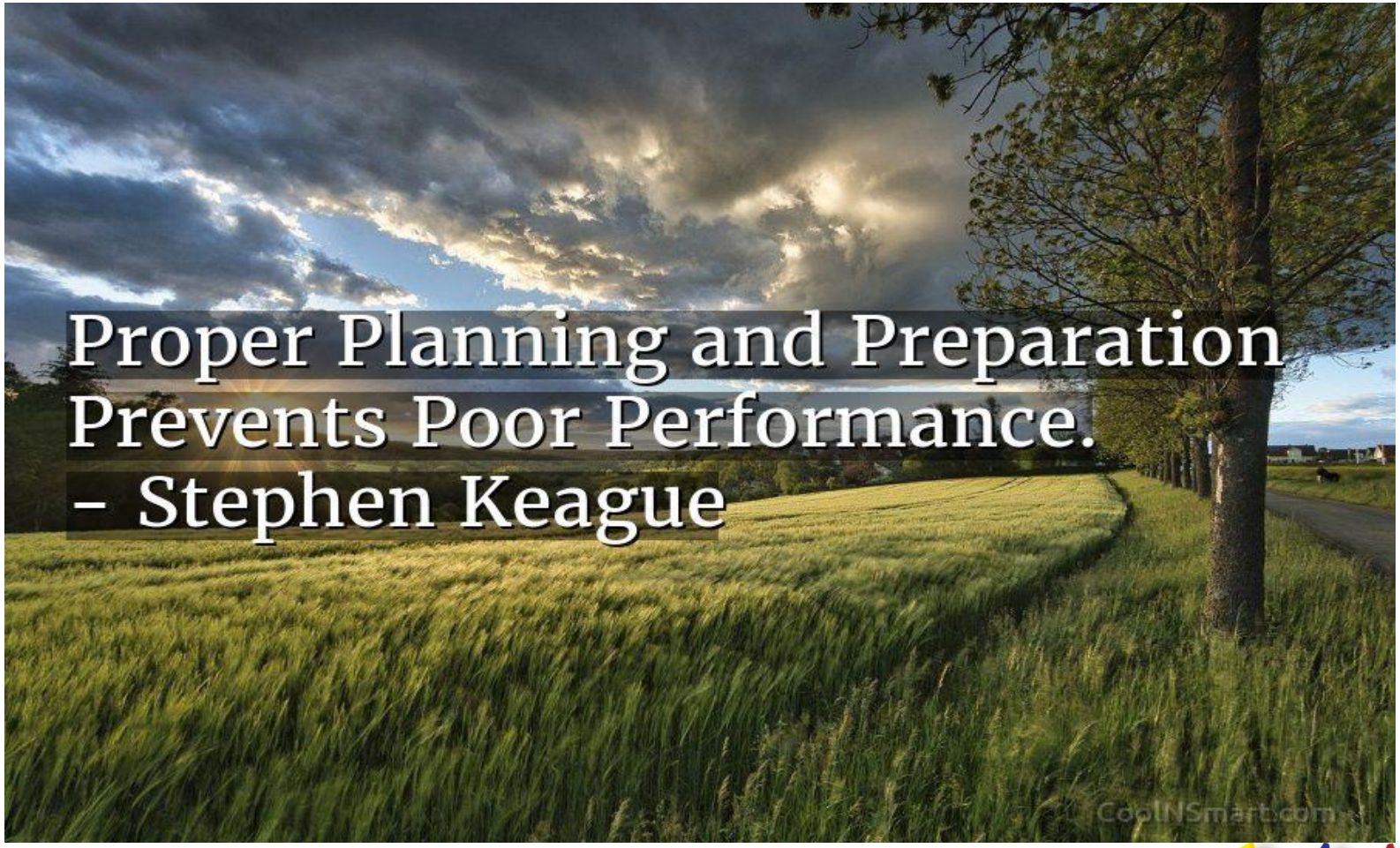
Optimizing Tooling Selection to Achieve Lowest Cost Per Foot Drilling

INROCK® Setting Global Standards for Service, Manufacturing and Technical Excellence

