

Concrete Paver Setup and Preparations

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Concrete Paver Setup and Preparations

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Nigara Fall, Canada

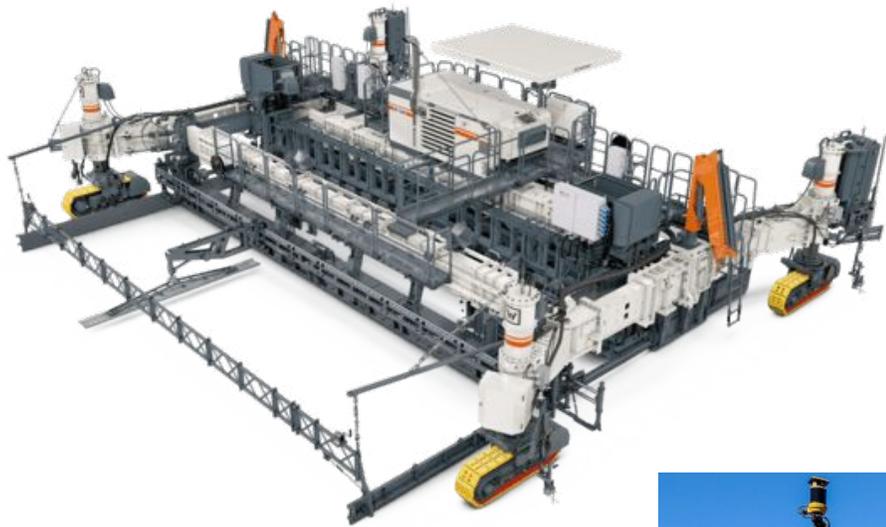


Introduction



- Successful concrete slipform paving of thick airfield pavement is over 50 years old.
- Modern concrete paving equipment
 - Built-in features and options
 - Art made easier.
- **The concrete mixture is extremely critical to success**

Slip Form Pavers



Specifications



September 3, 2024

Charlotte Douglas International Airport 4th Parallel Runway Program Bid Package 2: Runway 1C-19C and Associated Connectors Technical Specifications

Issued for Bid



CLT 4PR Bid Package 2: Runway 1C-19C and Associated Connectors
Project Number: 4020902025-4

(rev. 09.03.2024)

Item P-501 Cement Concrete Pavement

DESCRIPTION

501-1.1 This work shall consist of pavement composed of cement concrete with reinforcement or without reinforcement constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross sections shown on the plans. The terms cement concrete, hydraulic cement concrete, and concrete are interchangeable in this specification.

MATERIALS

501-2.1 Aggregates.

a. Reactivity. Fine and Coarse aggregates to be used in CCP on this project shall be tested and evaluated by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and ASTM C1567. Tests must be representative of aggregate sources which will be providing material for production. ASTM C1260 and ASTM C1567 tests may be run concurrently.

(1) Test coarse aggregate and fine aggregate separately, in accordance with ASTM C1260; however, extend the length of the test to 28 days (30 days from casting). Complete the tests within six months of the date of the concrete submittal. If expansion of either the coarse or fine aggregate exceeds 0.10% at 28 days, limit the alkali loading of the concrete to be less than or equal to 3.0 lb per cubic yard (1.8 kg per cubic meter), calculated in accordance with Engineering Brief No. 106.

(2) The combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

(3) If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) Concrete Research Division (CRD) C662 in lieu of ASTM C1567. If lithium nitrate admixture is used, it shall be nominal 30% 10.5% weight lithium nitrate in water. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

b. Fine aggregate. Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C33 and the parameters identified in the fine aggregate material requirements below. Fine aggregate material requirements and deleterious limits are shown in the table below.

Fine Aggregate Material Requirements		
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Sand Equivalent	45 minimum	ASTM D2419
Fineness Modulus (FM)	2.50 ≤ FM ≤ 3.40	ASTM C136
Limits for Deleterious Substances in Fine Aggregate for Concrete		
Clay lumps and friable particles	1.0% maximum	ASTM C142
Coal and lignite	0.5% using a medium with a density of Sp. Gr. of 2.0	ASTM C123
Total Deleterious Material	1.0% maximum	

Item P-501 Cement Concrete Pavement

P-501-1

The Task

- Pave concrete to specified alignment and elevation
 - Achieving optimum smoothness
 - Material consolidation
-
- Everyone is accountable
 - Material Suppliers
 - Plant operator
 - Loader operator
 - Paving Crew



Ten Commandments

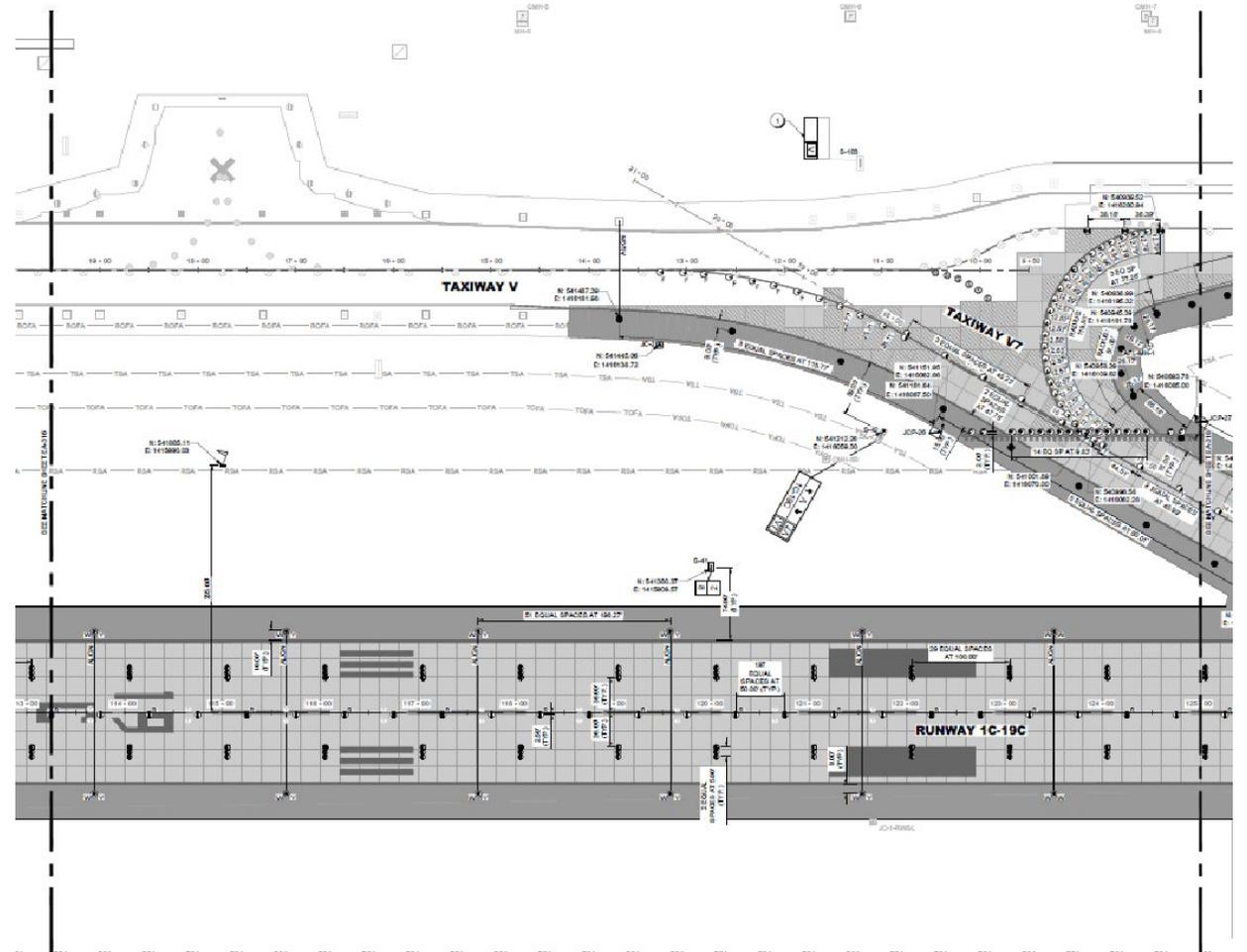
(Courtesy of Tim Nash—Wirtgen)

