



**COMPACTED
CONCRETE
PAVEMENT**

**SECOND AVE
BURBANK, WA**

INTRODUCTIONS



WALLA WALLA COUNTY

SETH WALKER, P.E. - PROJECT ENGINEER



Wm WINKLER

BRIAN WINKLER - PRESIDENT

PETE REED - CONSULTANT

PROJECT BACKGROUND

- Second Avenue is located near SR 12 and provides access to the Port of Walla Walla's Industrial Park in Burbank, WA.
- Second Avenue was showing significant signs of deterioration due to the heavy truck traffic accessing the Port's facilities.
- The Port of Walla Walla partnered with Walla Walla County on the project.
 - The Port Funded the construction contract, the County funded the design and inspection.
 - The Port wanted a design that would hold up to the heavy truck traffic and preferred concrete over asphalt.





PROJECT

W HWY 12 ON RAMP

W SUNSET DR

ICE HARBOR D

124

ATEWAY RD

TUTTLE LN

GALLANT RD

FIFTH-W HWY 12

KOHLER RD

SECOND AVE

FIFTH AVE

JANTZ RD

W MAPLE ST

E MAPLE ST

MAIN ST

THIRD AVE

FOURTH AVE

MAIN ST

W HUMORIST RD

E HUMORIST RD

SAGE RD

APPLE LN

MERRY LN

HANSON

ADAIR RD

AY BLVD

RINGHOFF RD

RRISON RD

QUINCY RD

W HI

EDITH ST



GRAIN TERMINAL RD

SECOND AVE

GATEWAY RD

PROJECT BACKGROUND

- A video was produced by the IMPA (International Pavement Management Association) that showed Andale Ready Mix in Wichita, Kansas placing Compacted Concrete Pavement (CCP).
- Walla Walla County contacted Andale Ready Mix for more information.
- Walla Walla County suggested to CRAB (County Road Administration Board) that CCP would be a good topic for the annual CRAB Road Design Conference.
- Richard Mfuko with Andale Ready Mix/ACEiT Industries presented at the 2016 CRAB RDC.
- The Port was in support of using this construction method for the project.
- This is the first project in the Northwest to use CCP for finished road surface.



RCC vs. CCP

- Roller Compacted Concrete (RCC) is the more traditional terminology.
- RCC gets its name from the heavy vibratory roller that is used to compact the material and is typically placed with asphalt-type paver.
- RCC is stiffer than typical zero slump conventional concrete and is stiff enough to remain stable under the roller.
- RCC typically has an unfinished surface which is generally considered ugly for a road surface.
- CCP has additional additives and can be placed with a high density asphalt-paver which may not require rolling to achieve compaction.
- The additives also allow the surface to be finished by a power trowel followed by a broom or tine finish.



1930s:
A form of RCC paving is performed in Sweden.



1970s:
RCC pavements become common for log-sorting yards in Canada.



Late 1980s—early 1990s:
RCC pavements are constructed for automotive, port, and intermodal facilities in the U.S.

History of RCC

Early 1940s:
The first RCC pavement in North America is an airport runway constructed in Yakima, Washington.



Early 1980s:
US Army Corps of Engineers begins researching and constructing RCC pavements at military facilities in the U.S.



2000s:
RCC pavements gain popularity for constructing low- to moderate-traffic streets and secondary highways.



PROPERTIES OF CCP

- Same basic ingredients as conventional concrete but with different proportions.
- Less cement than conventional concrete.
- Lower volume of coarse aggregate and higher volume of fine aggregate.
- Very stiff, zero slump concrete mixture.
- There is no need for reinforcing steel.
- ACEit additives allow finishing.
- Joint sawing is not required, but when specified, joints may be spaced farther apart than conventional concrete.
- Typically paved in 6-8 inch lifts with 4 inch min. and 10 inch max.
- Studies have shown good resistance to freeze-thaw cycles.
 - It is important to have a well-graded, well-proportioned, and well-compacted mixture.
 - The mixture tends to have natural “compaction voids” that offer some protection against frost actions.

SPECIFICATIONS

MIX DESIGN

- Maximum nominal aggregate size is 3/4 inch.
- The minimum cementitious material for the paving mix design shall be 450 pounds per cubic yard
- An approved admixture shall be required in the CCP mixture.
 - The admixture shall be ACEiT Plus Hydration Stabilizer or approved equal.
 - The admixture shall work as a hydration stabilizer and retarder that enables the mix to maintain a consistent moisture content, aids in the placement process in achieving compaction and densification while extending the haul time without significant moisture loss.
 - ACEiT Plus is typically added at a rate of 1 to 1.5 pounds per cubic yard of mix.