The P's

- Project details
- Planning
- Process
- Performance
- Profit

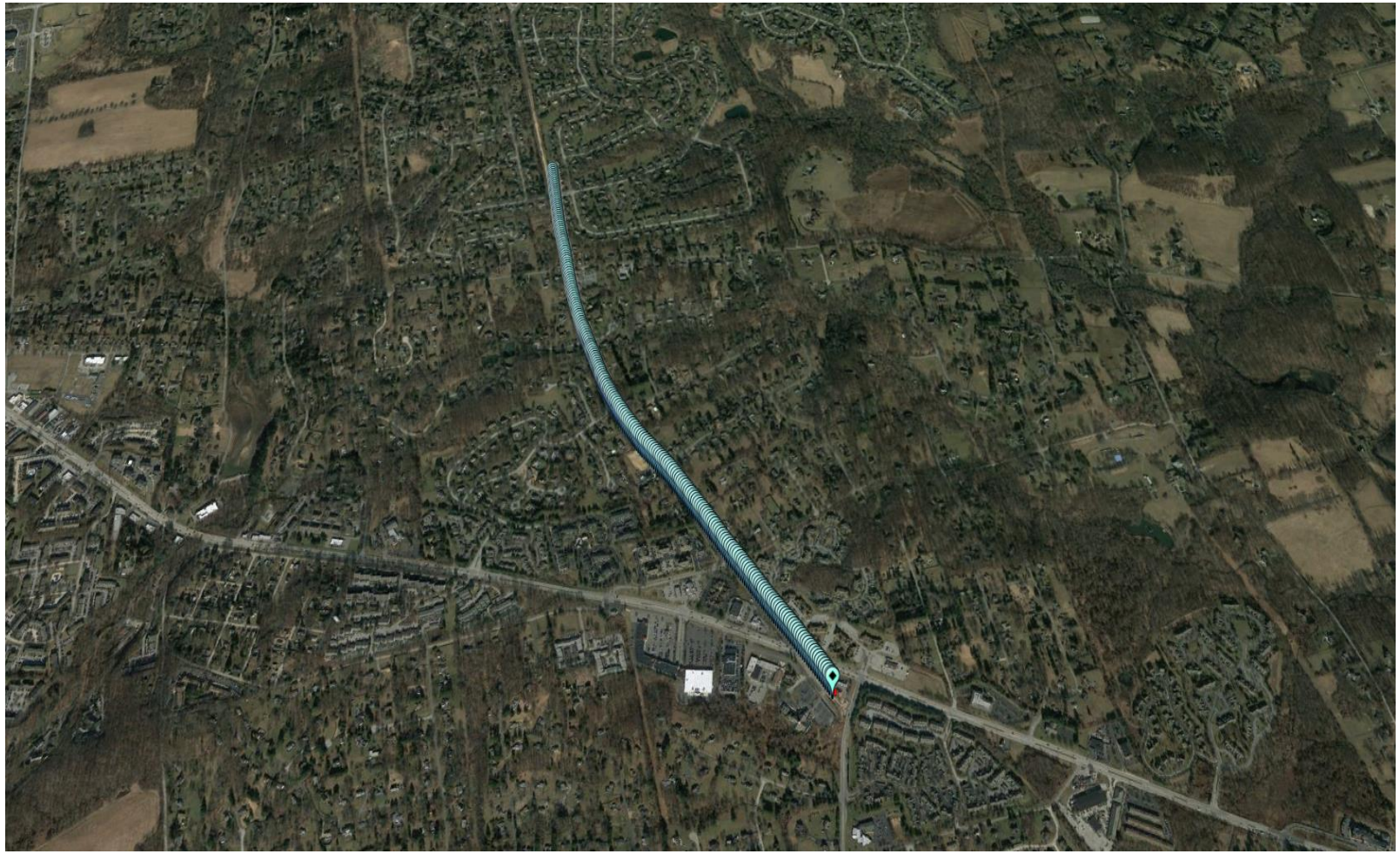


Project Details

- Site
- Bore length
- Product pipe
- Final hole size