1. Sound grade (to spec)
2. Monitor concrete supply
3. Consistent workability
4. Controlled vibration (consolidation)
5. Sensor common sense
6. Clean well-maintained machine
7. Proper machine attitude
8. Weight and traction
9. Finishing
10. People



It all starts with a plan

- Paving widths
- Machines used
- Steel Placement
- Thickness



Operator / Owners Manual

**Highway & Airport
Paving Equipment**

Concrete Batching
& Mixing Plants

Canal Construction
Equipment

Trenching
Equipment



S850Q/S850SL Slipform Paver

Operating and Maintenance Manual

Concrete Paver Setup

- Allow enough time
- Focus on the details
- 1/32" is close enough
- Everything should be on the same plain.
 - Frame
 - Pan
 - Oscillating Correcting Beam or Screed
 - Sensor boxes



Concrete Paver Schematic

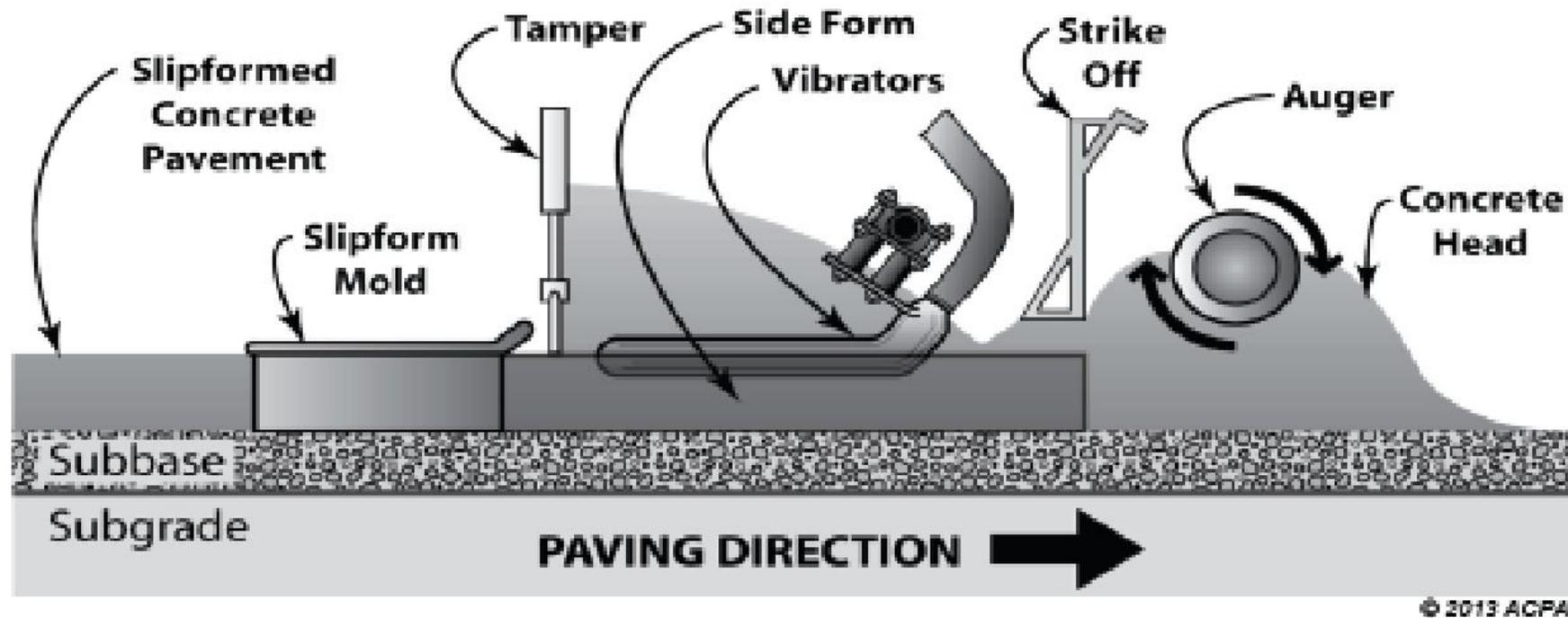
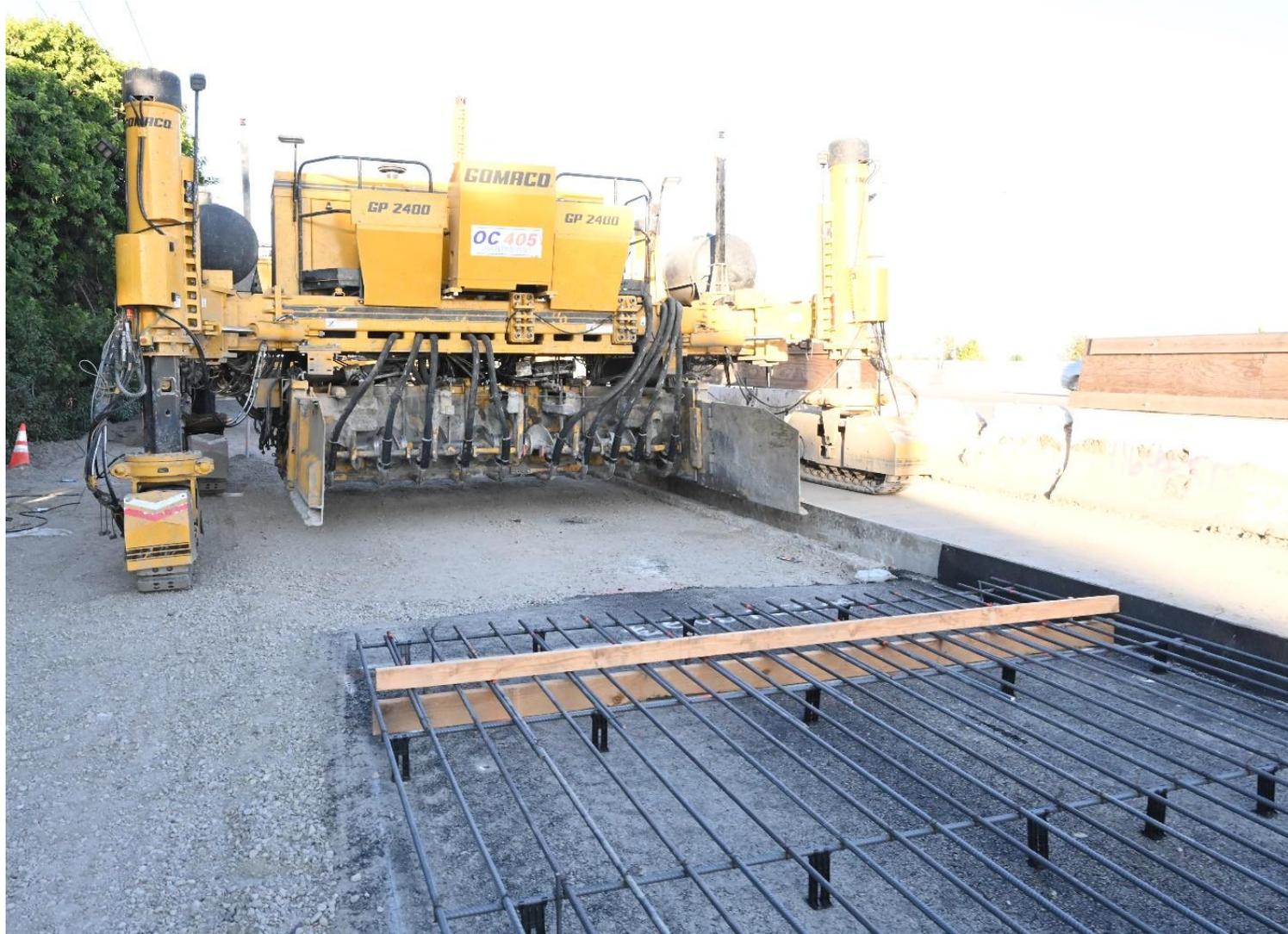
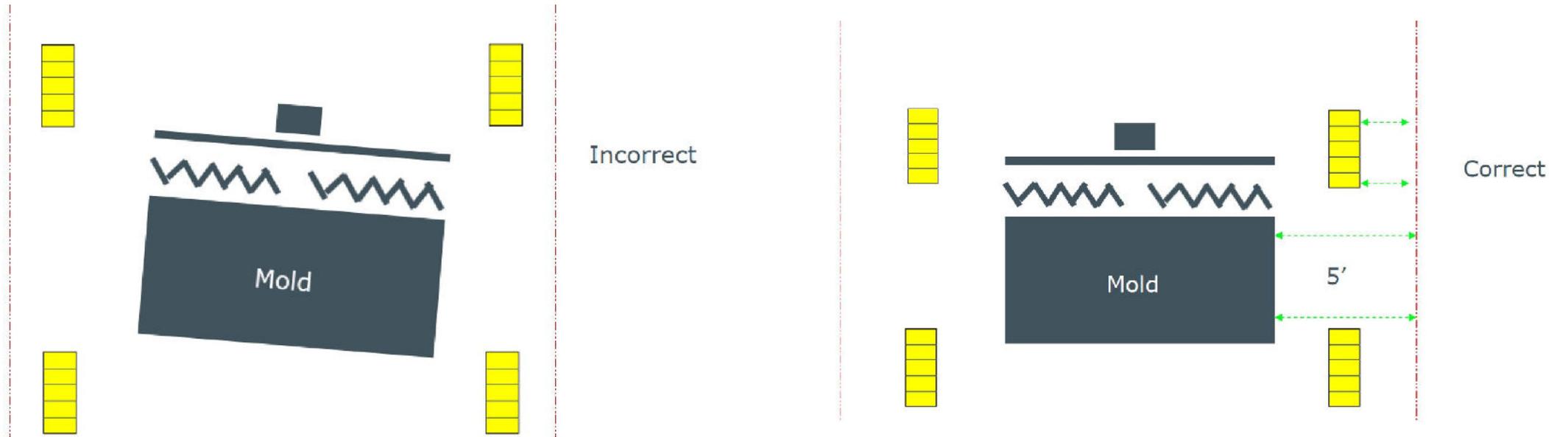


