Selling Concrete Parking Lots Workshop

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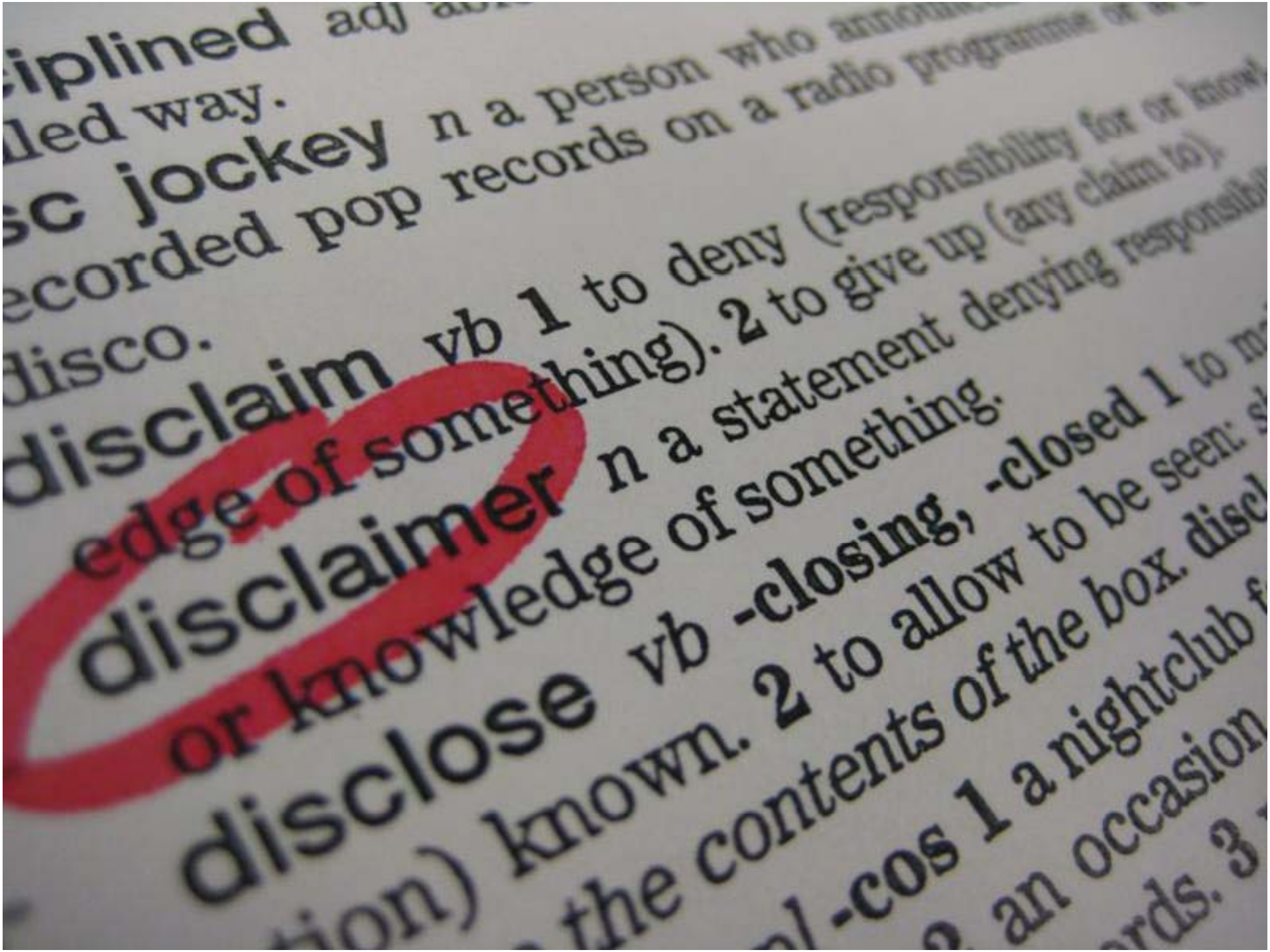
disclaim vb 1 to deny (responsibility for or knowledge of something). 2 to give up (any claim to).
disclaimer n a statement denying responsibility for or knowledge of something.
disclose vb -closing, -closed 1 to make known. 2 to allow to be seen: to disclose the contents of the box.
disco.
jockey n a person who announces and plays recorded pop records on a radio programme or in a disco.
-cos 1 a nightclub
an occasion

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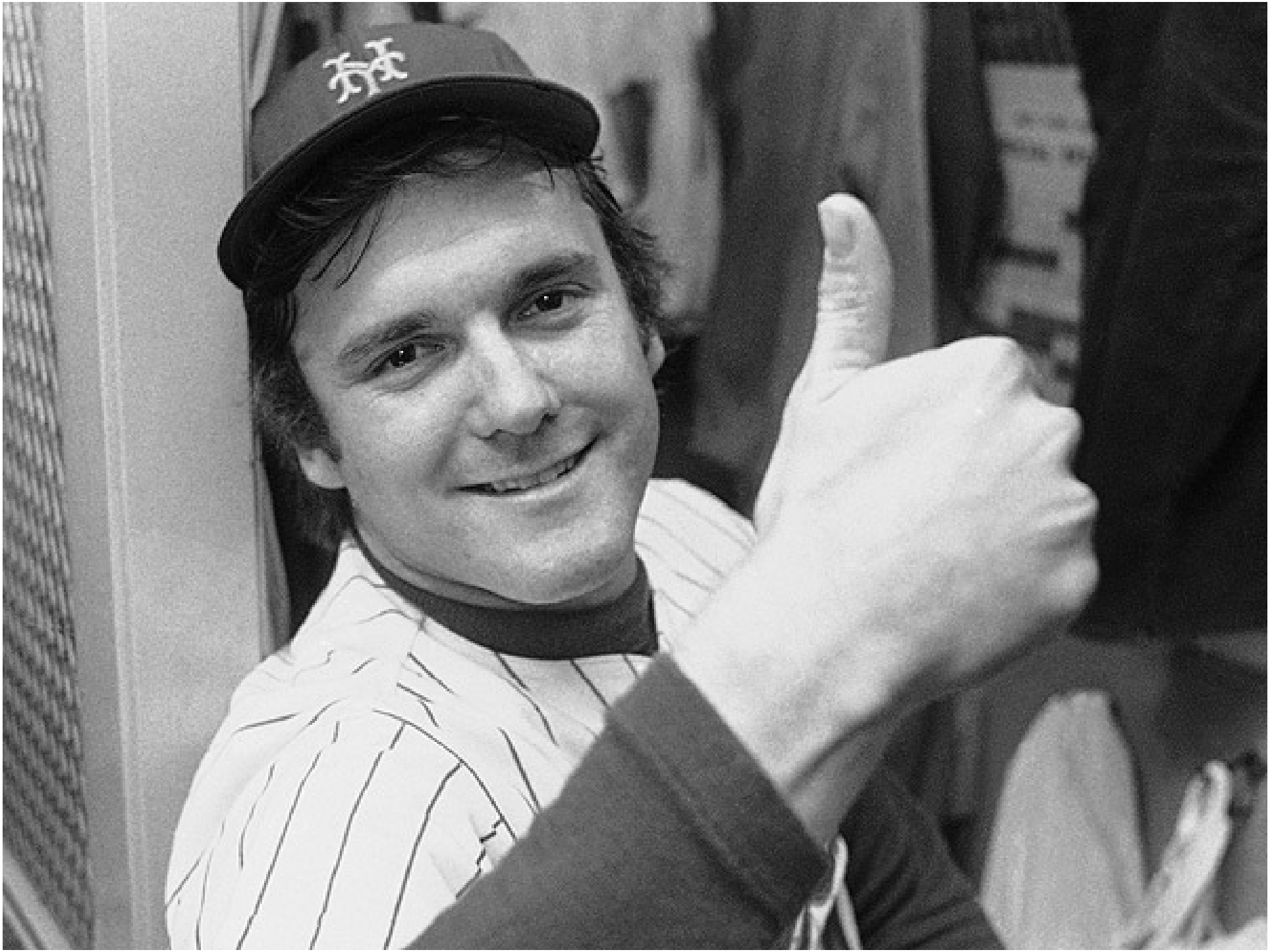
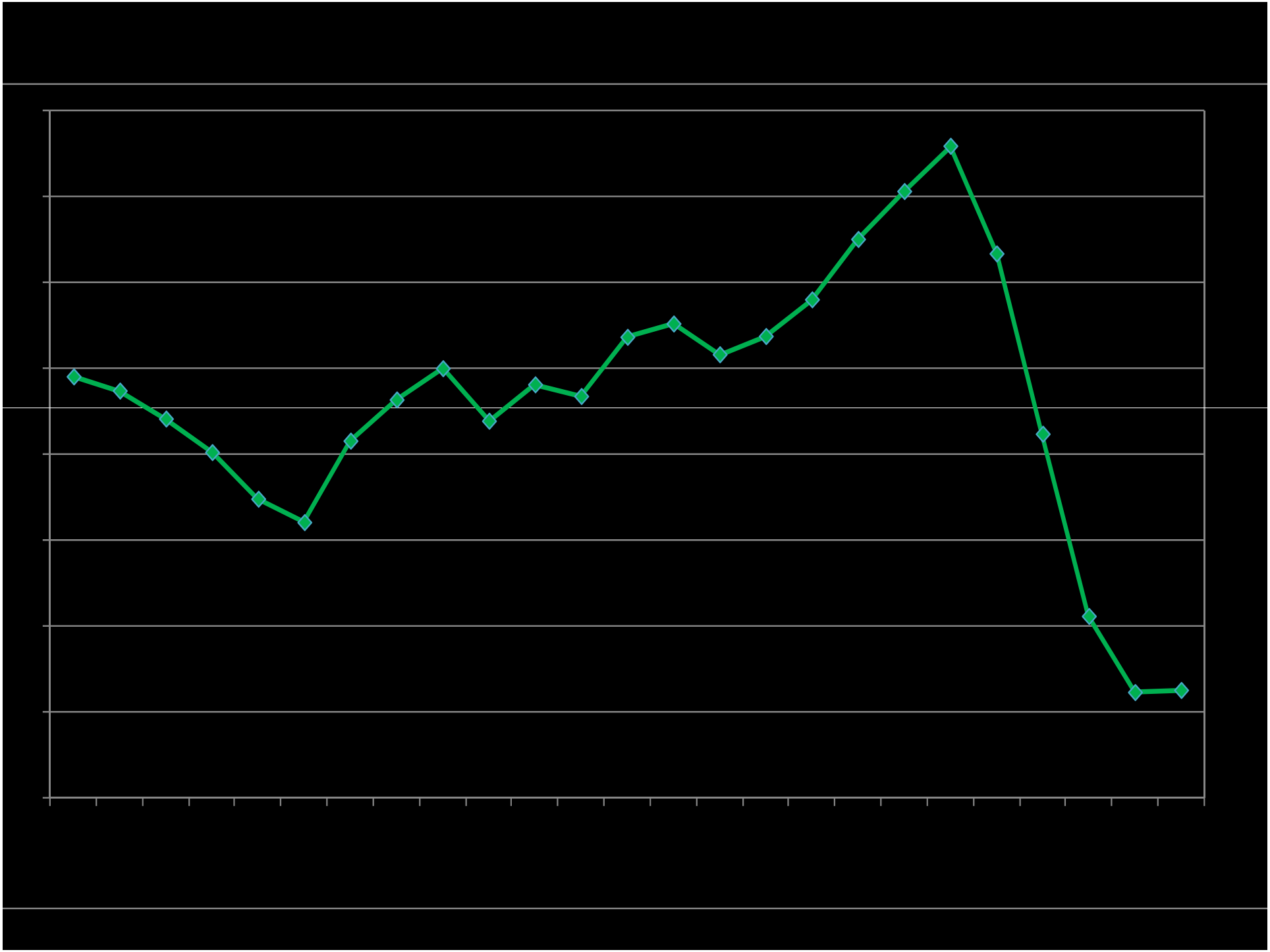
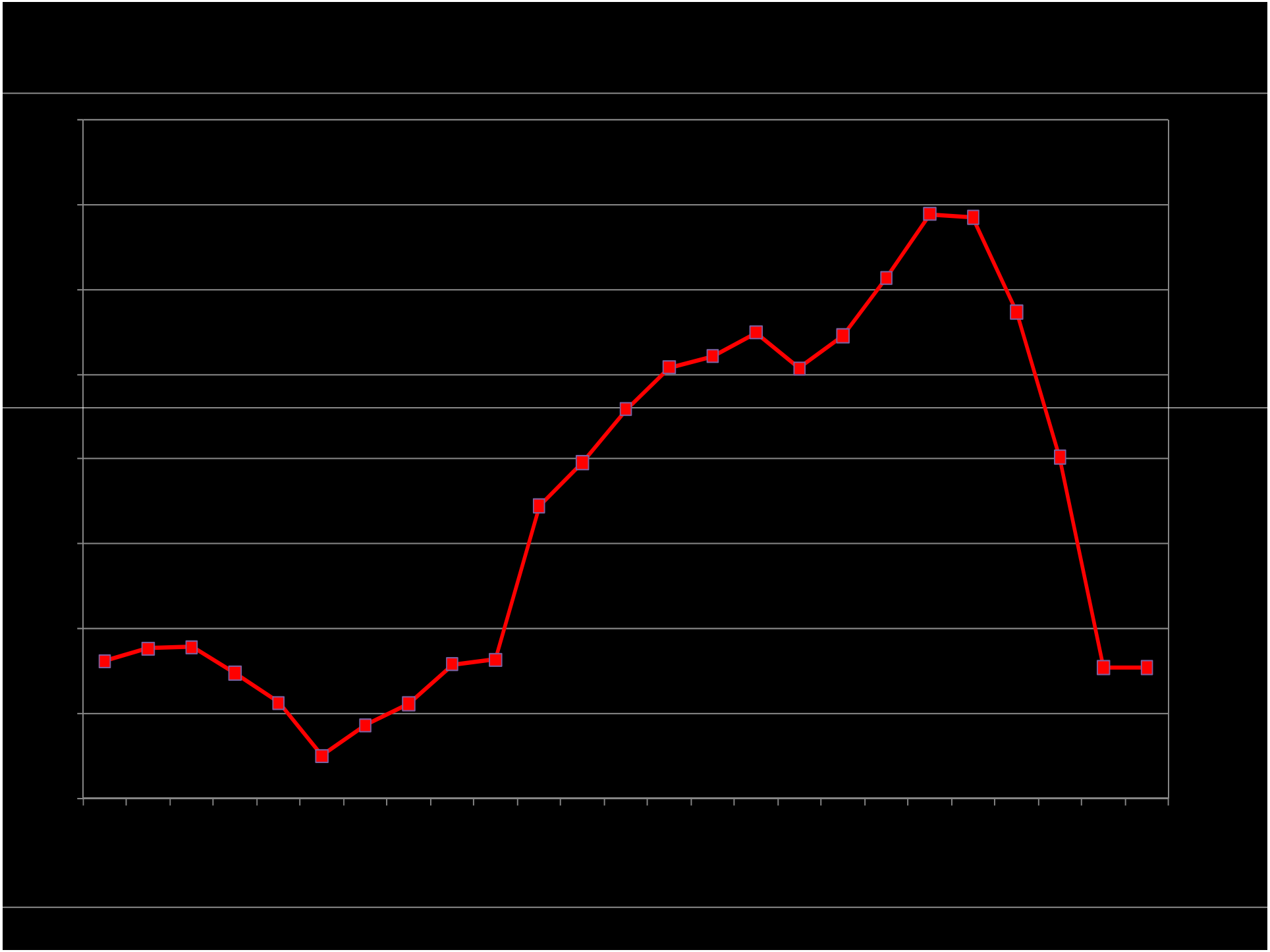
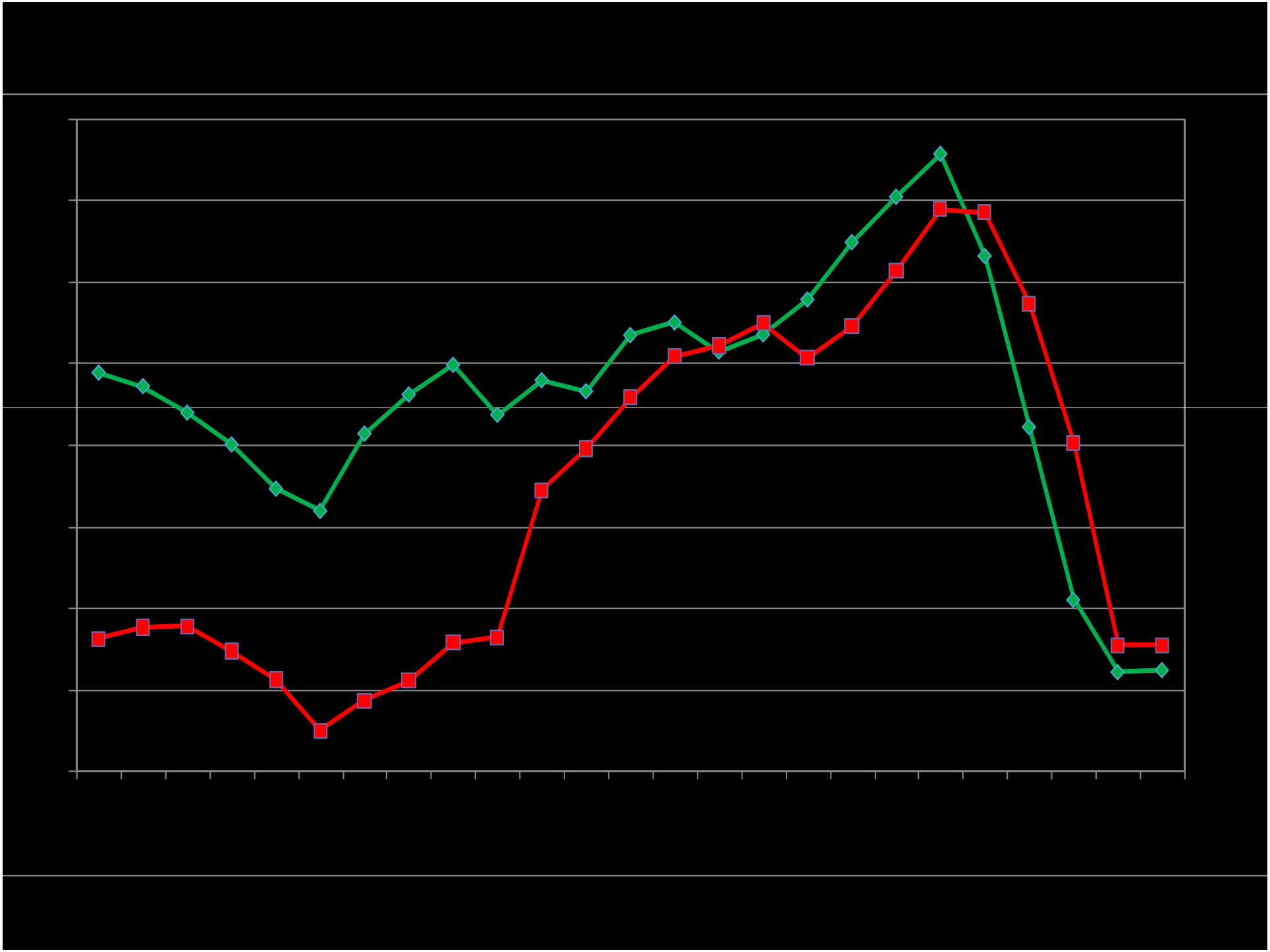
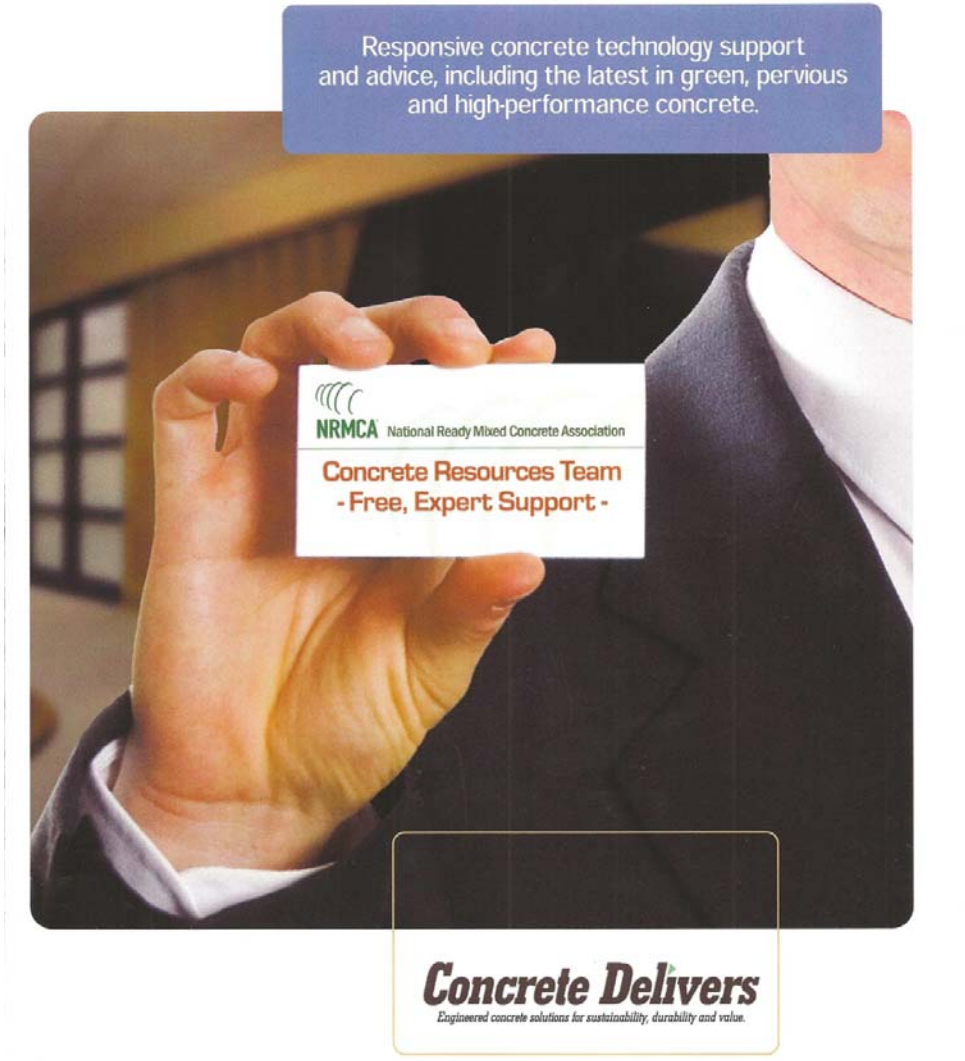








NRMCA National Accounts Promotion Program



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CHECKLIST
Wal-Mart
Walgreen's
Lowe's

Primary National Accounts

Owners:

- Aldi Foods
- CVS
- Dollar General
- Family Dollar
- Fed Ex
- GSA
- Home Depot
- Kroger
- Lowes
- McDonalds
- Safeway
- Target
- U.S. Dept. of Defense
- Walgreens
- Wal-Mart

Barriers to Promotion Efforts

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No Design Criteria

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Unwilling to Share Information