			CCP	CONVENTIONAL CONCRETE PAVEMENT
BINDER	CEMENT	PCY	500	
	FLY ASH	PCY	-	
AGGREGATES	MAXIMUM AGG SIZE	IN	3/4	
	COARSE AGG	PCY	1721	
	FINE AGG	PCY	1733	
ADMIXTURES	ACEiT	PCY	1.1	
	WATER REDUCER	OZ	-	
	AIR ENTRAINMENT	OZ	-	
	WATER	PCY	225	
STRENGTH	COMPRESSIVE 7-DAY	PSI	5496	
	COMPRESSICE 28-DAY	PSI	7510	

			CCP	CONVENTIONAL CONCRETE PAVEMENT
BINDER	CEMENT	PCY	500	705
	FLY ASH	PCY	-	-
AGGREGATES	MAXIMUM AGG SIZE	IN	3/4	1-1/2
	COARSE AGG	PCY	1721	1936
	FINE AGG	PCY	1733	1085
ADMIXTURES	ACEiT	PCY	1.1	-
	WATER REDUCER	OZ	-	40-60
	AIR ENTRAINMENT	OZ	-	1-20
	WATER	PCY	225	280
STRENGTH	COMPRESSIVE 7-DAY	PSI	5496	5157
	COMPRESSICE 28-DAY	PSI	7510	6211

SPECIFICATIONS CONT'D

MIXING EQUIPMENT

- Truck mixing of the CCP mixture is not allowed and the CCP may only be mixed at the batching plant, unless otherwise approved by the Engineer.
- The contractor proposed to use a pugmill portable mixing plant. The pugmill was brought on-site and set up.



RAPIDMIX 400C



ACEiT ADDITIVE DISPENSER

SPECIFICATIONS CONT'D

PAVER

- CCP shall be placed with either a conventional asphalt-type paver or a high-density asphalt-type paver.
- The paver shall be capable of placing the CCP at a minimum of 85% of the maximum wet density prior to any additional compaction.
- A high-density paver may be capable of achieving final compaction (98%) without the use of rollers.
 - This shall be demonstrated during the test section (200 square yards).
 - A roller shall be kept on-site during all paving.
- The paver shall be of suitable weight and stability to spread and finish the CCP without segregation, to the required thickness, smoothness, cross-section and grade.

SPECIFICATIONS CONT'D

PLACEMENT

- The standard method on constructing CCP shall be with an approved paver to spread, consolidate, screed, and initially (or fully) compact the freshly placed concrete in one complete pass of the machine so a homogeneous pavement is achieved with a minimum of hand finishing.
- The CCP surface shall be smooth, uniform, and continuous without tears, ridges, or aggregate segregation once it leaves the paver.
- The finished surface shall be mechanically troweled to evenly distribute the mixture and provide a smooth uniform surface.
- The pavement thickness is 7 inches



