

“The Effects of Variable
Extrusion Moisture on Extrusion,
Drying, and Fired Physical
Properties of a Shale Body and
How Extrusions Aids Can Effect
the Properties”

Harold B. Newman

Pine Hall Brick

Topics to be Discussed

- Variable Moisture Content-Factors
- Green Strength Properties
- Drying Shrinkage Properties
- Cold Water Absorption Properties
- Body Additives
 - Soda Ash
 - Lignosulfonate



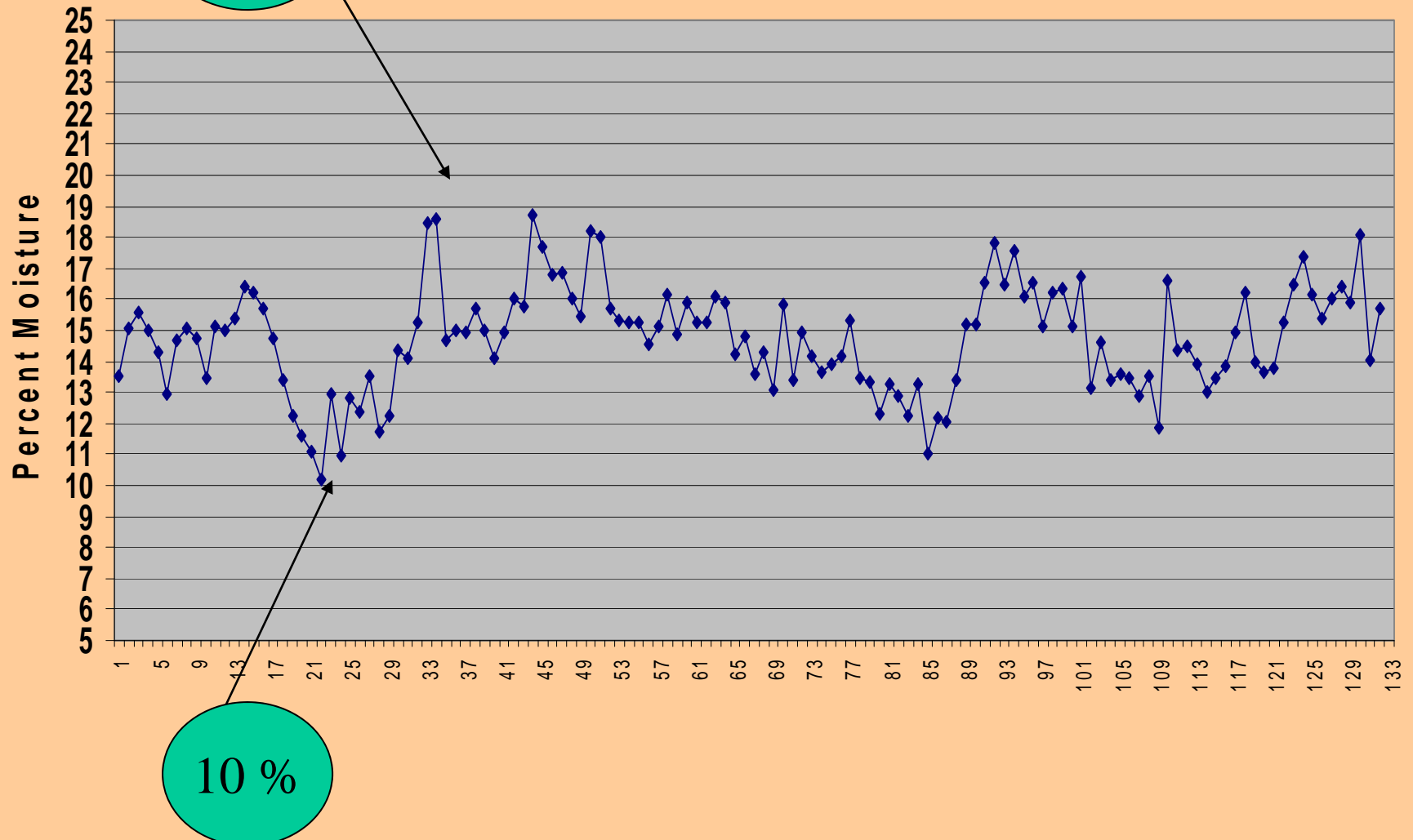




COVERED STORAGE-Material Blending



Ground Material Moisture Content 2008-2011



Research Project

- Proportion Batches of Shale Variable Moisture Contents
- Mix for Constant Time Period
- Extrude Lab Test Bars-Good Vacuum
- Test Bars For Green Strength
- Test Bars for Drying Properties
- Fire Bars and Test for Shrinkage and Absorption Properties