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Contractually Bound

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No Clear Directive

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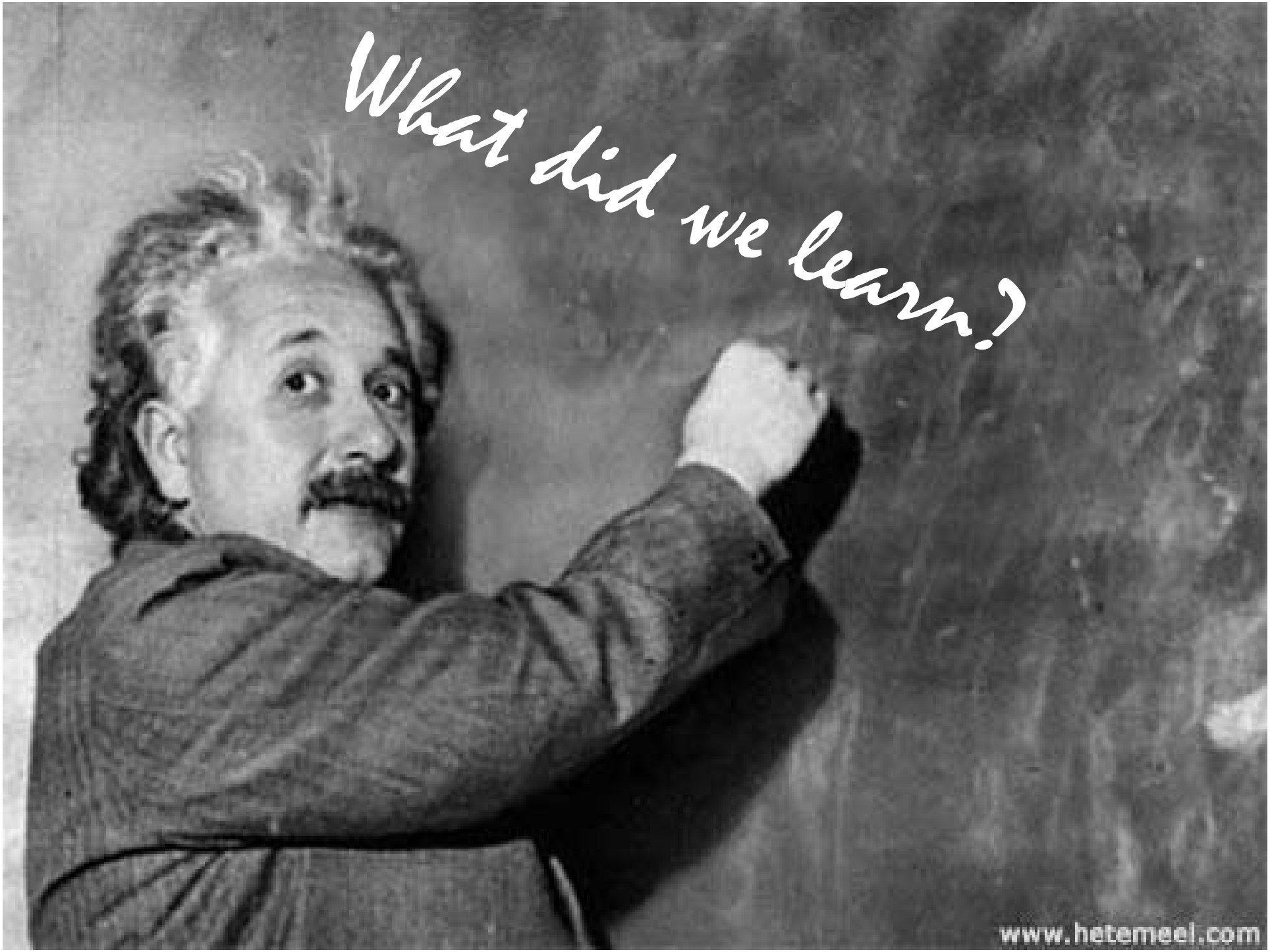
What did we learn?
www.hetemeel.com

N/A's with local connection

Identified Local Engineers doing N/A work

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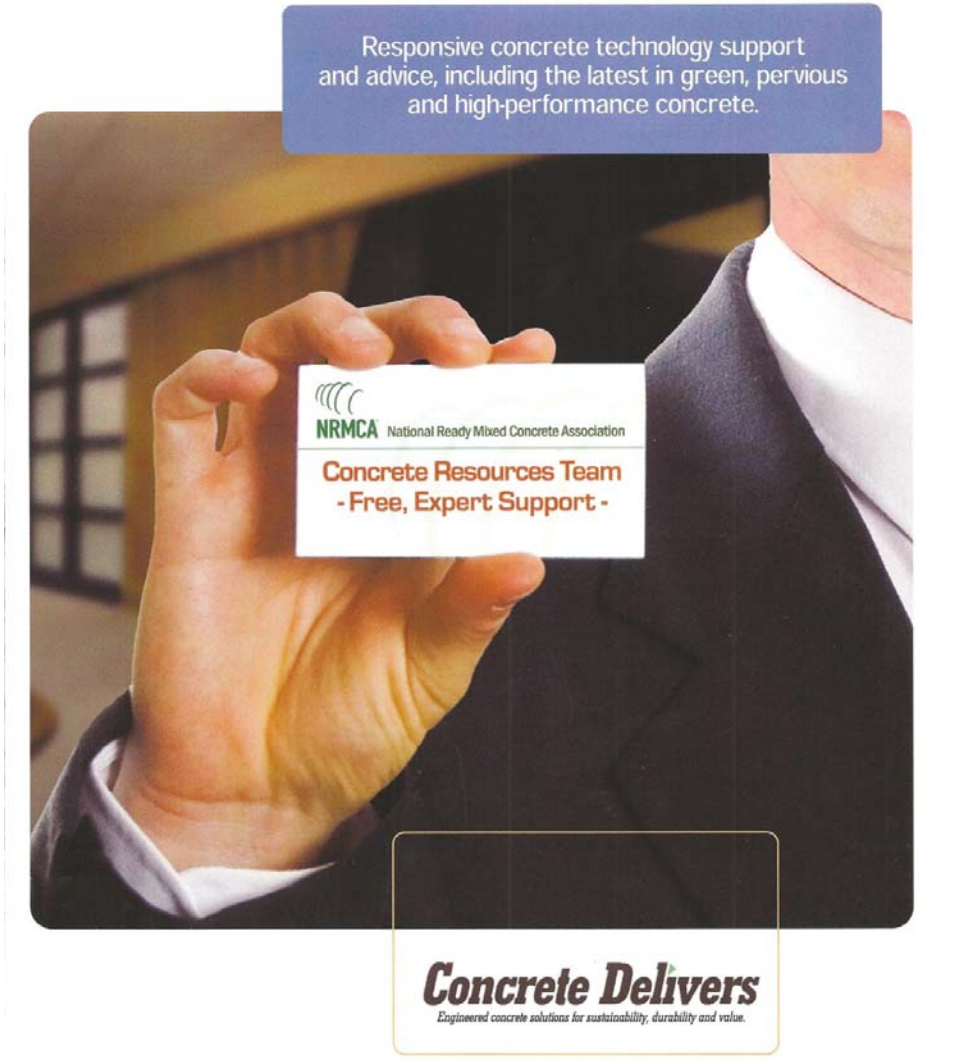
Other significant projects with high potential for concrete

NRMCA National Paving Program



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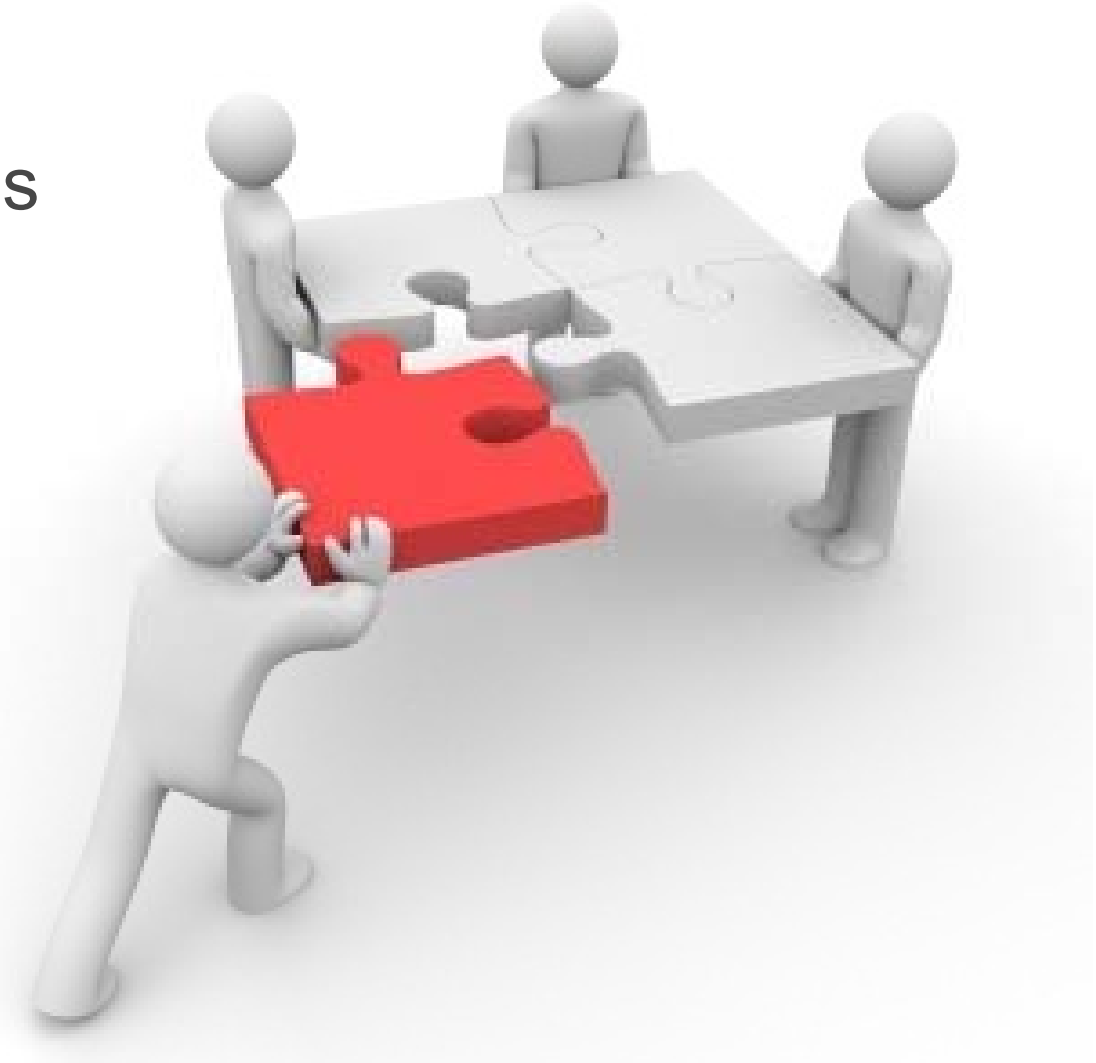
Develop/Nurture Relationships

- Owners
- Design Community
- Developers
- General Contractors

Importance of Collaboration

- NRMCA/State Association
- RM Producers
- Cement/Admix Reps
- Other Suppliers




Importance of the
Concrete Contractor

ASCC/NRMCA Joint Paving Committee

American Society of Concrete Contractors

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National Accounts

National Accounts

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Key Local Target Markets

- Schools/Universities
- Churches
- Healthcare
- Auto Dealerships
- Banks

- Locally Owned Businesses

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- Budget Constraints
- Sustainability
- Maintenance
- Safety/Security
- Stormwater Regulations

Schools/Universities


Churches

Health Care


EMERGENCY
Emergency
Patient Parking
Main Entrance
Physician
Parking


PAY HERE

Auto Dealerships


TOYOTA


TOYOTA
TANSKY SAWMILL

Banks


mcb
ATM
HELP

Know Your Customer

- Decision makers
  - Vote yes or no
- Influencers
  - Can convince decision makers
  - May be stakeholders
  - Could become part of your promotion team

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Who are the decision-makers?

- Either the guy that pays the bills or…
- the guy that can stop the project…
- Decision-makers change over the life of the project…
- It might start as the building owner… then the architect… then the finance company…and on and on…

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The Two Needs

Your buyer needs to solve a problem.

You need to sell a product or service for a profit.

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Filling the Needs

Features

- Important to us
- Answers “the what?”
- Descriptive
- Product or service related

As a Industry we are pretty good at this

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Filling the Needs

- Benefits
  - Important to customer
  - Answers “the how?”
  - Results of feature
  - Best when quantified in $

As an Industry we don’t make this link

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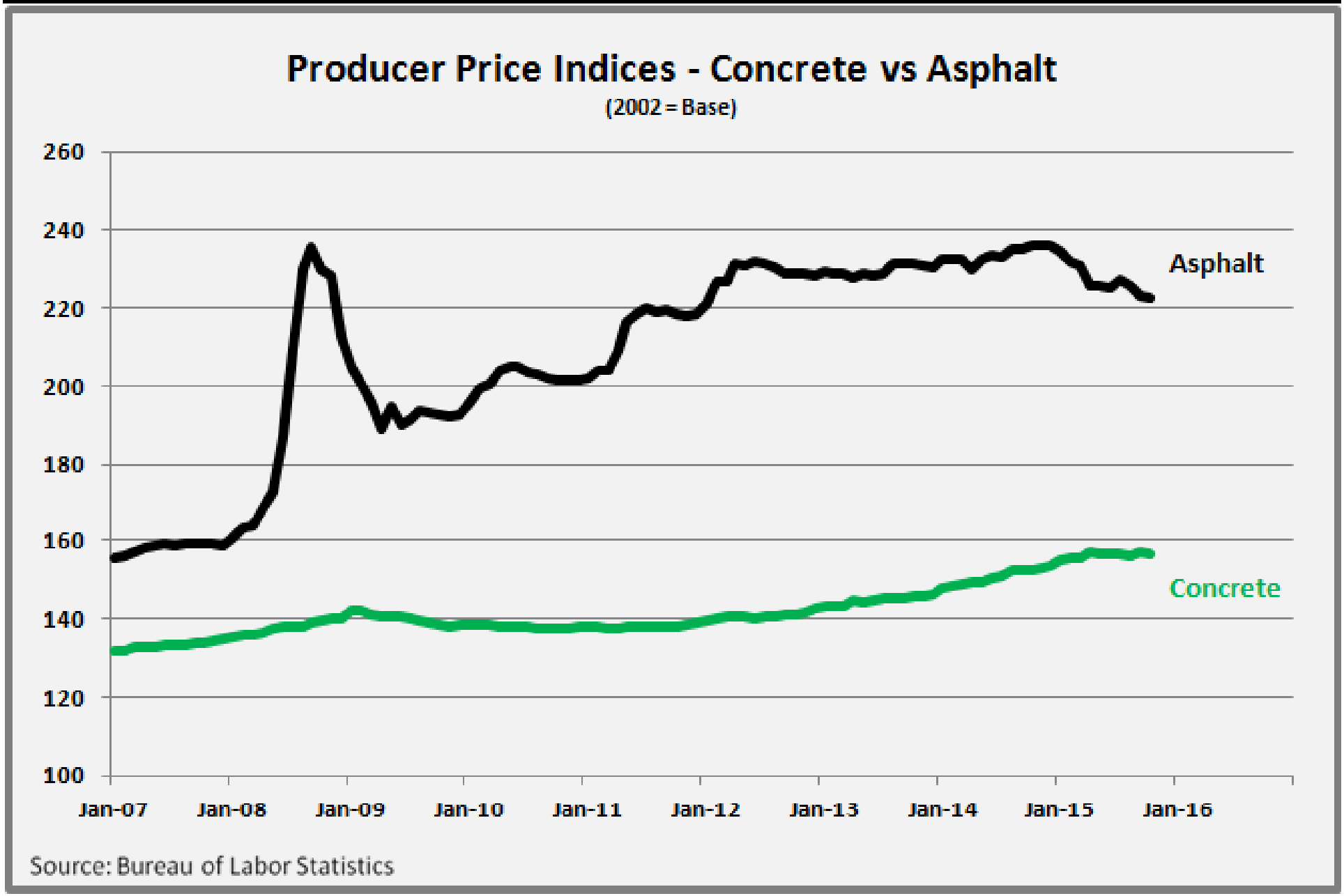
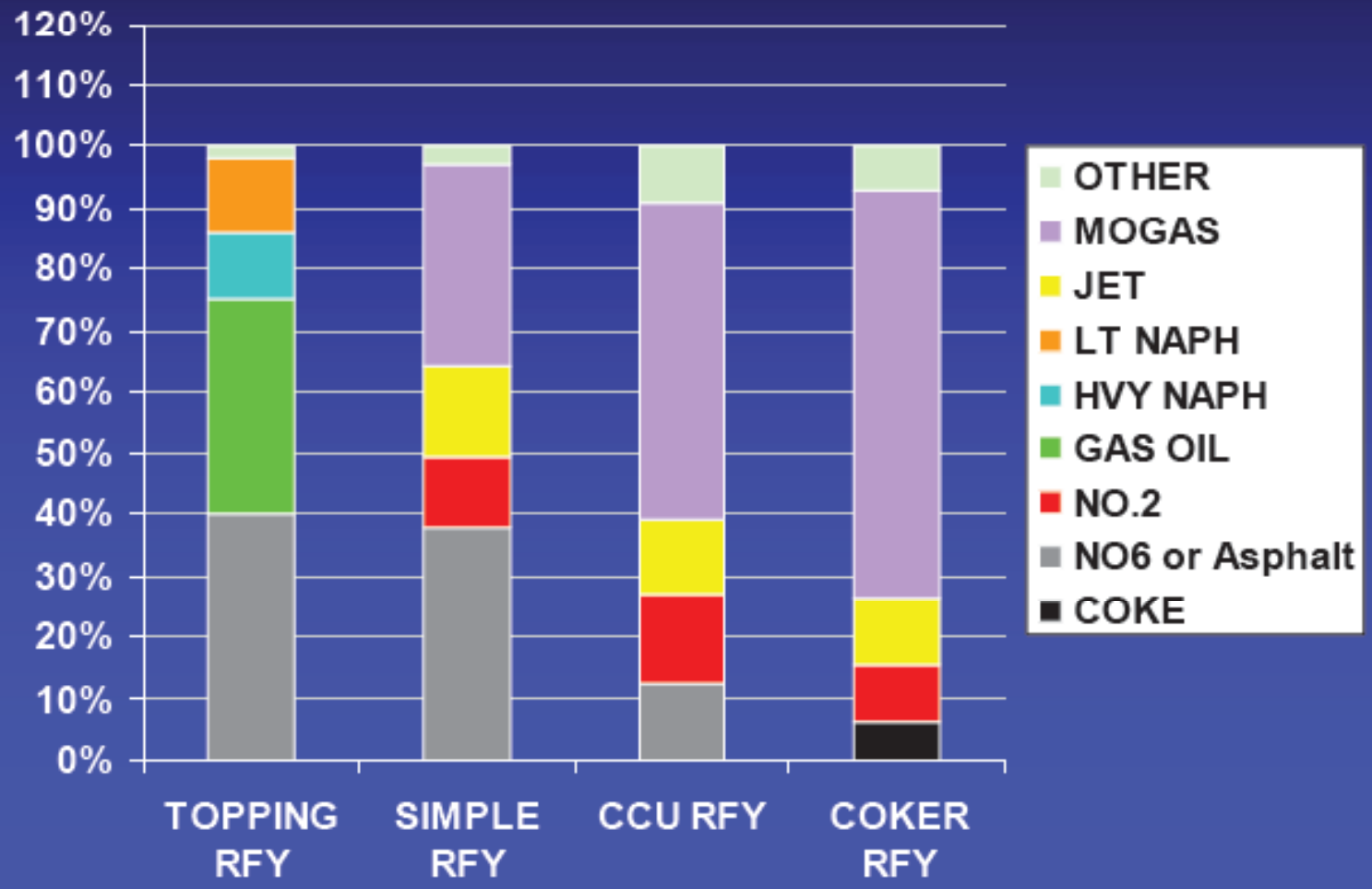

Producer Price Indices - Concrete vs Asphalt
(2002 = Base)
260
240
220
200
180
160
140
120
100
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Asphalt
Concrete
Source: Bureau of Labor Statistics

Catalytic Cracking Units & Coker Refineries

- Processing units convert Residual Oil (asphalt) into hydrocarbon gases (mogas) and light & heavy oils

Refinery Yield (% of Crude Intake)



*Slide from “Asphalt Supply in a Volatile Oil World” - ConocoPhillips Co.

Worldwide Coker Additions

- Refinery Coker Additions – 1,570M Barrels
- Crude Upgraders - 1,214M
- Total Resid Destruction - 2,784M*

*Reduces world asphalt and #6 oil supply

Source – Argus Asphalt Report

*Slide from “Asphalt Supply in a Volatile Oil World” - ConocoPhillips Co.


cost vs value

"Value is the emotional combination of price, quality, and service."

D. Forbes Ley, author
The Best Seller

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How do I convince them to switch to concrete?

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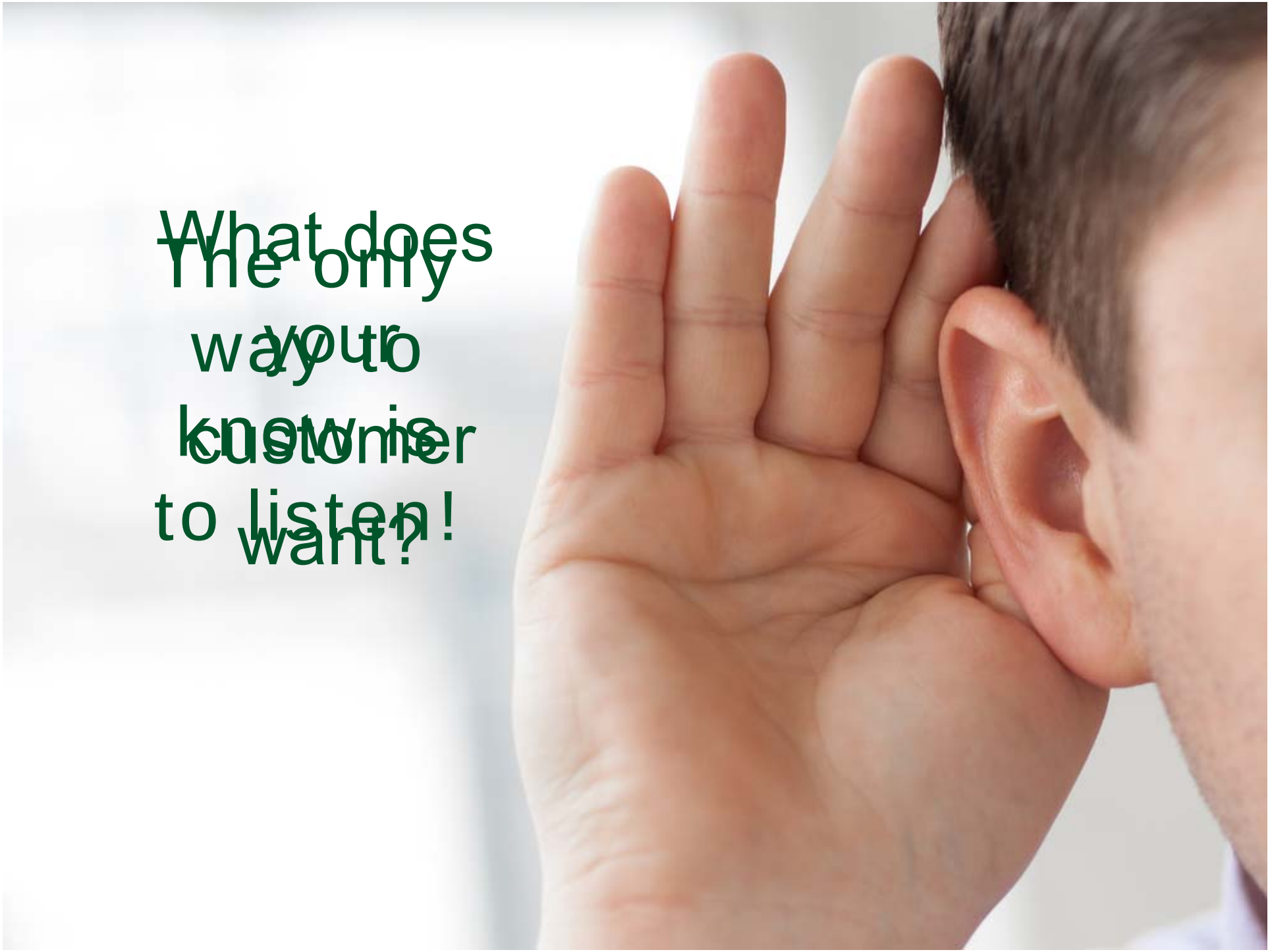
What does your customer want?
The only way to know is to listen!

Listen to customers' wants and decipher their needs

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“If I had asked people what they wanted, they would have said ‘faster horses’.”