DH6D54

35-61162

EX



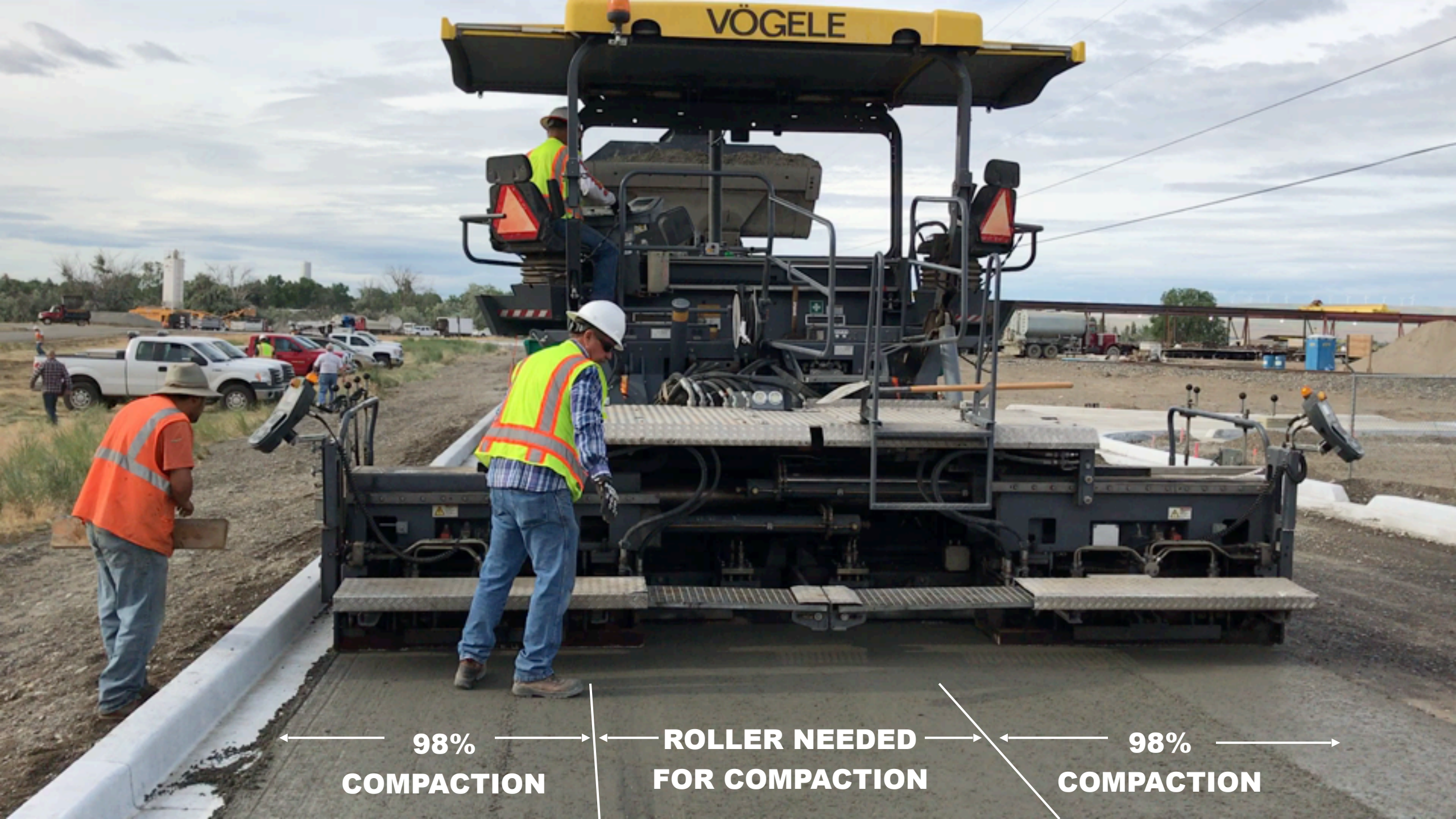
WM. WINKLER CO.
CONCRETE CONTRACTOR
Spokane, WA 409-6100

DEAD END

VOGEL SUPER 2100-2

R 2100-2





VÖGELE

← 98%
COMPACTION →

← ROLLER NEEDED
FOR COMPACTION →

← 98%
COMPACTION →

SPECIFICATIONS CONT'D

COMPACTORS (WHEN REQUIRED)

- CCP shall be compacted with self-propelled steel drum rollers having a minimum static weight sufficient to achieve the density requirements.
- Final compaction shall be a steel drum roller or rubber-tire (pneumatic) roller in static mode.
- Use walk-behind vibratory rollers or plate tampers for compacting areas inaccessible to large rollers.