Figure 3. Slip-form paving machine component schematic (ACPA 2013).

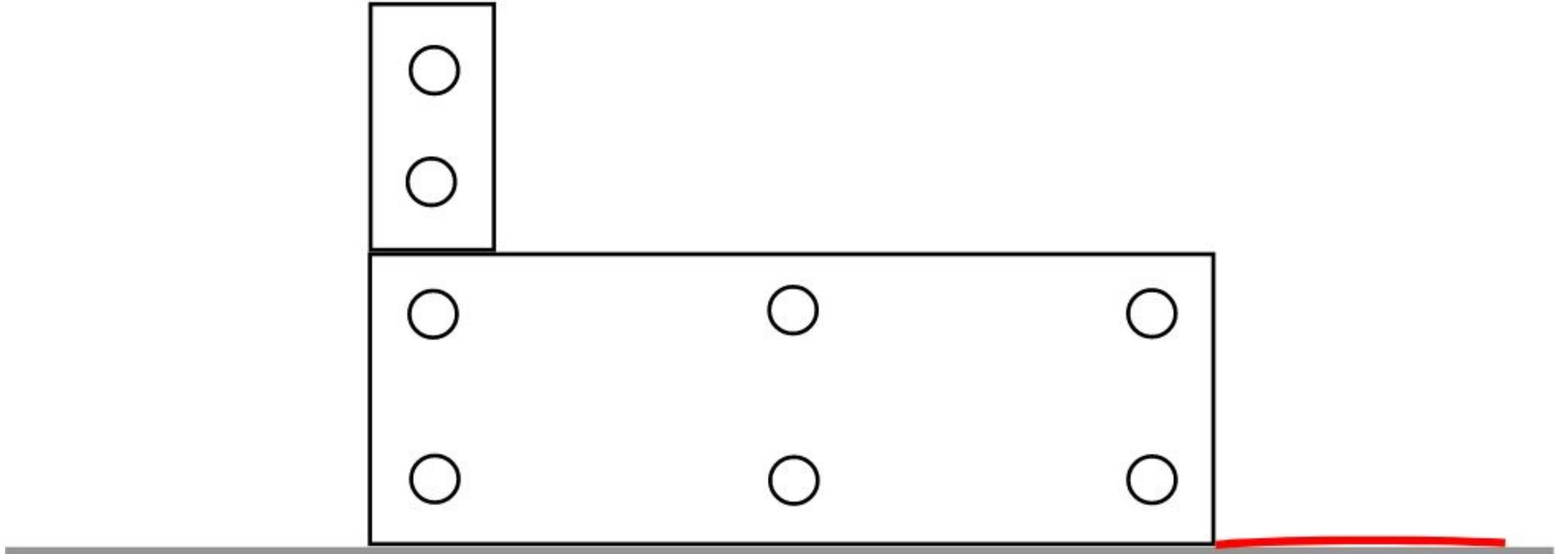
Frame, Pan/mold



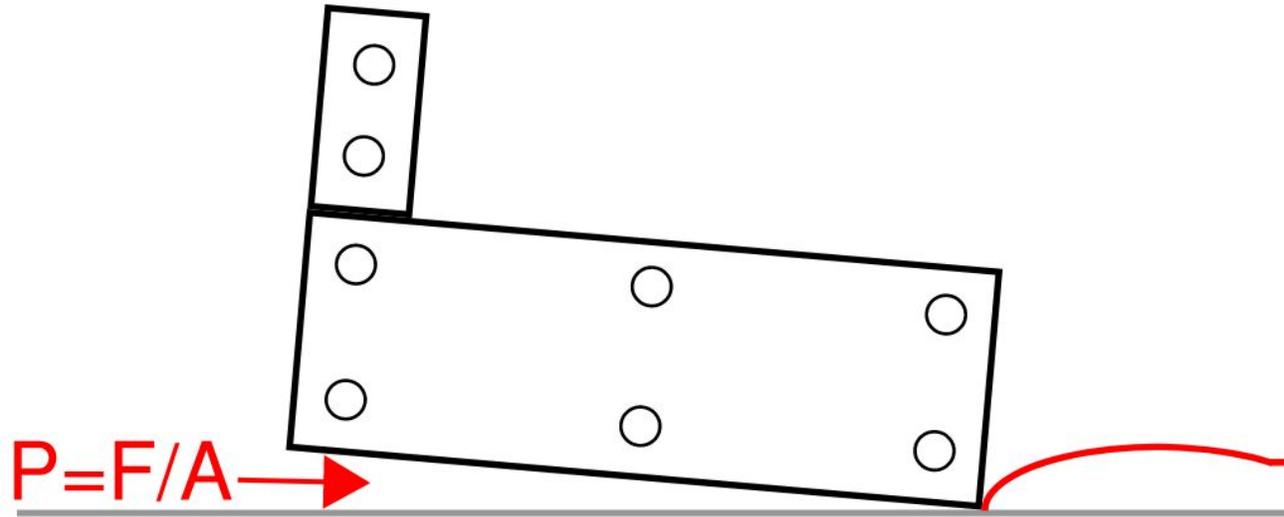
Mold Set Up



Plane of the paving pan

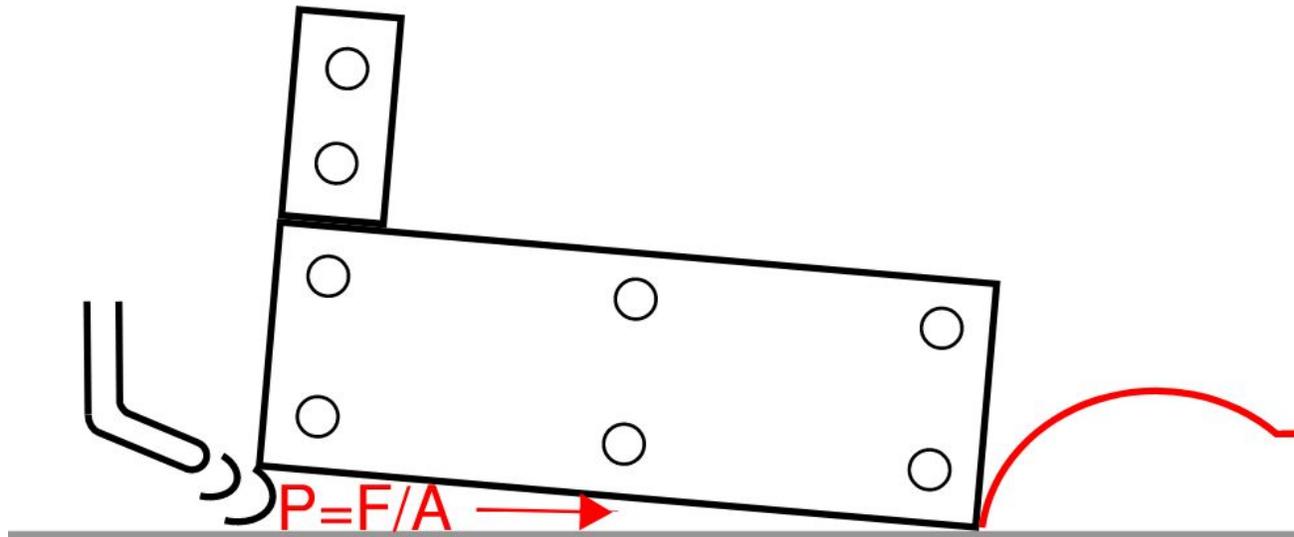


Pressure is equal to the force divided by the area



Plane of the paving pan

Pressure is equal to the force divided by the area



Plane of the paving pan

Pressure is equal to the force divided by the area

Factors Contributing to High Quality Slipformed Concrete Pavement

Concrete

Vibration