Listen and learn what they need

Teach customers to want what they need

Muncy Homes – Muncy, PA

Owner looking to upgrade gravel lot
Spec'd asphalt paving
Team identified "hot buttons"
- Low maintenance
- Life-cycle cost

Taught owner to want what he needs
Owner chose to pay $500,000 over asphalt bid
Initial proposal
- 550,000 ft^2 =12,000 yd^3
- Owner added 200,000 ft^2

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Economic Reasons

- Lower life cycle costs / less maintenance
- Reduced lighting cost
- Reduced light bulb replacement cost
- Reduced energy for cooling
- Concrete has proven to be less prone to slips and falls which means reduced liability to the owner

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Design Reasons

- Concrete can be integrally colored or stained
- Concrete can be stamped or textured to replicate most any material
- It is the “cool pavement” and a hands-down winner relative to sustainability

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Construction Reasons

- Concrete parking lots can be placed early in the project schedule and provide a work and storage surface that can speed projects when weather conditions are bad
- Laser screeds and large paving machines can install concrete parking areas much more quickly than most people assume

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Concrete Parking Lot Design with ACI 330

Source of Much of What We Know About Pavement Design

AASHO Road Test

Late 50's and early 60's

Ottawa, Illinois

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ESALS - *Equivalent Single Axle Loads*

- 18,000 lb single axle with dual tires
- Different Axle Loads and Configurations converted into equivalent 18 kip single axle loads

Axle Type (lbs)	Axle Load		Load Equivalency Factor (from AASHTO, 1993)	
	(kN)	(lbs)	Flexible	Rigid
Single axle	8.9	2,000	0.0003	0.0002
	44.5	10,000	0.118	0.082
	62.3	14,000	0.399	0.341
	80.0	18,000	1.000	1.000
	89.0	20,000	1.4	1.57
	133.4	30,000	7.9	8.28
Tandem axle	8.9	2,000	0.0001	0.0001
	44.5	10,000	0.011	0.013
	62.3	14,000	0.042	0.048
	80.0	18,000	0.109	0.133
	89.0	20,000	0.162	0.206
	133.4	30,000	0.703	1.14
	151.2	34,000	1.11	1.92
	177.9	40,000	2.06	3.74
	222.4	50,000	5.03	9.07

One 18,000 lbs. single axle does
over 3,000 times more damage
to a pavement than an 2,000 lbs. single axle

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PCA thickness design method

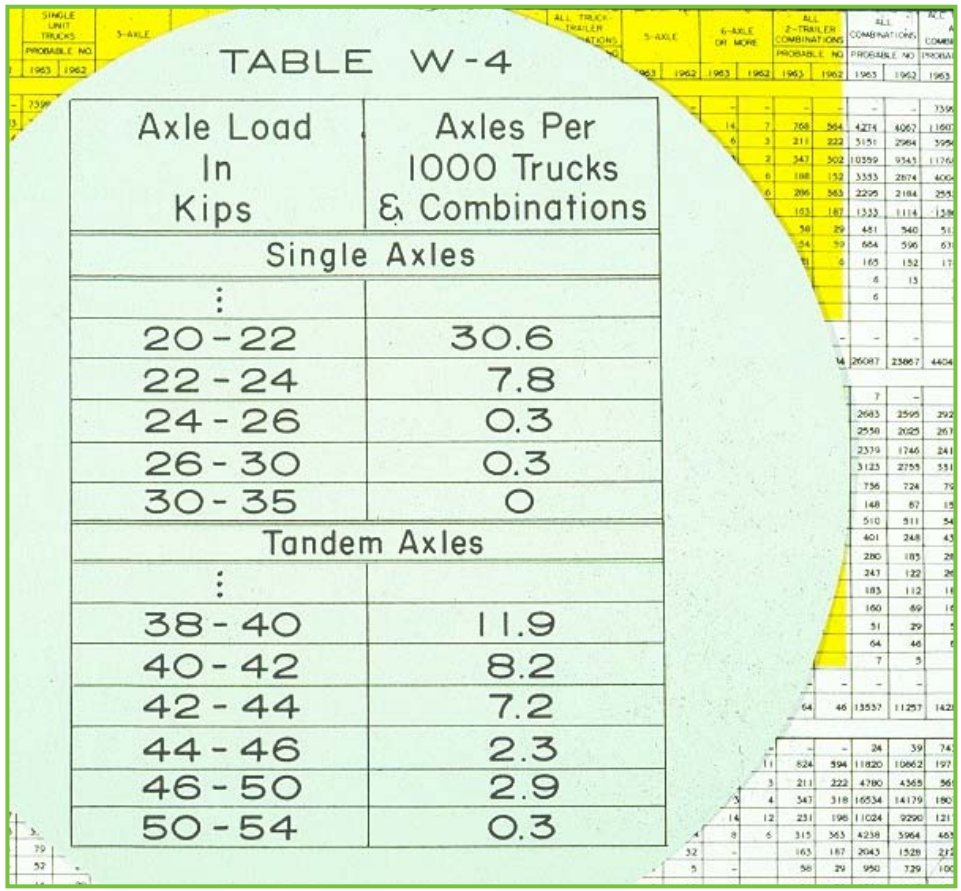

TABLE W-4

Axle Load In Kips	Axles Per 1000 Trucks & Combinations
Single Axles	
⋮	
20-22	30.6
22-24	7.8
24-26	0.3
26-30	0.3
30-35	0
Tandem Axles	
⋮	
38-40	11.9
40-42	8.2
42-44	7.2
44-46	2.3
46-50	2.9
50-54	0.3

- Theoretical, based on calculated pavement stress as % of MOR
- Traffic input via ADTT (Average Daily Truck Traffic)
- Direct input of data
- Assumed traffic mixes
- Basis of ACPA “Street Pave” and thickness tables in ACI 330R

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What do designers currently use for concrete parking lots?

Nothing – No concrete design. Only design in asphalt

AASHTO Design Guide – ‘72, ‘86, ’93

DOT specifications (Do DOT’s design parking lots?)

“What we’ve always used”

ACI 330!

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What is ACI 330?

Committee within American Concrete International

Leading Industry Experts - Engineers

Complete and Concise for Design and Construction

ACI 330R-08: Guide for Design and Construction of Concrete Parking Lots

ACI 330.1-10: Specification for Plain Concrete Parking Lots

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Designing with ACI 330

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Key Terminology

k – modulus of subgrade or

CBR – California Bearing Ratio (R and SSV)

Table 3.1—Subgrade soil types and approximate support values (Portland Cement Association 1984a,b; American Concrete Pavement Association 1982)

Type of soil	Support	*k*, psi/in.	CBR	*R*	SSV
Fine-grained soils in which silt and clay-size particles predominate	Low	75 to 120	2.5 to 3.5	10 to 22	2.3 to 3.1
Sands and sand-gravel mixtures with moderate amounts of silt and clay	Medium	130 to 170	4.5 to 7.5	29 to 41	3.5 to 4.9
Sand and sand-gravel mixtures relatively free of plastic fines	High	180 to 220	8.5 to 12	45 to 52	5.3 to 6.1

Notes: CBR = California bearing ratio; *R* = resistance value; and SSV = soil support value. 1 psi = 0.0069 MPa, and 1 psi/in. = 0.27 MPa/m.

Key Terminology

ADTT – average daily truck traffic

Table 3.3—Traffic categories*

1. Car parking areas and access lanes—Category A		
2. Shopping center entrance and service lanes—Category B		
3. Bus parking areas, city and school buses Parking area and interior lanes—Category B Entrance and exterior lanes—Category C		
4. Truck parking areas—Category B, C, or D		
Truck type	Parking areas and interior lanes	Entrance and exterior lanes
Single units (bobtailed trucks)	Category B	Category C
Multiple units (tractor trailer units with one or more trailers)	Category C	Category D

*Select A, B, C, or D for use with Table 3.4.

Key Terminology

MOR – modulus of rupture/flexural strength

*Concrete Industry uses compressive strength (f'c)

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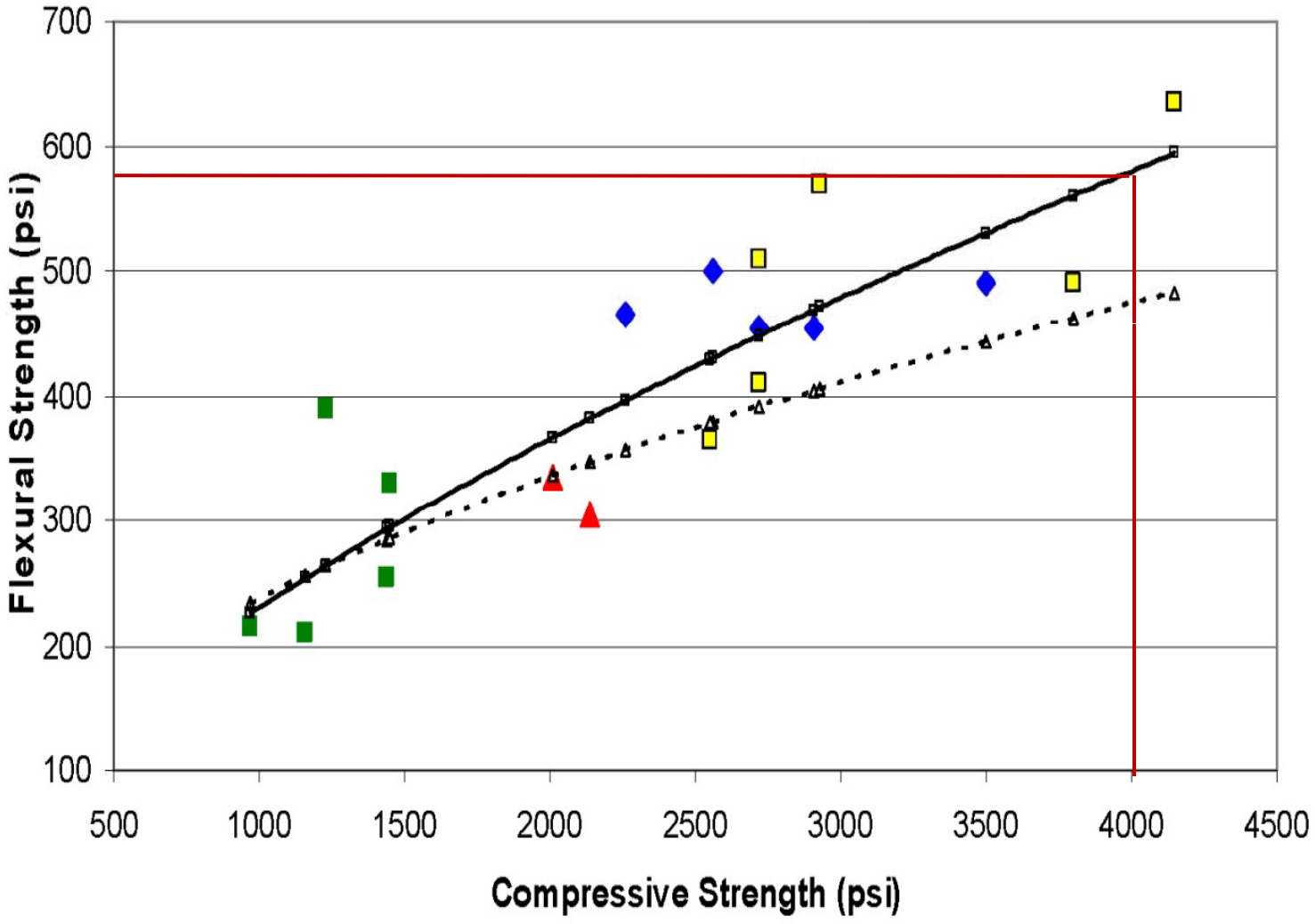
Flexural Strength vs. Compressive Strength



Key Terminology

MOR – modulus of rupture/flexural strength

*Concrete Industry uses compressive strength (f'c)

4000 psi compressive = 580 psi flexural

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ACI 330R-08 Guidelines – Table 3.4

		k = 500 psi/in. (CBR = 50, R = 86)				*k* = 400 psi/in. (CBR = 38, R = 80)				*k* = 300 psi/in. (CBR = 26, R = 67)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.5
	A (ADTT = 10)	4.0	4.0	4.0	4.5	4.0	4.0	4.5	4.5	4.0	4.5	4.5	4.5
	B (ADTT = 25)	4.0	4.5	4.5	5.0	4.5	4.5	5.0	5.5	4.5	4.5	5.0	5.5
	B (ADTT = 300)	5.0	5.0	5.5	5.5	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0
	C (ADTT = 100)	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0
	C (ADTT = 300)	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0	5.5	6.0	6.0	6.5
	C (ADTT = 700)	5.5	5.5	6.0	6.0	5.5	5.5	6.0	6.5	5.5	6.0	6.5	6.5
	D (ADTT = 700)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
		k = 200 psi/in. (CBR = 10, R = 48)				*k* = 100 psi/in. (CBR = 3, R = 18)				*k* = 50 psi/in. (CBR = 2, R = 5)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.5	4.0	4.5	4.5	5.0	4.5	5.0	5.0	5.5
	A (ADTT = 10)	4.5	4.5	5.0	5.0	4.5	5.0	5.0	5.5	5.0	5.5	5.5	6.0
	B (ADTT = 25)	5.0	5.0	5.5	6.0	5.5	5.5	6.0	6.0	6.0	6.0	6.5	7.0
	B (ADTT = 300)	5.5	5.5	6.0	6.5	6.0	6.0	6.5	7.0	6.5	7.0	7.0	7.5
	C (ADTT = 100)	5.5	6.0	6.0	6.5	6.0	6.5	6.5	7.0	6.5	7.0	7.5	7.5
	C (ADTT = 300)	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.5	7.5	8.0
	C (ADTT = 700)	6.0	6.5	6.5	7.0	6.5	7.0	7.0	7.5	7.0	7.5	8.0	8.5
	D (ADTT = 700)	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0

Thickness criteria based on soil support…

		k = 500 psi/in. (CBR = 50, R = 86)				*k* = 400 psi/in. (CBR = 38, R = 80)				*k* = 300 psi/in. (CBR = 26, R = 67)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.5
	A (ADTT = 10)	4.0	4.0	4.0	4.5	4.0	4.0	4.5	4.5	4.0	4.5	4.5	4.5
	B (ADTT = 25)	4.0	4.5	4.5	5.0	4.5	4.5	5.0	5.5	4.5	4.5	5.0	5.5
	B (ADTT = 300)	5.0	5.0	5.5	5.5	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0
	C (ADTT = 100)	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0
	C (ADTT = 300)	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0	5.5	6.0	6.0	6.5
	C (ADTT = 700)	5.5	5.5	6.0	6.0	5.5	5.5	6.0	6.5	5.5	6.0	6.5	6.5
	D (ADTT = 700)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
		k = 200 psi/in. (CBR = 10, R = 48)				*k* = 100 psi/in. (CBR = 3, R = 18)				*k* = 50 psi/in. (CBR = 2, R = 5)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.5	4.0	4.5	4.5	5.0	4.5	5.0	5.0	5.5
	A (ADTT = 10)	4.5	4.5	5.0	5.0	4.5	5.0	5.0	5.5	5.0	5.5	5.5	6.0
	B (ADTT = 25)	5.0	5.0	5.5	6.0	5.5	5.5	6.0	6.0	6.0	6.0	6.5	7.0
	B (ADTT = 300)	5.5	5.5	6.0	6.5	6.0	6.0	6.5	7.0	6.5	7.0	7.0	7.5
	C (ADTT = 100)	5.5	6.0	6.0	6.5	6.0	6.5	6.5	7.0	6.5	7.0	7.5	7.5
	C (ADTT = 300)	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.5	7.5	8.0
	C (ADTT = 700)	6.0	6.5	6.5	7.0	6.5	7.0	7.0	7.5	7.0	7.5	8.0	8.5
	D (ADTT = 700)	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0

…concrete strength…

		k = 500 psi/in. (CBR = 50, R = 86)				*k* = 400 psi/in. (CBR = 38, R = 80)				*k* = 300 psi/in. (CBR = 26, R = 67)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
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	A (ADTT = 10)	4.0	4.0	4.0	4.5	4.0	4.0	4.5	4.5	4.0	4.5	4.5	4.5
	B (ADTT = 25)	4.0	4.5	4.5	5.0	4.5	4.5	5.0	5.5	4.5	4.5	5.0	5.5
	B (ADTT = 300)	5.0	5.0	5.5	5.5	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0
	C (ADTT = 100)	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0
	C (ADTT = 300)	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0	5.5	6.0	6.0	6.5
	C (ADTT = 700)	5.5	5.5	6.0	6.0	5.5	5.5	6.0	6.5	5.5	6.0	6.5	6.5
	D (ADTT = 700)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
		k = 200 psi/in. (CBR = 10, R = 48)				*k* = 100 psi/in. (CBR = 3, R = 18)				*k* = 50 psi/in. (CBR = 2, R = 5)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.5	4.0	4.5	4.5	5.0	4.5	5.0	5.0	5.5
	A (ADTT = 10)	4.5	4.5	5.0	5.0	4.5	5.0	5.0	5.5	5.0	5.5	5.5	6.0
	B (ADTT = 25)	5.0	5.0	5.5	6.0	5.5	5.5	6.0	6.0	6.0	6.0	6.5	7.0
	B (ADTT = 300)	5.5	5.5	6.0	6.5	6.0	6.0	6.5	7.0	6.5	7.0	7.0	7.5
	C (ADTT = 100)	5.5	6.0	6.0	6.5	6.0	6.5	6.5	7.0	6.5	7.0	7.5	7.5
	C (ADTT = 300)	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.5	7.5	8.0
	C (ADTT = 700)	6.0	6.5	6.5	7.0	6.5	7.0	7.0	7.5	7.0	7.5	8.0	8.5
	D (ADTT = 700)	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0

…and Average Daily Truck Traffic (ADTT)

		k = 500 psi/in. (CBR = 50, R = 86)				*k* = 400 psi/in. (CBR = 38, R = 80)				*k* = 300 psi/in. (CBR = 26, R = 67)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.5
	A (ADTT = 10)	4.0	4.0	4.0	4.5	4.0	4.0	4.5	4.5	4.0	4.5	4.5	4.5
	B (ADTT = 25)	4.0	4.5	4.5	5.0	4.5	4.5	5.0	5.5	4.5	4.5	5.0	5.5
	B (ADTT = 300)	5.0	5.0	5.5	5.5	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0
	C (ADTT = 100)	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0
	C (ADTT = 300)	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0	5.5	6.0	6.0	6.5
	C (ADTT = 700)	5.5	5.5	6.0	6.0	5.5	5.5	6.0	6.5	5.5	6.0	6.5	6.5
	D (ADTT = 700)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
		k = 200 psi/in. (CBR = 10, R = 48)				*k* = 100 psi/in. (CBR = 3, R = 18)				*k* = 50 psi/in. (CBR = 2, R = 5)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.5	4.0	4.5	4.5	5.0	4.5	5.0	5.0	5.5
	A (ADTT = 10)	4.5	4.5	5.0	5.0	4.5	5.0	5.0	5.5	5.0	5.5	5.5	6.0
	B (ADTT = 25)	5.0	5.0	5.5	6.0	5.5	5.5	6.0	6.0	6.0	6.0	6.5	7.0
	B (ADTT = 300)	5.5	5.5	6.0	6.5	6.0	6.0	6.5	7.0	6.5	7.0	7.0	7.5
	C (ADTT = 100)	5.5	6.0	6.0	6.5	6.0	6.5	6.5	7.0	6.5	7.0	7.5	7.5
	C (ADTT = 300)	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.5	7.5	8.0
	C (ADTT = 700)	6.0	6.5	6.5	7.0	6.5	7.0	7.0	7.5	7.0	7.5	8.0	8.5
	D (ADTT = 700)	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0

Recommende… e 4.5 inches

		k = 500 psi/in. (CBR = 50, R = 86)				k = 400 psi/in. (CBR = 38, R = 80)				k = 300 psi/in. (CBR = 26, R = 67)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.5
	A (ADTT = 10)	4.0	4.0	4.0	4.5	4.0	4.0	4.5	4.5	4.0	4.5	4.5	4.5
	B (ADTT = 25)	4.0	4.5	4.5	5.0	4.5	4.5	5.0	5.5	4.5	4.5	5.0	5.5
	B (ADTT = 300)	5.0	5.0	5.5	5.5	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0
	C (ADTT = 100)	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0
	C (ADTT = 300)	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0	5.5	6.0	6.0	6.5
	C (ADTT = 700)	5.5	5.5	6.0	6.0	5.5	5.5	6.0	6.5	5.5	6.0	6.5	6.5
	D (ADTT = 700)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
		k = 200 psi/in. (CBR = 10, R = 48)				k = 100 psi/in. (CBR = 3, R = 18)				k = 50 psi/in. (CBR = 2, R = 5)			
	MOR, psi:	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category	A (ADTT =1)	4.0	4.0	4.0	4.5	4.0	4.5	4.5	5.0	4.5	5.0	5.0	5.5
	A (ADTT = 10)	4.5	4.5	5.0	5.0	4.5	5.0	[illegible]	5.5	5.0	5.5	5.5	6.0
	B (ADTT = 25)	5.0	5.0	5.5	6.0	5.5	5.5	6.0	6.0	6.0	6.0	6.5	7.0
	B (ADTT = 300)	5.5	5.5	6.0	6.5	6.0	6.0	6.5	7.0	6.5	7.0	7.0	7.5
	C (ADTT = 100)	5.5	6.0	6.0	6.5	6.0	6.5	6.5	7.0	6.5	7.0	7.5	7.5
	C (ADTT = 300)	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.5	7.5	8.0
	C (ADTT = 700)	6.0	6.5	6.5	7.0	6.5	7.0	7.0	7.5	7.0	7.5	8.0	8.5
	D (ADTT = 700)	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0

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Parking Area Quick Reference

From American Concrete Institute Committee 330

Step 1:	Step 2:	Step 3:	Step 4:	Step 5:	Example:
Determine concrete compressive strength requirement. For all concrete exposed to freeze-thaw cycling and de-icers, use no less than 4000 psi. 4500 psi is recommended.	Determine Modulus of Subgrade Reactivity, k. Use guidelines below.	Determine Traffic Categories (car parking area, entrances etc.).	Determine Average Daily Truck Traffic (ADTT) on the pavement. It is safe to always assume at least one ADTT.	Read across row that corresponds to your Traffic Category and ADTT to the column that represents your concrete strength and *k* value.	» Car parking area truck access lane. » Traffic Category A, ADTT = 1. » Concrete strength of 4500 psi. » Soil is sandy gravel with some clay and silt; *k* value is 130-170; therefore use *k* = 100. » Under area with *k* = 100, read across row with "Traffic Category A (ADTT = 1)" to column under *f'c* = 4500. » Thickness necessary for this situation is 4.5.