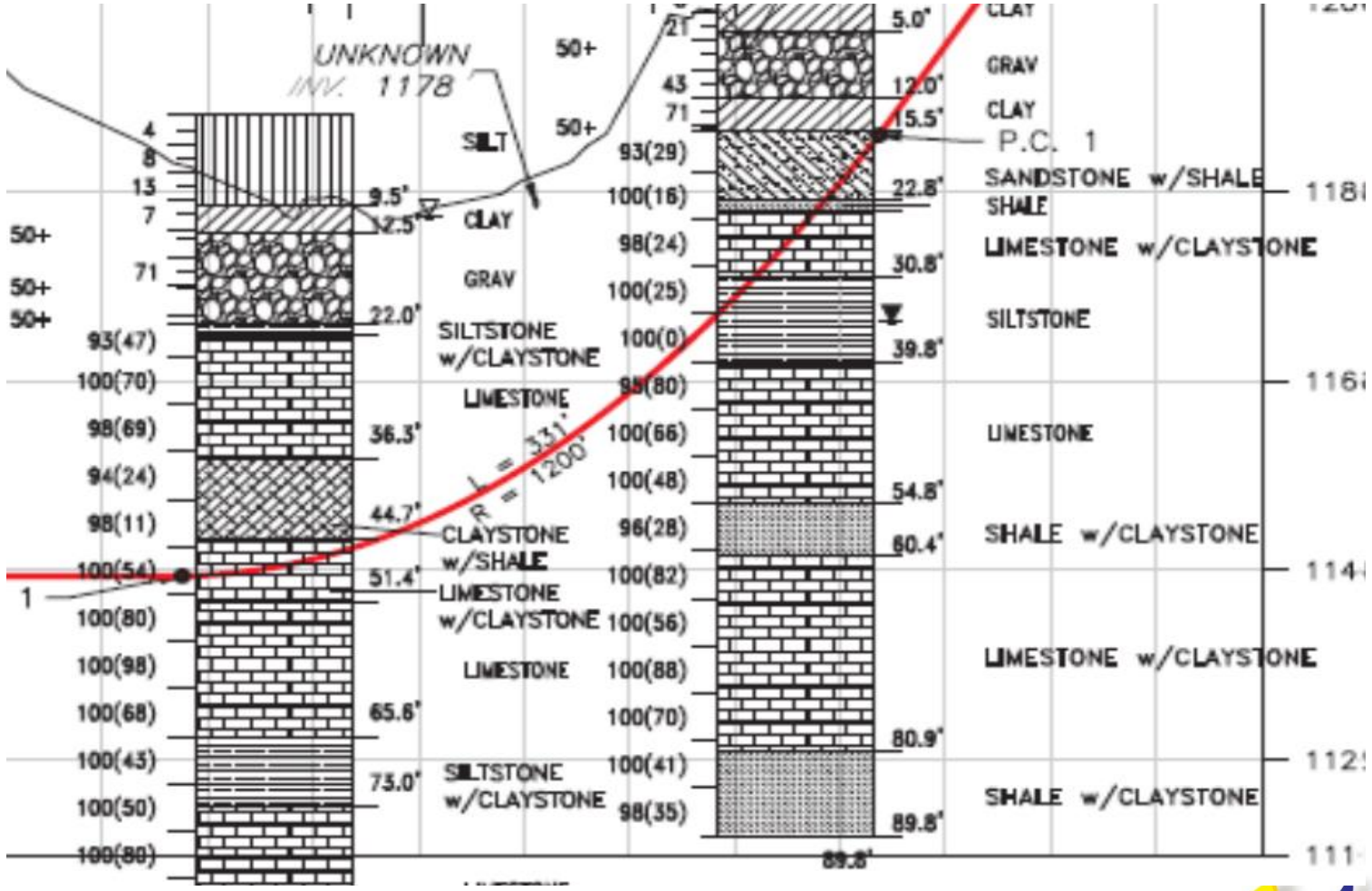
Planning

- Rig selection
- Drill pipe
- Pump



Process

- Geology
- UCS
- RQD
- CAI



Process

- Type of rock
- How does it fail?
- How do we choose the right bit?