HAMM HD 13 VIBRATORY ROLLER



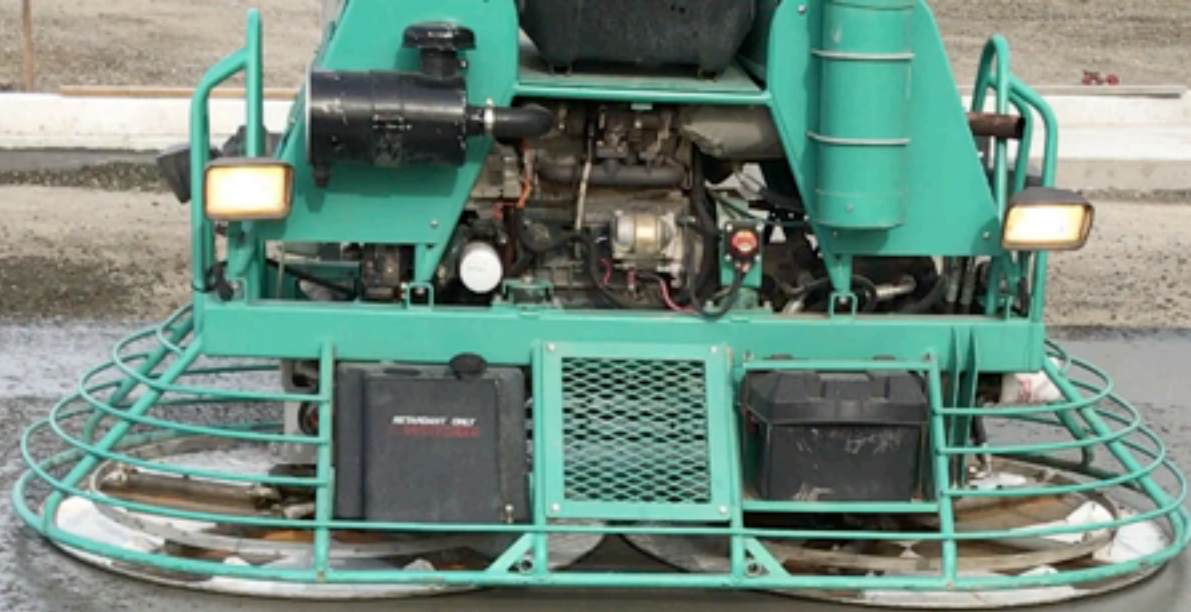
SPECIFICATIONS CONT'D

FINISHING

- ACEiT Blue or an approved equal shall be applied as a finishing agent enabling the surface of CCP to be finished mechanically and physically by producing a finishing “paste” that can be generated without the application of water on the surface of the pavement.
- ACEiT Blue has been tested and shown to increase the surface durability.
- The application rate for ACEiT Blue is typically one gallon per 100-200 square feet of surface area and should be applied as recommended by the manufacturer
- The surface shall receive a transverse tine finish.

APPLICATION OF ACEIT BLUE





HYDRA-STATIC POWER TROWEL



**BROOM FINISH TO
SMOOTH OUT TROWEL
MARKS FOLLOWED BY TINING**



FINISHED TINED SURFACE

SPECIFICATIONS CONT'D

PAVING JOINT

Fresh Joint

- A fresh joint is a joint where the adjacent CCP is placed within 60 minutes.
- The time limit may be adjusted based on the use of retarders.

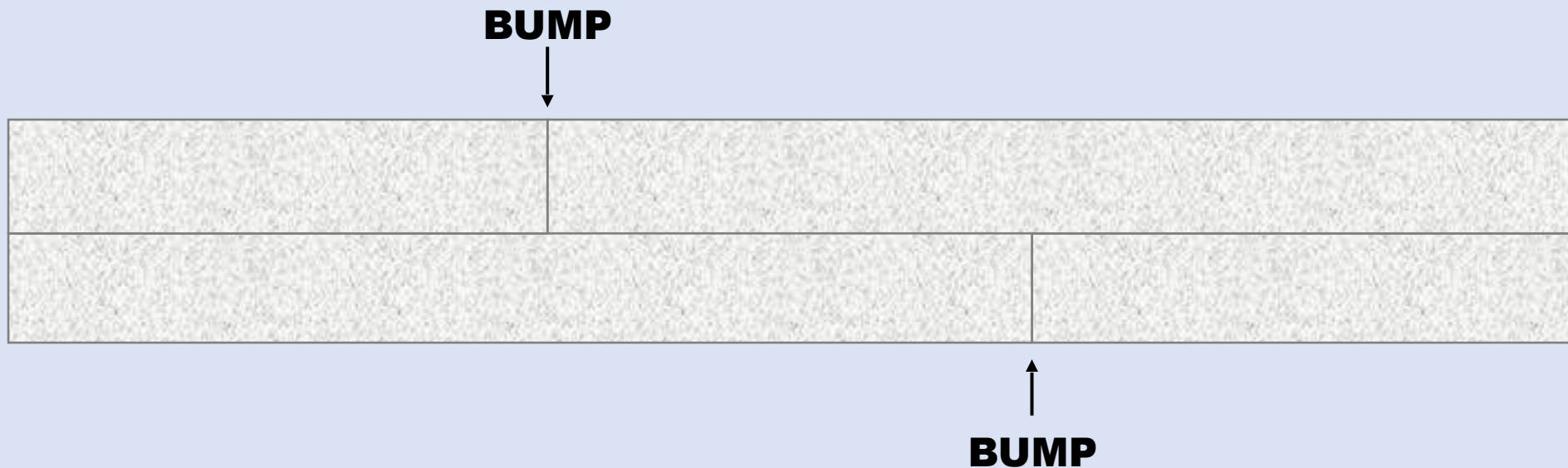
Cold Joint

- A cold joint is any planned or unplanned longitudinal or transverse construction joint that does not qualify as a fresh joint.
- Before placement of the adjacent CCP lane, prepare the cold vertical joint by cutting the pavement for the full depth in sound compacted material at least 6 inches from the exposed edge.