Modulus of Subgrade Reactivity

Type of Subgrade Soil	*k* Value	CBR
Fine-grained soils in which silt & clay-sized particles predominate	75 - 120	2.5 - 3.5
Sands & sand-gravel mixtures with moderate amounts of silt & clay	130 - 170	4.5 - 7.5
Sands & sand-gravel mixtures relatively free of plastic fines	180 - 220	8.5 - 12

Traffic Categories

Select Category A, B, C or D

Car Parking Areas & Access Lanes *(Autos, pick-ups, & panel trucks only)*		Category A
Shopping Center Entrance & Service Lanes		Category B
City & School Bus Parking Areas: » Parking area & interior lanes. » Entrance & exterior lanes.		Category B Category C
Truck Parking Areas:		
Parking Areas & Interior Lanes	Single-Unit Trucks*	Category B
	Multiple-Unit Trucks**	Category C
Entrance & Exterior Lanes	Single-Unit Trucks*	Category C
	Multiple-Unit Trucks**	Category D

**Single-Unit Trucks = Bobtailed Trucks*

***Multiple-Unit Trucks = Tractor-trailer units with 1 or more trailers*

Twenty-Year Design Thickness Recommendations in Inches (No Dowels)

		k = 500 psi/in. (CBR = 50; *R* = 86)				*k* = 400 psi/in. (CBR = 38; *R* = 80)				*k* = 300 psi/in. (CBR = 26; *R* = 67)			
	f'c	5000	4500	4000	3500	5000	4500	4000	3500	5000	4500	4000	3500
	MOR, psi	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category*	A (ADTT=1)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.5
	A (ADTT=10)	4.0	4.0	4.0	4.5	4.0	4.0	4.5	4.5	4.0	4.5	4.5	4.5
	B (ADTT=25)	4.0	4.5	4.5	5.0	4.5	4.5	5.0	5.5	4.5	4.5	5.0	5.5
	B (ADTT=300)	5.0	5.0	5.5	5.5	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0
	C (ADTT=100)	5.0	5.0	5.5	5.5	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0
	C (ADTT=300)	5.0	5.5	5.5	6.0	5.5	5.5	6.0	6.0	5.5	6.0	6.0	6.5
	C (ADTT=700)	5.5	5.5	6.0	6.0	5.5	5.5	6.0	6.5	5.5	6.0	6.5	6.5
	D (ADTT=700)†	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
		k = 200 psi/in. (CBR = 10; *R* = 48)				*k* = 100 psi/in. (CBR = 3; *R* = 18)				*k* = 50 psi/in. (CBR = 2; *R* = 5)			
	f'c	5000	4500	4000	3500	5000	4500	4000	3500	5000	4500	4000	3500
	MOR, psi	650	600	550	500	650	600	550	500	650	600	550	500
Traffic Category*	A (ADTT=1)	4.0	4.0	4.0	4.5	4.0	4.5	4.5	5.0	4.5	5.0	5.0	5.5
	A (ADTT=10)	4.5	4.5	5.0	5.0	4.5	5.0	5.0	5.5	5.0	5.5	5.5	6.0
	B (ADTT=25)	5.0	5.0	5.5	6.0	5.5	5.5	6.0	6.0	6.0	6.0	6.5	7.0
	B (ADTT=300)	5.5	5.5	6.0	6.5	6.0	6.0	6.5	7.0	6.5	7.0	7.0	7.5
	C (ADTT=100)	5.5	6.0	6.0	6.5	6.0	6.5	6.5	7.0	6.5	7.0	7.5	7.5
	C (ADTT=300)	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.5	7.5	8.0
	C (ADTT=700)	6.0	6.5	6.5	7.0	6.5	7.0	7.0	7.5	7.0	7.5	8.0	8.5
	D (ADTT=700)†	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	9.0	9.0	9.0	9.0

**ADTT =Average Daily Truck Traffic Trucks are defined as vehicles with at least 6 wheels; excludes panel trucks, pick-up trucks & other 4-wheeled vehides. Refer to Appendix A.*

k = Modulus of subgrade reaction; CBR =Califomia Bearing Ratio; R=Resistance value & MOR=Modulus of Rupture.

† Thickness of Category D (only) can be reduced by 1.0 in. (25 mm) if dowels are used at all transverse joints (that is joints located perpendicular to direction of traffic). Note: 1in.=25.4mm; 1psi=0.0069 MPa; & 1psi/in.=0.27 MPa/m.

Preparing the Subgrade for Best Performance

Proper subgrade preparation will ensure superior performance of your concrete pavement. While no special subbase is required, it is important that the soil type, moisture content, and density of the subgrade be uniform. Replace non-uniform subgrade areas with materials that are similar to the rest of the area.

The subgrade must also be reasonably smooth and without tire ruts so that the concrete placed over it will be uniform in thickness.

Materials & Proportions

Quality concrete starts with a well chosen mixture using consistently high quality materials.

In regions where the pavement will be subjected to freeze-thaw cycles air entrainment is essential. Air entrainment is so important in providing freeze-thaw durability that it pays to test the concrete frequently for air content at the job site and make the necessary corrections as soon as possible. See the table below for recommended air contents.

Because air entrainment also enhances workability and reduces the amount of bleed water, it is wise to consider its use even where freeze-thaw conditions do not exist.

Compressive strength is the most common and easiest property of concrete to measure, and as such, it is the property most used when specifying concrete. Concrete with a 28-day specified compressive strength of 4000 psi (27.6 MPa), is adequate for most areas of the country.

In areas subjected to freeze-thaw cycles, it is further recommended that the mix contain at least 564 lb of cement per cubic yard. In mild climates a minimum cement content of 520 lb per cubic yard is adequate. A mixture with a maximum slump of 4 inches is acceptable. If a water reducing admixture is specified, slumps can be higher.

Recommended Air Contents for Durable Concrete

	Total Target Air Content Percent*	
Maximum Size Aggregate	Severe Exposure	Moderate Exposure
3/8 in. (9.5 mm)	7-1/2	6
1/2 in. (12.5 mm)	7	5-1/2
3/4 in. (19.0 mm)	6	5
1 in. (25.0 mm)	6	4-1/2
1-1/2 in. (37.5 mm)	5-1/2	4-1/2
2 in. (50.0 mm)	5	4

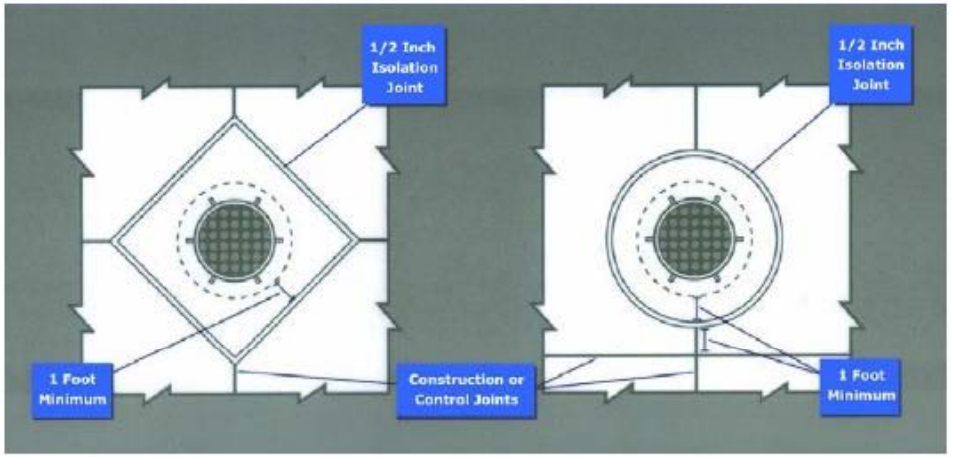
**A reasonable tolerance for air content in field construction is -1 to +2 percentage points*

Jointing Guidelines

It is recommended that you follow these guidelines unless local experience indicates otherwise:

- Joint spacing should not exceed 24 to 30 times the pavement thickness with a maximum spacing of 15 feet.
- Lay out joints to form square panels. When this is not practical, rectangular panels can be used if the long dimension is no more than 1-1/2 times the short.
- Control joints should have a depth of at least one-fourth the slab thickness.

Manhole or Inlet Box



Construction Practices

Procedures that ensure a quality job are:

- Slope pavement 1% or 1/8 inch per foot to drainage.
- Moisten subgrade just prior to placement of concrete.
- Avoid over-finishing slabs. Generally a bullfloat finish is adequate. Sometimes a burlap drag is added in the finishing process to provide a textured finish.
- Cure fresh concrete. Liquid membrane-forming curing compound is usually recommended as the most cost-effective curing agent.
- Keep automobile traffic off the slab for three days and truck traffic off the slab for seven days, unless tests are made to determine that the concrete has gained adequate strength. This is usually 3000 psi.

Common Design Misconceptions

"Concrete pavement requires a subbase"*

*Subbase: a layer of imported or improved material between the natural site material (subgrade) and the concrete.

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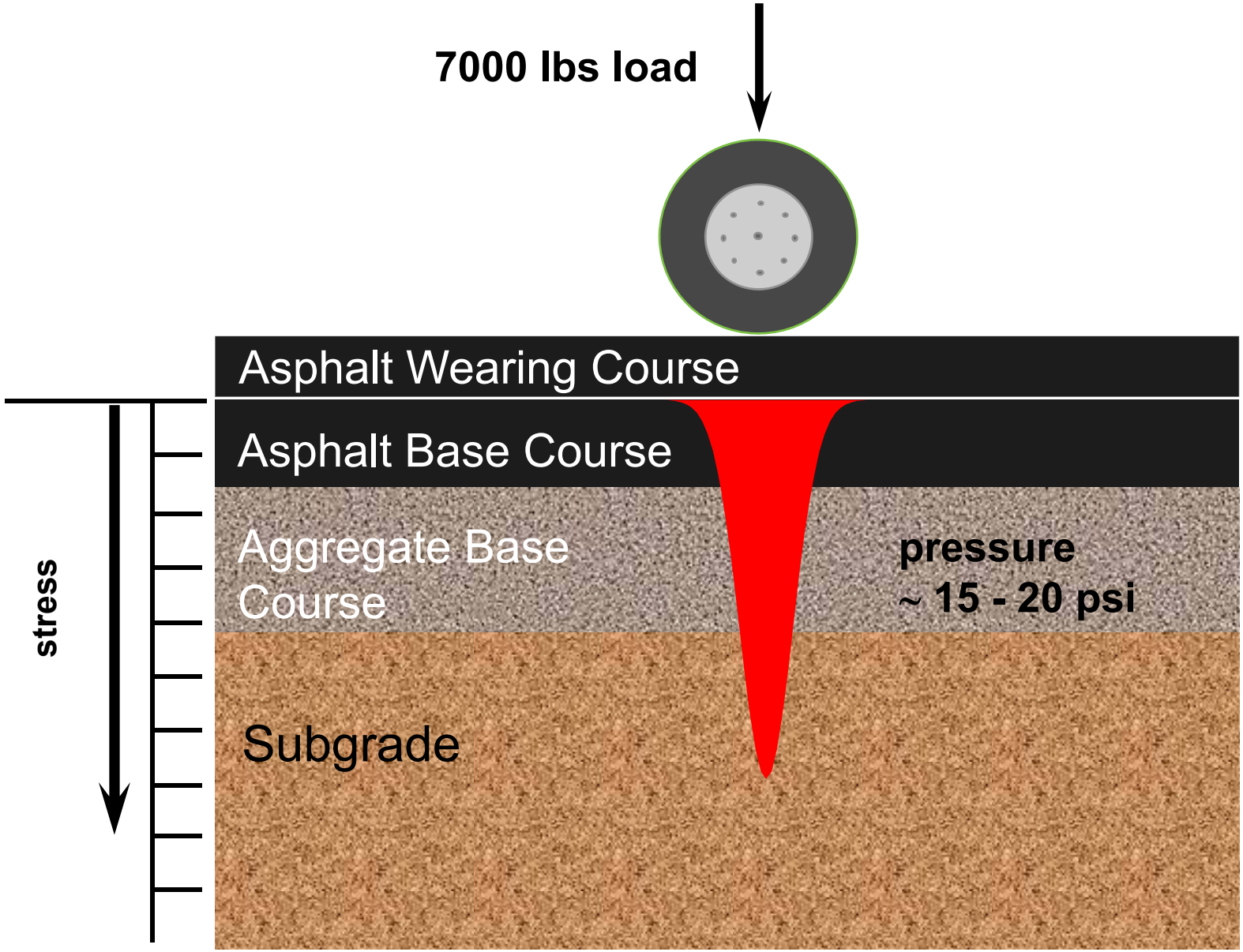
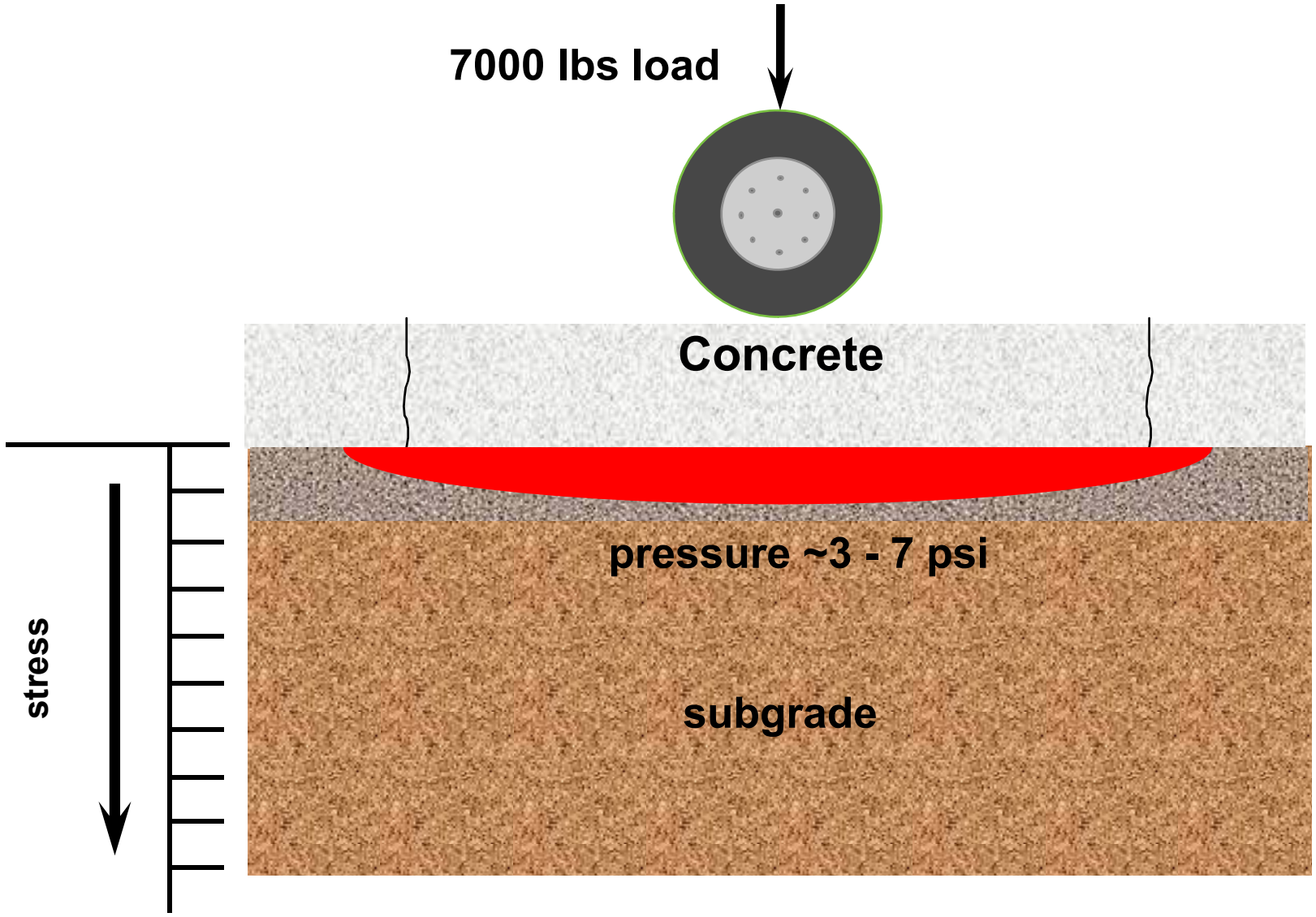

7000 lbs load
Asphalt Wearing Course
Asphalt Base Course
Aggregate Base Course
pressure
~ 15 - 20 psi
Subgrade
stress

The load-carrying structure for concrete pavement is primarily thickness.



ACI 330 position on subgrade/subbase

"A well-prepared, uniform subgrade at the correct elevation is essential to the construction of a quality pavement."

"The subgrade should have a dense, firm, and uniformly smooth surface when concrete is placed on it."

"Granular aggregate subbases are not normally used for concrete parking lots."

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Do you ever need a subbase layer?

May warrant consideration if:

- Construction platform is needed
- Subgrade is very poor quality
- Heavy truck traffic & load transfer concerns
- Pumping of subgrade is likely

Can result in higher *k* value for design and slightly thinner concrete section

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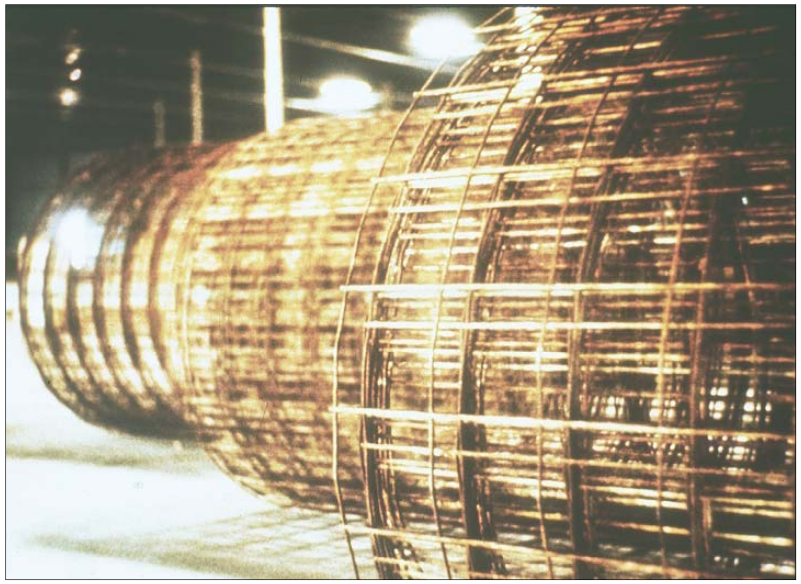
Common Design Misconceptions

Concrete pavements require steel reinforcement!

Reinforcing steel in concrete has its place!



Secondary Steel Reinforcement

- Does not make concrete stronger!
- Does not stop concrete from cracking!
- Holds concrete together when it cracks

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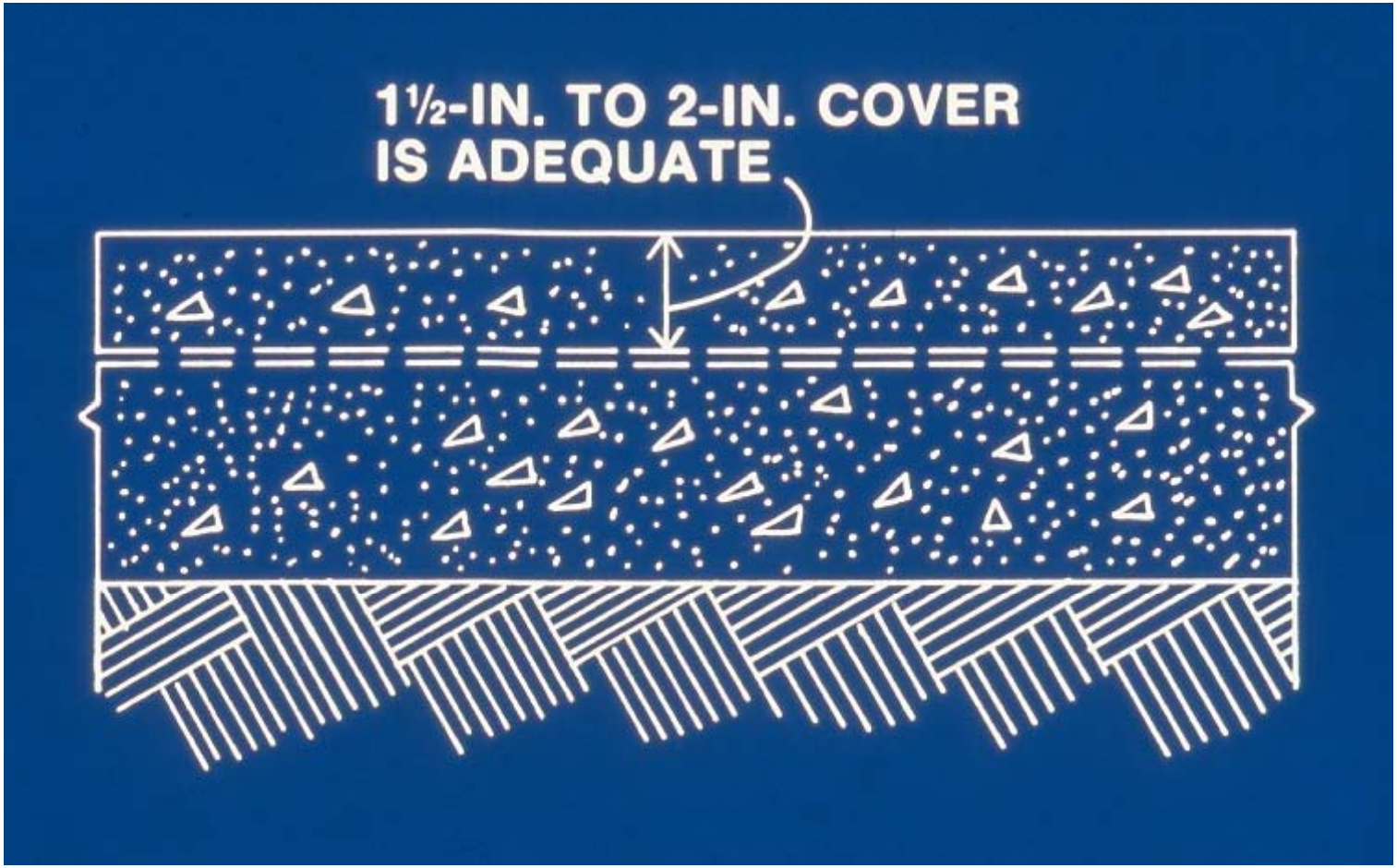
Proper placement of secondary steel reinforcement



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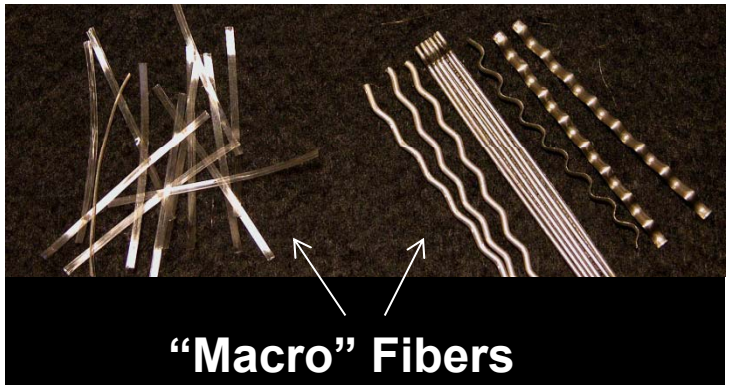
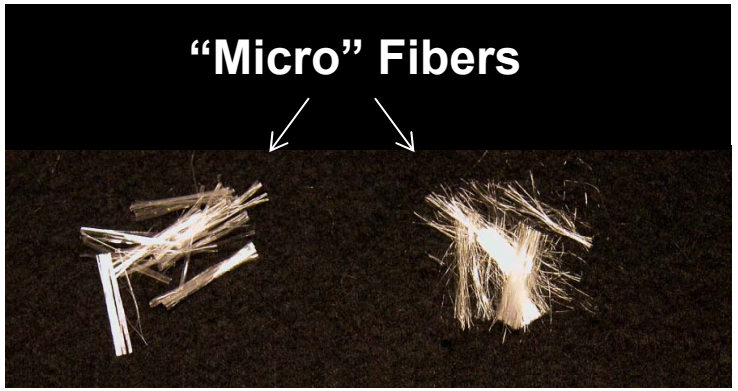
What about Fibers?

Steel & Macro Fibers
(0.008-0.03”)
Secondary Reinforcement



Micro Fibers (<0.004”)
Plastic Shrinkage Crack
Control



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"See how much better it looks Without all those ugly joints?"

How important is jointing?

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Objectives of jointing

- Control the location, width, and appearance of expected cracks
- Facilitate construction
- Accommodate normal slab movements
- Provide load transfer where needed
- Minimize performance implications of any random (unexpected) cracks

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Recommended Spacing of Control Joints

24-30 times the thickness

Thickness (inches)	Spacing (feet)
4	8-10
5	10-12
6	12-15
7	14-15
8+	15

Some designs may call for closer joint spacing due to load transfer considerations.