Sideforms /
Edge
Support

Edge
Overbuild

Flow of
Concrete to
the Edges

Concrete
Finishing
Devices



Concrete – Mix Design

Vibration is transmitted easily achieving better consolidation



Finishes easily even at low slump



No Edge slump



No joint or surface spalling



Smooth

Edge Slump

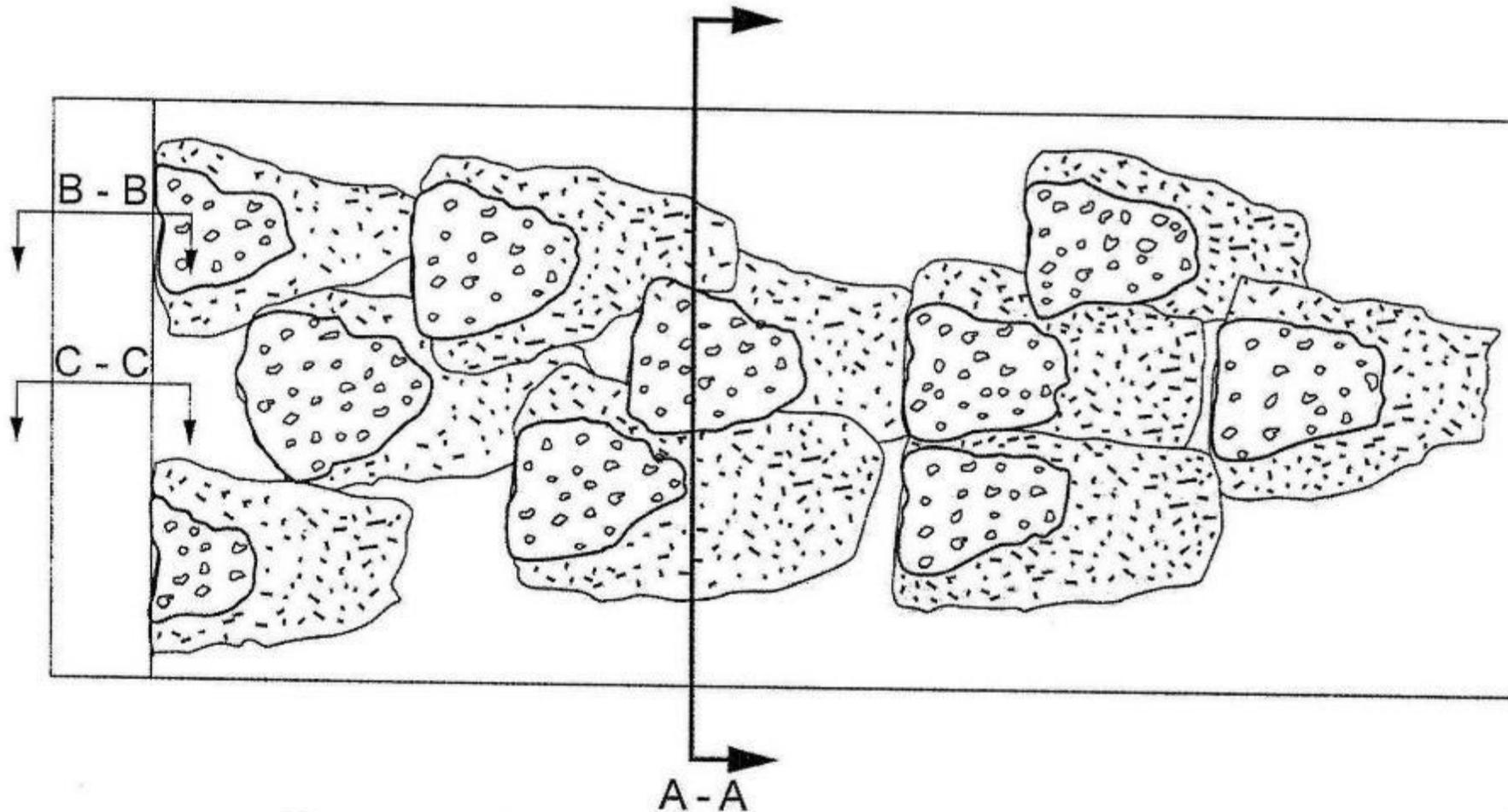
- Refine mixture proportions
- Adjust overbuilds
- Lower vibrators (less grout in the grout box)



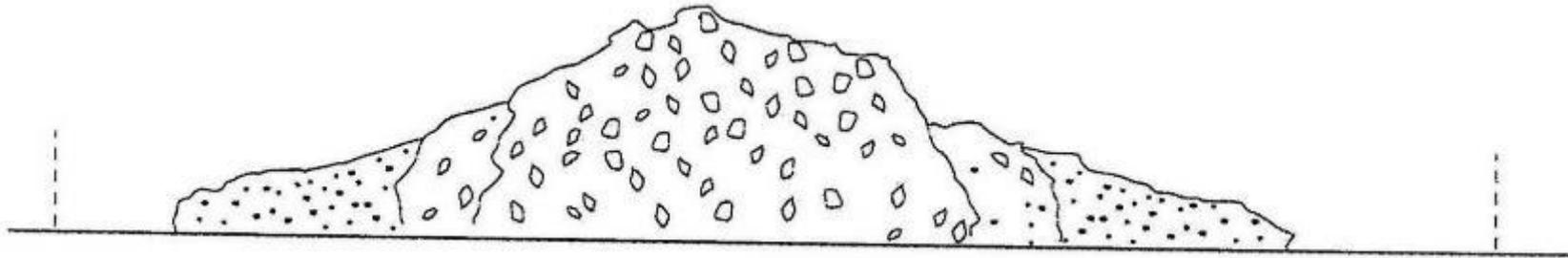
Segregated / Non-uniform Concrete – Passing Through Slipform