PAVING JOINTS CONT'D

On this project the Contractor paved in a “leap frog” pattern to avoid cold joints. In a future project I would re-write this specification to disallow paving in such a way.

**SAWED
JOINT NOT
RIGHT ON
MEET-LINE** →

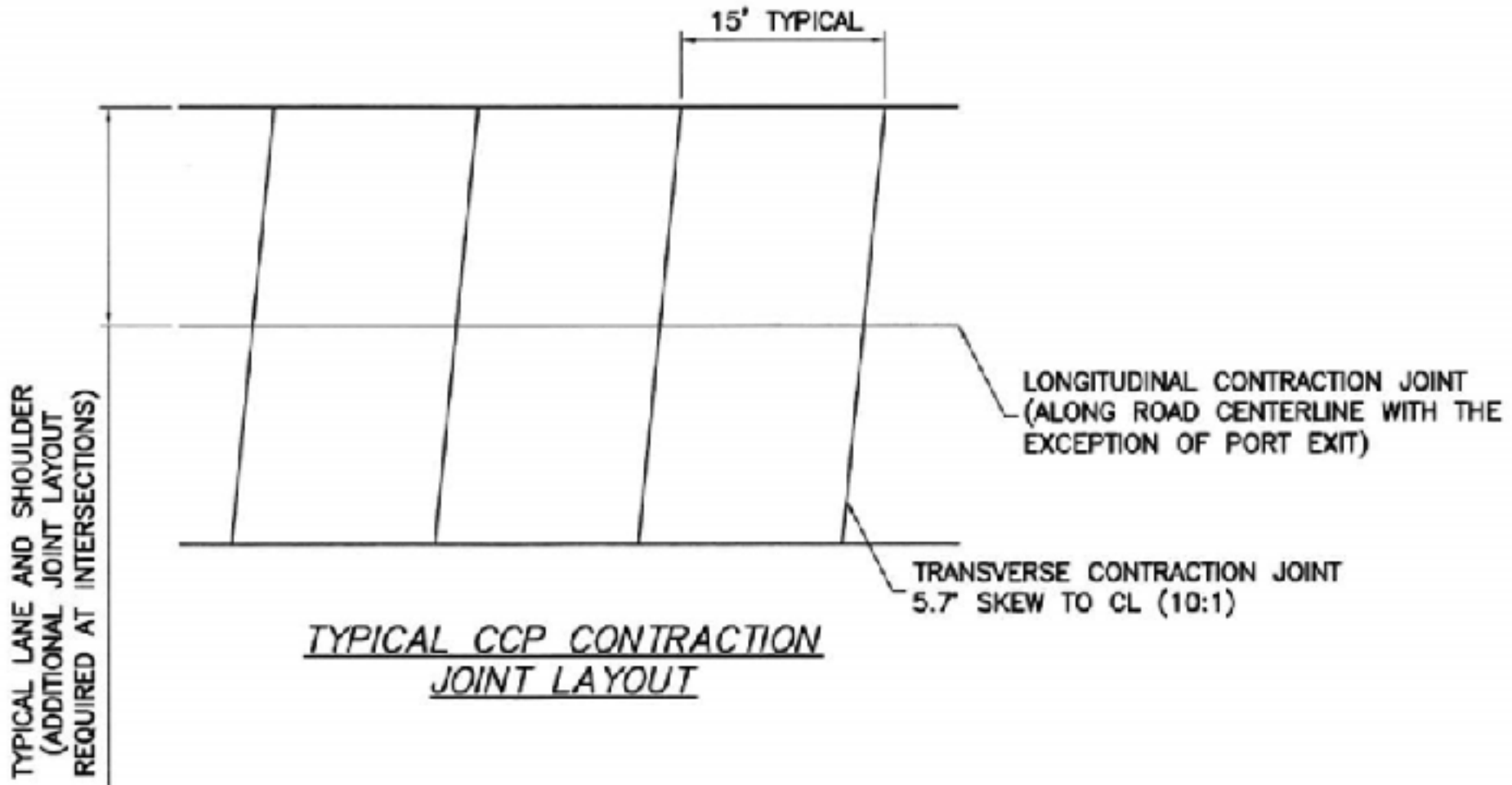




SAWED JOINTS

- CCP does not require sawed joints, random cracks are generally tight and acceptable when aesthetics are not a factor.
- Sawed joints are typically utilized when paved on an arterial street.
- Guidance for joint spacing is:
 - Transverse joints should be spaced at 15 to 20 feet intervals for pavements less than 8 inches thick and 3 to 4 times in feet the pavement thickness in inches for pavements 8 inches thick or greater.
 - Longitudinal joints should be spaced at 15 to 20 feet intervals for pavements less than 8 inches thick and 2.5 times in feet the pavement thickness in inches for pavements 8 inches thick or greater.