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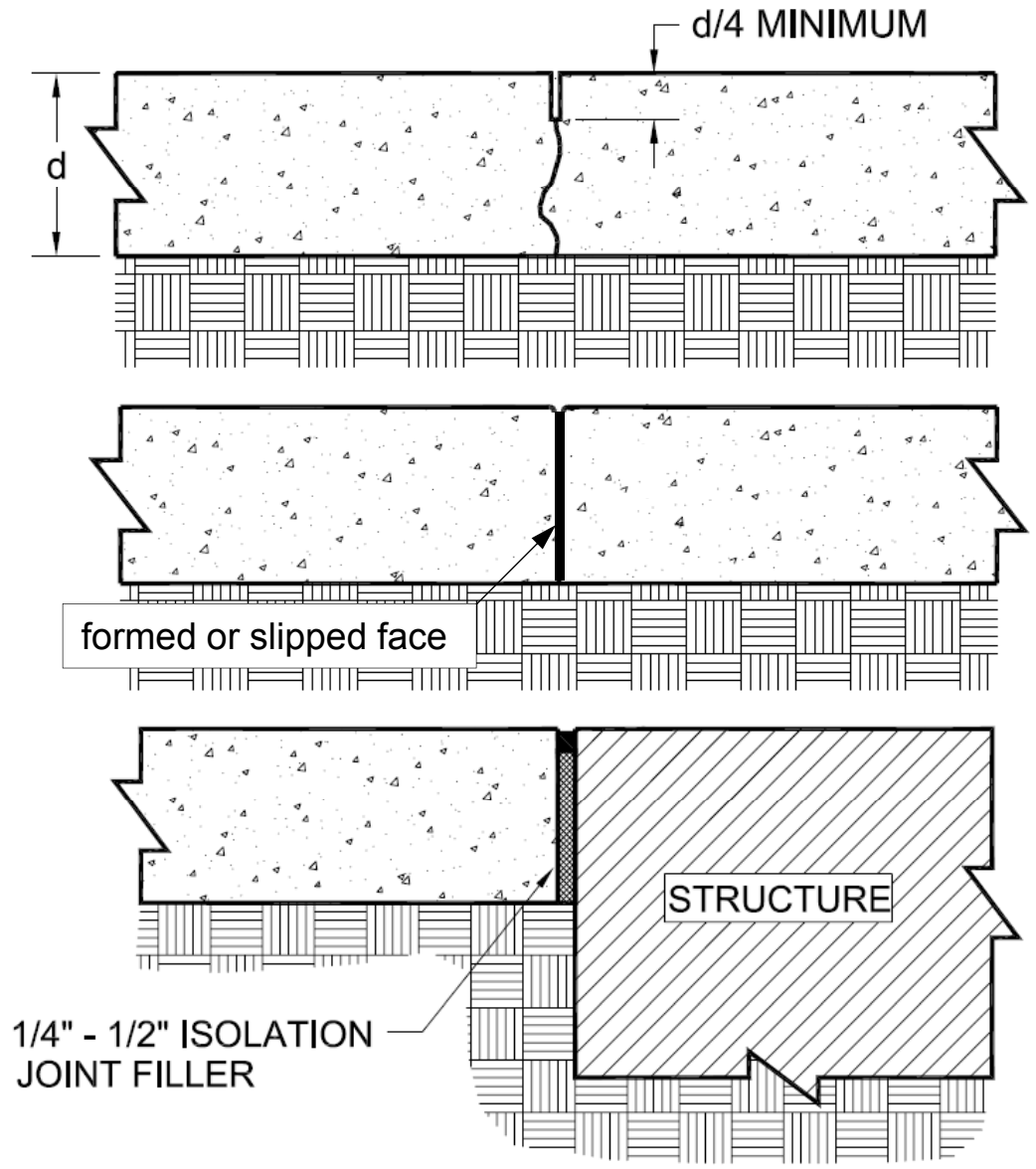
Types of joints in concrete pavement



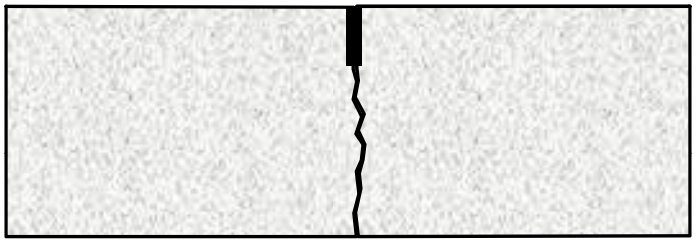
Control joint

Construction joint

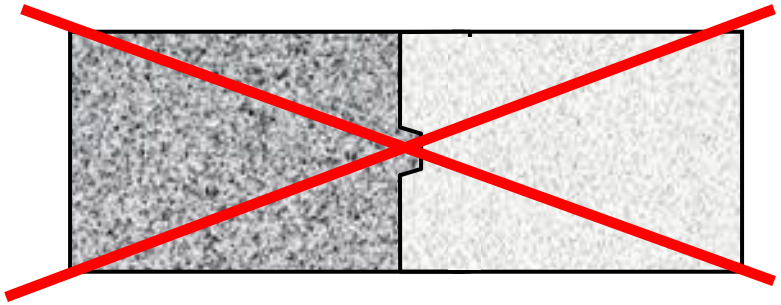
Isolation joint

Load transfer joint details:

Pavements less than 7”



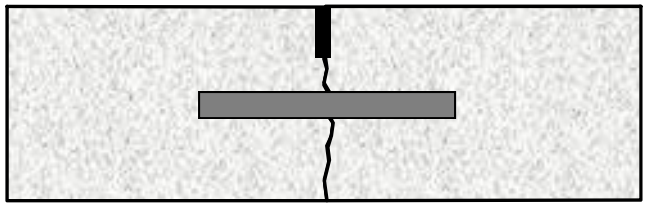
Aggregate Interlock



Keyways

Load transfer joint details:

Pavements greater than 7”



Round Dowels

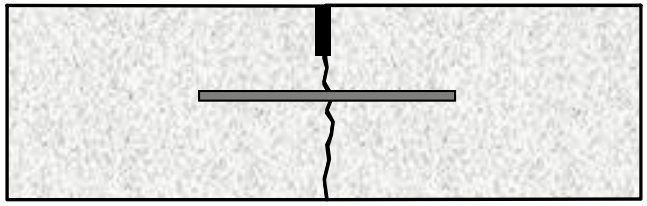
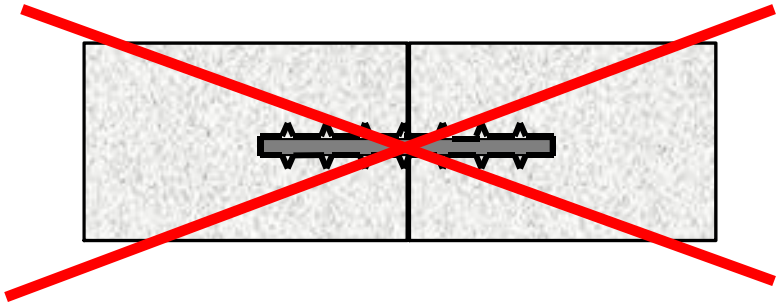
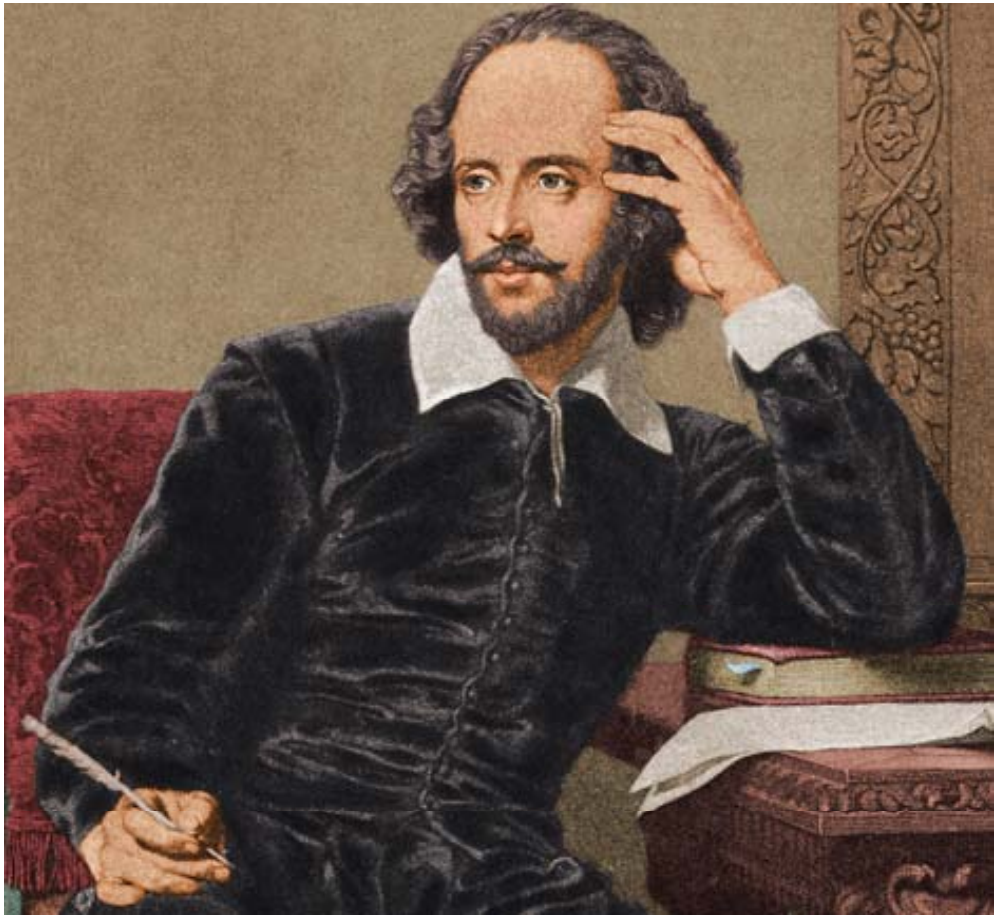


Plate Dowels



Tiebars ≠ Dowels!
(not used for load transfer)



“To seal, or not to seal?”

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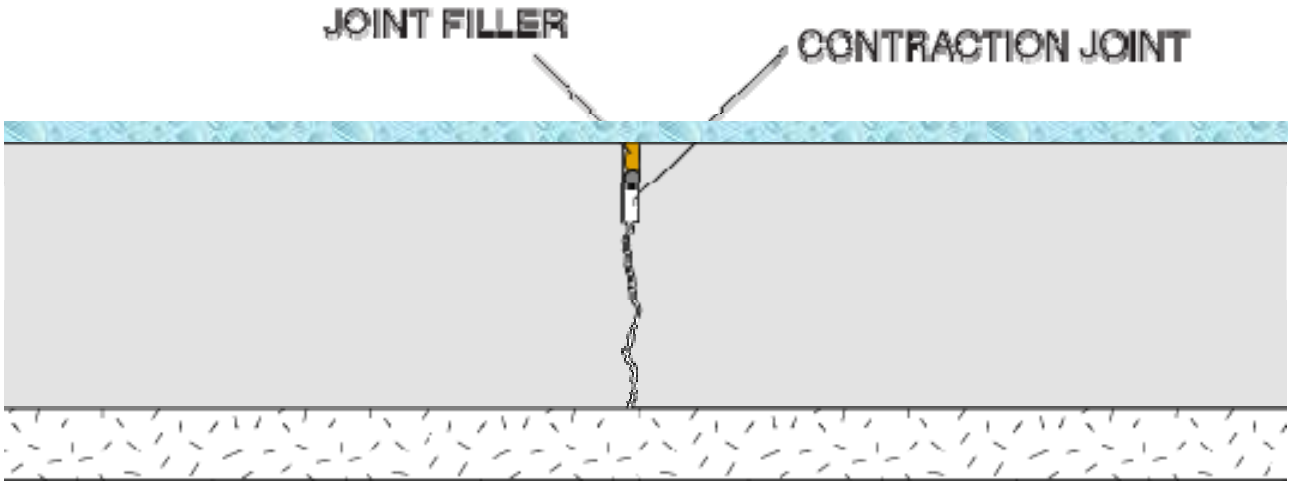

Purpose is to prevent infiltration of water and solids into joint

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Factors to consider

Traffic level
Soil types & local performance
Subbase use

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Most effective to reduce joint width

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Sealants on wide joints extremely ineffective

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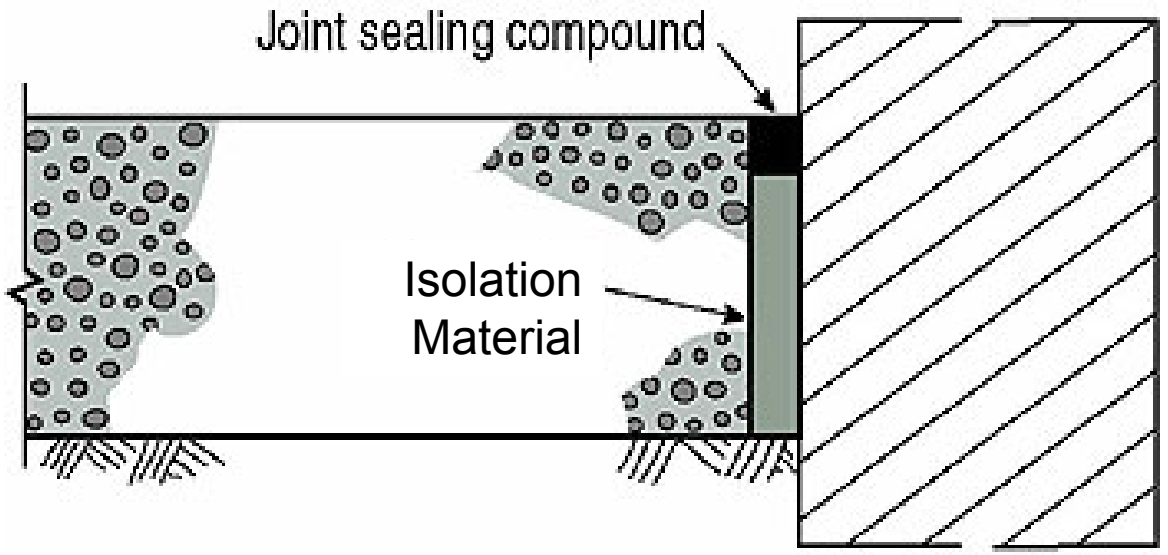
Seal isolation joint against building



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Evaluating Concrete and Asphalt Using Structural Numbers

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Pavement Failure

Not due to # of years

Due to stress of carrying loads

- Vehicle traffic
- Heat / Cold

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Design Thickness

- Design for purpose (adjust thickness)
  - Passenger vehicle parking
  - Truck lanes
  - Loading areas
  - Truck parking (sand shoes/dollies)
    - Increase thickness
    - Thickened beam

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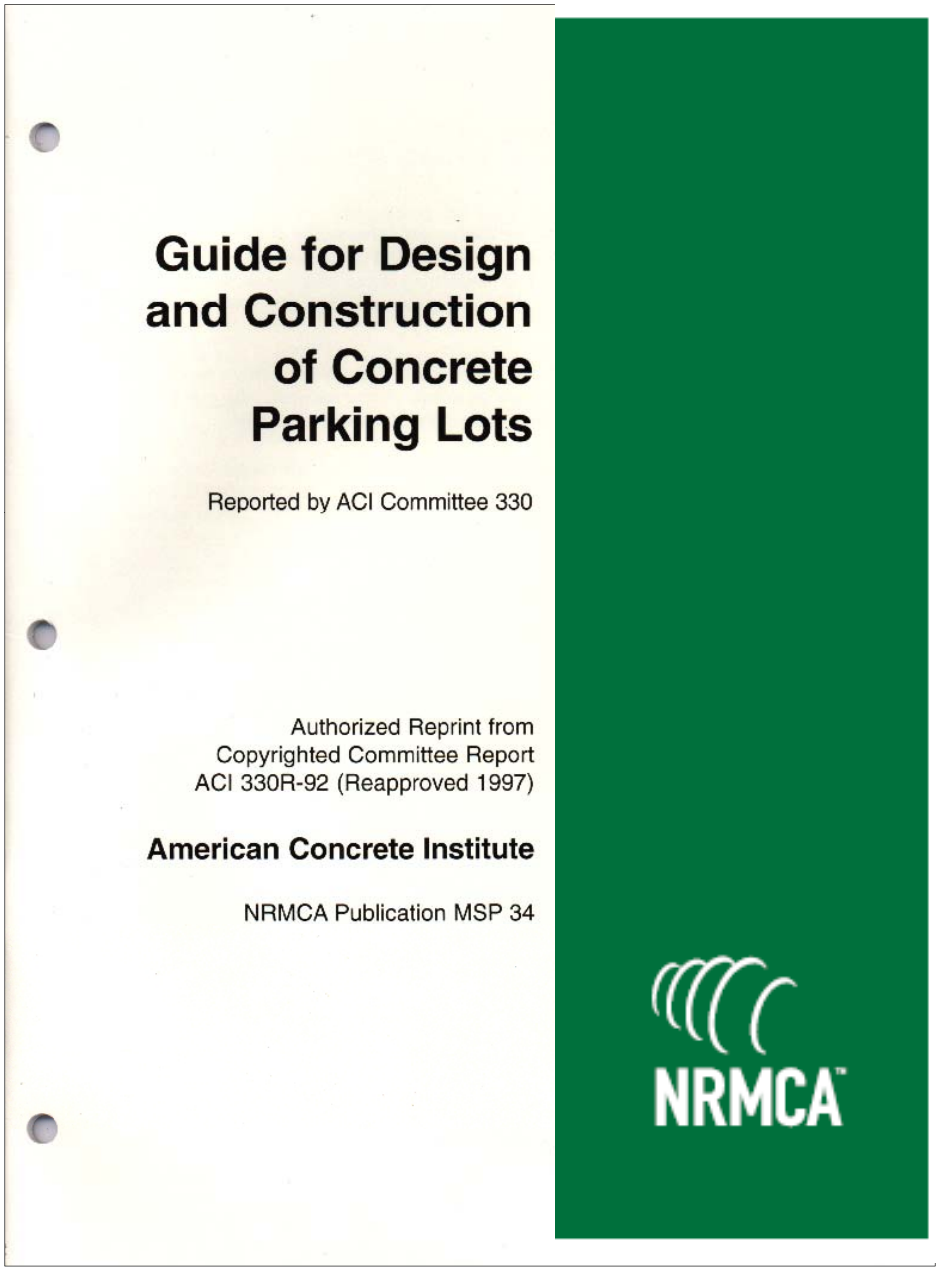
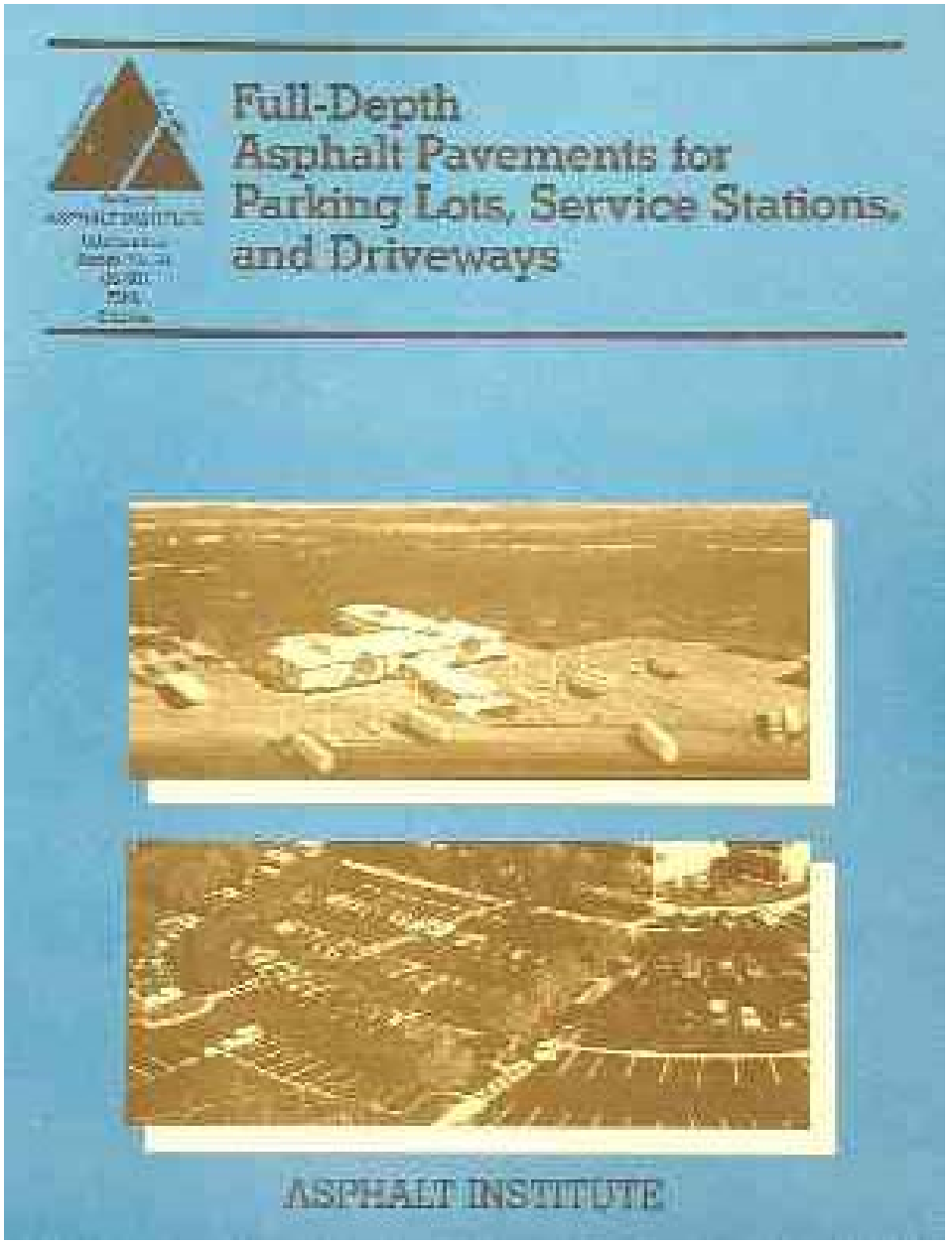
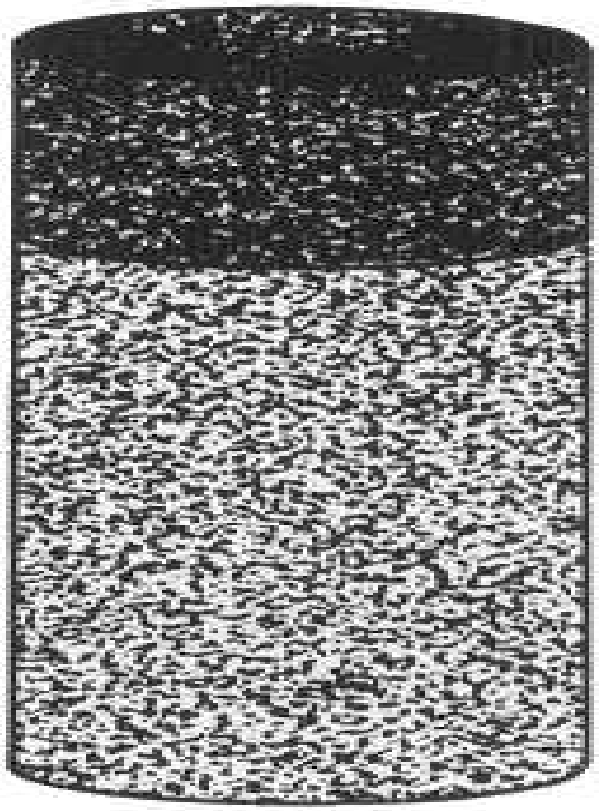
- Established rational design – ACI 330
  - 4000 psi
  - Unreinforced
  - Placed on compacted subgrade
    - No stone base required



- MS-1
  - Thickness Design – Asphalt Pavement for Highways and Streets
- IS-91
  - Full-Depth Asphalt Pavements for Parking Lots, Service Stations, and Driveways



- Two layer construction
  - Base course asphalt
  - Wear course
- Place on compacted subgrade
  - No stone base required



How Can We Make an Accurate Comparison of Equivalent Design?