Add to Mixer



Add Controlled Amounts of Water





Constant Mixing Time 5 Min

Discharge Mixed Material



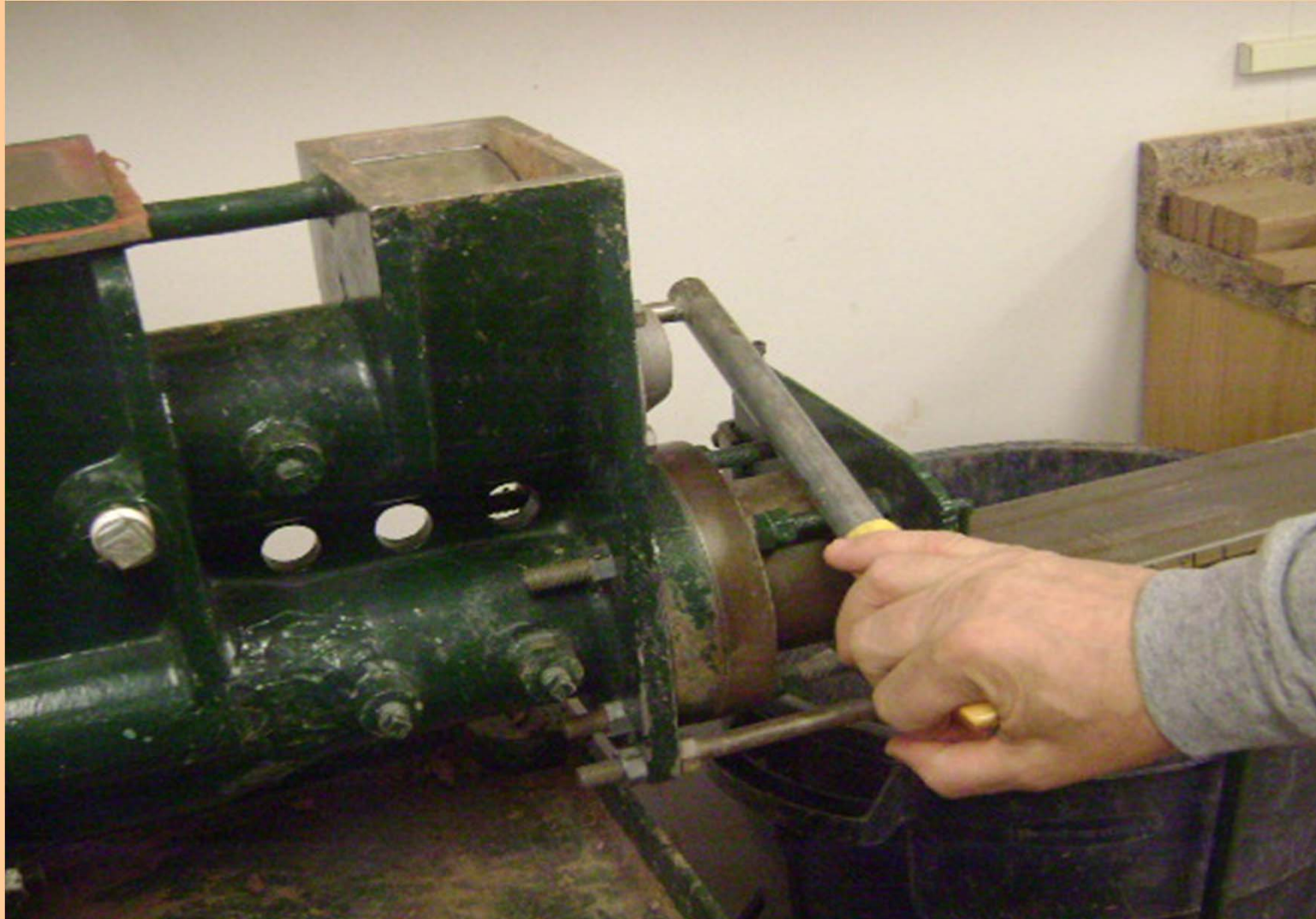
Check Consistency





Maintain Good Vacuum

Extrude Bars with Good Vacuum



Extruded Column

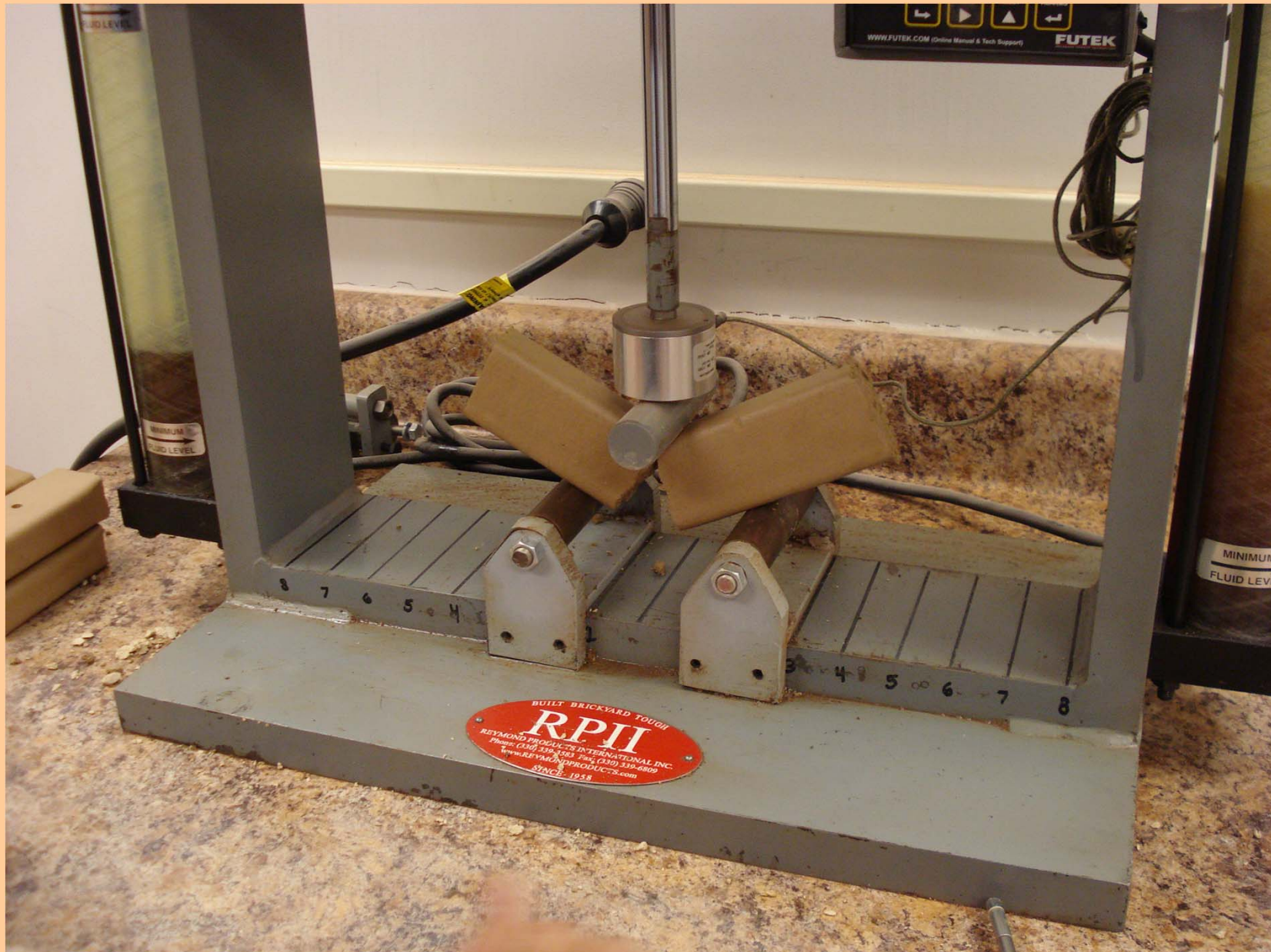


Cut Sample Bars for Testing