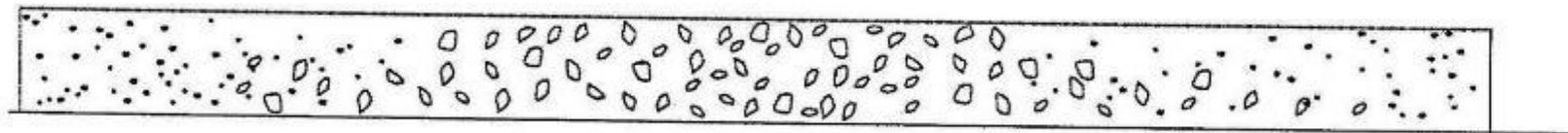
Segregated / Non-Uniform Concrete Plan View



Segregated / Non-Uniform Concrete Section View – Concrete Pile



Section A - A
Before Slipform



Section A - A
After Slipform

Segregated / Non-Uniform Concrete
Section View – Slipform Pan

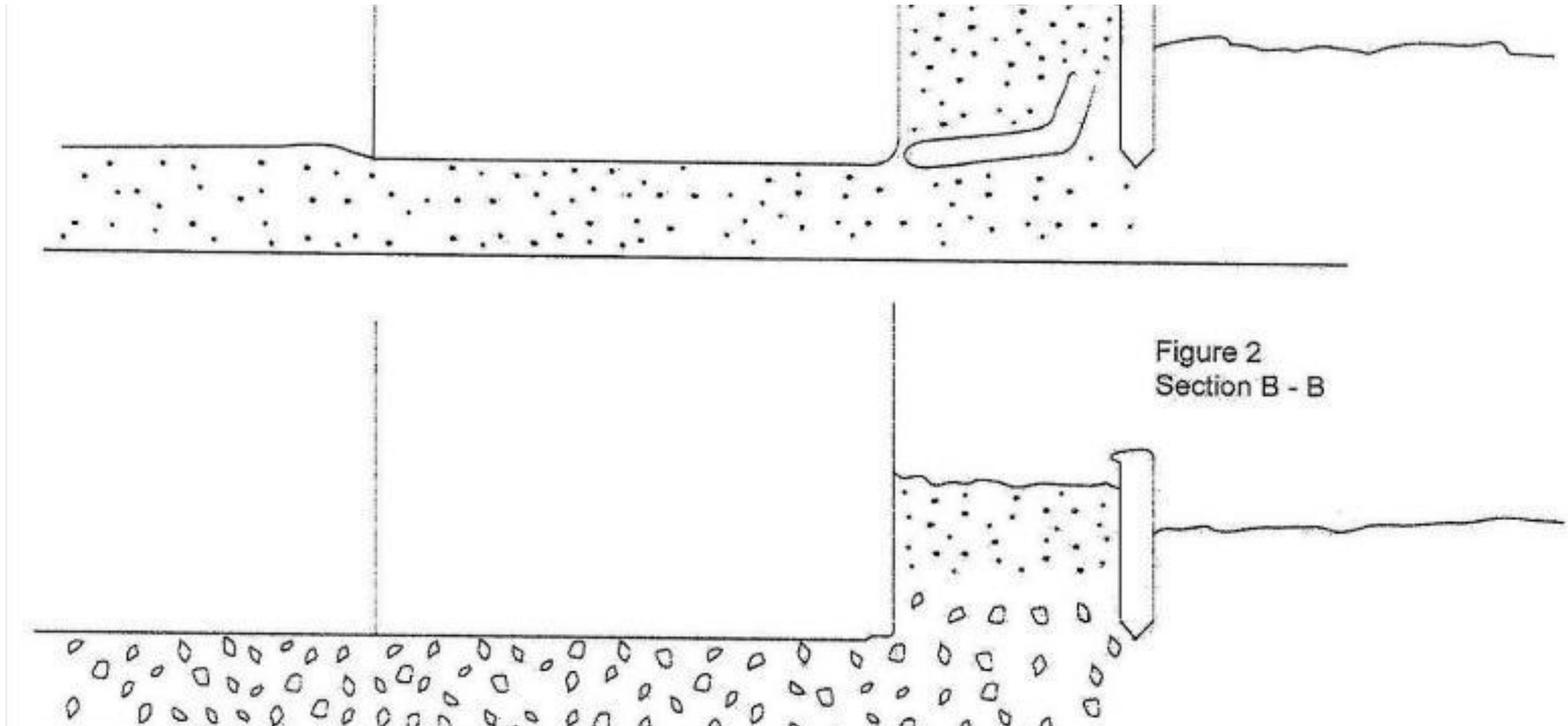
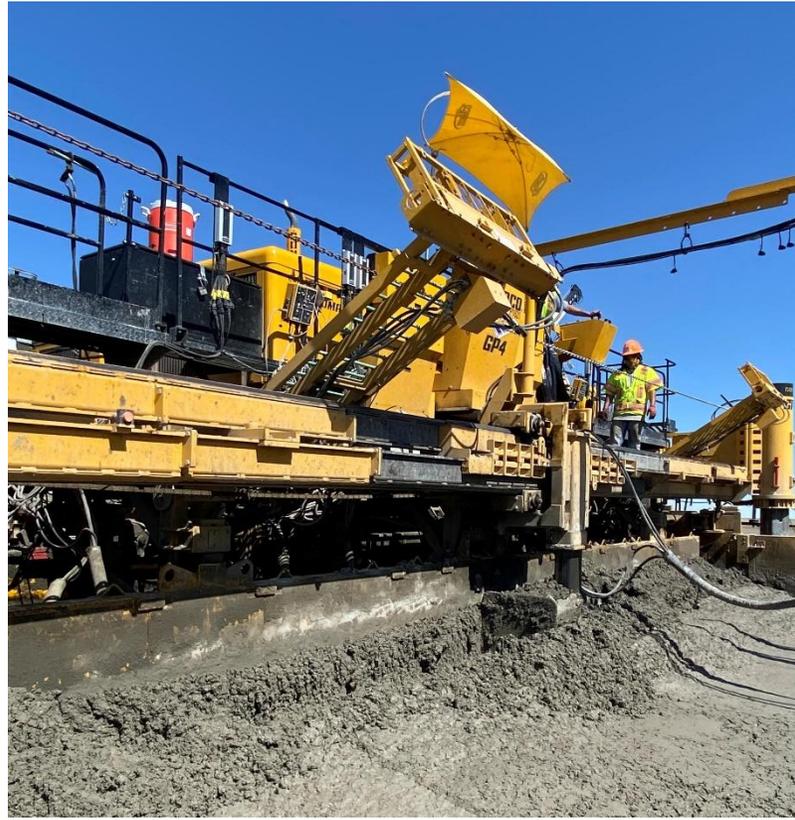