By using structural layer coefficients:

A relative number assigned for the value of 1” of material

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Structural Layer Coefficients*

Concrete = 0.50

Surface Asphalt = 0.20 to 0.42

Bituminous Base = 0.10 to 0.34

Aggregate Base = 0.07 to 0.14

#57 crushed stone ≈ 0.12

* Per AASHO Road Test - 1961

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For Example:

- **5” Concrete Pavement**
- **5” X 0.50 = 2.50 SN**

- **1.5” Surface Asphalt & 5.5” of Bituminous Base**
- **1.5” X 0.42 = 0.63**
- **5.5” X 0.34 = +1.87**

2.50 SN

For Example:

- **5” Concrete Pavement**

- **5” X 0.50 = 2.50 SN**

- **1.5” Surface Asphalt, w/ 3” Bituminous Base and 7” Aggregate Base**

- **1.5” X 0.42 = 0.63**
- **3.0” X 0.34 = 1.02**
- **7.0” X 0.12 = +0.84**

2.49 SN

For Example:

- **6” Concrete Pavement & 6” Aggregate Base**

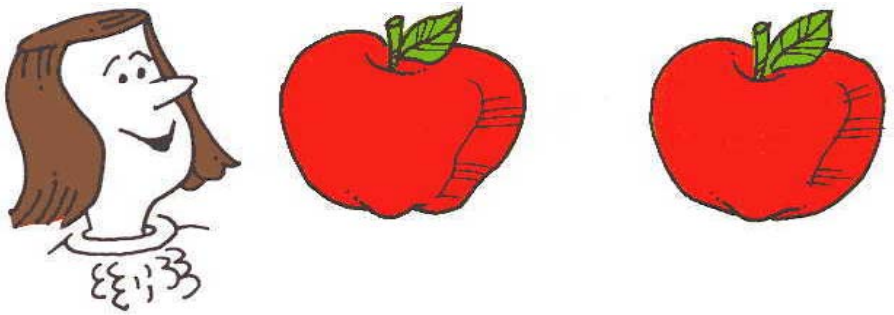
- **6” x 0.50 = 3.00**
- **6” x 0.12 = +0.72**
  3.72 SN

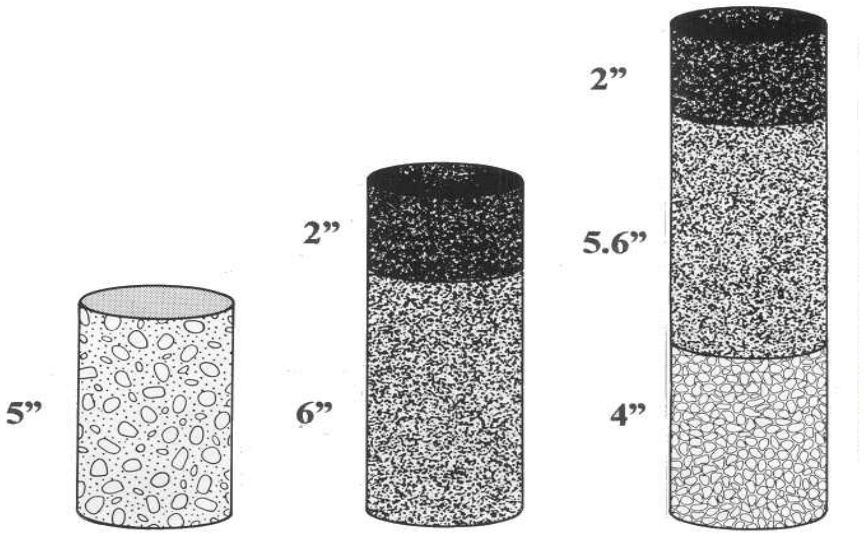
- **2.5” Asphalt & 6.0” of Aggregate Base**

- **2.5” x 0.42 = 1.05**
- **6.0” x 0.12 = +0.72**
  1.77 SN

Concrete vs. Asphalt

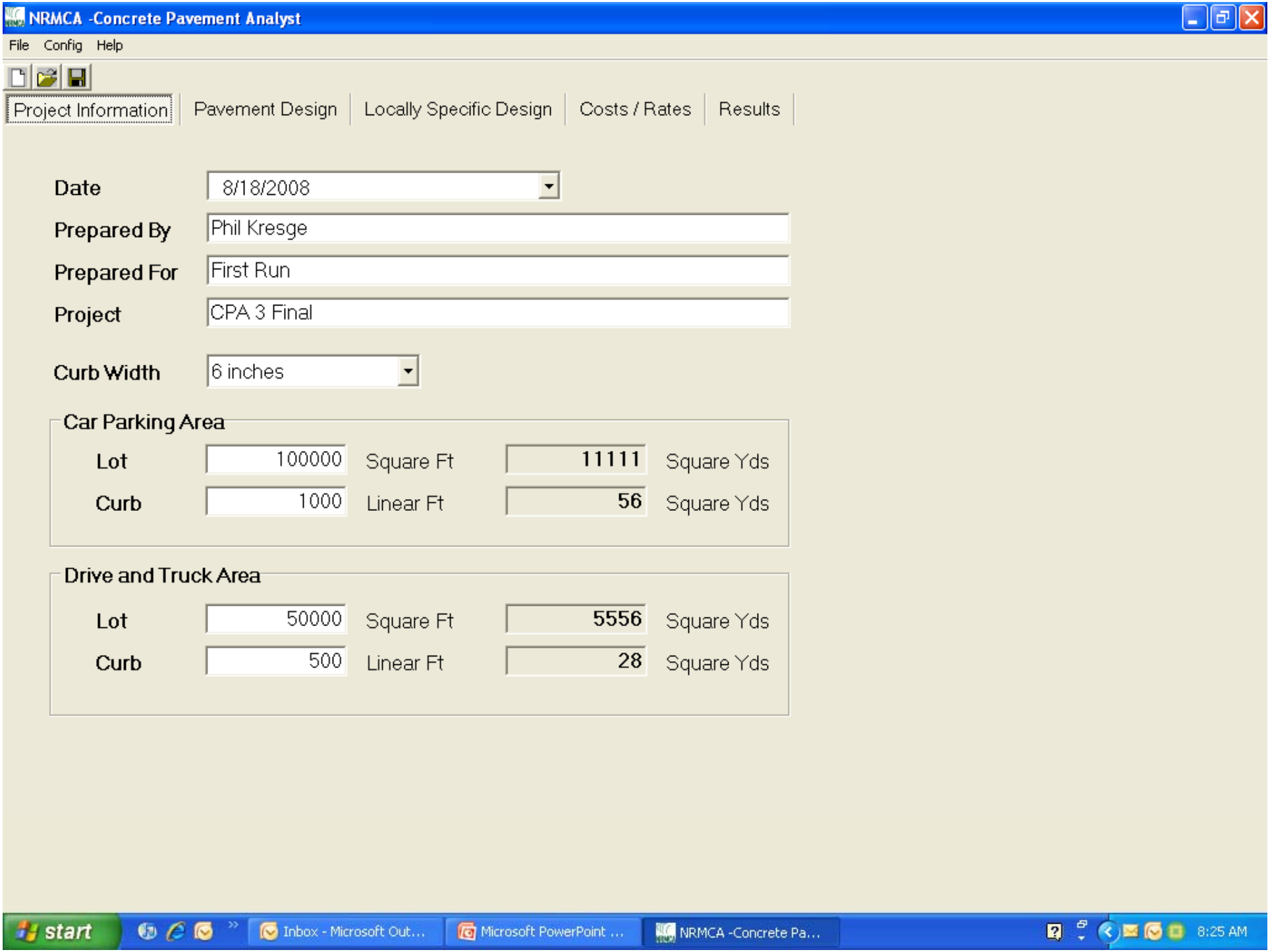
- Apples-to-apples comparison of pavement design should always be considered
- Quantification in $ allows for a better business decision on pavement choice





Design Comparison

Life Cycle Cost Comparison


NRMCA -Concrete Pavement Analyst
File Config Help
Project Information
Pavement Design
Locally Specific Design
Costs / Rates
Results
Date
8/18/2008
Prepared By
Phil Kresge
Prepared For
First Run
Project
CPA 3 Final
Curb Width
6 inches
Car Parking Area
Lot
100000
Square Ft
11111
Square Yds
Curb
1000
Linear Ft
56
Square Yds
Drive and Truck Area
Lot
50000
Square Ft
5556
Square Yds
Curb
500
Linear Ft
28
Square Yds
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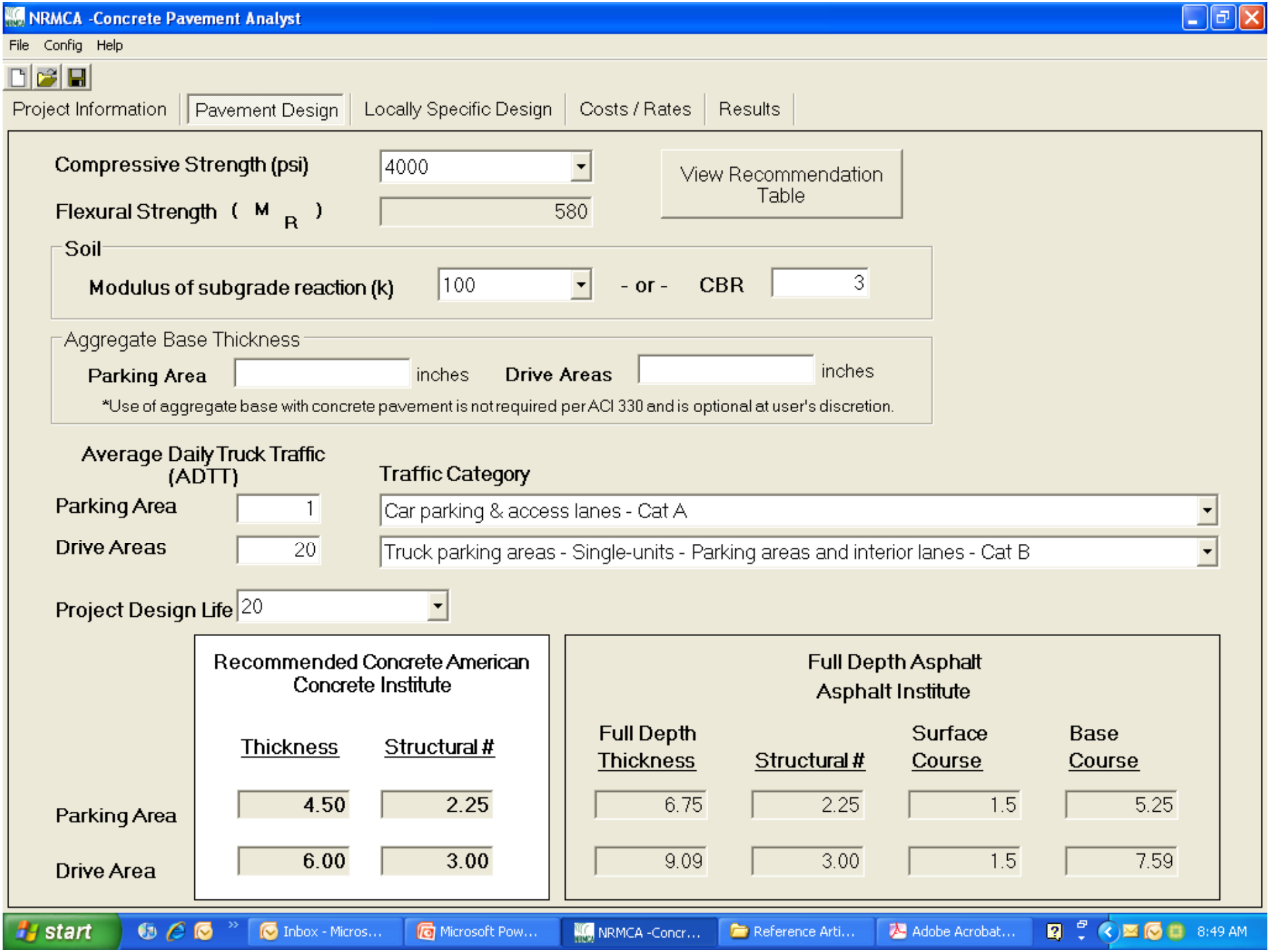
NRMCA -Concrete Pavement Analyst
File Config Help
Project Information
Pavement Design
Locally Specific Design
Costs / Rates
Results
Compressive Strength (psi)
4000
View Recommendation Table
Flexural Strength (M R)
580
Soil
Modulus of subgrade reaction (k)
100
- or -
CBR
3
Aggregate Base Thickness
Parking Area
inches
Drive Areas
inches
*Use of aggregate base with concrete pavement is not required per ACI 330 and is optional at user's discretion.
Average Daily Truck Traffic (ADTT)
Traffic Category
Parking Area
1
Car parking & access lanes - Cat A
Drive Areas
20
Truck parking areas - Single-units - Parking areas and interior lanes - Cat B
Project Design Life
20
Recommended Concrete American Concrete Institute
Thickness
Structural #
Parking Area
4.50
2.25
Drive Area
6.00
3.00
Full Depth Asphalt Asphalt Institute
Full Depth Thickness
Structural #
Surface Course
Base Course
6.75
2.25
1.5
5.25
9.09
3.00
1.5
7.59
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NRMCA -Concr...
Reference Arti...
Adobe Acrobat...
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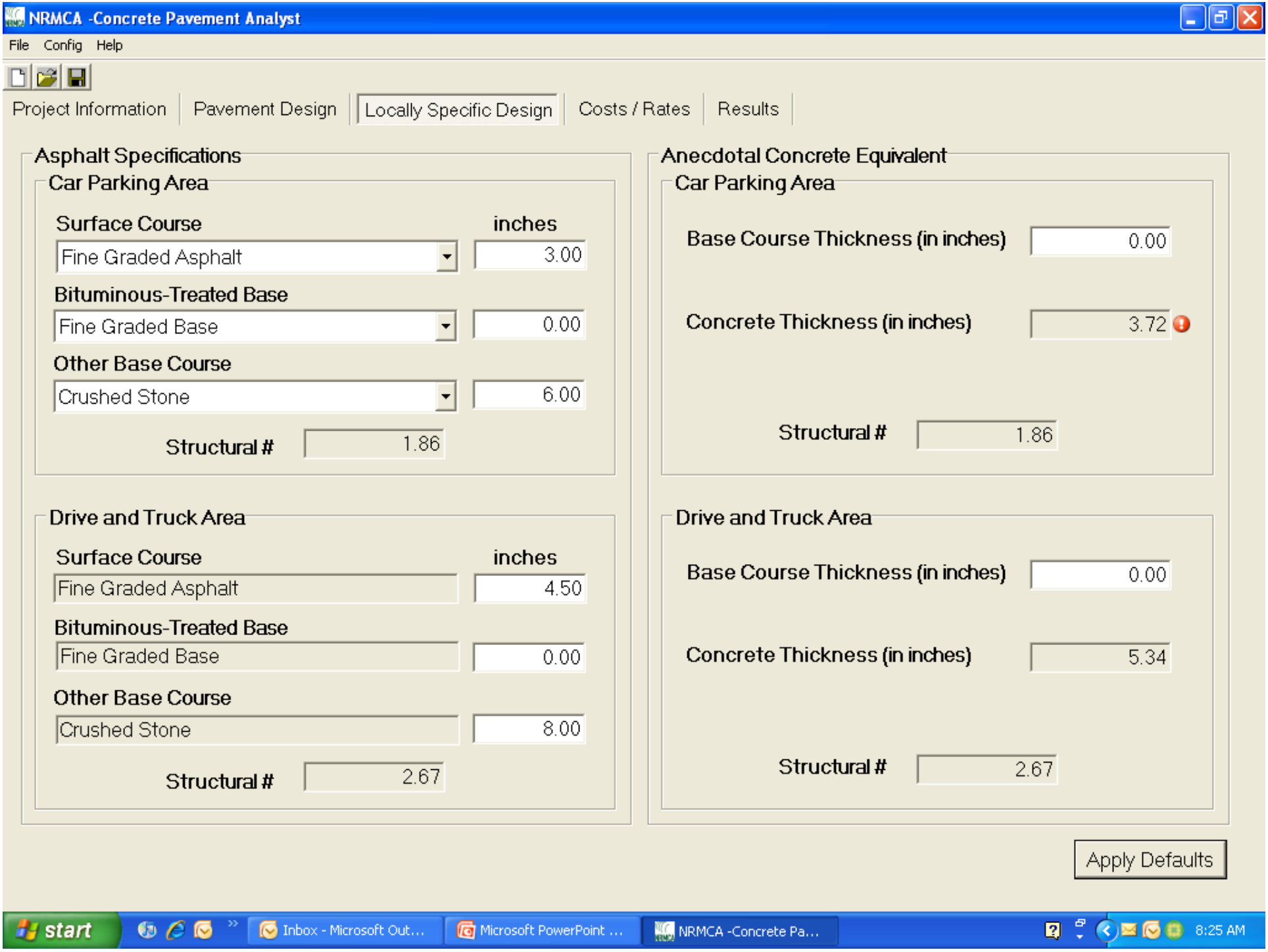
NRMCA -Concrete Pavement Analyst
File Config Help
Project Information
Pavement Design
Locally Specific Design
Costs / Rates
Results
Asphalt Specifications
Car Parking Area
Surface Course
inches
Fine Graded Asphalt
3.00
Bituminous-Treated Base
Fine Graded Base
0.00
Other Base Course
Crushed Stone
6.00
Structural #
1.86
Drive and Truck Area
Surface Course
inches
Fine Graded Asphalt
4.50
Bituminous-Treated Base
Fine Graded Base
0.00
Other Base Course
Crushed Stone
8.00
Structural #
2.67
Anecdotal Concrete Equivalent
Car Parking Area
Base Course Thickness (in inches)
0.00
Concrete Thickness (in inches)
3.72
Structural #
1.86
Drive and Truck Area
Base Course Thickness (in inches)
0.00
Concrete Thickness (in inches)
5.34
Structural #
2.67
Apply Defaults
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Concrete Pavement Analyst

Parking Area Design and Costing Software

Cost Summary Comparison

Project Information

Project Name: CPA 3 Final
Project Date: 08/18/2008
Prepared By: Phil Kresge
Prepared For: First Run

Car Parking Square Footage:	100,500.00
Drive Truck Square Footage:	50,250.00
Total Square Footage:	150,750.00

Recommended Concrete Design (ACI-330)

Concrete Strength:	4,000	psi		
Car Parking Area Concrete Thickness:	4.50	inches	2.25	SN
Car Parking Area Aggregate Base Thickness:	0.00	inches		
Drive & Truck Concrete Thickness:	6.00	inches	3.00	SN
Drive & Truck Aggregate Base Thickness:	0.00	inches		

Full Depth Asphalt Design (Asphalt Institute)

Car Parking Area	Type	Thickness		
Asphalt Surface Course	Fine Graded Asphalt	1.50	inches	
Bituminous-Treated Base	Fine Graded Base	5.25	inches	
Total Thickness		6.75	inches	2.25 SN

Drive & Truck Area	Type	Thickness		
Asphalt Surface Course	Fine Graded Asphalt	1.50	inches	
Bituminous-Treated Base	Fine Graded Base	7.59	inches	
Total Thickness		9.09	inches	3.00 SN

Locally Specified Asphalt Design

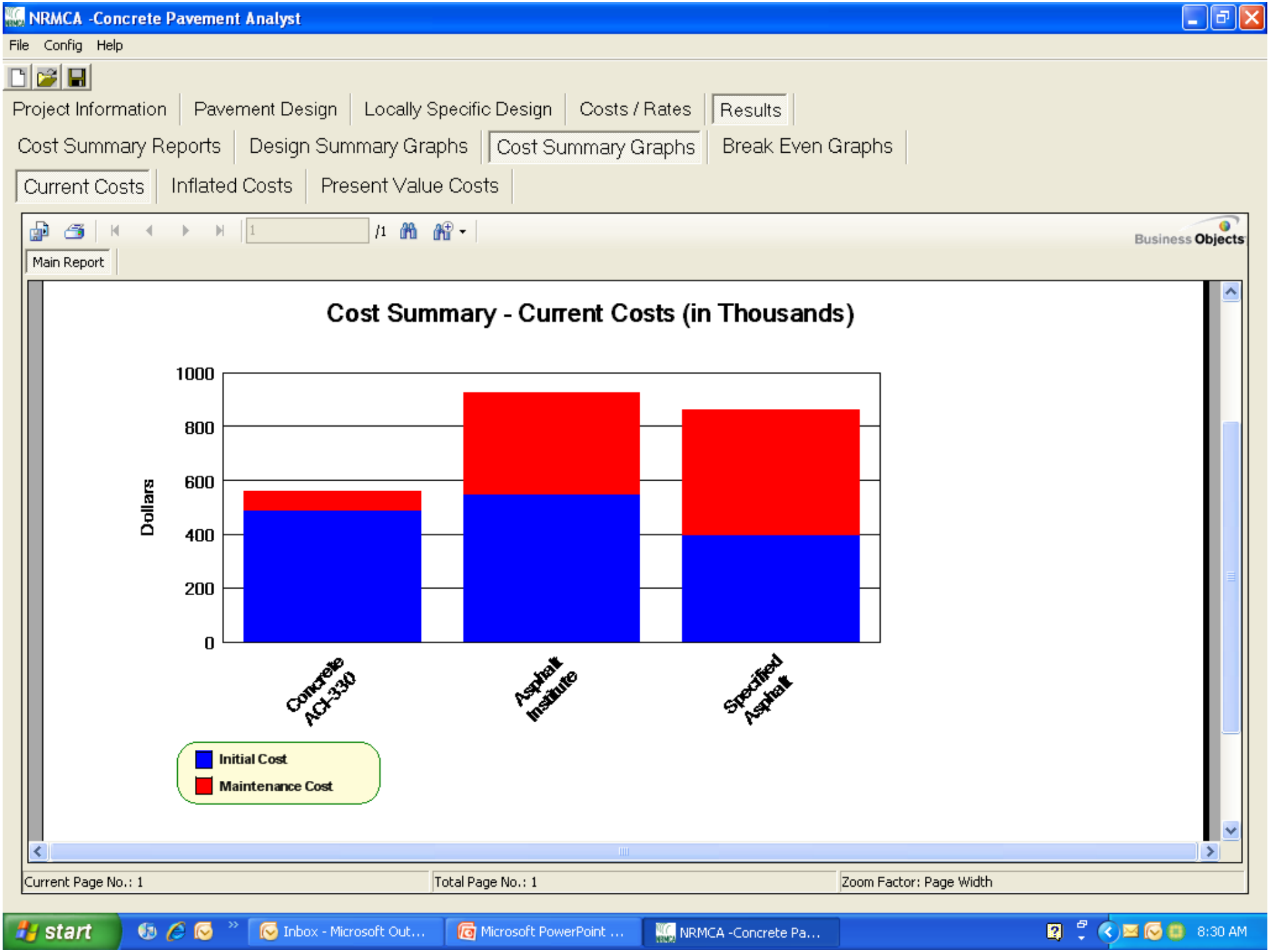
Car Parking Area	Type	Thickness		
Asphalt Surface Course	Fine Graded Asphalt	3.00	inches	
Bituminous-Treated Base	Fine Graded Base	0.00	inches	
Other Base	Crushed Stone	6.00	inches	
Total Thickness		6.75	inches	1.86 SN

Drive & Truck Area	Type	Thickness		
Asphalt Surface Course	Fine Graded Asphalt	4.50	inches	
Other Base	Fine Graded Base	0.00	inches	
Bituminous-Treated Base	Crushed Stone	8.00	inches	
Total Thickness		9.09	inches	2.67 SN

Anecdotal Concrete Design

Car Parking Area	Thickness		
Concrete Thickness	3.72	inches	Warning
Other Base (Crushed Stone)	0.00	inches	

Drive & Truck Area	Thickness	
Concrete Thickness	5.34	inches
Other Base (Crushed Stone)	0.00	inches


NRMCA -Concrete Pavement Analyst
File Config Help
Project Information
Pavement Design
Locally Specific Design
Costs / Rates
Results
Cost Summary Reports
Design Summary Graphs
Cost Summary Graphs
Break Even Graphs
Current Costs
Inflated Costs
Present Value Costs
Business Objects
Main Report
Cost Summary - Current Costs (in Thousands)
Dollars
1000
800
600
400
200
0
Concrete ACI-330
Asphalt Institute
Specified Asphalt
Initial Cost
Maintenance Cost
Current Page No.: 1
Total Page No.: 1
Zoom Factor: Page Width
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NRMCA -Concrete Pavement Analyst