JOINT LAYOUT FROM PLANS



QUALITY ASSURANCE MATERIAL TESTING

- QA materials testing was contracted out to Intermountain Material Testing out of Pasco, WA.
- We had early conversation with the testers regarding the test methods required
- Specialty equipment was required for casting the cylinders.

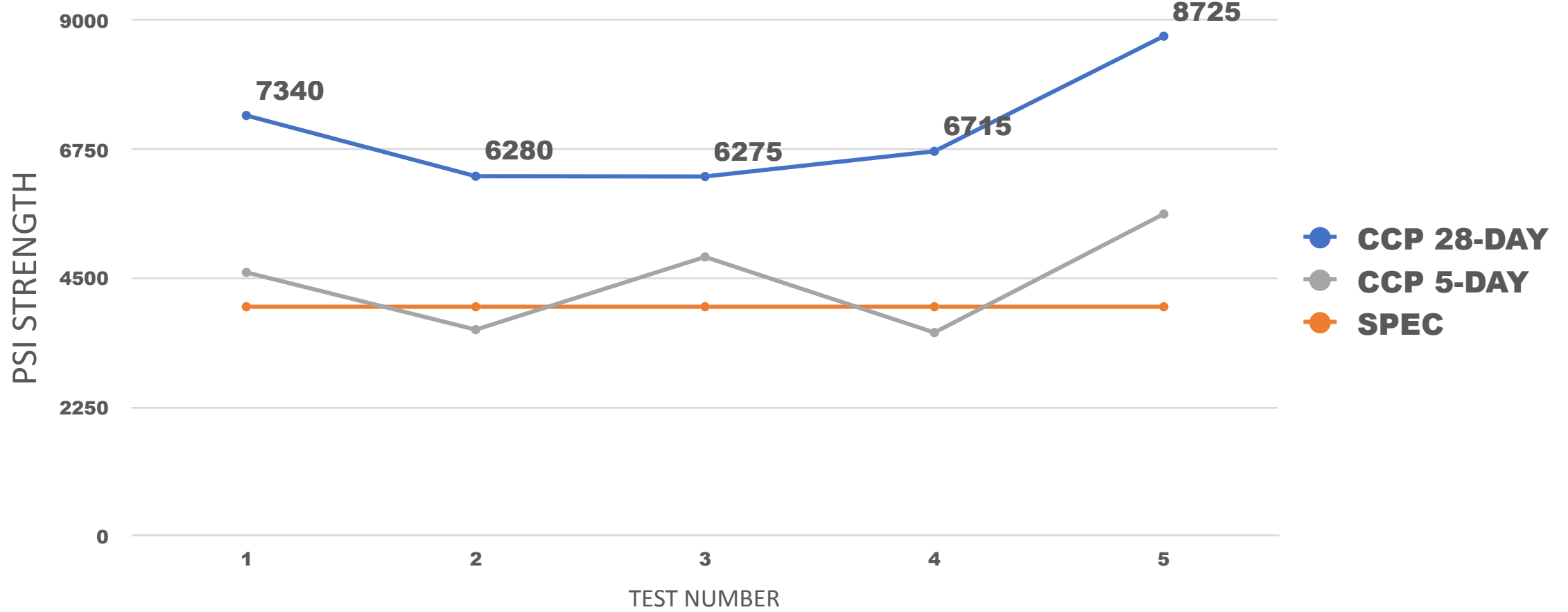


**INTERMOUNTAIN MATERIALS
TESTING & GEOTECHNICAL
PASCO, WA**



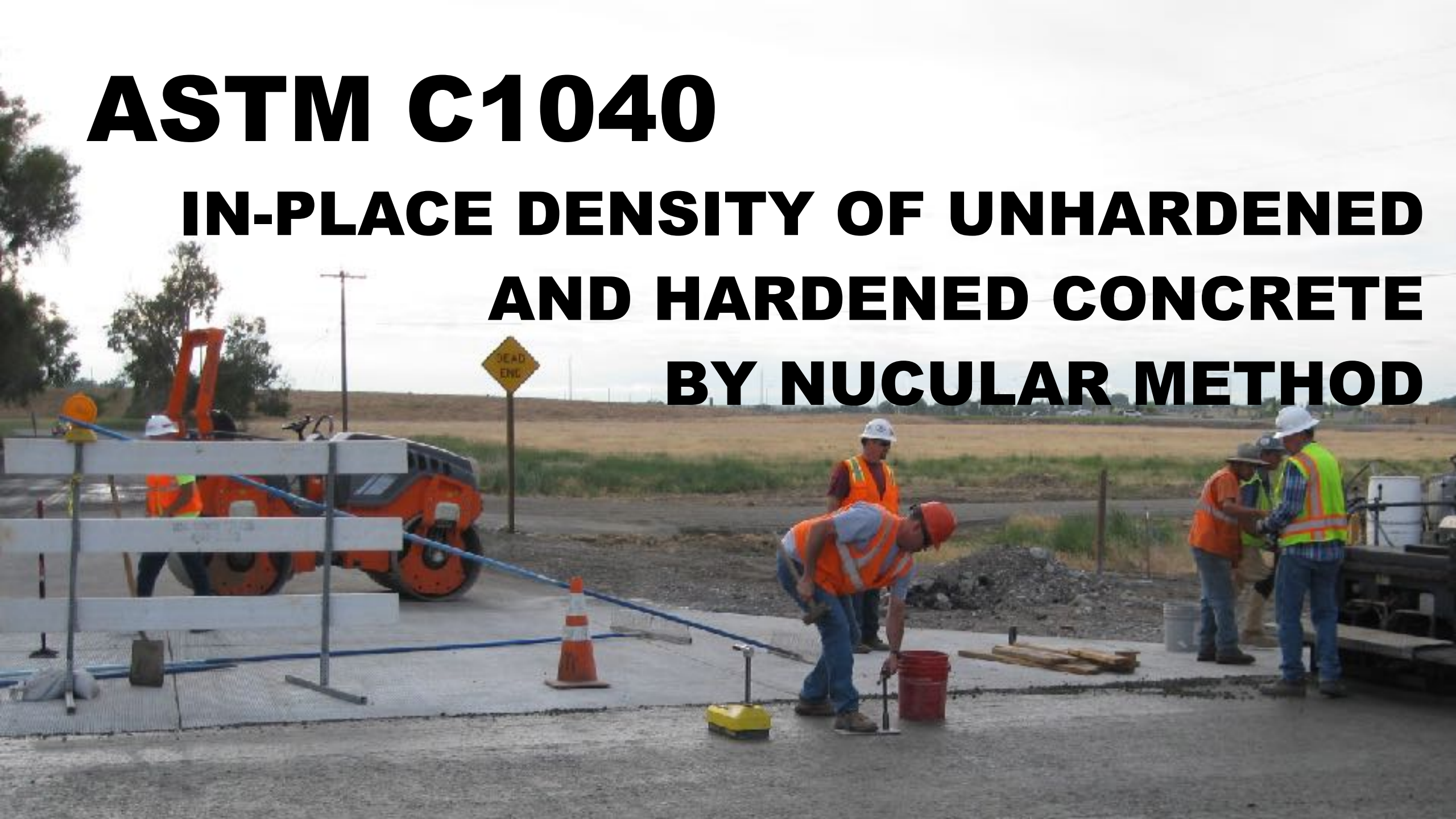
**ASTM C1435
MOLDING ROLLER-
COMPACTED CONCRETE IN
CYLINDER MOLDS USING A
VIBRATING HAMMER**