Figure 2
Section B - B

Augers and Plows

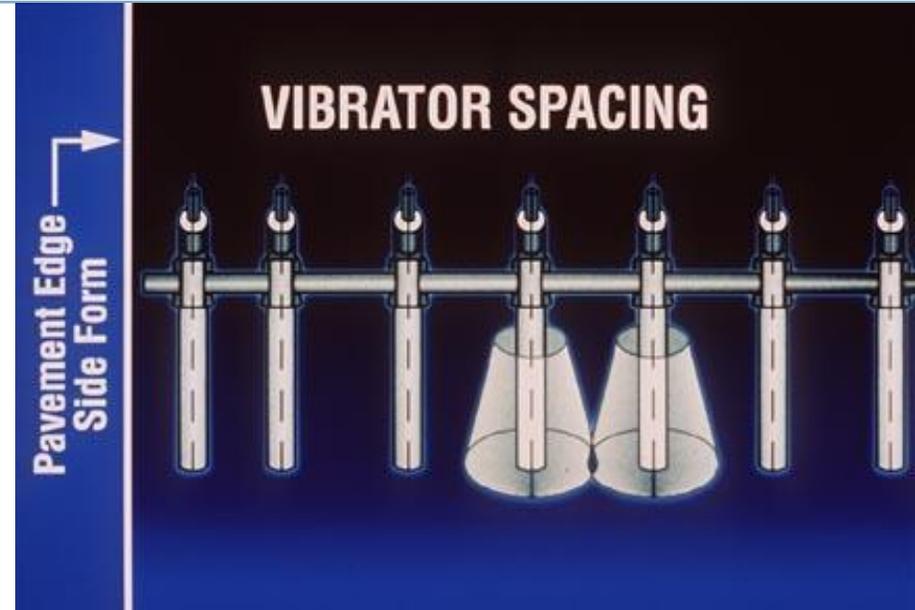


Vibrators

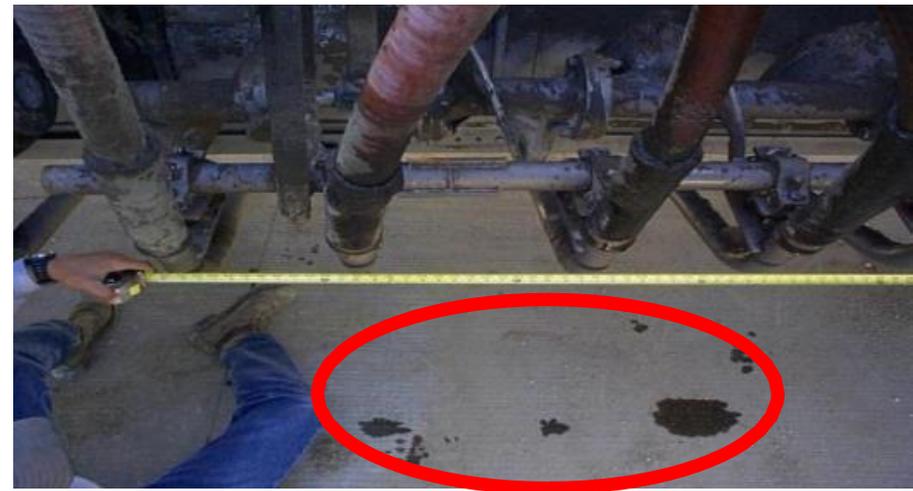


Slipform Paver – Vibrators

- Spacing
- Amplitude
- Frequency
- Angle



Hydraulic fluid is not a concrete admixture!



Setting the Vibrators height & angle



Consolidation / Vibration

- Match vibrator frequency to workability and paver speed
- Electronic vibrator monitor



Flow of Concrete to the Edges

The paver operator must always:

- Keep fresh concrete fed to the corners of the liquification hopper (keep them full) to displace grout and fill the edge.
- Maintain a constant concrete head height over the top of the vibrators using the metering gate.

Most operators prefer to keep a high head height on thick slabs. Proper head management yields smoother pavements.

Paver Sensors

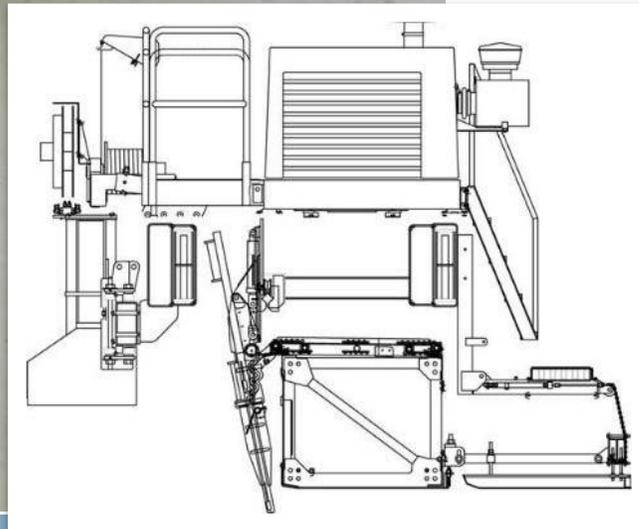
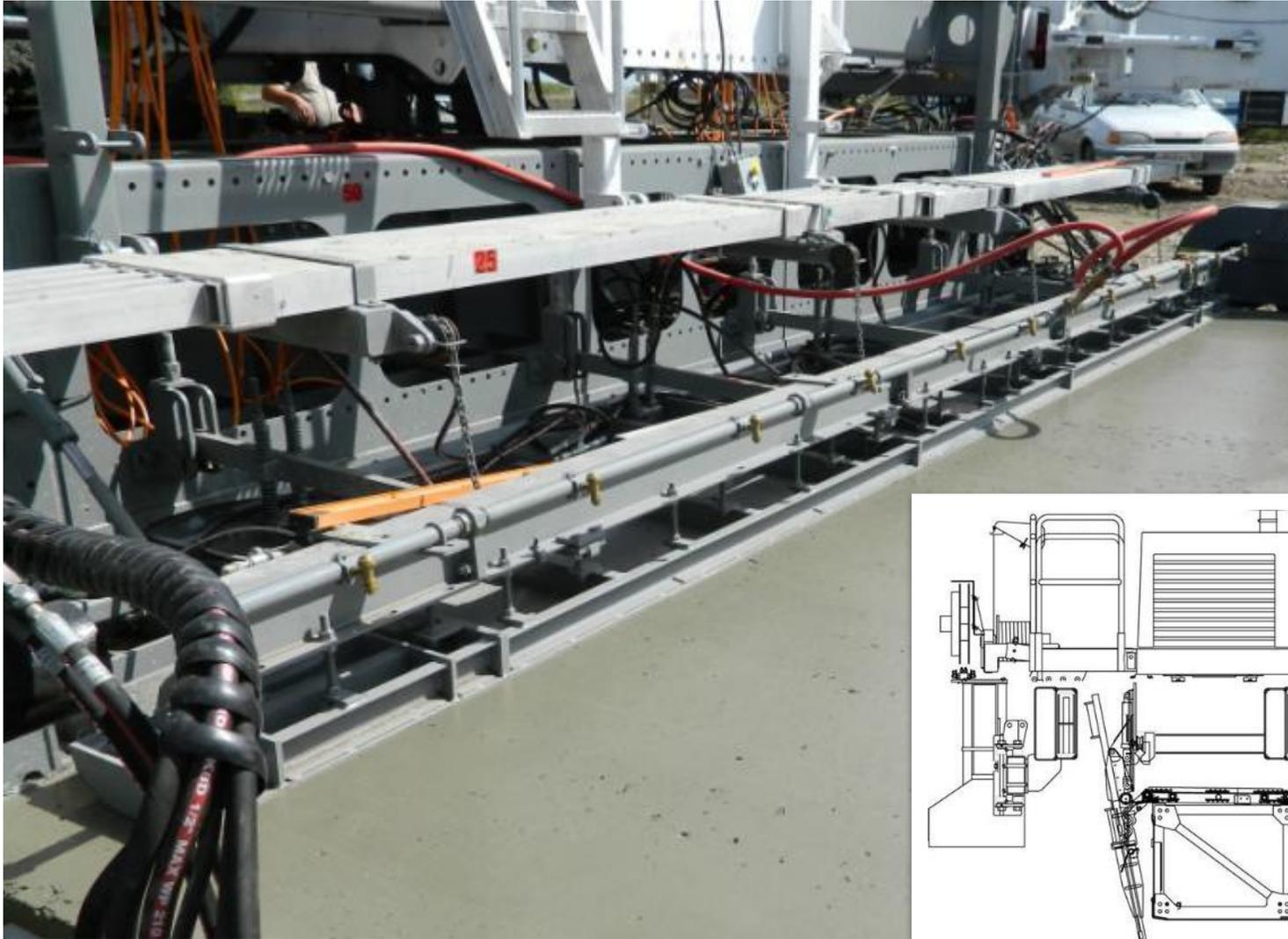
- Control alignment and elevation of the paver
- Sensitivity Controls
- Each track controlled separately