Test Results

Test Date:	21-Jun-17	
Load at Failure:	19,250	(lb)
Unconfined Compressive Strength:	6,225	(psi)
Dry Unit Weight:	150.6	(pcf)
Load Rate:	0.28	(%/min)
Tested by:	TV	
Reviewed by:	YM	

Before Test

After Test

Test Results

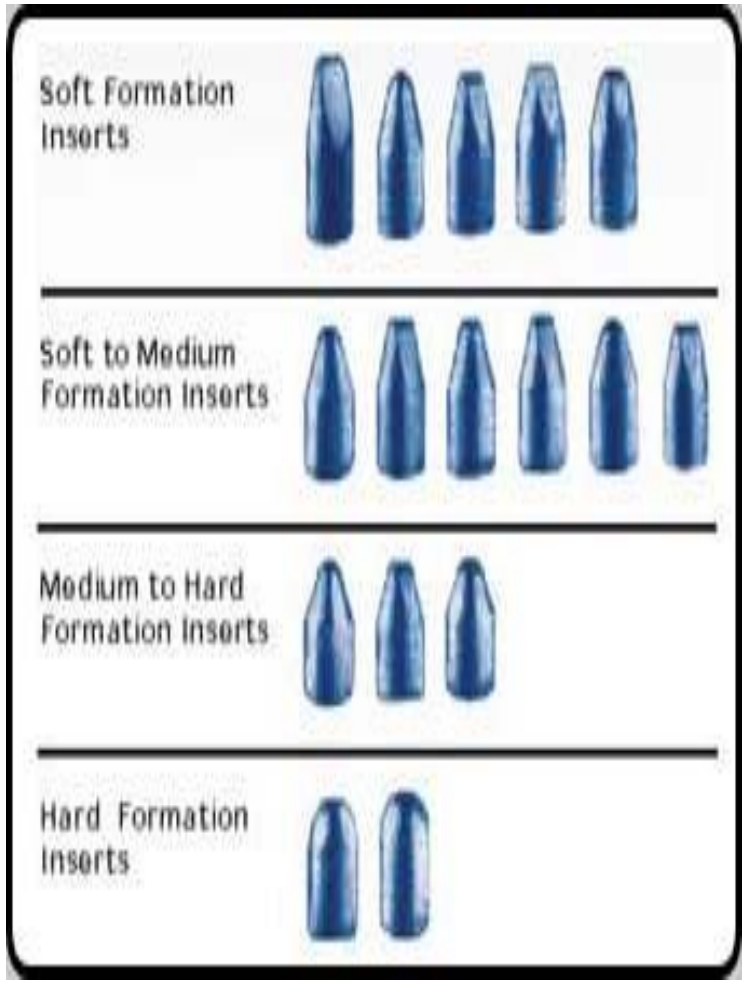
Test Date:	21-Jun-17	
Load at Failure:	37,000	(lb)
Unconfined Compressive Strength:	11,940	(psi)
Dry Unit Weight:	149.4	(pcf)
Load Rate:	0.28	(%/min)
Tested by:	TV	
Reviewed by:	YM	

Before Test

After Test

Process

- Bit selection
- IADC code
- Life expectancy



IADC CODE REFERENCE

1 1 1

First Digit:
1, 2, and 3 designate Steel Tooth Bits with 1 for soft, 2 for medium and 3 for hard formations.
4, 5, 6, 7, and 8 designate Tungsten CarbideInsert Bits for varying formation hardness with 4 being the softest and 8 the hardest.

1 **1** 1

Second Digit:
1, 2, 3, and 4 help further breakdown the formation with 1 being the softest and 4 the hardest.

1 1 **1**

Third Digit:
This digit will classify the bit according to bearing/seal type and special
gauge wear protection as follows:
1.Standard open bearing roller bit
2.Standard open bearing bit for air drilling only
3.Standard open bearing bit with gauge protection which is defined as
carbide inserts in the heel of the cone.
4.Roller sealed bearing bit
5.Roller sealed bearing bit with carbide inserts in the heel of the cone.
6.Journal sealed bearing bit
7.Journal sealed bearing bit with carbide inserts in the heel of the cone.

Tricone Bearing Designs
4 Primary Types of Bearing Designs
1. Standard Open Bearing Roller Bit----3rd digit will end with 1
2. Air Bearing Roller Bit----------3rd digit will end with 2 or 3
3. Sealed Bearing Roller Bit----------3rd digit will end with 4 or 5
4. Journal Bearing Roller Bit----------3rd digit will end with 6 or 7