File Config Help

Project Information | Pavement Design | Locally Specific Design | Costs / Rates | Results

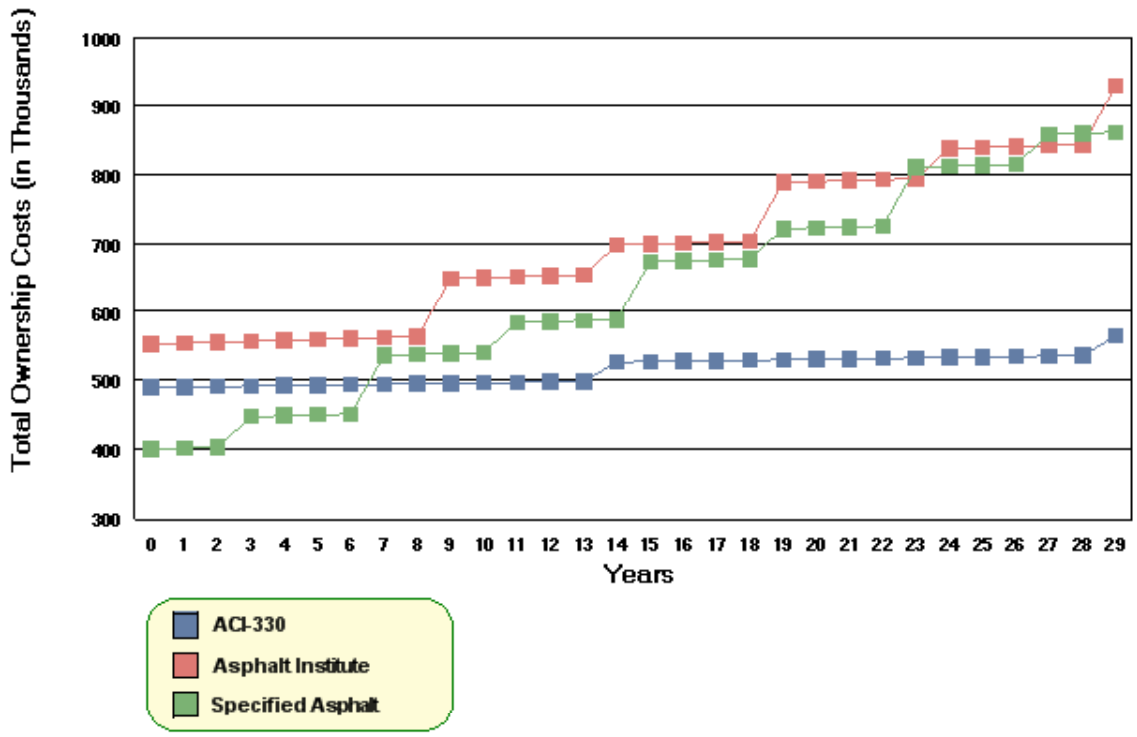
Cost Summary Reports | Design Summary Graphs | Cost Summary Graphs | Break Even Graphs

Current Costs | Inflated Costs | Present Value Costs

Business Objects

Main Report

Break Even Analysis - Current Costs



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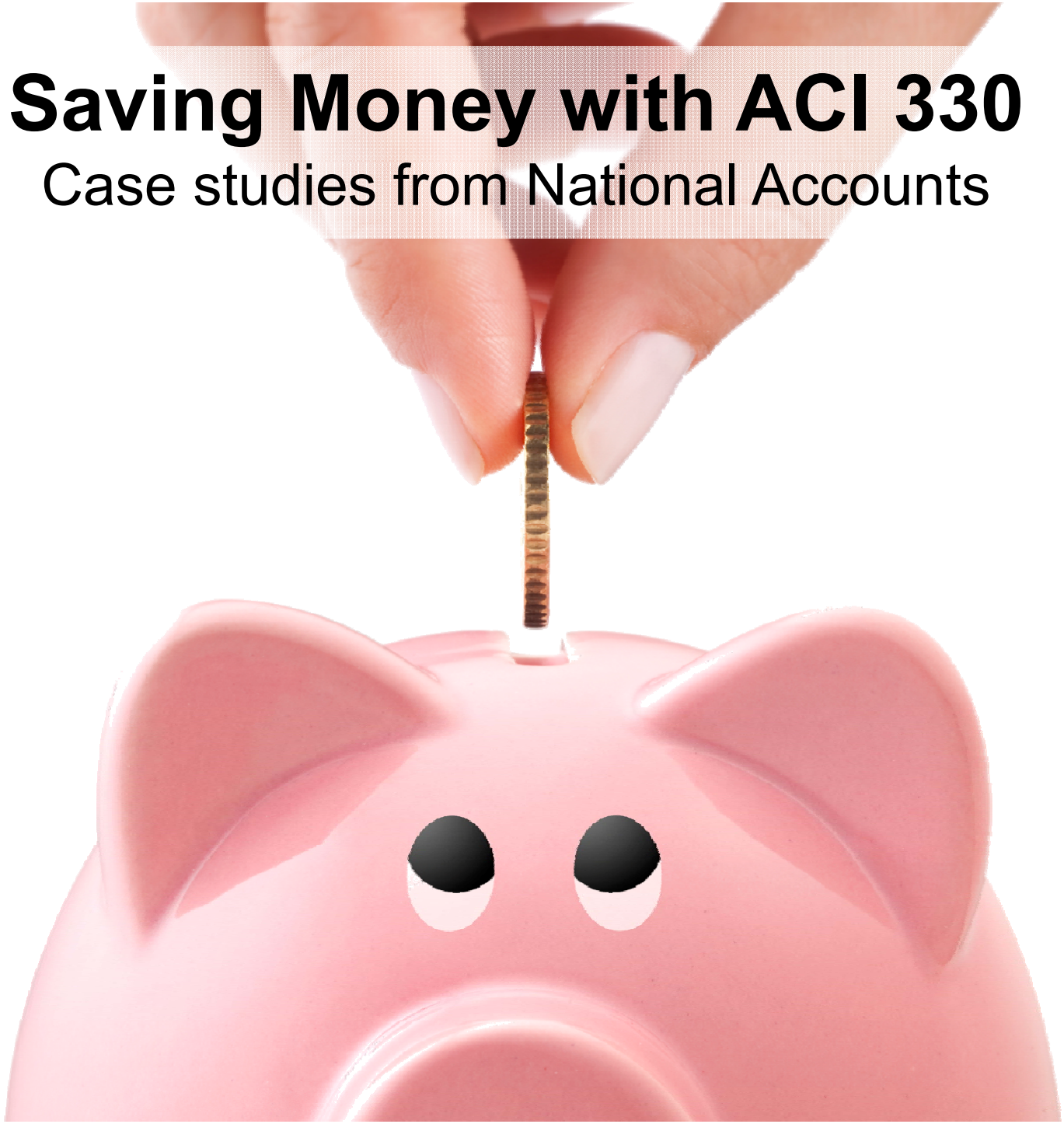
Saving Money with ACI 330

Case studies from National Accounts



Lowe's Home Improvement
Wilmington, NC

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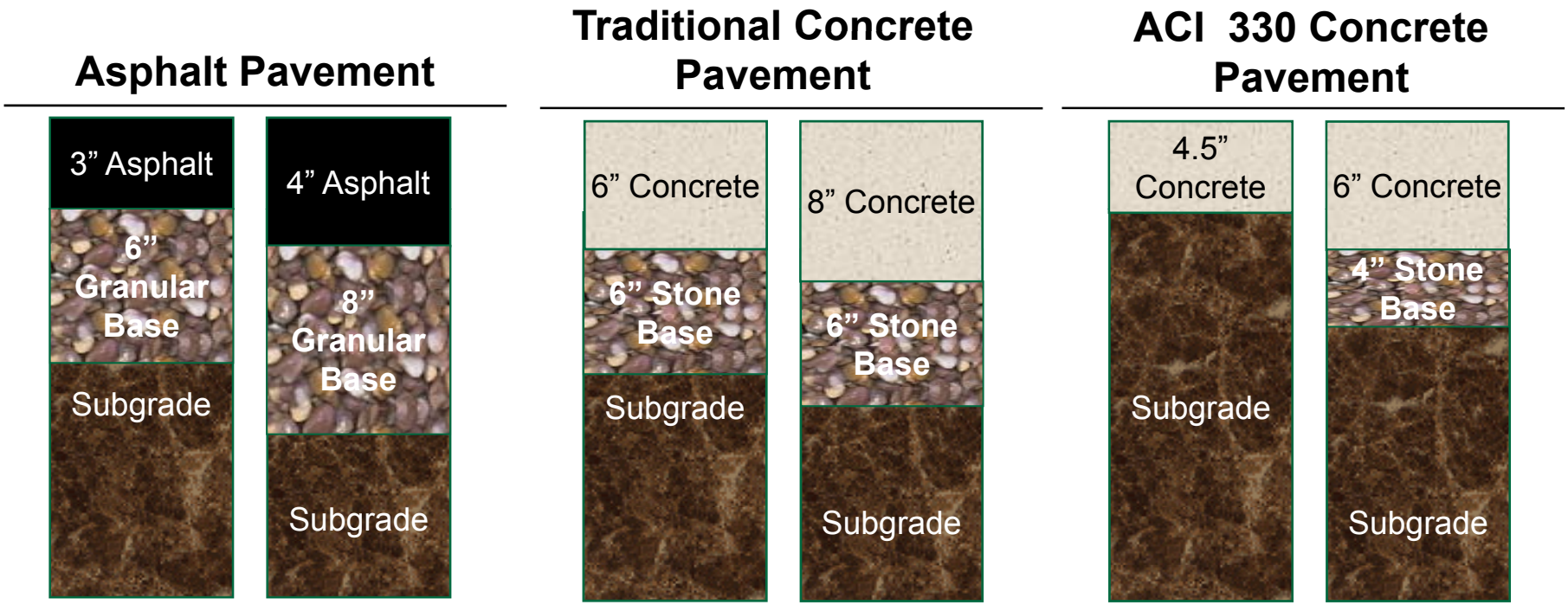
Lowe's Home Improvement
Wilmington, NC



Savings to the owner over traditional concrete design:
Undisclosed (reported to be 6-figures!)

Dollar General

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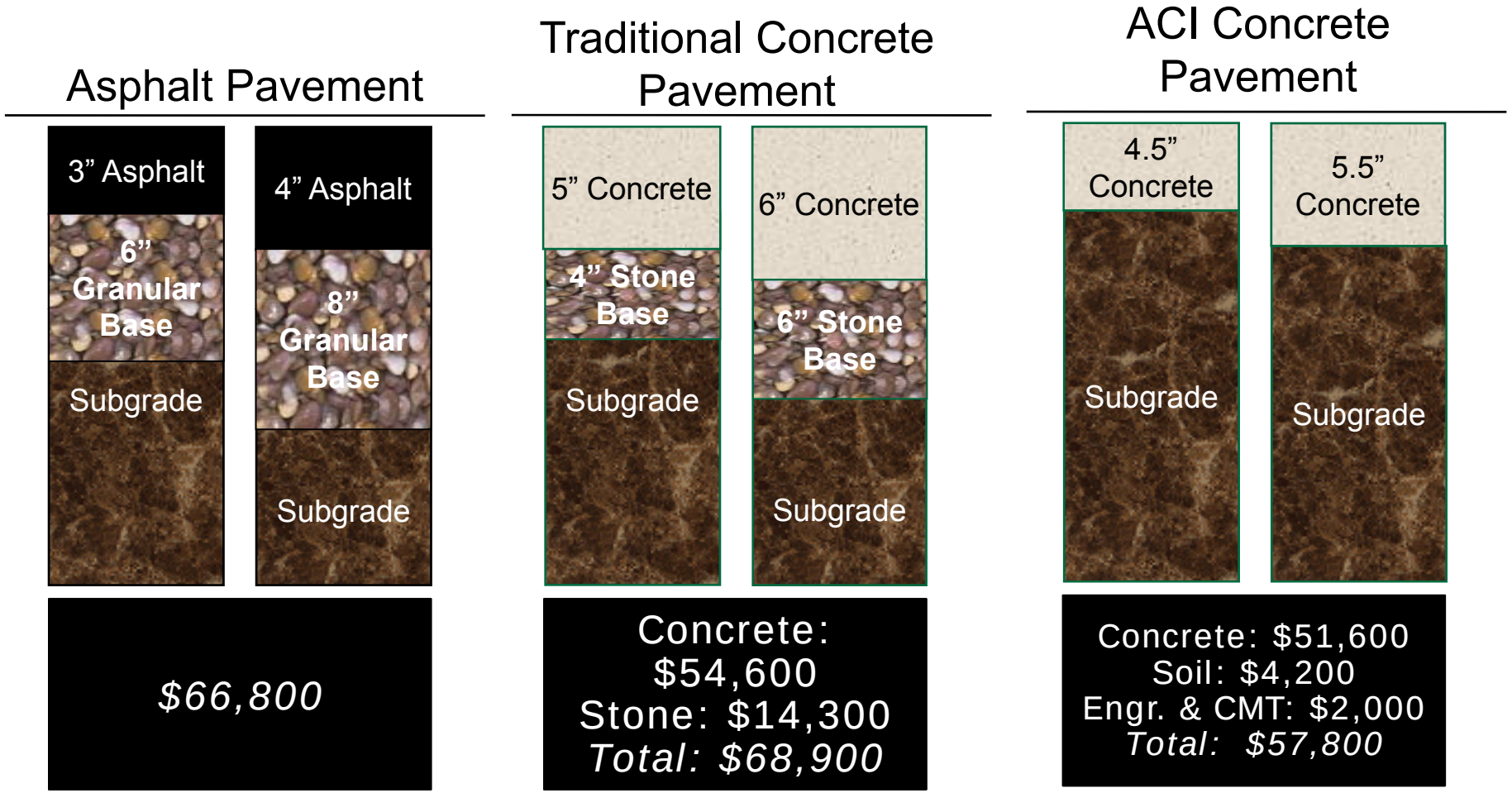
Dollar General



ACI 330 saved developer $9000 paving with Concrete instead of Asphalt

Taco Bell - Lenoir, NC

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Taco Bell - Lenoir, NC

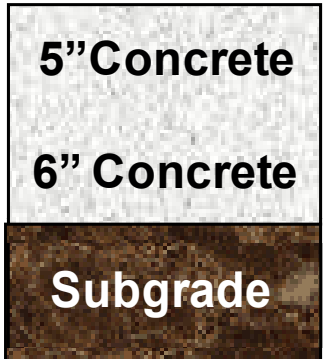
Asphalt Pavement

$59,450

Original Concrete Pavement

$88,670

ACI Concrete Pavement



$76,950

The Owners Paid $17,500 *MORE*
for Concrete vs. Asphalt

FAQ

Concrete Parking Lot Design & Construction Specifications

The intent of this document is to address, through references to industry publications and expertise, common design questions and issues that arise during the course of designing and constructing concrete parking lots.

Reinforcement

We've always used Welded Wire Mesh (WWM) and you are telling us not to. What gives? Welded wire mesh provides no increase in pavement structural capacity as some mistakenly believe. The job of WWM is to keep cracks tight that may form from environmental or traffic loading stresses. To keep cracks tight, the mesh has to be put in the correct place, which is rarely done. Below are references citing more explanations:

1. **ACI 330R-08** "When pavement is jointed to form short panel lengths that will minimize intermediate cracking, distributed steel reinforcing is not necessary. The practice of adding distributed steel to increase panel lengths has largely been discredited, and generally leads to excessive joint movements and interior panel cracks that deteriorate over time."
2. **ACPA (RT3.01)** (http://www.concreteparking.org/downloads/RT3.01.pdf) "If the pavement is jointed to form relatively short panels that will control cracking, distribute steel is not necessary. This design is called plain or non-reinforced concrete. For light traffic situations, load transfer is provided by aggregate interlock – the roughness of the cracked faces beneath the joint."

When should dowels be incorporated?
ACI 330 R-08 "Experience has shown that dowels or other load-transfer devices are not needed for most parking lot conditions... In thinner pavements of 7 in. and less, round dowels can be impractical or counterproductive. Usually, it is more economical to keep joint space close, using aggregate interlock, and thicken the pavement slightly, if necessary to reduce deflections."

Jointing

Why is jointing so important? Beyond aesthetics, jointing has many purposes including improving long-term durability. Some of the best concrete parking lots have been achieved with proper jointing patterns, completed at the correct time of placement with proper tools and without secondary reinforcement. Jointing details are often over-looked and can lead to pavement performance issues if not designed and detailed correctly. In fact, NRMCA believes proper jointing is so important that it created a program called the Design Assistance Program to aid engineers in concrete parking lot design and jointing at no cost to the engineer. References and other educational related to jointing may be found in:

1. **ACI 330R-08** (Section 3.7)
2. **NRMCA Concrete In Practice (CIP) Series #4 and #6**
3. **NRMCA Jointing Webinar**
4. **ACPA Intersection Joint Layout ISOO6P**
5. **ACPA Design and Construction of Joints for Concrete Streets ISOO061P**
6. **ACPA Concrete Pavements with Undoweled Joints for Light Traffic Facilities ISOO405P**

ACI 330 Support

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NRMCA Design Assistance Program

What is DAP?

Parking Lot and Street & Local Road (SLR) pavement design assistance.

Provides concrete pavement design alternatives that may be used for planning and bidding purposes as well as jointing plan to be used for construction

For members, state affiliates, concrete producers, contractors, consultants, owners, and developers.

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What is the purpose of DAP?

- Teach by example
- Results in correct concrete design
- Does the “heavy lifting” for design engineers not familiar with concrete pavement design
- Provides a no or little cost second opinion
- Does not compete with local consultants

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Brian Killingsworth, P.E
Senior Vice-President,
Division Head - Local Paving

Amanda H. Hult, P.E
Senior Director, Local Paving

Don Clem, P.E
Vice President, Local Paving

Ken Justice, P.E
Senior Director, Local Paving

- Parking Lot Design Assistance Program (DAP)
- Streets & Local Roads Design Assistance Program (DAP)
- Parking Lot CPA Software
- MIT Research
- Downloads
- Photos
- Concrete Paving Project Success Series
- Other Resources

Concrete Sites
for Architects, Engineers & Owners

Parking Lot Design Assistance Program (DAP)

Design Assistance Application Form (PDF) | Parking Lot Sample Design Proposal (PDF)

Jointing Plan Sample (PDF)

Parking Lot Design Assistance Program Handout (PDF)

The National Ready Mixed Concrete Association (NRMCA) provides concrete parking lot design recommendations intended for designers and specifiers not familiar with concrete parking lots. Specifiers may request these "DAP Recommendations" on their own behalf, or entities, including NRMCA members, may obtain them to pass along to specifiers. By providing detailed pavement design and CAD jointing recommendations, the Design Assistance Program helps deliver quality parking lot designs to ensure successful concrete projects.

Click the application form link above to submit a DAP request. Contact NRMCA's Amanda Hult at ahult@ntmca.org or 720-648-0323 with any questions.

DAP Concrete Parking Lot

Design Assistance Program Project Application

National Ready Mixed Concrete Association
email to Amanda Holt: aholt@nrmca.org
www.nrmca.org

☐ New Conventional Pavement Design ☐ Overlay Design ☐ Roller Compacted Concrete Design

APPLICANT INFORMATION (NAME, ADDRESS, PHONE, EMAIL, COMPANY):		
PROJECT OWNER & LOCATION (REQUIRED):	CIVIL ENGINEER (IF KNOWN):	GEOTECHNICAL ENGINEER (IF KNOWN):

SUPPORTING DOCUMENTATION (SUBMIT WITH APPLICATION)
Please provide as much of the following information as possible so the most relevant design recommendations can be provided. NRMCA will make the best available assumptions where insufficient information is provided. Such assumptions will be detailed in the recommendations along with an explanation of the accurate information needed for a final quality design.

YES	NO	
☐	☐	PLAN SHEETS (PLAN, PROFILE, PAVING, ETC.)
☐	☐	GEOTECHNICAL REPORT
☐	☐	MATERIALS AND CONSTRUCTION SPECIFICATIONS (SPECIFYING AGENCY):
☐	☐	STANDARD DETAILS
☐	☐	DEVELOPMENT GUIDELINES AND/OR PAVEMENT DESIGN PROCEDURE
☐	☐	PAVEMENT MAINTENANCE GUIDELINES
☐	☐	CAD FILE

Fill out the following information as best you can if there is no corresponding supporting documentation as noted above or for clarification:

SUBGRADE SOILS (CBR, K-VALUE, M_r, SOIL DESIGNATION, PI, ETC.)
TRAFFIC DATA (AADTT) AND BUILDING USE (IF APPLICABLE)
CURRENT OR PROPOSED FLEXIBLE PAVEMENT CROSS SECTION (THICKNESS AND MATERIAL DESCRIPTION)
CONCRETE PAVEMENT DETAILS FOR LOCAL CONDITIONS (I.E. CURBS/GUTTERS, JOINT SEALING, SUBGRADE STABILIZATION, ETC.)
MISCELLANEOUS PROJECT INFORMATION (PROVIDE PERTINENT PROJECT INFORMATION NOT COVERED ABOVE)
☐ PROJECT CONTACT INFORMATION: (CHECK IF SAME AS APPLICANT)

Requested* Information for DAP

- Site Plan
- Geotechnical Report
- Design/Anticipated Traffic Count
- Local Design Specifications
- Proposed Asphalt/Concrete Section

If all requested information is not available, a design report will be provided based on the available information available and assumptions that will be defined in the report.

NRMCA

March 19, 2015

Mr. Scott Smith
Ready Mix LLC
91550 NW 131st Avenue
Columbia, IL 46932

RE: Pavement Design for ABC Bookstore Parking Lot
Lawrence, IN

Mr. Smith:

The National Ready Mixed Concrete Association (NRMCA) is pleased to provide these concrete pavement design recommendations through the Design Assistance Program (DAP) for the above mentioned project. Specific information used to develop this concrete paving design was gathered from information provided by the Applicant. If the information provided is updated or changed, NRMCA will need to review our recommendations for applicability. Please contact us if you desire further assistance regarding this project.

Sincerely,
National Ready Mixed Concrete Association

Amanda H. Hult

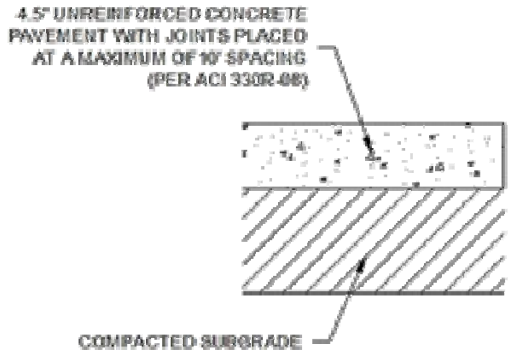
Amanda H. Hult, P.E.
Director, Pavement Structures
456 Lorraway Drive
Castle Rock, CO 80108
(720) 648-0323
ahult@nrmca.org

Summary

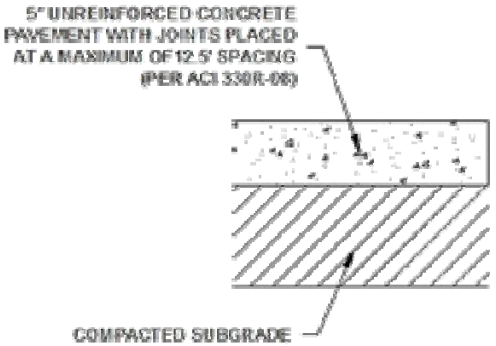
Project Description

The proposed construction for the site includes a parking lot that will service a retail center building.

NRMCA Concrete Pavement Recommendation (from ACI 330R-08)



STANDARD DUTY
N.T.S.