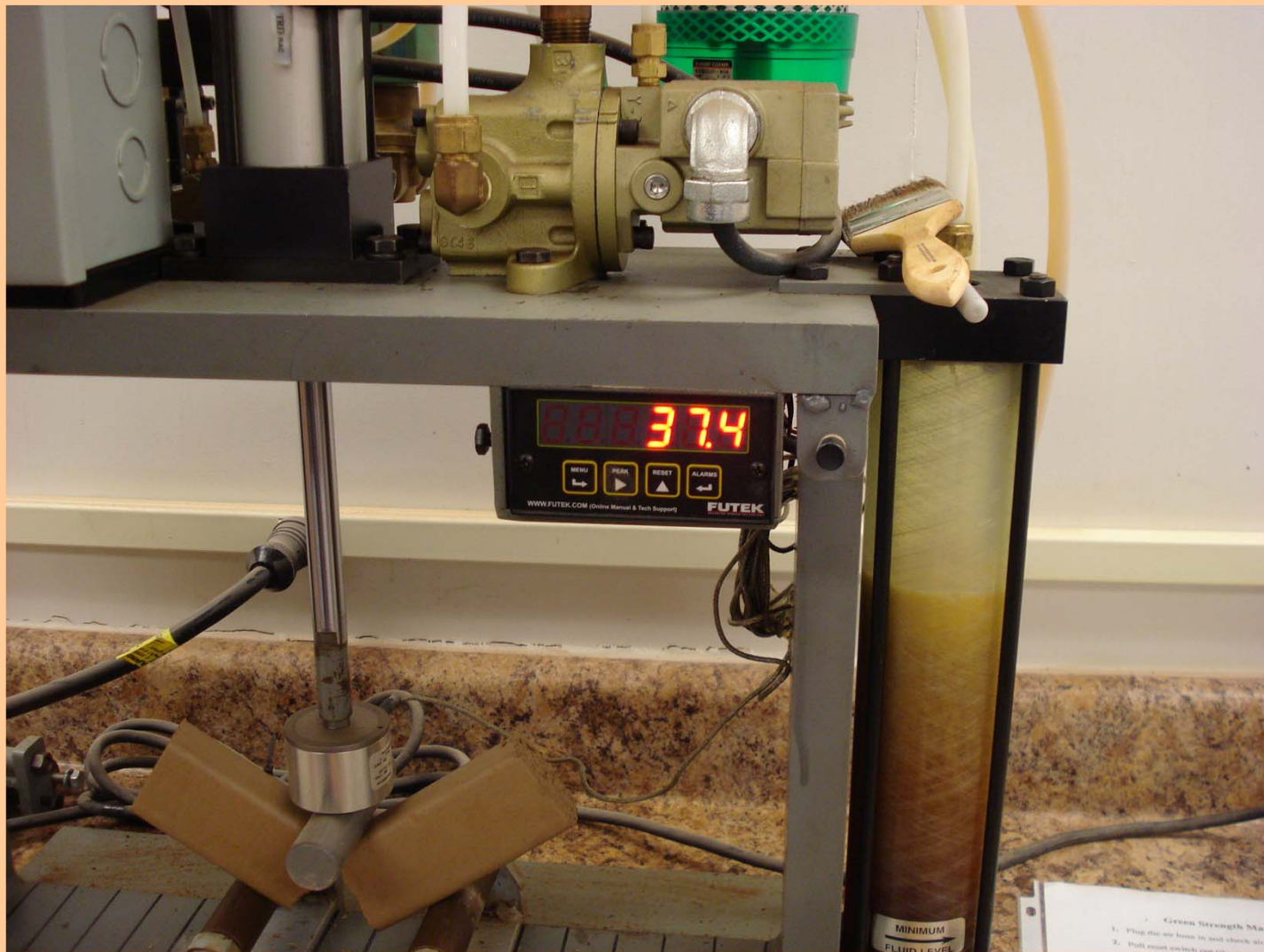


Test Bars

- Green weight
- Dry weight
- Column hardness
- Green strength



Testing Green Strength

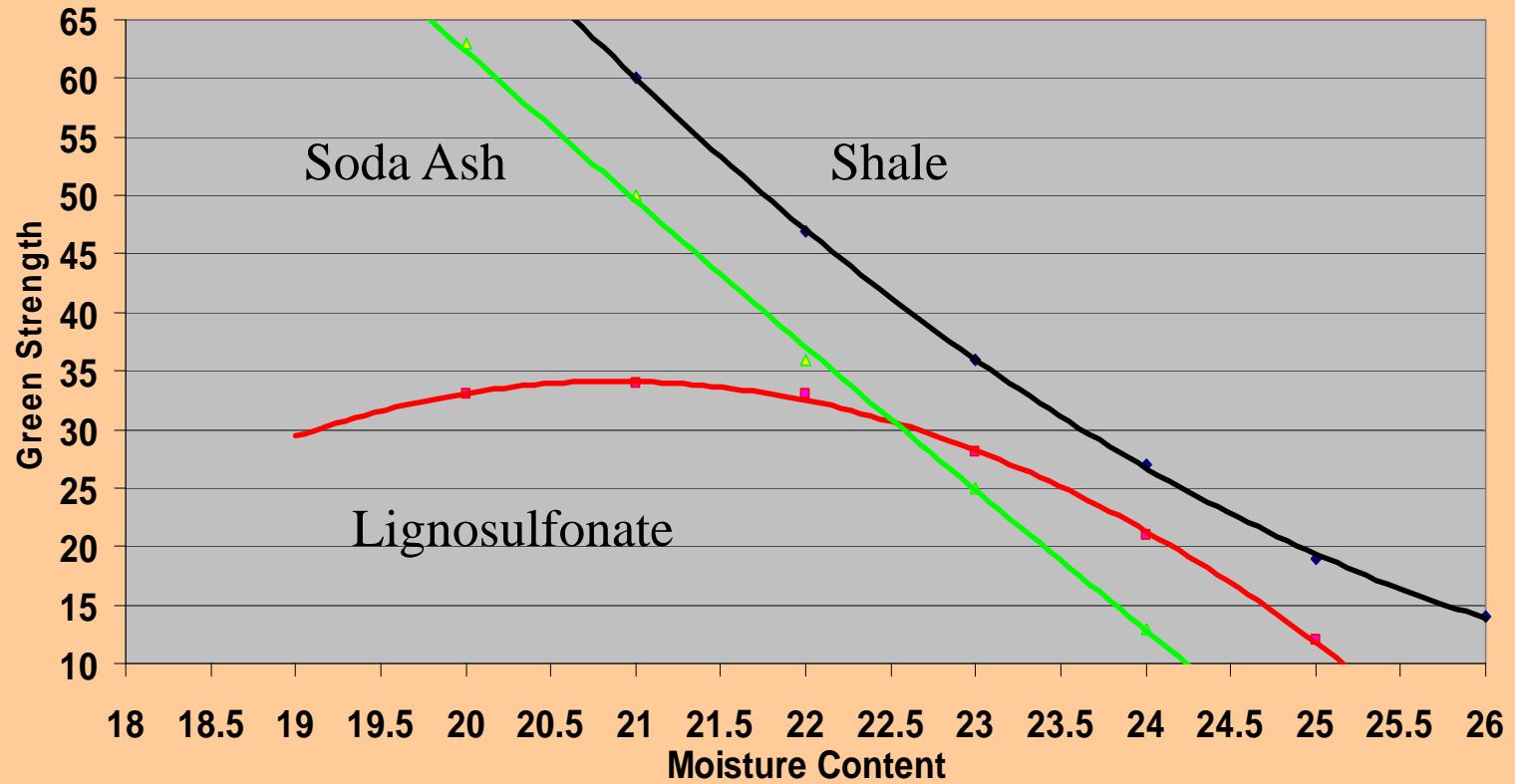


Record the Data



Recording the Sample Weight
Determine Moisture Content

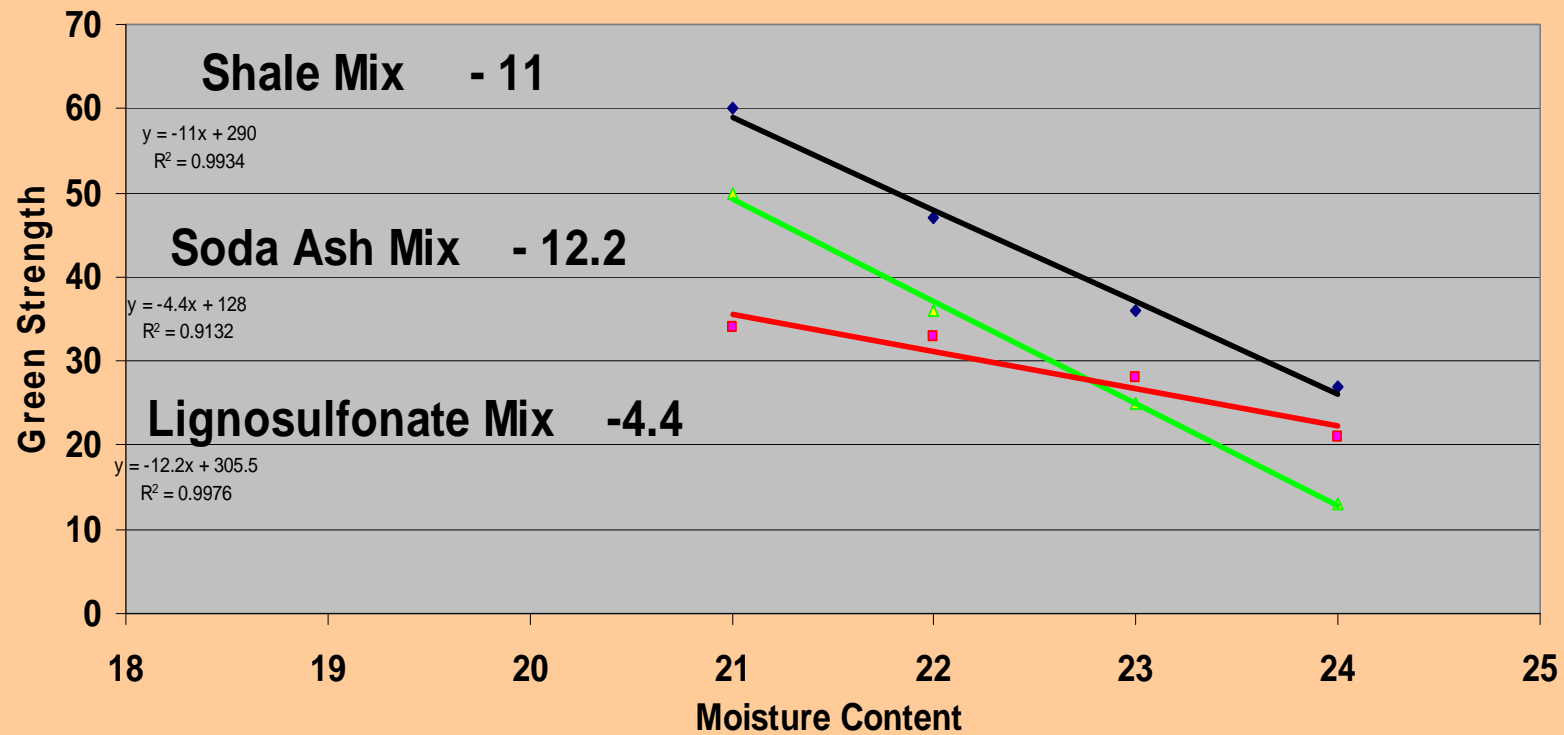
Shale Body Green Strength Vs Extrusion Moisture