Performance

- Power section
- Bit speed
- Torque

8 in (203 mm) 5-6 Lobe 3.0 Stage SERIES 2

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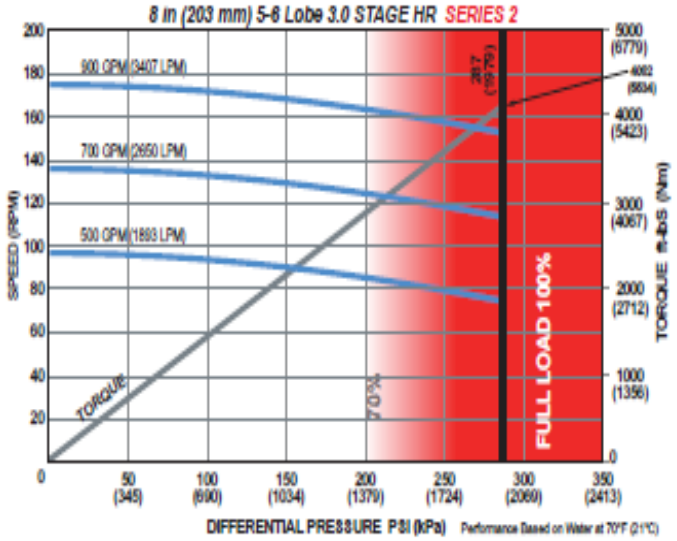

Lobe Configuration	5-6 Lobe 3.0 Stage		Flow Rate		Speed
Displacement (NO LOAD)	0.19 rev/gal	0.05 rev/l	GPM	LPM	RPM