COMPRESSIVE STRENGTH

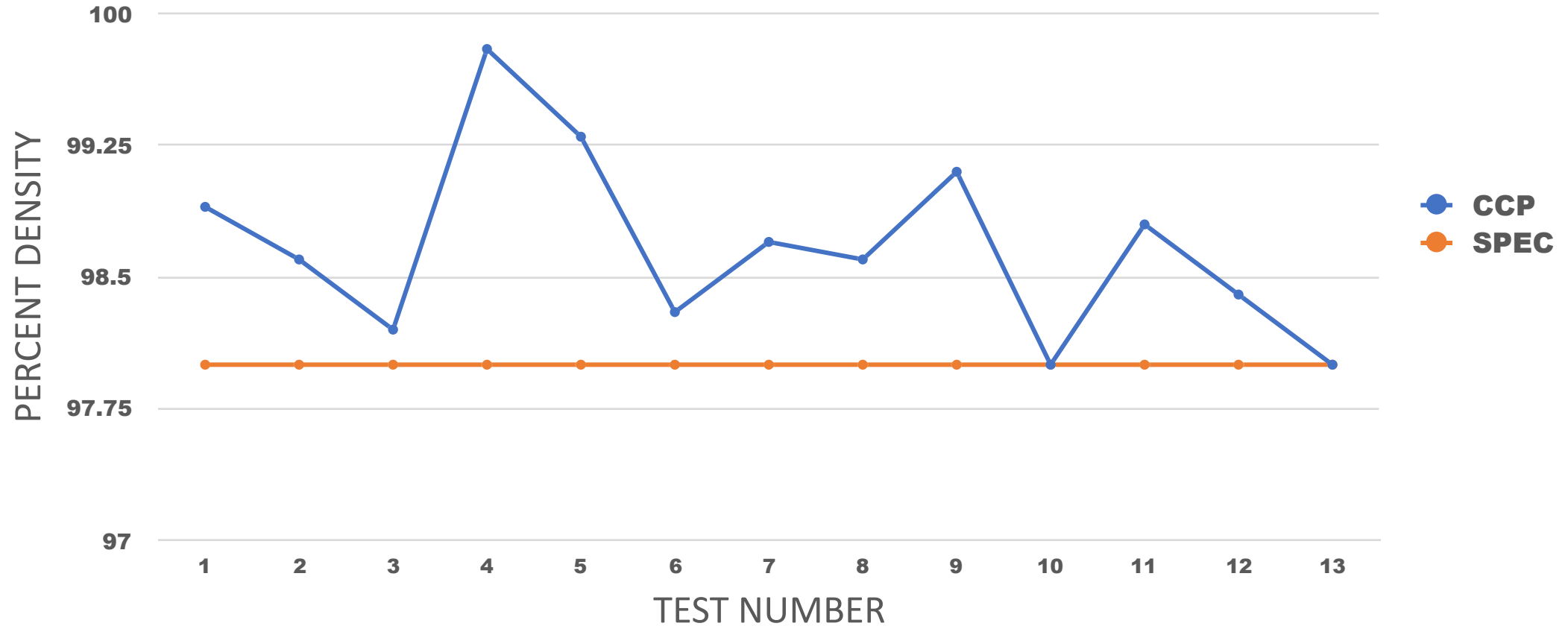


ASTM C1040

**IN-PLACE DENSITY OF UNHARDENED
AND HARDENED CONCRETE
BY NUCULAR METHOD**



IN-PLACE DENSITY



COST COMPARISON

CCP vs. TRADITIONAL PAVING PRACTICE

CCP

LOW BID = \$52.60/SY (\$270.51/CY)

PROJECT QUANTITY = 5,000 SY (972.2 CY)

PROJECT TOTAL CCP = \$263,000.00

COST COMPARISON

CCP vs. TRADITIONAL PAVING PRACTICE

CCP

\$263,000.00

CONVENTIONAL CONC.

CONCRETE	\$248.38/CY	\$276,500.00
DOWEL BARS	\$20.19/EACH	\$47,500.00
TIE BARS	\$21.50/EACH	\$26,000.00

TOTAL CONVENTIONAL CONC. = \$350,000.00

***PRICES FROM WSDOT UBA LAST 5 YEARS PROJECTS WITH 1,000 TO 3,500 CY USING AVERAGE LOW BID**

COST COMPARISON

CCP vs. TRADITIONAL PAVING PRACTICE

CCP	\$263,000.00
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CONVENTIONAL CONC.	\$350,000.00
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HOT MIX ASPHALT

HMA	\$85.00/TON	\$170,000.00
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CHIP SEAL TWICE OVER 20 YR	\$25,000.00
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GRIND AND OVERLAY	\$70,000.00
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TOTAL HMA LIFESPAN = \$265,000.00

COST COMPARISON

CCP vs. TRADITIONAL PAVING PRACTICE

CCP	\$263,000.00
CONVENTIONAL CONC.	\$350,000.00
HOT MIX ASPHALT	\$265,000.00

REFERENCES

Walla Walla County Public Works

www.wwcountyroads.com

Seth Walker, P.E.

swalker@wwcountyroads.com

Wm Winkler

www.wmwinkler.com

Andale Construction

www.andaleconstruction.com

ACEiT Industries

www.aceitusa.com

“Guide for Roller-Compacted Concrete Pavements”, August 2010

National Concrete Pavement Technology Center