What is the Cost of Poor Quality?

QUALITY CONTROL
ALWAYS
COSTS LESS THAN
“REMOVE & REPLACE”

Compliments of
HMA Lab Supply Inc.
**Good** is the enemy of **Great**!

Quality is hurt by the attitude of “that’s good enough!”

Jim Collins - Author
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NAPA - San Francisco
Section 00745.48  Hauling, Depositing, and Placing- Haul, deposit and place HMAC as follows:

(a) Hauling...

Deliver the mixture to the paving machine at a rate that provides continuous operation of the paving machine, except for unavoidable delay or breakdown. If excessive stopping of the paving machine occurs during paving operations, the Engineer may suspend paving operations until the mixture delivery rate matches the paving operation.
Continuous Paving ??
Public Perception on Roads

- Roads need to be smooth
- Project finished same day
- No disruptions to traffic flow or travel speeds
- We need more roads and lanes
- Road building costs are too high
- No new taxes
Good Roads Don’t Just Happen!!

...they’re built by good contractors using best practices
What Plan? Too Many Details!
Why Continuous Paving?

- Smoother roads
  - Longer service life and life cycle costs
  - Less noise
  - Lower vehicle fuel consumption
  - Lower vehicle owner costs
  - There may be smoothness incentive

- Reduces potential segregation of pavements

- More consistency in density and structure
As initial pavement roughness increases, so does the average annual maintenance cost.

Source: Janoff 1991, in NCHRP 1-31
What Affects Continuous Paving?

- Asphalt plant capacity & production
  - sea level
  - 5% moisture in aggregates
  - 70 F ambient temperature

- Haul distance
  - traffic
  - accidents
  - convenience stores??

- Number of trucks

- Paving best practices
  - use of MTV, material exchange
  - paving basics of operation

- Compaction process
50 Ton Trucks
Many Ways to Determine Paving Speed

Must know plant production rate to determine paving speed!

\[
\frac{\text{tph} \times 34}{\text{Paving width (in)} \times \text{Paving thickness (in)}} = \text{paving speed (fpm)}
\]

\[
\frac{250 \text{ tph} \times 34}{144'' \times 2.5''} = 23.6 \text{ fpm}
\]

\[
\frac{350 \text{ tph} \times 34}{144'' \times 2.5''} = 33.0 \text{ fpm}
\]

NOTE: 600 tph only allows for 56 fpm paving
Paving Speed Determination

\[
\text{Tons per hour (tph) } \times 2000 = \frac{\text{Pounds per hour}}{145 \text{ (lbs per cu ft.)}} = \text{cubic feet/hour}
\]

\[
\left(\frac{\text{Cubic feet/hour}}{\text{Panel width (ft)}}\right) \times \frac{\text{Panel thickness (ft)}}{} = \text{linear feet/hour}
\]

\[
\frac{\text{linear feet/hour}}{60 \text{ (minutes/hour)}} = \text{feet per minute (paving speed)}
\]
Paving Speed Determination

\[ 250 \text{ (tph)} \times 2000 = 500,000 \text{ lbs/hour} \]

\[ \frac{500,000}{145 \text{ (lbs per cu ft.)}} = 3448 \text{ cu ft/hour} \]

\[ \frac{3448}{12 \text{ (ft)}} \times \frac{1}{0.2083 \text{ (ft)}} = 1379 \text{ linear feet/hour} \]

\[ \frac{1182}{60 \text{ (min/hour)}} = 23.0 \text{ fpm (paving speed)} \]
Paving Speed Determination

\[
350 \text{ (tph) } \times 2000 = 700,000 \text{ lbs/hour} \quad \quad \quad \quad \quad \frac{700,000}{145 \text{ (lbs per cu ft.)}} = 4827 \text{ cu ft/hour}
\]

\[
\left( \frac{4827}{12 \text{ (ft)}} \right) \quad = 1931 \text{ linear feet/hour}
\]

\[
\frac{1655}{60 \text{ (min/hour)}} = 32 \text{ fpm (paving speed)}
\]
Correct use of Material Transfer Vehicles?
Correct Use Of Material Transfer Vehicles (MTV)

1. **Consistent** paving speed
2. Balance production
3. Control segregation and temperature
Gotta Find that Balance!

Plant Production

Laydown and Compaction rate
MTV’s Are Being Used Globally and on Special Projects to Produce Smooth Pavements from Continuous Paving
Plan for Continuous Paving

- Plan laydown and paving speed by determining
  - Available HMA from the plant
  - Consider haul time, temperatures, and # of trucks available

- Use of an MTV will not guarantee continual paving

- Insure the right equipment is at jobsite. 1, 2, or 3 rollers available to match paving speed to the optimal compaction speed

- Be sure the laydown understand paving basics and best practices

PLAN, PLAN and be CONSISTENT
Line of Pull: runs through the screed pivot point, the center of the auger shaft and the tow point and is parallel to the paving surface. This allows the maximum screed area to be used producing the best mat.
Material Flow Through the Paver

- Hopper
- Conveyors
- Augers
- Screed
- Fresh Mat
Material Management - Material in Hopper

Keep Hopper 1/3 full as minimum

Never below this - It may be too late!
Conveyor area is exposed and augers are starved!
Forces Affecting Screed Performance

Factor No 1: Angle of Attack
Factor No 2: Head of Material
Factor No 3: Paving Speed
Factor No 4: Screed Vibration
Factor No 5: Screed Weight
Factor No 6: Material Stability
Factor #1- Angle of Attack

Definition: The angle of the screed plate bottom to the grade over which it is paving. This angle is a factor in determining the amount of material that will pass under the screed in a given distance and is critical in controlling mat depth.
Method of Changing Angle of Attack

Manual Depth Cranks

Electronic Controls
Change Tow Points
Factor #2- Head of Material

The head of material is the mass of paving material directly in front of and spans the entire width of the screed. Head of Material should be kept level with auger shaft. Never vary +/- 1 inch. Over 75% of all mat deficiencies originate from paving with an improper head of material.
Varying the Head of Material

The increased forces causes the screed to rise, leaves too much paving material. The increased depth also may/will decrease density.

The decreased forces causes the screed to fall and leaves too little paving material. This decreased increases density.

Head of Material Too High

Head of Material Too Low

Paving Direction
For best efficiency, the conveyors/augers should remain full and running 90% of the paving time.
The Result of Not Controlling Head of Material

1. Conveyor/augers run out of HMA
2. Paver has to stop
3. Screed may sink into mat
4. Laborers hand fill with lose HMA
5. Smoothness and quality issues are now in question
The Number of Trucks Waiting Doesn’t Determine Paving Speed
Never Hurry Up to Wait!
Screed Performance Requires Consistency and Proper Attention

No clowns or dare devils need apply!!
The Bad and the Good- Continuous Paving Can Help Prevent This

End of Load Segregation and no consistency in temperatures

Good temperature distribution
Thanks!