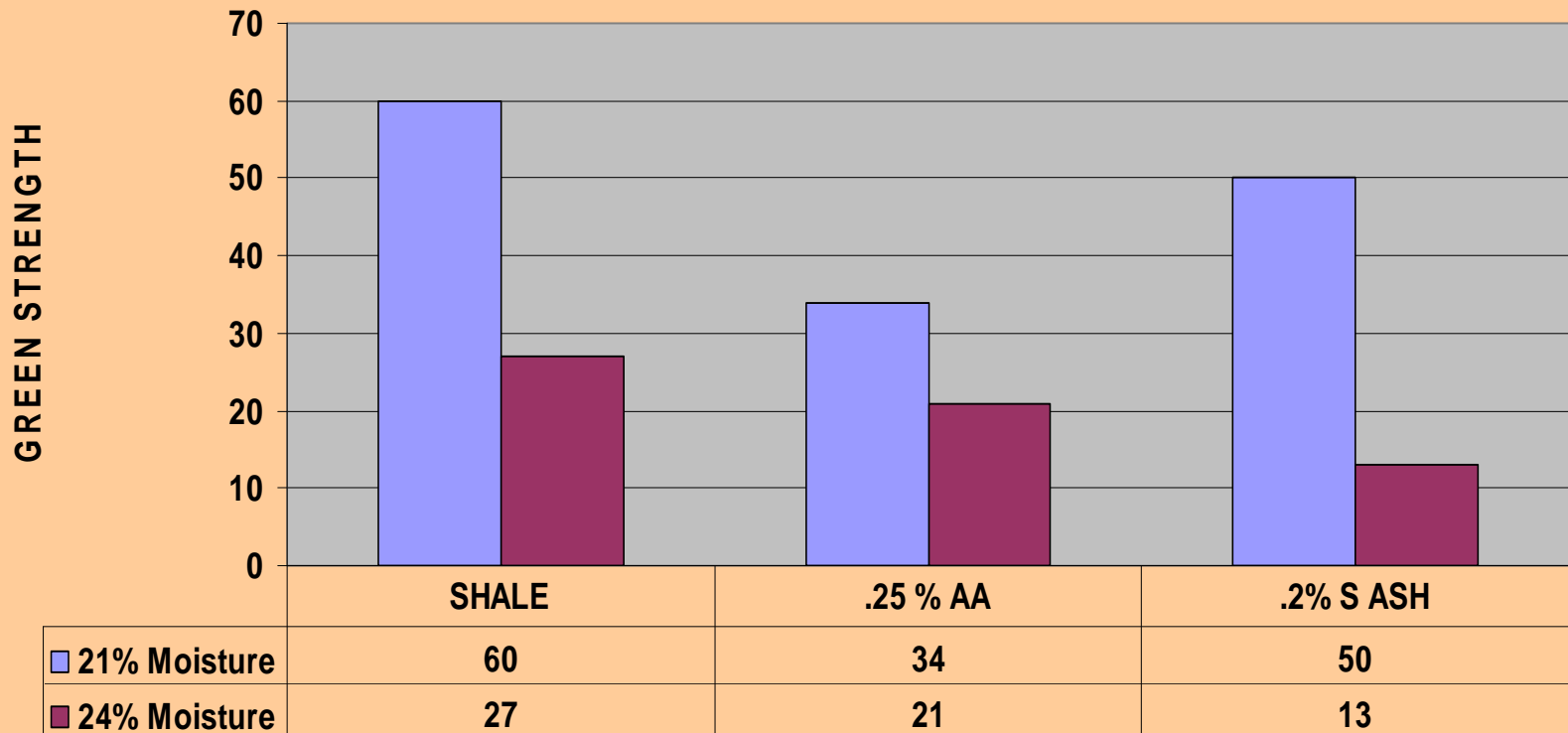
Shale Mix Body Additions

Green Strength Vs Extrusion Moisture Sensitivity

21 -24 % Linear Regression Lines

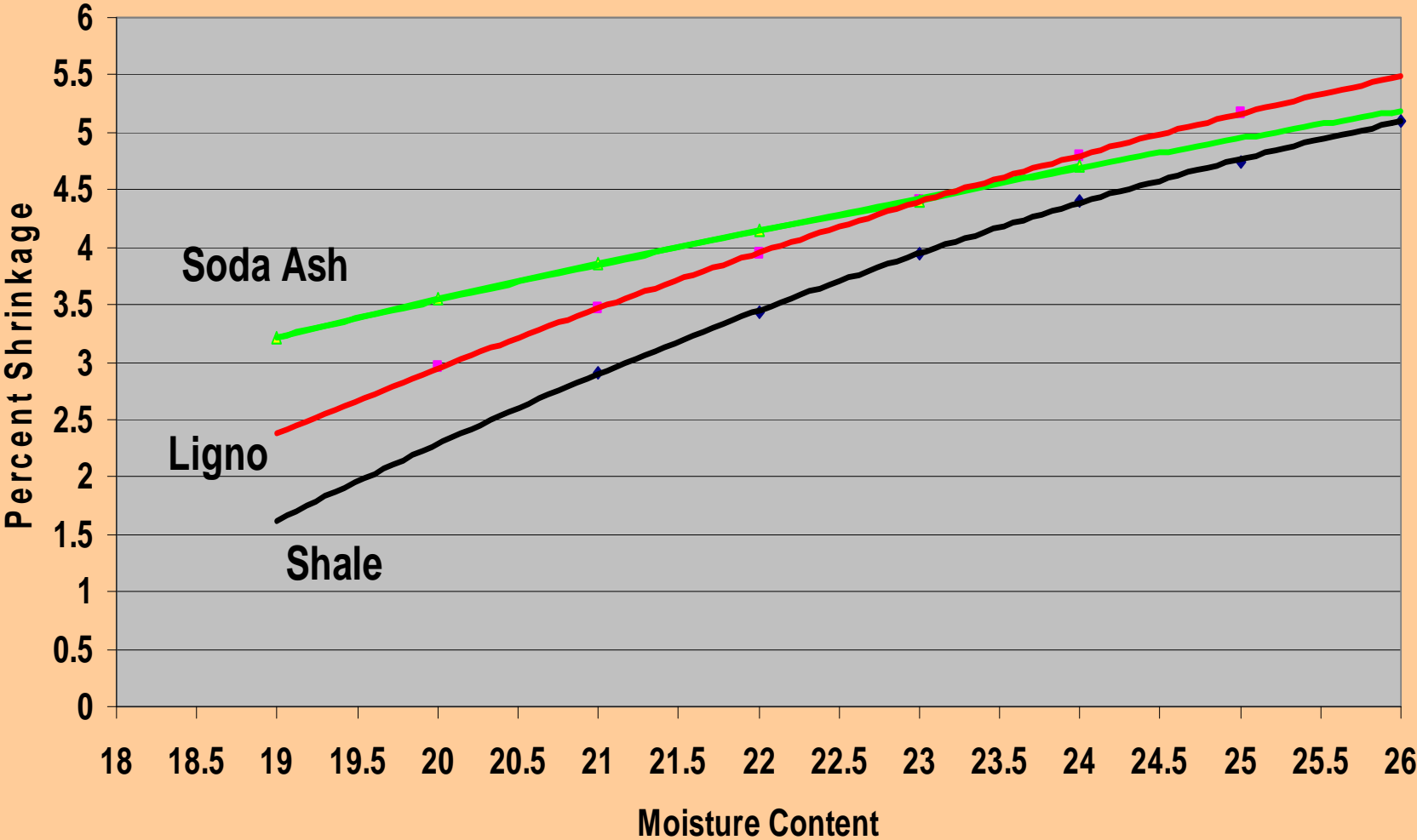


SHALE MIX BODY ADDITIONS GREEN STRENGTH 21 % AND 24 % EXTRUSION MOISTURE

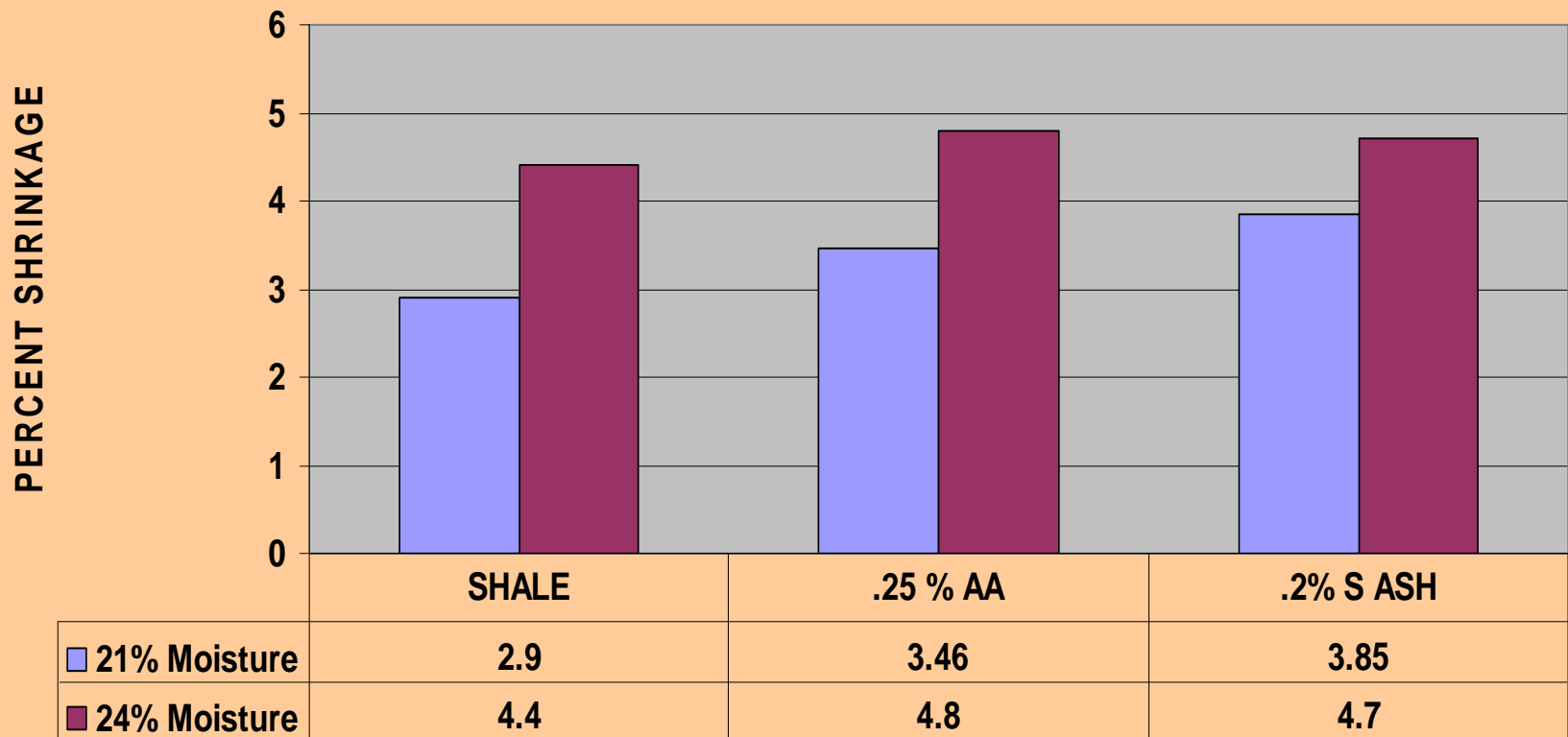


Shale Body

Dry Shrinkage Vs Moisture Content

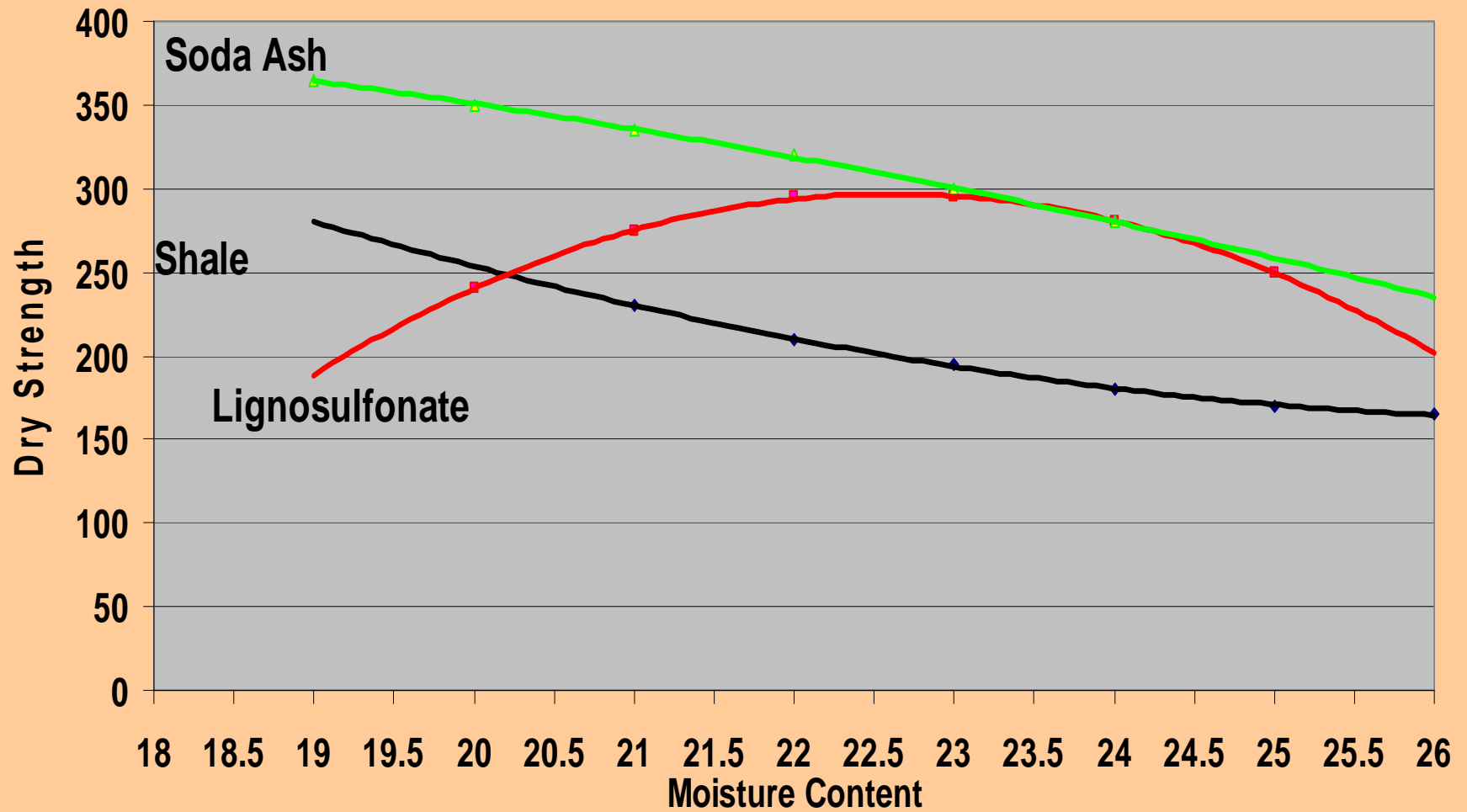


SHALE MIX BODY ADDITIONS PERCENT DRY SHRINKAGE 21% AND 24 % EXTRUSION MOISTURE