Max. Differential @ FULL LOAD	287 psi	1,979 kPa	500	1,893	65 - 96
Max. Torque	4,082 ft-lbs	5,534 Nm	700	2,650	104 - 135
Max. Power	110 HP	82 kW	900	3,407	142 - 174

8 in (203 mm) 7-8 Lobe 3.0 Stage SERIES 2

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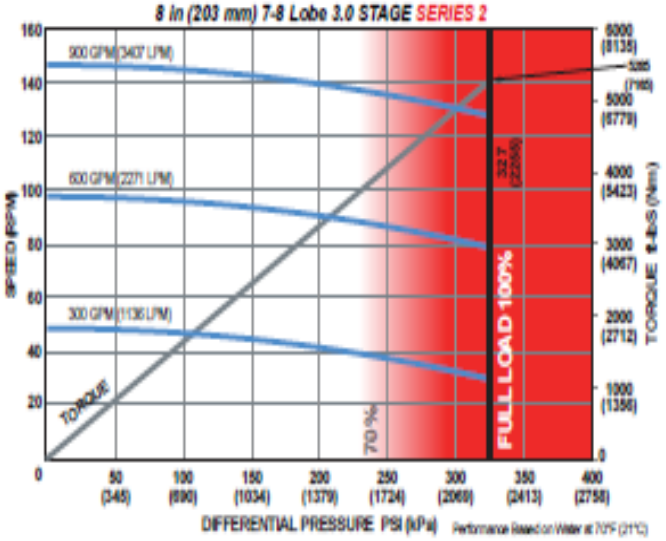
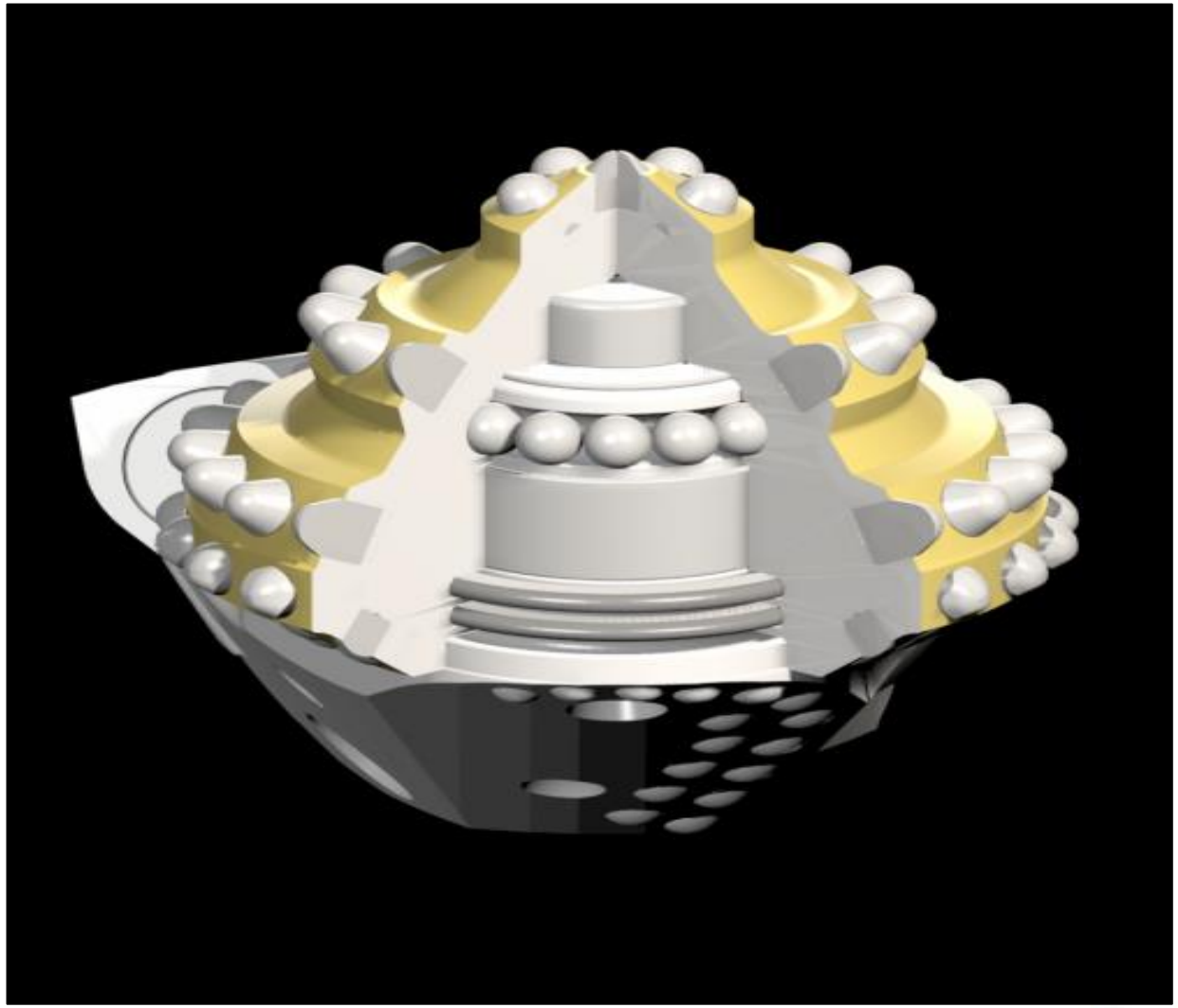


