art StreetPave design software and the asphalt thickness was determined using the Asphalt Institute's procedure. By using both industry-recognized procedures, local agencies can make informed pavement decisions based solely on the estimated total load carry capacity for a given design period.

StreetPave incorporates a life-cycle cost module so designers can evaluate the total costs passed on to the taxpayers for 30 to 40 years or longer.

Asphalt paving prices are related to oil prices. The latest economic indicators from Engineering News Record show asphalt paving prices are continuing to increase during this extended period of oil price inflation. Ready-Mix concrete has increased less than 6% over the past year and has leveled off in recent months. Below are graphic representations of both concrete and asphalt prices over the past twelve months, reported in ENR's August 2006 issue.



Source: ENR Construction Economics Dept.

The examples illustrated in this chart were for a Mean Average Annual Temperature (MAAT) of 45 degrees Fahrenheit. Figure 1, shows the various MAAT regions for determining asphalt pavement thicknesses. Concrete pavements are not sensitive to environmental temperatures and thicknesses do not increase with rising mean average ambient temperatures.

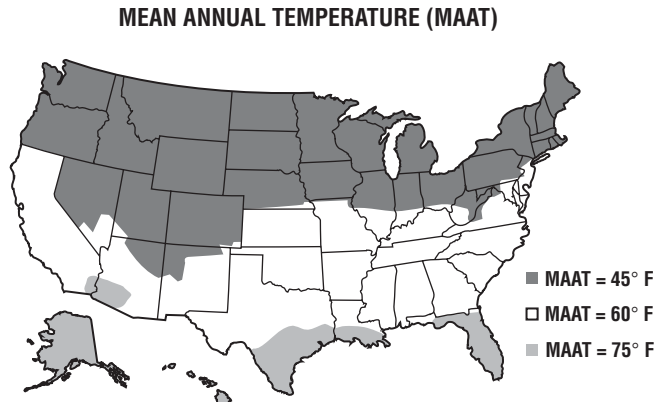
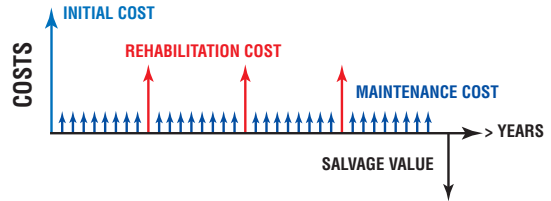


Figure 1: Increases in MAAT from 45 to 60 or 60 to 75 requires additional asphalt thickness.

20 CITY AVERAGE				
ITEM	UNIT	PRICE MONTH	% CHG. YEAR	% CHG.
ASPHALT PAVING				
PG 58	Ton	277.00	+0.6	+43.1
Cutback, MC800	Ton	299.09	+0.3	+12.0
Emulsion, RAPID SET	Ton	257.32	+0.2	+15.8
SLOW SET	Ton	251.02	+0.2	+11.7
PORTLAND CEMENT				
Type one	Ton	92.92	+0.3	+5.5
MASONRY CEMENT				
70-lb. bag	Bag	6.38	+1.8	+11.0
GRAVEL				
1-1/2" down to 3/4"	Ton	10.72	0.0	+4.1
3/4" down to 3/8"	Ton	10.40	0.0	+0.3
CRUSHED STONE				
Base course	Ton	8.23	+0.8	-0.2
Concrete course	Ton	8.69	+0.8	+2.3
Asphalt course	Ton	9.09	0.0	+0.6
SAND				
Concrete	Ton	7.98	0.0	+3.9
Masonry	Ton	8.82	+0.2	+5.1
CONCRETE READY-MIX				
3,000 psi	cy	84.51	+0.2	+4.8
4,000 psi	cy	88.70	+0.1	+5.3
5,000 psi	cy	93.22	+0.2	+5.6
STD. MODULAR BRICK	M	348.91	+0.7	+2.8
CONCRETE BLOCK				
Normal-weight 8" x 8" x 16"	C	127.50	+0.9	+4.4
Lightweight: 8" x 8" x 16"	C	150.80	+0.8	+13.4
12" x 8" x 16"	C	173.04	+1.7	+3.2
MASONS LIME	Ton	198.22	0.0	+3.2

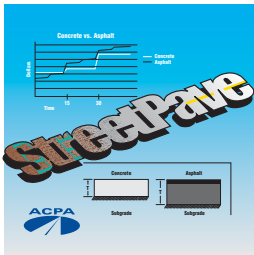
Table 1: Data reported in ENR August 2006 Issue