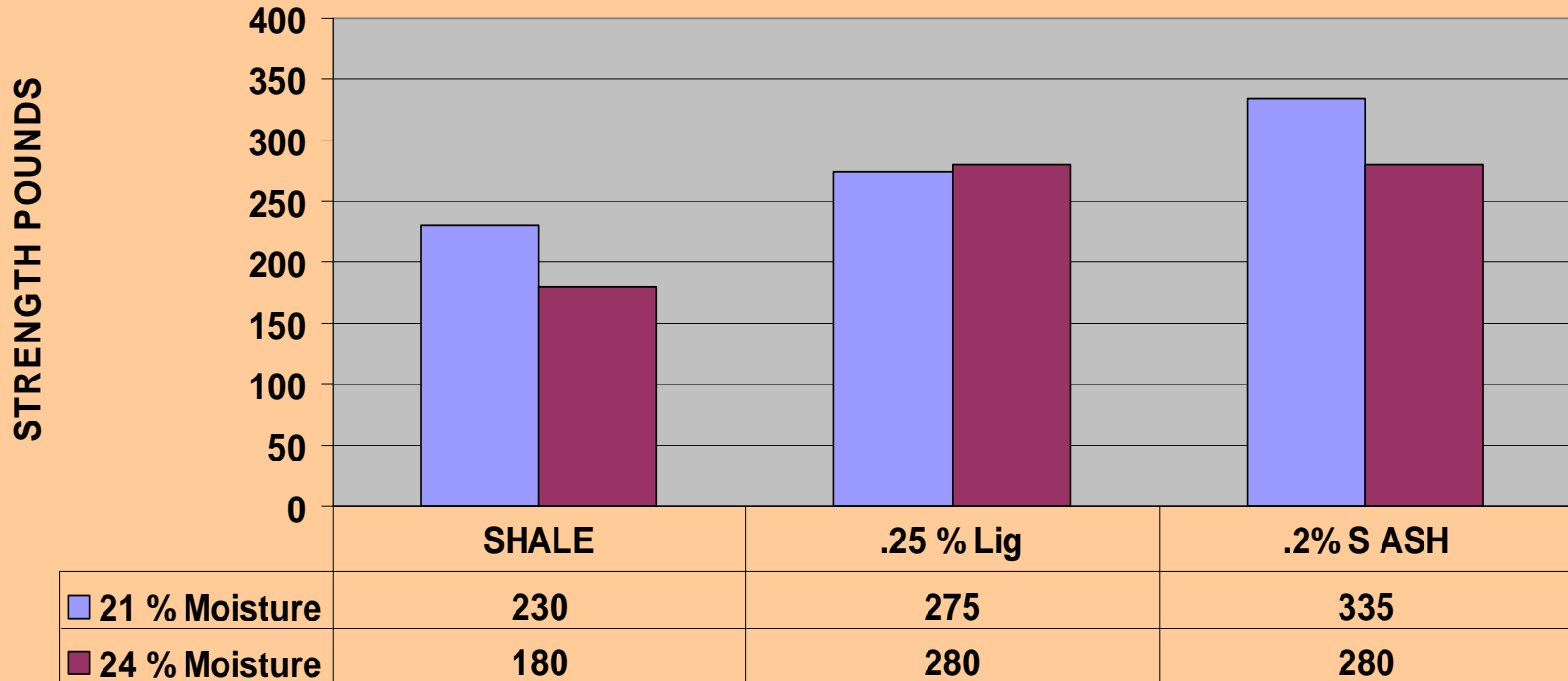
Shale Body

Dry Strength Vs Extrusion Moisture



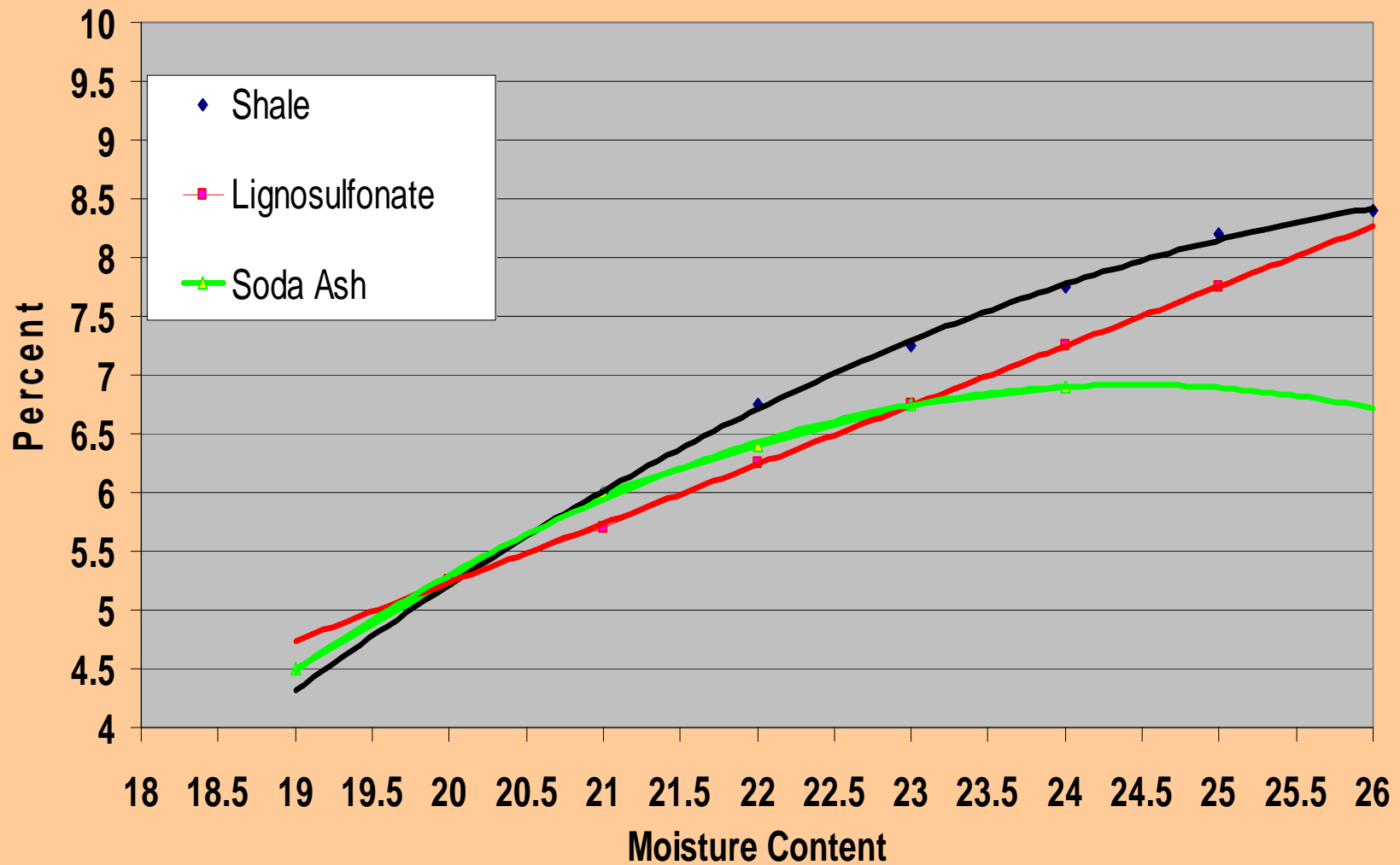
SHALE MIX BODY ADDITIONS DRY STRENGTH

21 % AND 24 % EXTRUSION MOISTURE

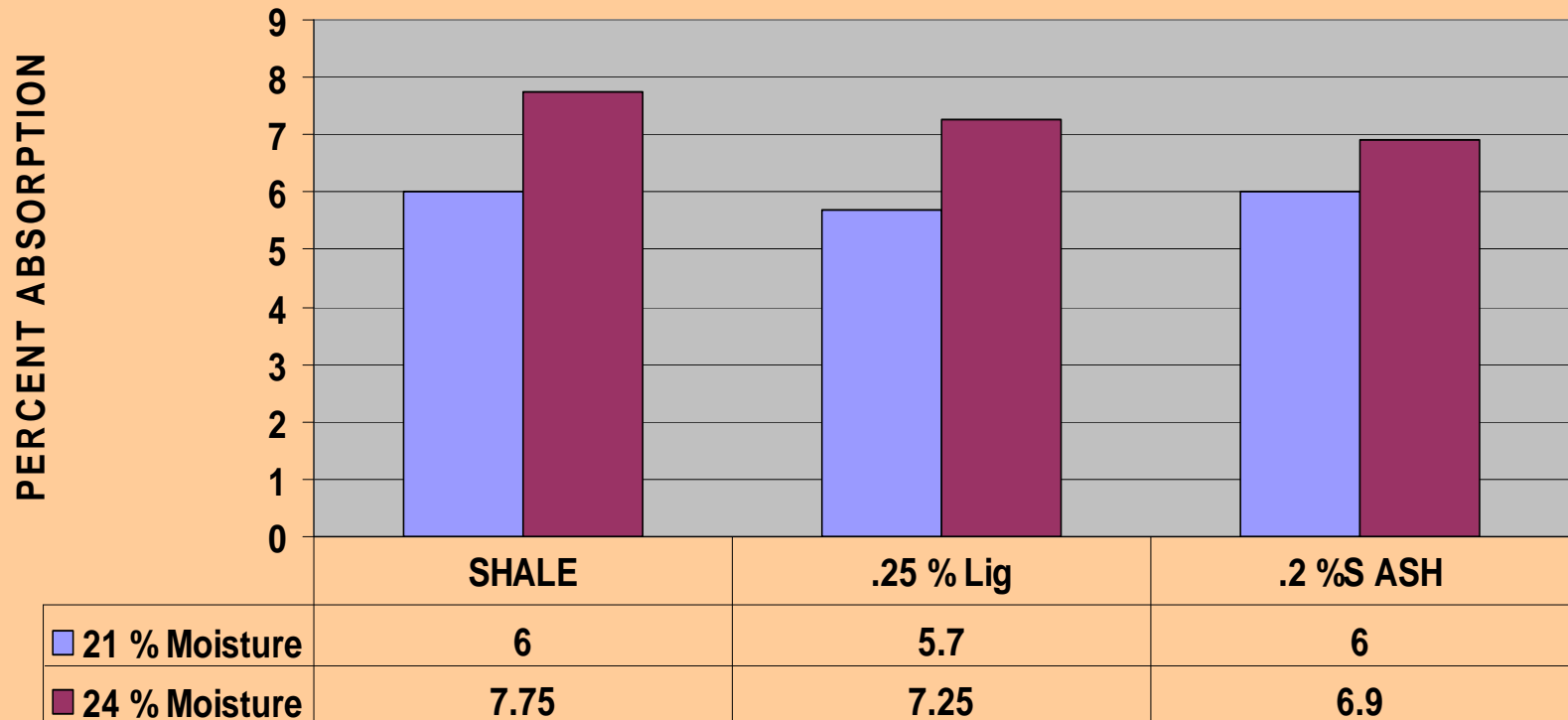


Shale Body

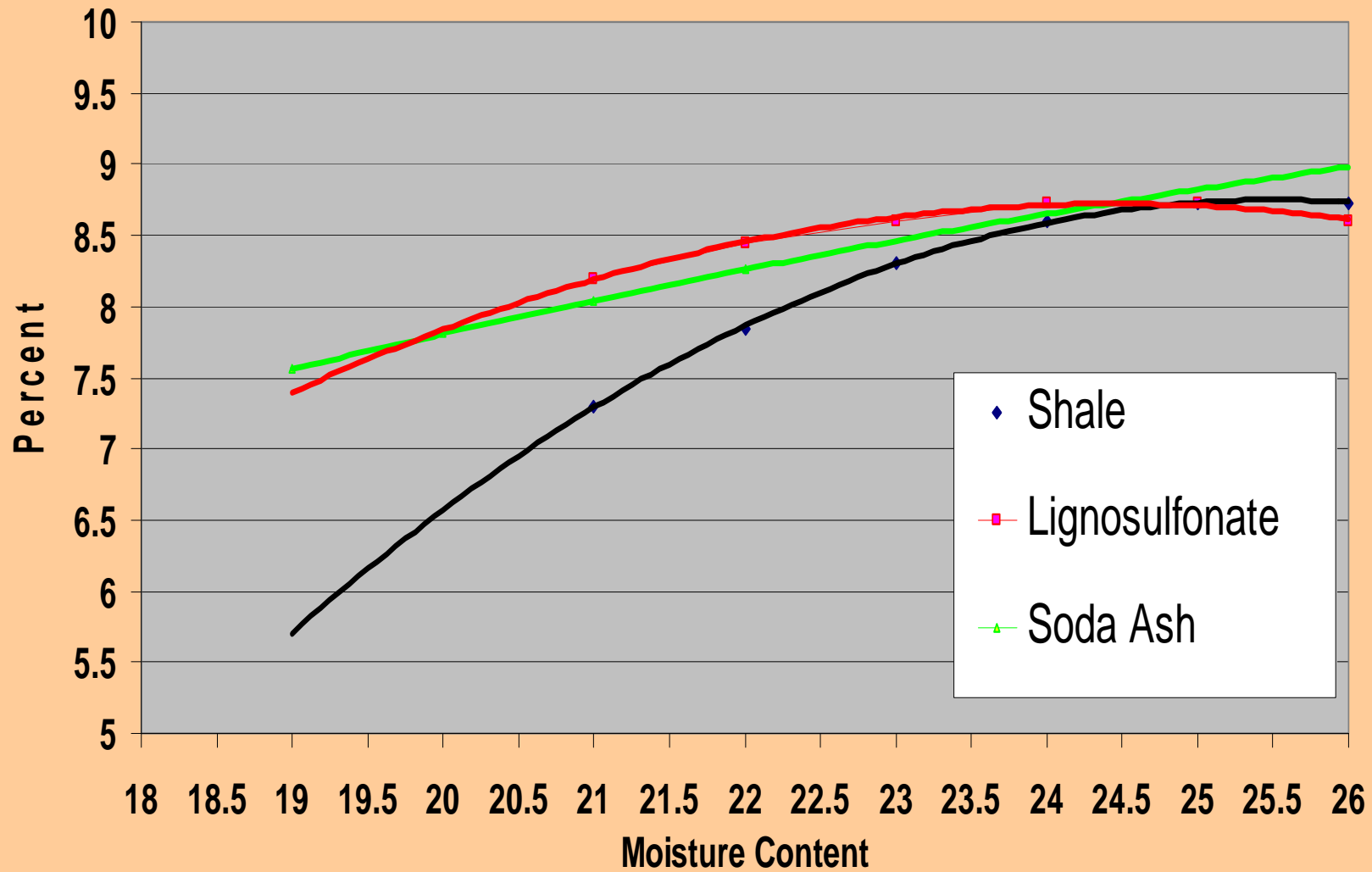
Cold Water Absorption Vs Extrusion Moisture



**SHALE MIX BODY ADDITIONS
24 HR COLD WATER ABSORPTION
21 % AND 24 % EXTRUSION MOISTURE**