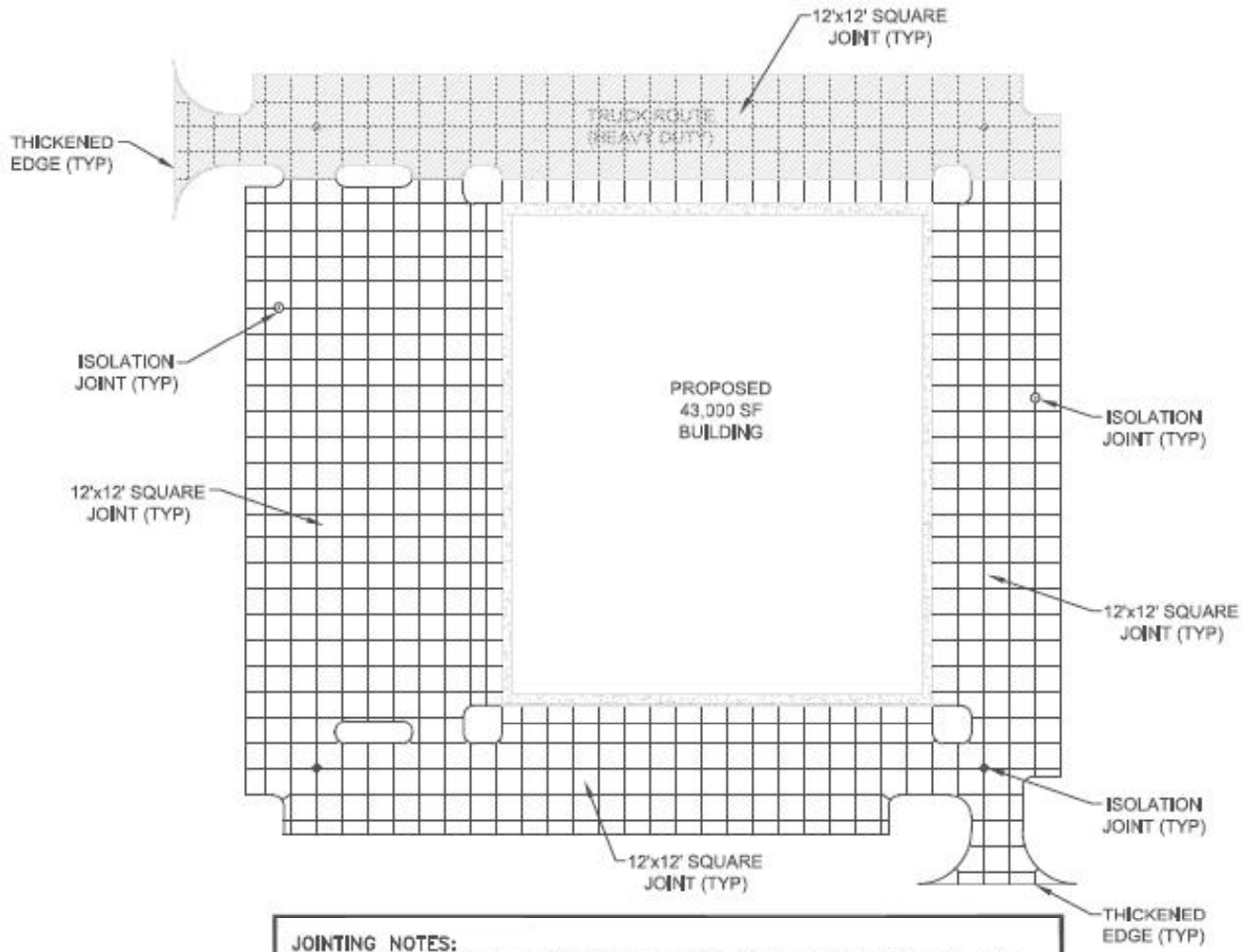
HEAVY DUTY
N.T.S.

Standard Duty

Portland Cement Concrete Thickness (550 psi)	4.5 inches
Maximum Allowable Joint Spacing (Panel Size)	10.0 by 10.0 feet
Recommended Joint Spacing (Panel Size)	6.0 by 6.0 feet
Edge Support (Curb/Gutter, Thickened Edge, etc)	Required
Dowel Bars	Contraction: Not Required Construction: Not Required

Heavy Duty

Portland Cement Concrete Thickness (550 psi)	5.0 inches
Maximum Allowable Joint Spacing (Panel Size)	12.5 by 12.5 feet
Recommended Joint Spacing (Panel Size)	8.0 by 8.0 feet



JOINTING NOTES:
1. ALL JOINTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ACI 330.
2. JOINTS ARE TO ENTER CURVED EDGES WITH PERPENDICULAR CUTS.
3. JOINTS ARE TO BE CUT WITHIN 12 HOURS OF FINISHING.
4. ISOLATION JOINTS ARE TO BE PLACED AROUND FIXED STRUCTURES AND AS NOTED ON PLAN.
5. RECOMMENDED JOINT PLAN MUST BE REVISED TO ACCOMMODATE CONSTRUCTION JOINTS.
6. IF EDGE RESTRAINTS ARE NOT USED, TIE BARS SHOULD BE PLACED AT THE FIRST LONGITUDINAL JOINT.
7. SPECIAL ATTENTION SHOULD BE GIVEN TO STRUCTURES (DRAINAGE, SEWER, WATER, ETC) NOT SHOWN ON THIS PLAN.


Google™
Earth

DAP Effectiveness

FY 2016

173 Reports Completed

Potentially Influencing 540,000 yd^3

Over 60% of DAP Projects Go Concrete

*Still Following Up On Projects From 2014-2016

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All we ask in return...

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What Gets Measured…

…Gets Done!

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Promotion Tools

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www.concretepromotion.org

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CONCRETE PROMOTION

THE CONCRETE PROMOTERS' RESOURCE CENTER

- Parking Lot Design Assistance Program (DAP)
- Streets & Local Roads Design Assistance Program (DAP)
- Parking Lot CPA Software
- MIT Research
- Downloads
- Photos
- Concrete Paving Project Success Series
- Other Resources

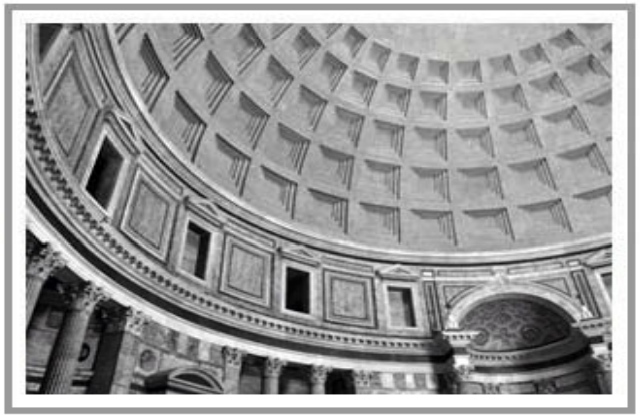
Concrete Sites for Architects, Engineers & Owners

- ConcreteAnswers.org Hub Site
- ConcreteParking.org
- ConcreteBuildings.org
- PerviousPavement.org
- GreenConcrete.info
- FlowableFill.org
- GreenRooftops.org
- ConcreteStreets.org

Welcome to the Resource Center!

Let's work together to advance concrete as the construction material of choice...
For today, tomorrow and ages to come!

- Concrete has been a leading building material for thousands of years. No other construction material provides the strength, durability and economy of concrete. Modern ready mixed concrete also provides remarkable flexibility in meeting the needs of challenging placement and sustainable design. *We in the concrete industry are fortunate to work with an outstanding product that has served mankind for ages and yet is still advancing rapidly.*



MIT Concrete Sustainability Hub

The Massachusetts Institute of Technology (MIT) released comprehensive research findings that will help set a new standard in life-cycle assessment (LCA) modeling.

The studies, which are part of an ongoing research initiative at the **MIT Concrete Sustainability Hub**, quantifies the cradle-to-grave environmental and economic costs of paving and building materials, and is one of the most comprehensive LCA model produced to-date.

...more

NRMCA Promotion Collateral

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I couldn't help but notice…

that your parking lot is in need of some repair

If you'd like to get out of the rut of asphalt repairs, call me about Concrete.

Troy Ahlrich, Owner
712-540-3284
ahlrichinc@yahoo.com

Make your own opportunity!

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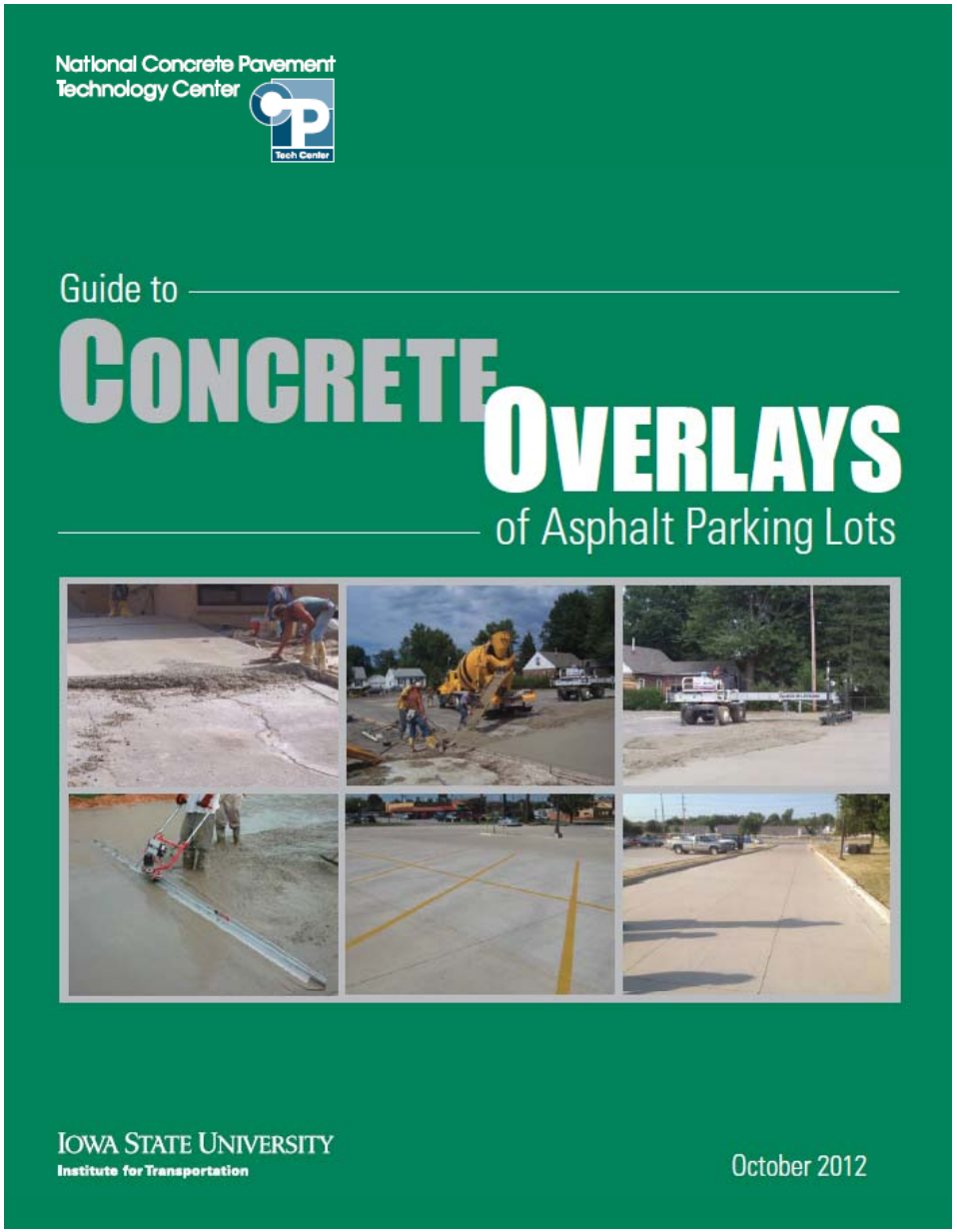

Concrete Overlays Support

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CONCRETE PARKING LOTS BOOT CAMP

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Concrete Parking Lots Boot Camp

- 10-hours
- 1 R/M Producer
- 1 Contractor
- Other Supplier(s)

- ACI 330
- Concrete Overlays
- Concrete Pavement Analyst
- Key Target Markets

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Concrete Parking Lots Boot Camp

<u># of Boot Camps</u>

2013 = 1
2014 = 5
2015 = 4
2016 = 7

Sept. 2016 - Boot Camp at ASCC

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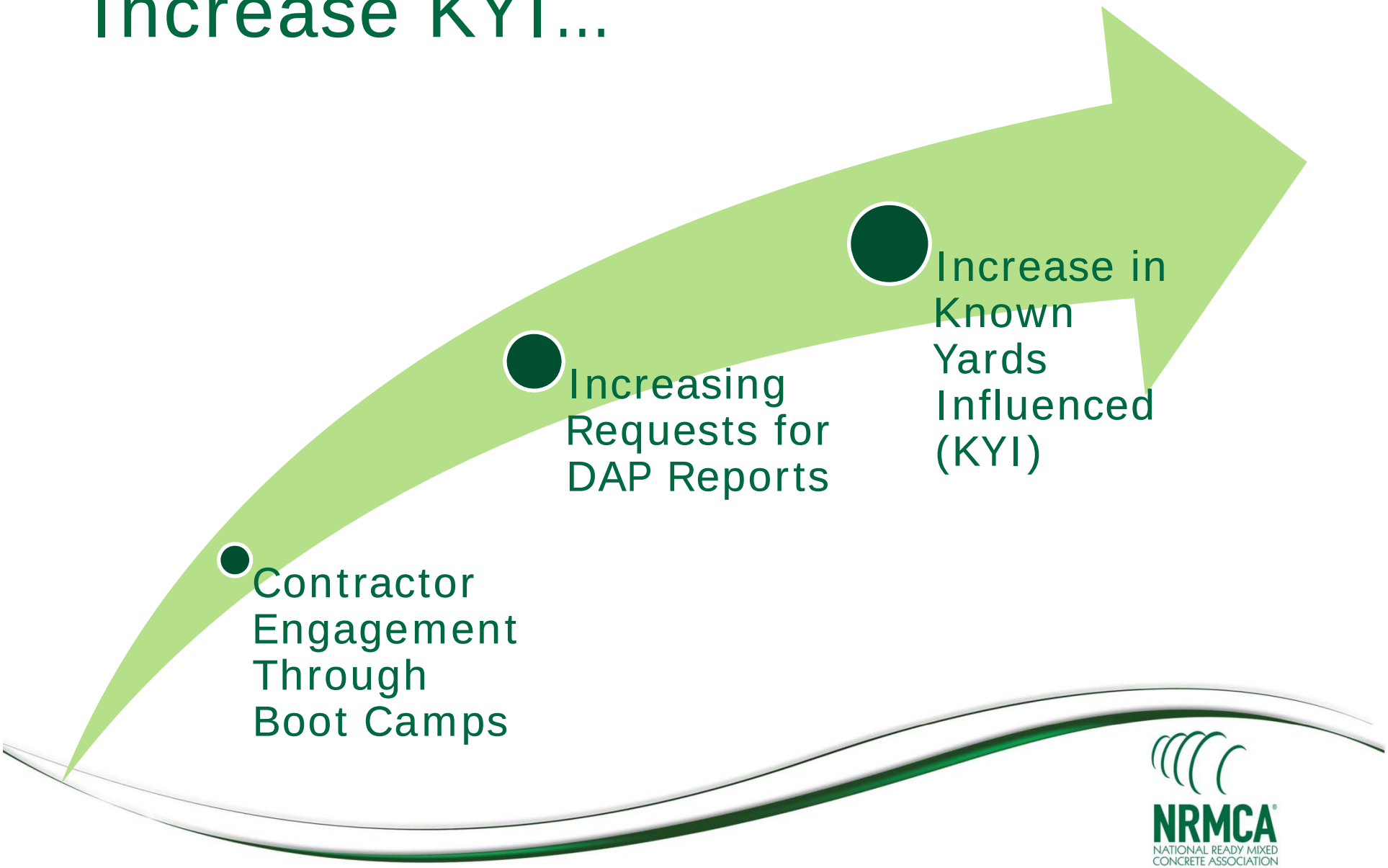
Local Paving Strategy to Increase KYI…



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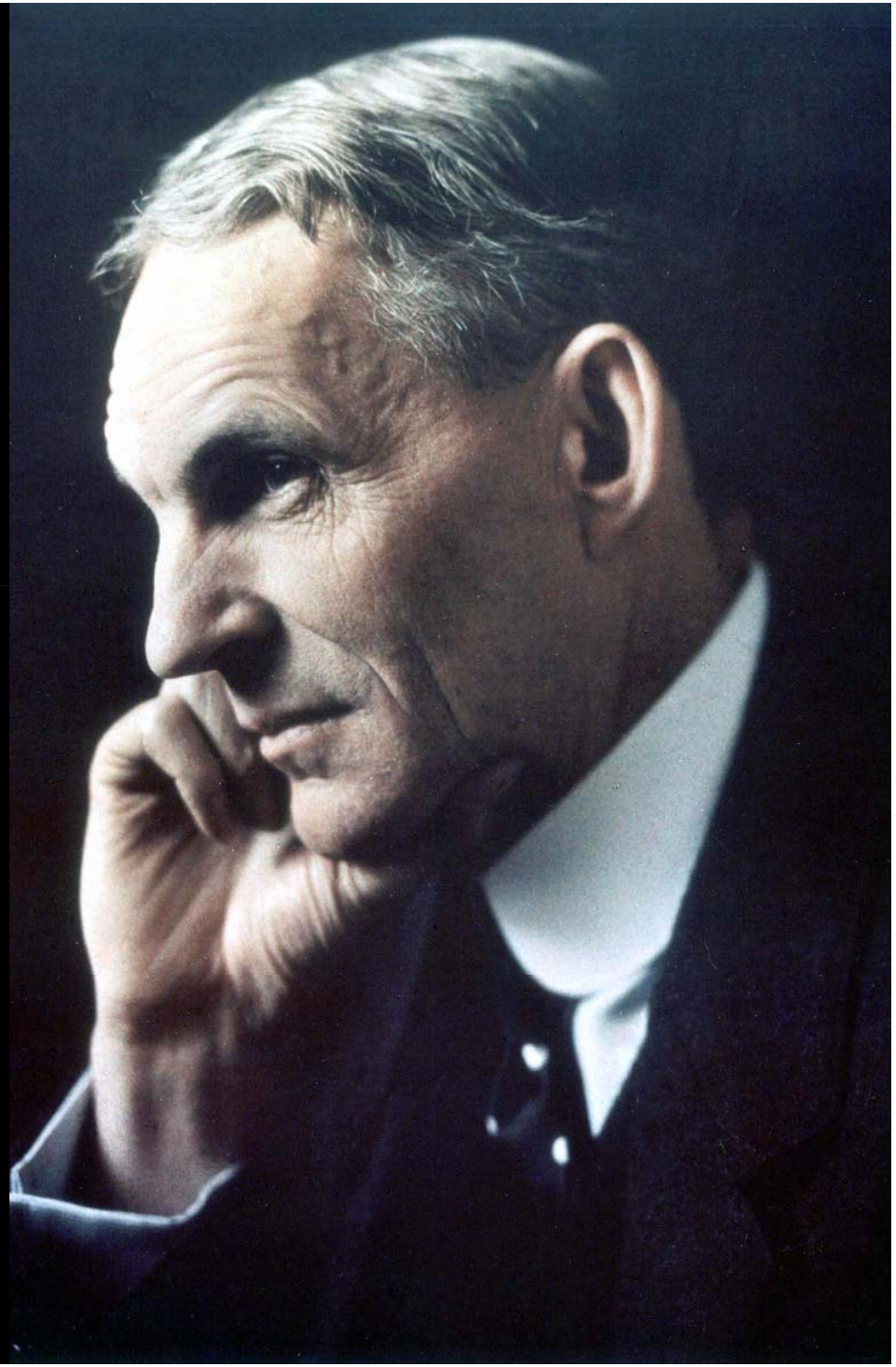
Directions:

1. Place kit on FIRM surface.
2. Follow directions in circle of kit.
3. Repeat step 2 as necessary, or until unconscious.
4. If unconscious, cease stress reduction activity.

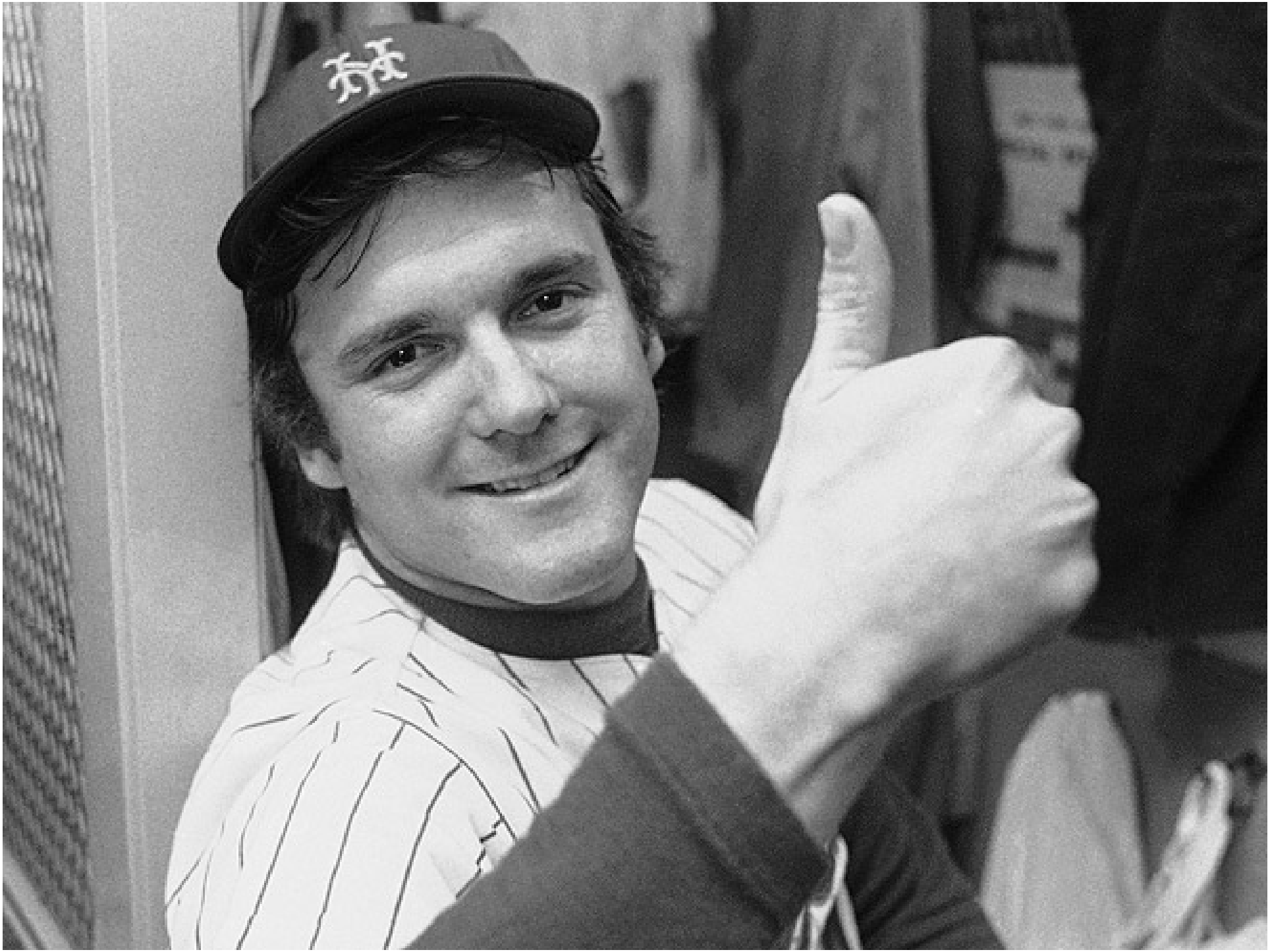

Where the magic happens
Your Comfort Zone


ON THE ROAD TO SUCCESS,
THERE ARE NO SHORTCUTS.
JOIN OUR TEAM
SHAFFER
TRUCKING
OUR MOST
VALUABLE
RESOURCE SITS
63 FEET AHEAD.
C 240

“Whether you think you can, or you think you can’t, you’re right.”



"Most people fail, not because of a lack of desire, but because of a lack of commitment."

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