Finishing Devices for Airfield Paving

- Trailing Finishing Pan (TFP)
- Final Finisher (FF) – Longitudinal Oscillating Ski
- Oscillating Correcting Beam (OCB)

Trailing Finishing Pan



Final Finisher

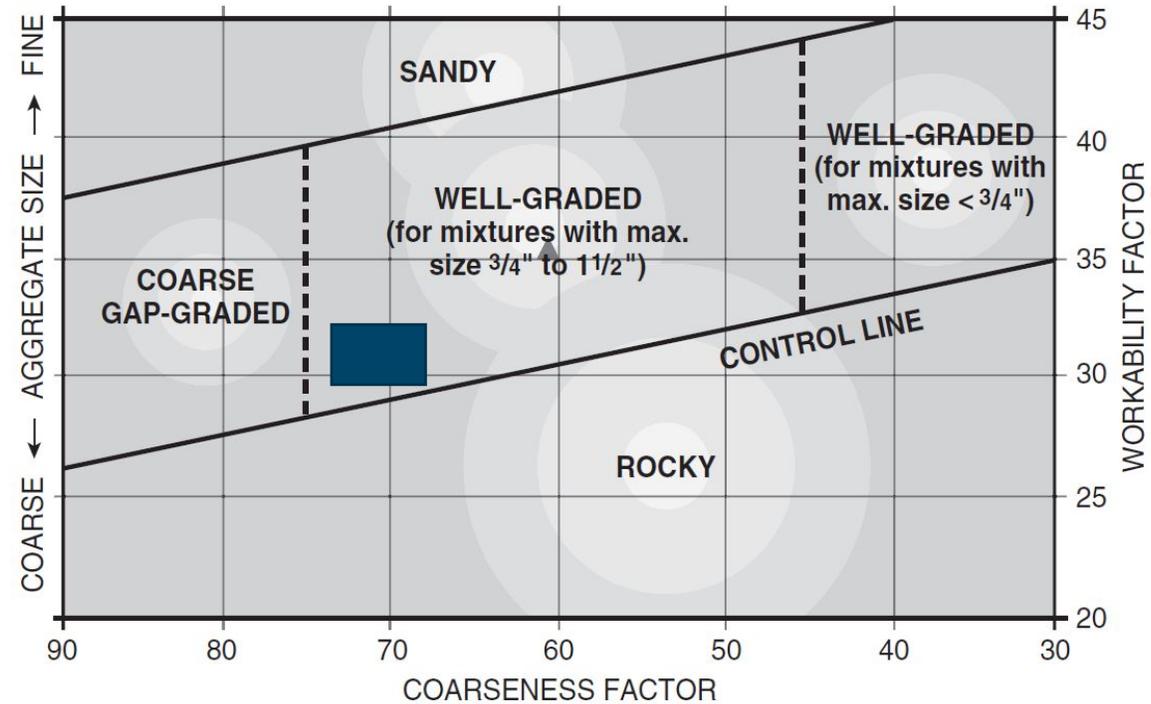


Oscillating Correcting Beam/ Tamper Bars

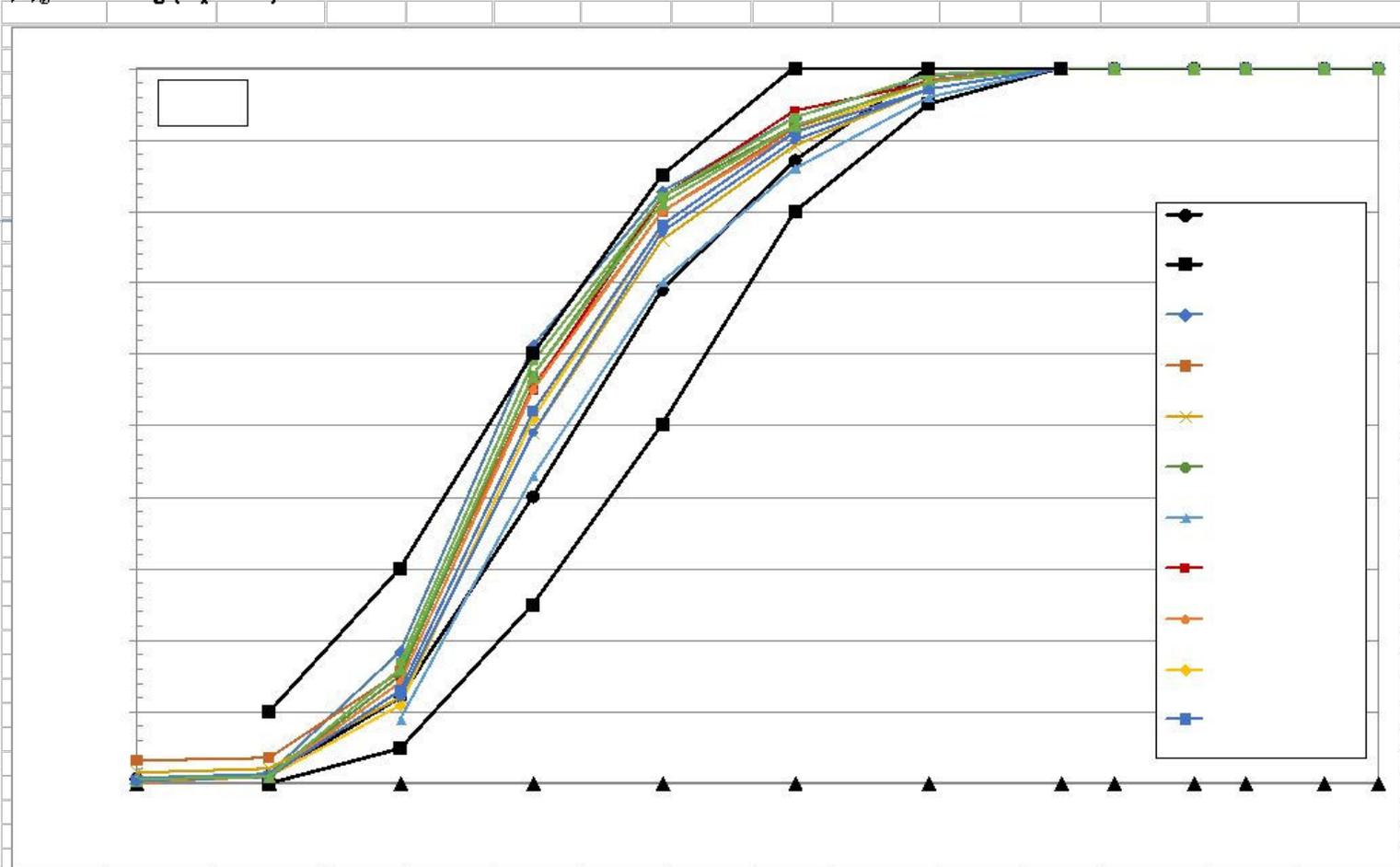


CF/WF Adjustment

Establish a target CF/WF at the control/test strip and then adjust for variability during production! Always start the day with proportions that return the CF/WF to the origin!!!