Shale Body Total Shrinkage Vs Extrusion Moisture



PLANT STUDY

Old Plant

Hand Hack

Tumbled Line

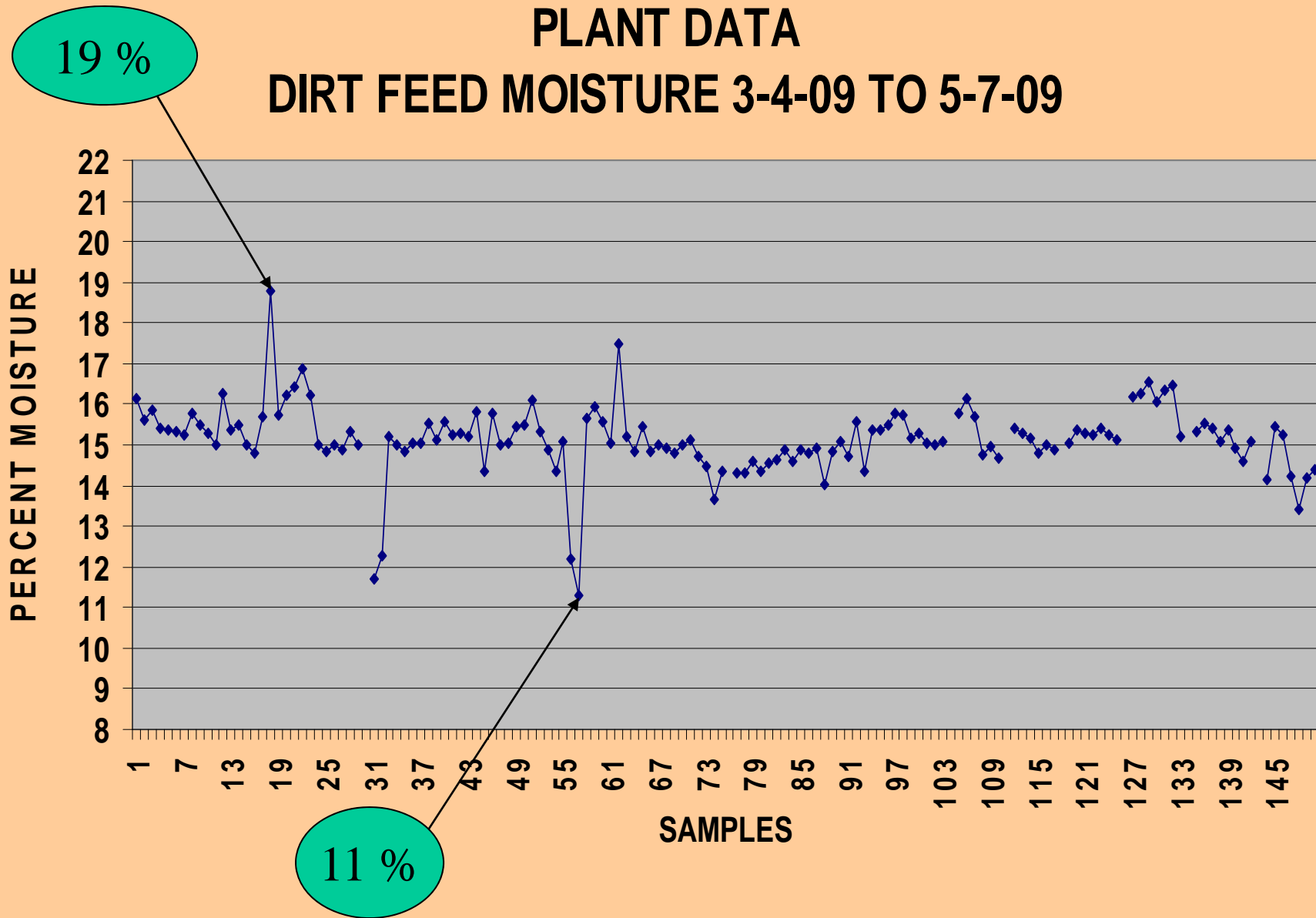
16 Wide Kiln

Monitor Plant Conditions

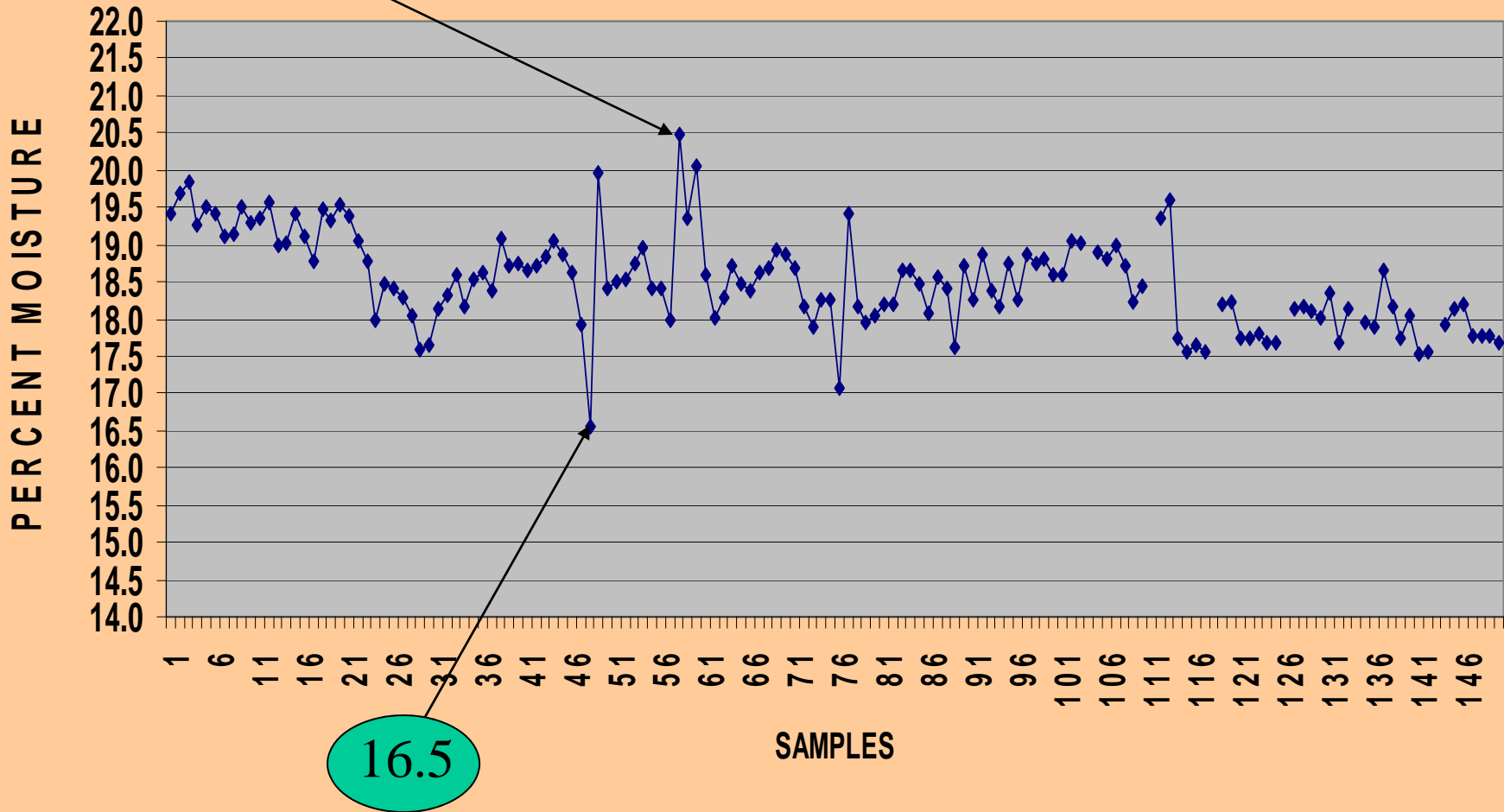
- Moisture of Ground Dirt
- Moisture of Dirt Fed to Pug Mill
- Manual Water Addition Rate-Die Oil Pressure
- Production Rate
- Vacuum Level
- Green Brick Moisture
- Green Strength-Penetrometer
- Additive Feed Rate