Lobe Configuration	7-8 Lobe 3.0 Stage		Flow Rate		Speed
Displacement (NO LOAD)	0.16 rev/gal	0.04 rev/l	GPM	LPM	RPM
Max. Differential @ FULL LOAD	327 psi	2,255 kPa	300	1,136	21 - 48
Max. Torque	5,285 ft-lbs	7,165 Nm	600	2,271	71 - 97
Max. Power	121 HP	90 kW	900	3,407	120 - 146

Performance

- Bearing life
- RPM
- Mud
- Cutter ratio



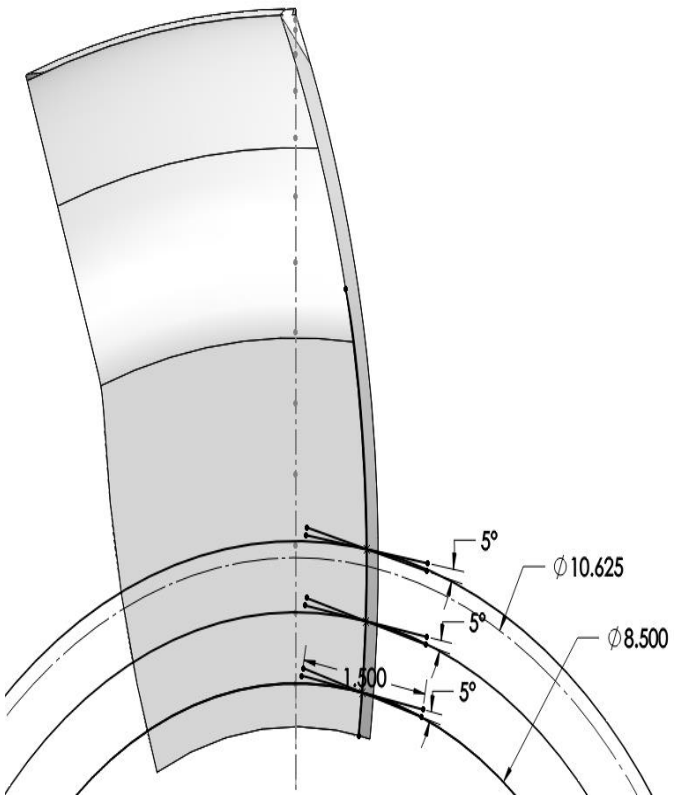
Performance

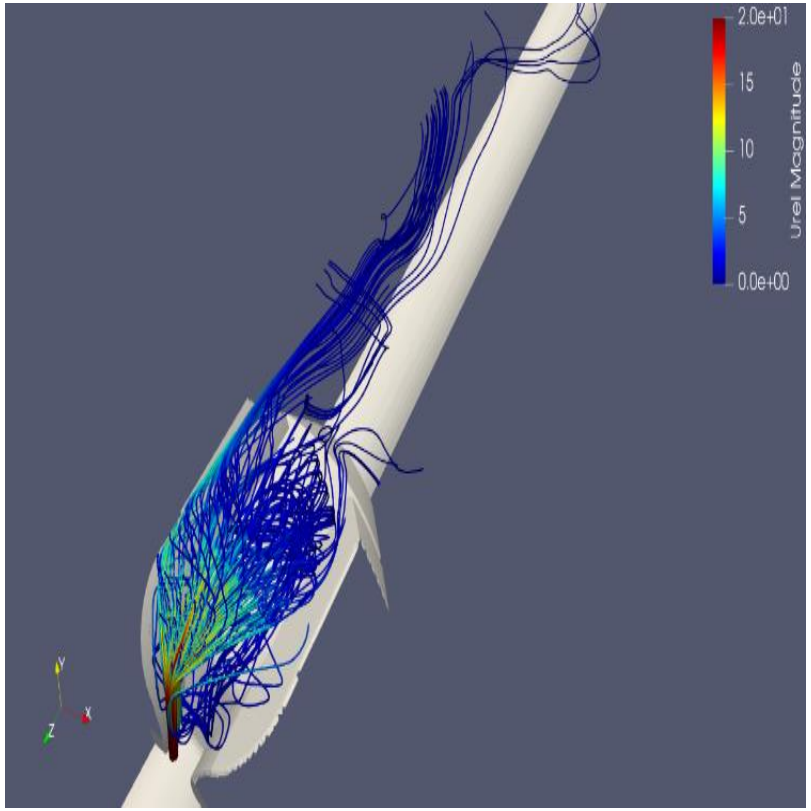
- Track
- Weight
- Speed
- Hydraulics

JT#	Pull Weight	RPM	Min	Tot	Crevs	Tot Revs
21	90	26	60	11.5	3806.4	45394
22	100	26	90	13.0	5709.6	51104
23	130	26	53	13.9	3362.32	54466
24	130	25	75	15.1	4575	59041
25	130	25	60	16.1	3660	62701
26	130	27	73	17.3	4809.24	67511
27	130	25	72	18.5	4392	71903