LIFE-CYCLE COST ANALYSIS



The life-cycle cost analysis (LCCA) provided with each road classification shows the initial, rehabilitation, and maintenance costs for the equivalent concrete and asphalt sections. In these examples, concrete strength was 4000 psi and the design did not include integral curbs. If either the concrete strength were increased or an integral curb and gutter were used as design options, the initial concrete cost would be reduced. The LCCA example is based on:

1. ENR August 2006 Issue 20 City Average prices
2. Initial Costs 1-mile 12' wide pavement with curbs place separately
3. Design Period 40 years
4. If integral curbs are placement with concrete pavement an additional \$45,000 can be saved on initial costs



Concrete Properties

1. Flexural Strength 600 psi
2. Reliability 80%
3. k-value 100
4. Design Life 30 years

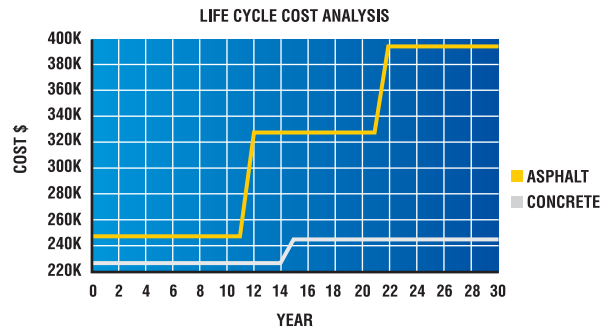
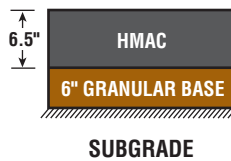
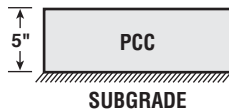


Asphalt Properties

1. MAAT 45 degrees F
2. Modulus of Resilience (subgrade support) 3000 psi
3. Design Life 30 years

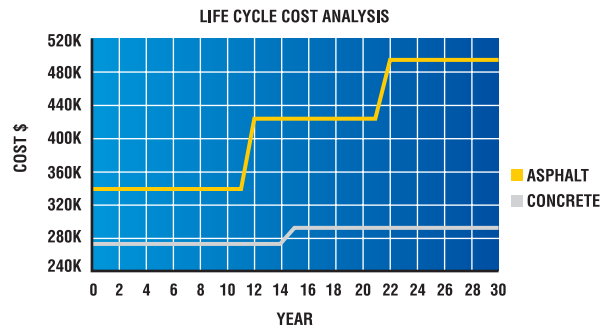
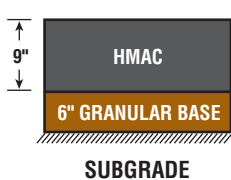
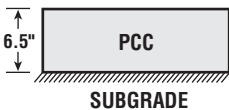
RESIDENTIAL

(ADTT 3 trucks/day, 11,500 ESALs, 2-lane with curbs) initial costs



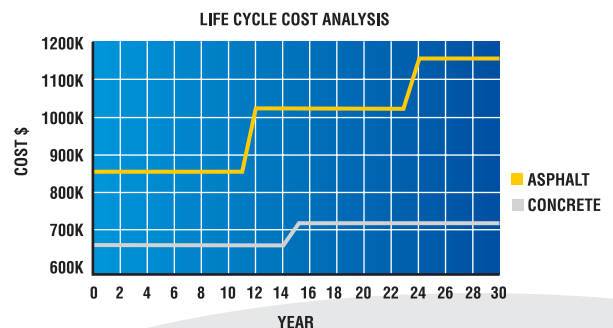
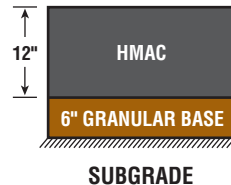
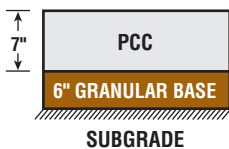
COLLECTOR

(ADTT 100 trucks/day, 405,000 ESALs, 2-lane with curbs)



MINOR ARTERIAL

(ADTT 500 trucks/day, 3,500,000 ESALs, 4-lane with curbs)



5420 Old Orchard Road, Suite A100
Skokie, Illinois 60077-1059

Phone: 847.966.2272
Fax: 847.966.9970
Web: www.pavement.com

500 New Jersey Ave., NW, 7th Floor
Washington, DC 20001

Phone: 202.638-ACPA
Fax: 202.638.2288
Web: www.pavement.com