PLANT DATA

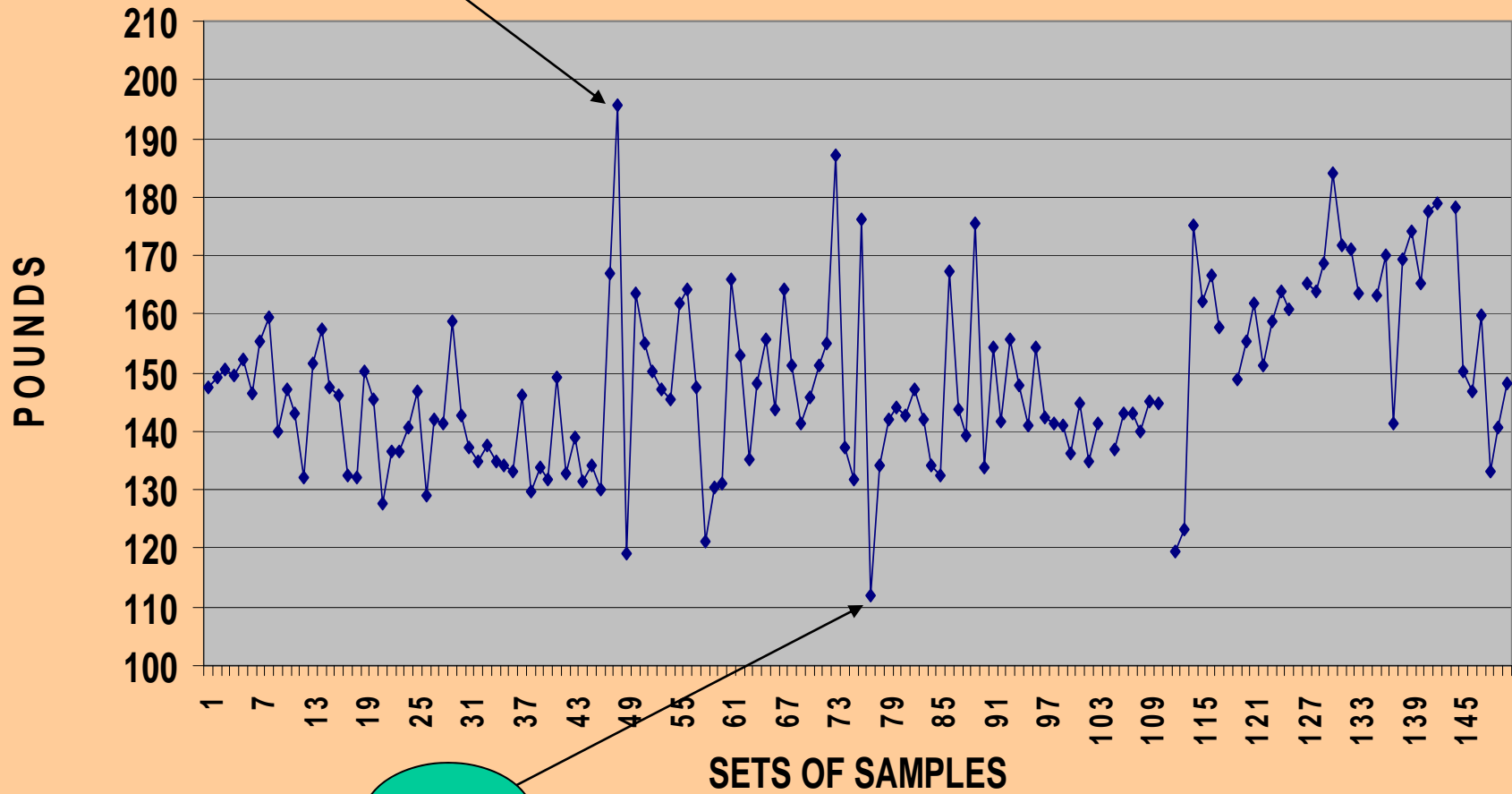
DIRT FEED MOISTURE 3-4-09 TO 5-7-09



PLANT DATA EXTRUDED BRICK MOISTURE 3-4-09 TO 5-7-09



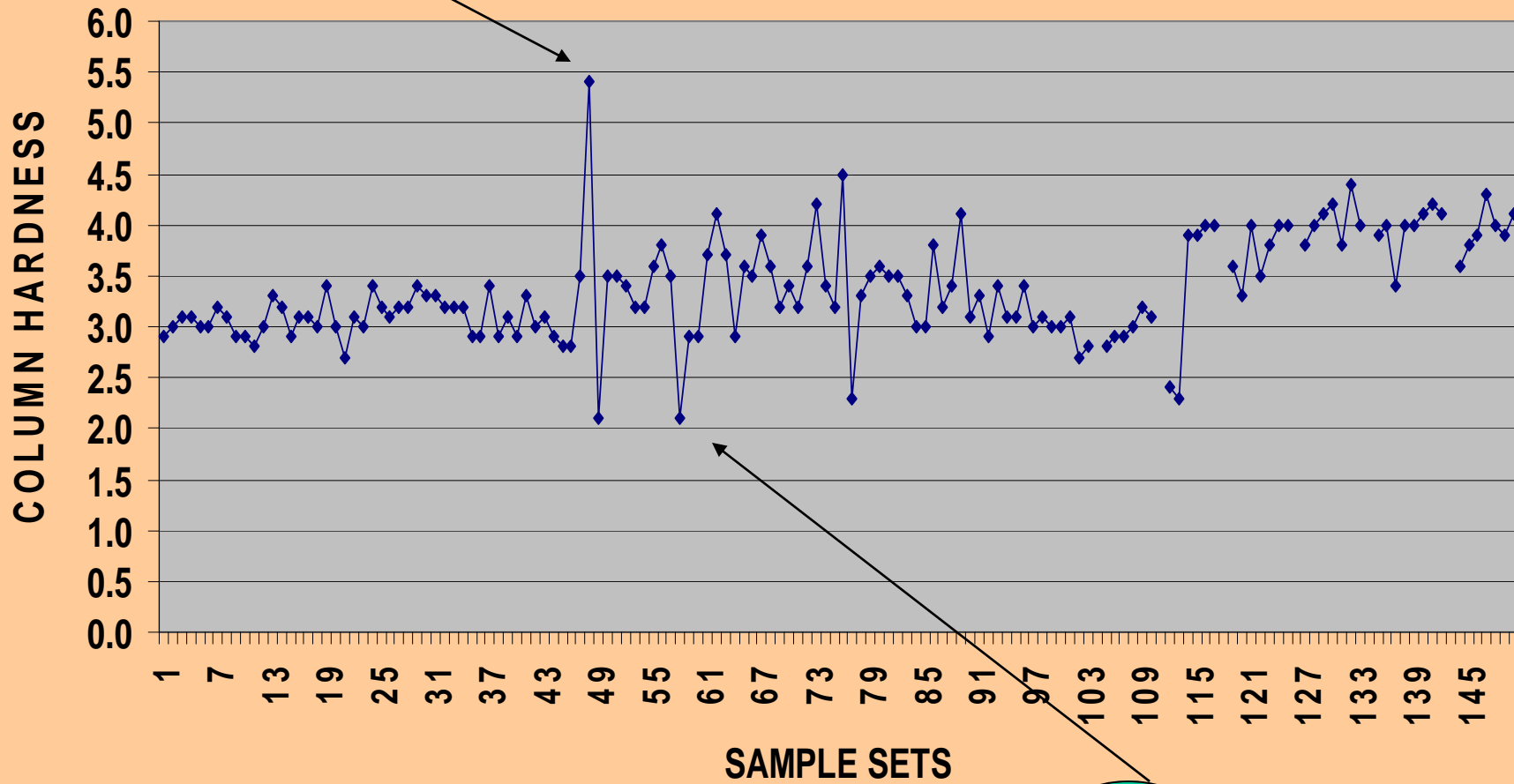
PLANT DATA BRICK GREEN STRENGTH 3-4-09 TO 5-7-09