Performance

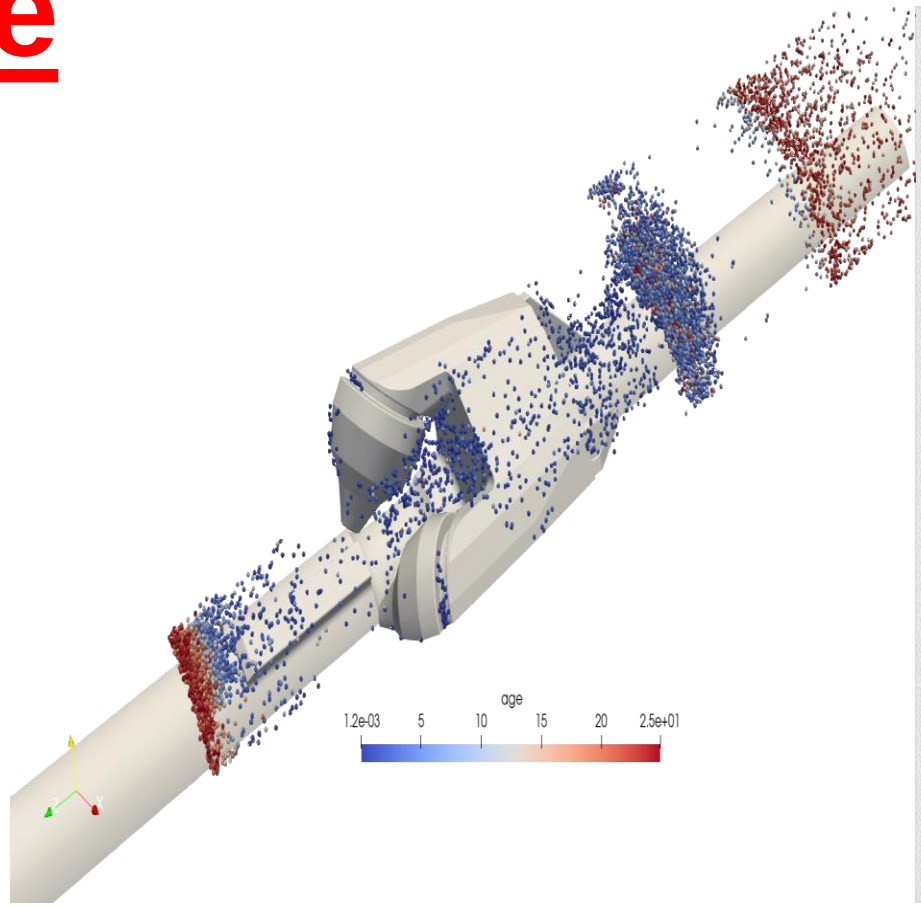
- Grade
- Rake Angle
- # of Blades
- Hydraulics

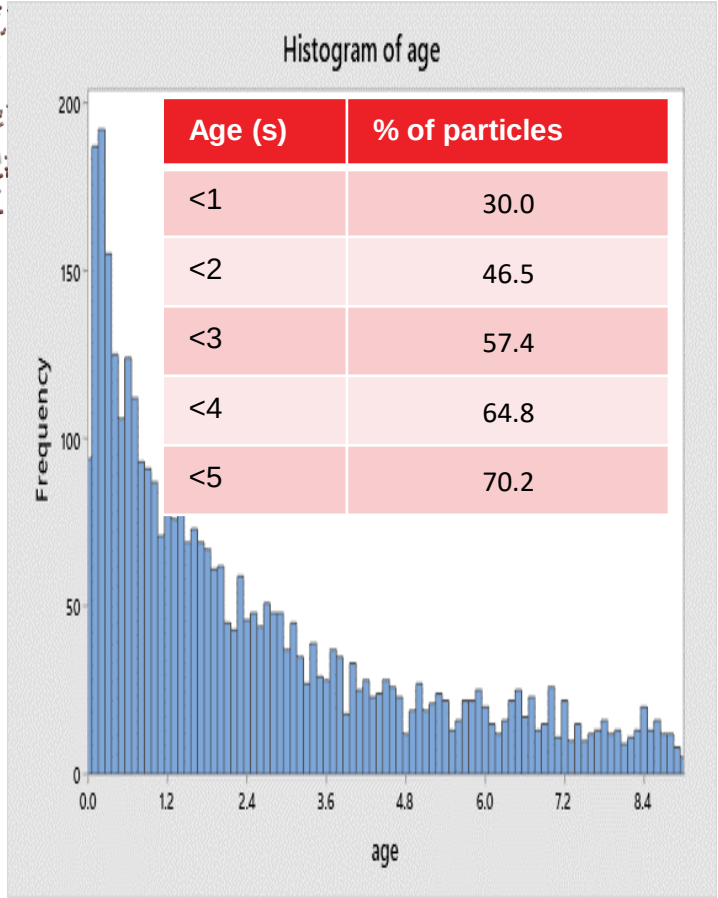




Performance

- Nozzle
- Delta
- HHP
- IF
- Velocity





Age (s)	% of particles
<1	30.0
<2	46.5
<3	57.4
<4	64.8
<5	70.2

Performance

- Hydraulics
- Cleaning
- Up Hole
- Down Hole

Case Study

- IADC Code
- Parameters
- Production

Profit

- +ROP
- +Ft drilled
- +Bottom line

Thank you!

Q&A

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