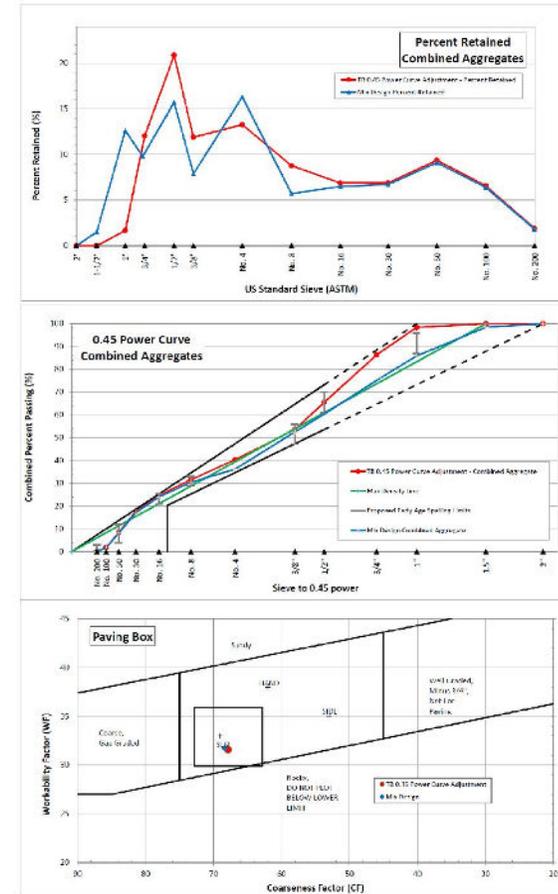
The Blue Box (± 5 and ± 3) is not a tolerance – It defines what is expected as a daily deviation



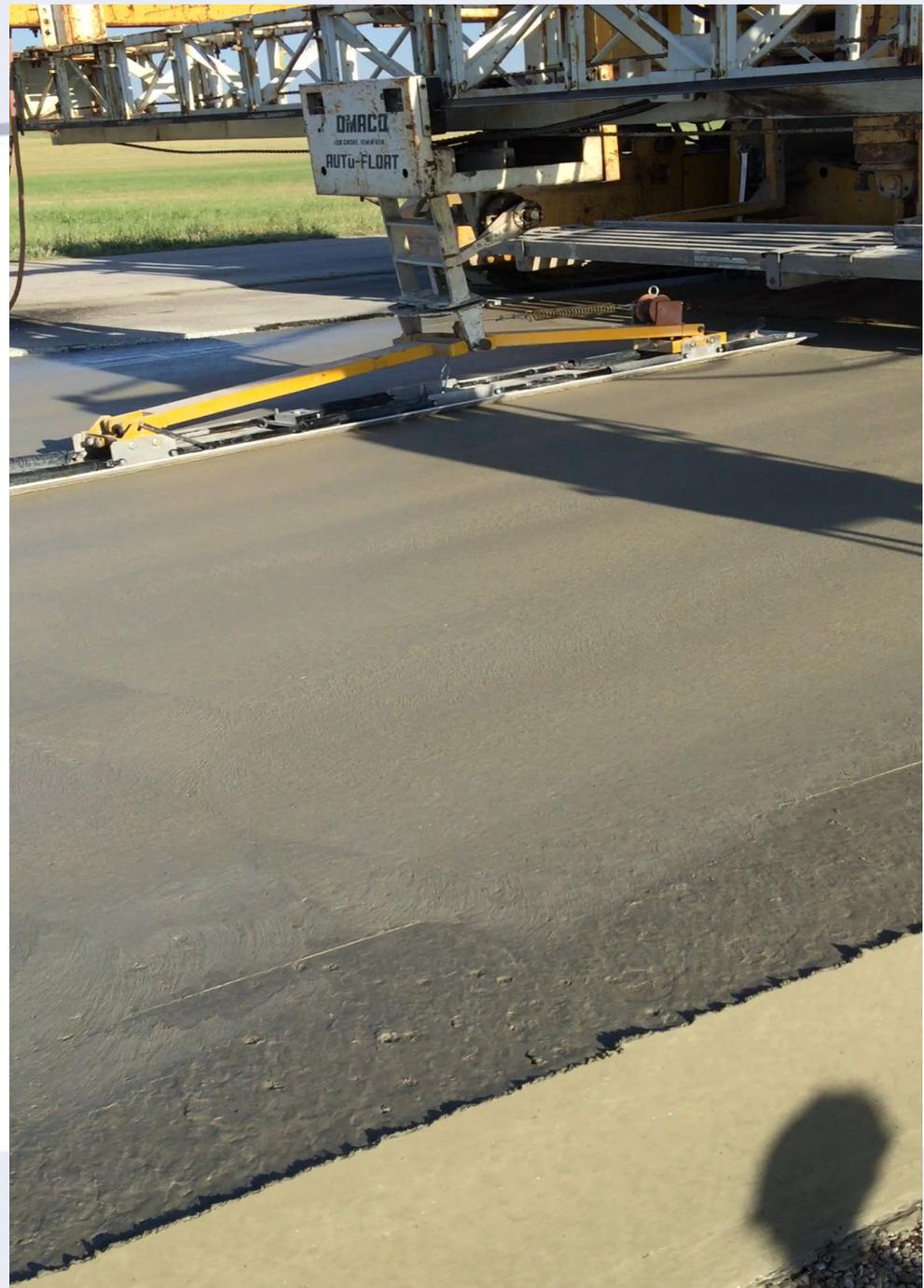
Sieve		Sand													
Metric (mm)	ASTM	Mix Design	5/1/2016	#####	#####	5/25/2016	6/6/2016	6/7/2016	6/7/2016 - 2	6/8/2016	6/9/2016	6/9/2016 - 2	6/25/2016	6/25/2016 - 2	
50.0	2"	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
37.5	1-1/2"	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
25.0	1"	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
19.0	3/4"	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
12.5	1/2"	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
9.5	3/8"	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
4.75	No. 4	100	98.8	98.2	97.0	98.0	96.0	98.0	98.0	98.0	97.0	98.0	97.0	99.0	
2.36	No. 8	87	93.0	91.5	89.0	92.0	86.0	94.0	91.0	91.0	91.0	92.0	90.0	93.0	
1.18	No. 16	69	82.7	80.0	76.0	82.0	70.0	82.0	80.0	78.0	78.0	81.0	77.0	82.0	
0.600	No. 30	40	61.1	55.6	49.0	57.0	43.0	55.0	55.0	51.0	52.0	57.0	49.0	59.0	
0.300	No. 50	12	18.3	15.6	12.0	15.0	9.0	14.0	14.0	11.0	13.0	16.0	12.0	17.0	
0.150	No. 100	1	1.2	3.5	2.0	1.0		1.0	1.0	1.0	1.0	1.0			
0.075	No. 200	0.6	0.7	3.2	1.6	0.3	0.3	0.3	0.1	0.3	0.3	0.5	0.1		
Fineness Modulus		2.91	2.45	2.56	2.75	2.55	2.96	2.56	2.61	2.70	2.68	2.55	2.75	2.50	

CF/WF same = same placement?

- Set it and forget it?
- Consistency?
- Workability?
- Key QC metric?
- How do we maintain CF & WF?



Air Force Base Paving Video



Web Site

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CP Tech Center

National Concrete Pavement Technology Center



CP TECH CENTER | AIRPORT PAVEMENTS | AIRPORT CONCRETE PAVEMENT TECHNOLOGY PROGRAM

Airport Concrete Pavement Technology Program



The Airport Concrete Pavement Technology Program (ACPTP) is a cooperative contract between the National Concrete Pavement Technology Center (CP Tech Center) and Federal Aviation Administration (FAA). Its goal is the implementation of airfield pavement technologies that extend the life of airfield pavements—to improve airfield reliability, efficiency, and safety to keep America moving forward.

OBJECTIVES

ACPTP objectives are as follows:

1. To identify airport pavement issues and problems eligible for ACPTP funding
2. To coordinate FAA and industry efforts to implement technologies and to solve problems identified through the program as important to the interests of FAA and industry
3. To pursue the technology transfer of new solutions, practices, and recommendations as needed, resulting from the individual or collective results of implementation trials and research



ABOUT THE ACPTP

The purpose of the ACPTP is to foster