195

110

PLANT DATA PENETROMETER READINGS 3-4-09 TO 5-7-09

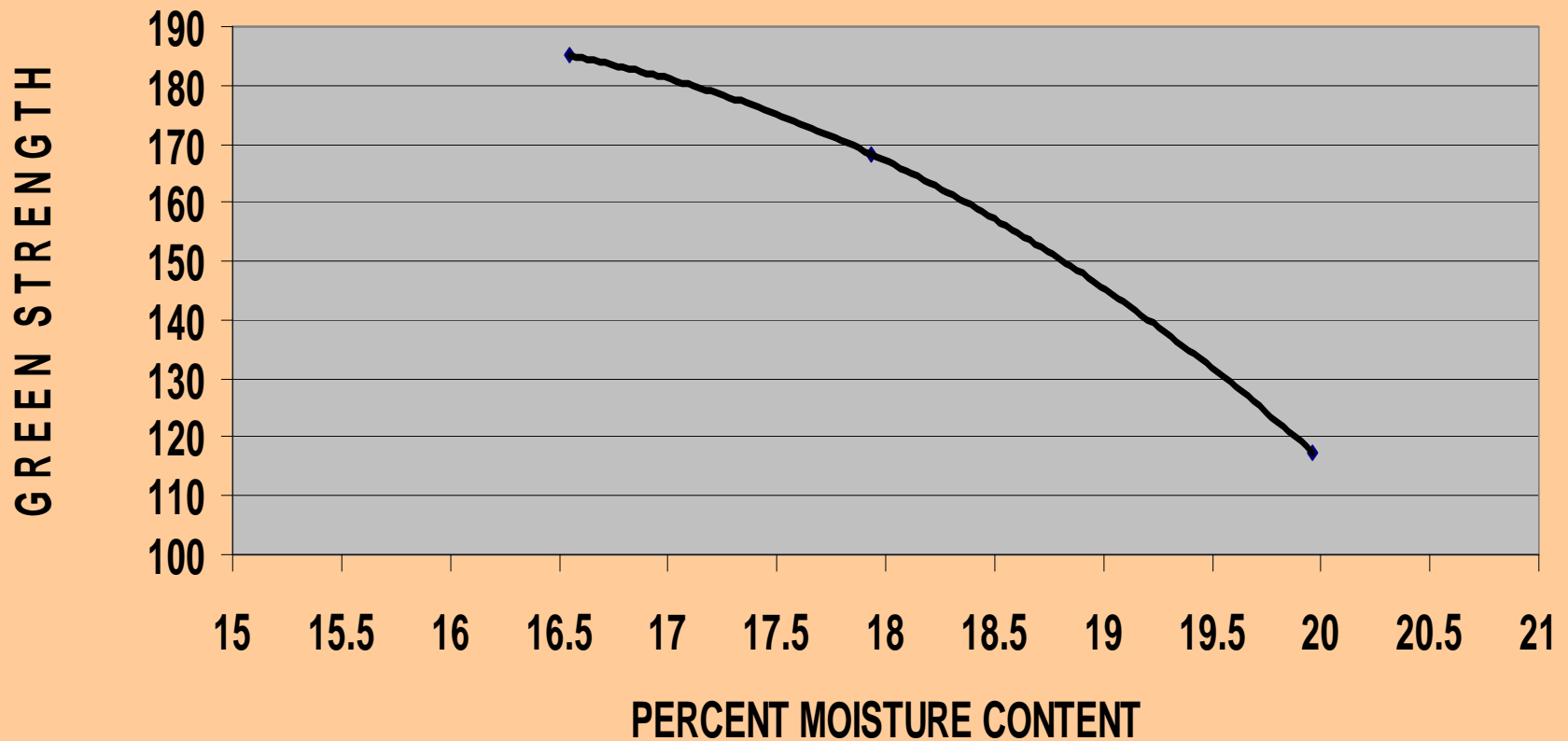


5.5

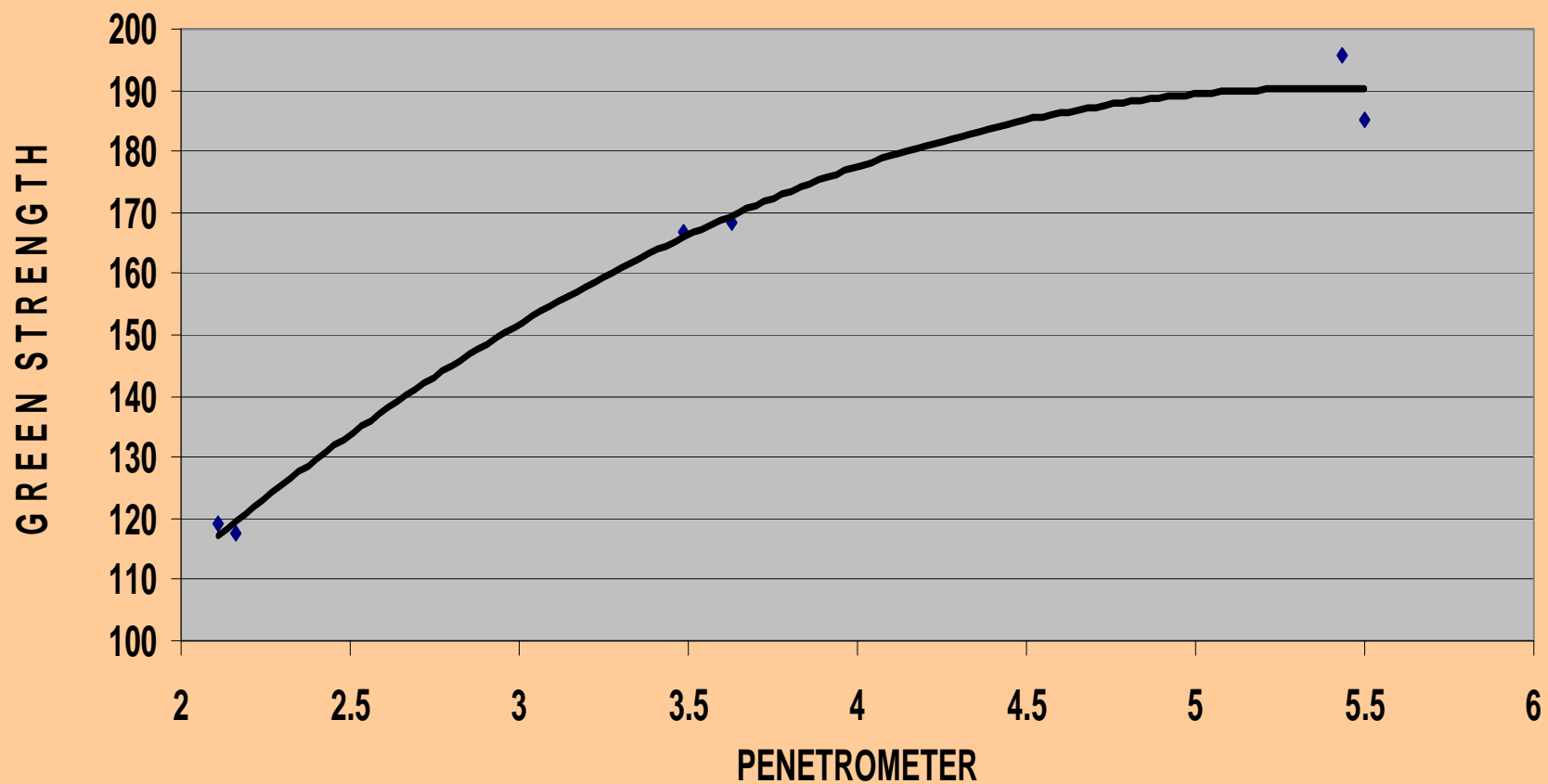
2.0

THINGS OUT OF CONTROL

PLANT TEST
CONTROLLED MOISTURE CONTENT TEST
GREEN STRENGTH VS MOISTURE CONTENT



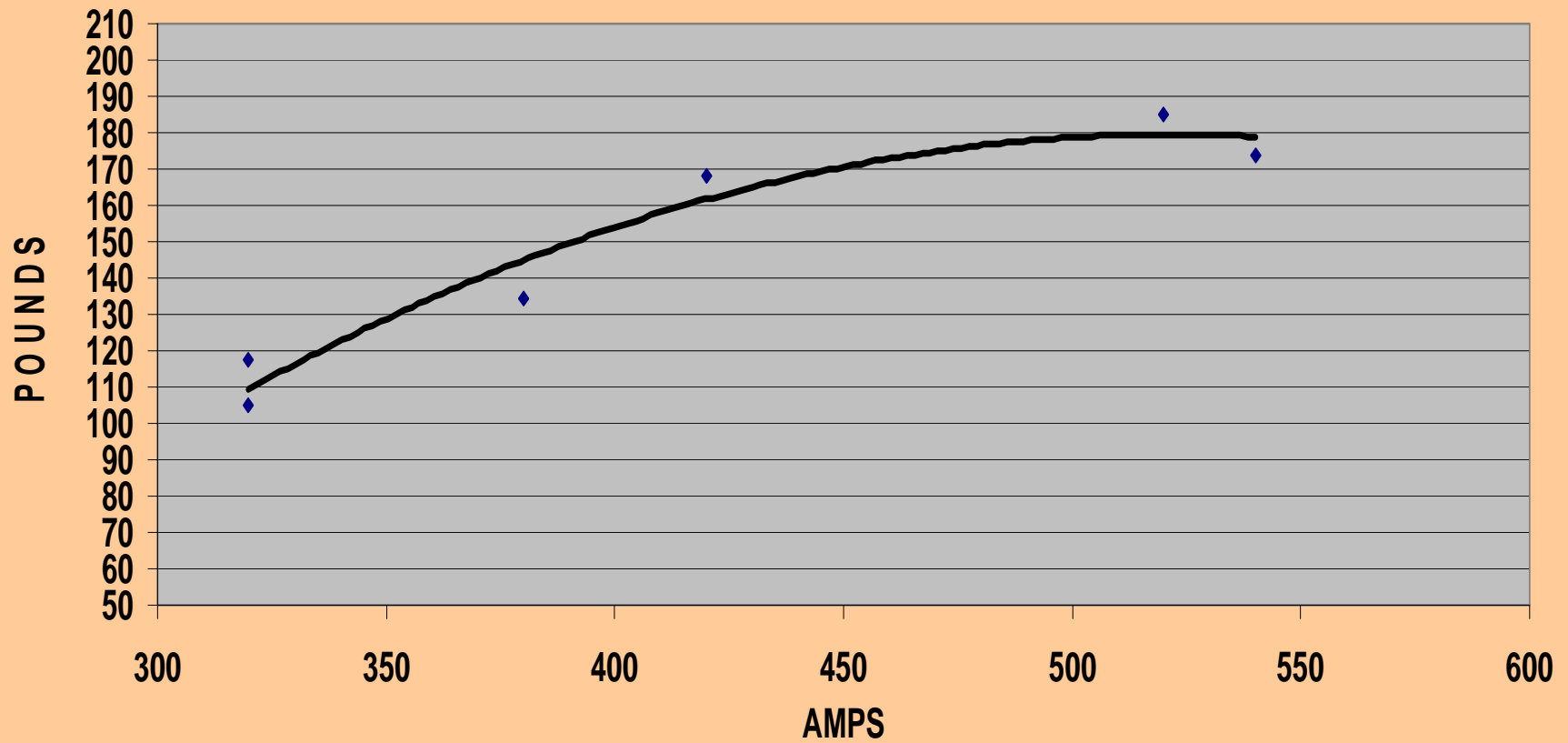
PLANT DATA
VARIED MOISTURE CONTENT
GREEN STRENGTH VS PENETROMETER



PLANT TESTS

CONTROLLED EXTRUSION MOISTURE

GREEN STRENGTH VS EXTRUDER AMPS



Action Taken

- Installed a Moisture Control System-In House
- Monitor Incoming Dirt Feed Rate and Moisture Content
- Control Water Addition and Additive Feed Rate Based on Incoming Dirt Feed Rate
- Eliminated Manual Water Feed Adjustments
- **Control Moisture Feed Rate Based on Automatic Continuous Penetrometer Readings**

RESULTS

- Got Control of Extrusion Process
Moisture Addition Rate
Additive Feed Rate
Production Rate
- Set Target Penetrometer Reading at 3.9
- Improved Green Brick Quality
- Improved Brick Hack Quality
- Allowed Control of Drying Process
- **Increased Recovery Rate by 5-7 %**

Potential Value

6 % Increase in Recovery

- 40 Million Brick Production
 - 2.4 Million Extra Brick to Sell
 - Market Value \$225 / M
 - Increased Revenue \$540,000
- 75 Million Brick Production
 - 4.5 Million Extra Brick to Sell
 - Market Value \$225 / M
 - Increased Revenue \$1,012,500

Message to Sales

“We Got Extra Brick”

“You Need to Sell Them”