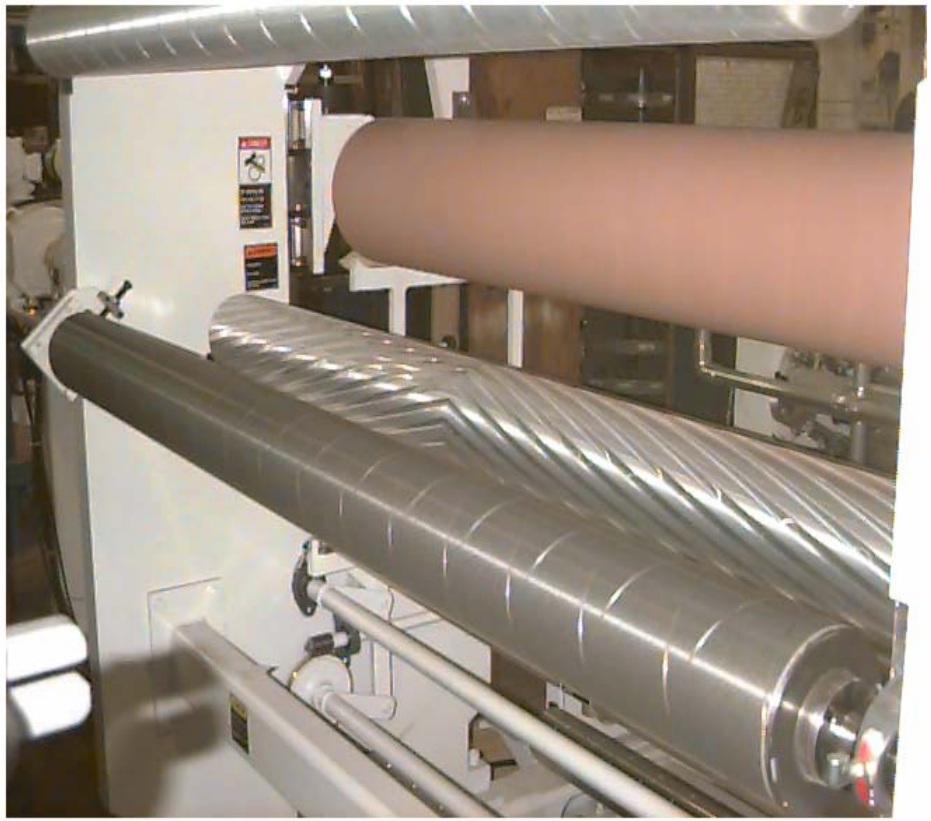
Web Handling Rolls

SAMPLE OF VARIABLES & RECORDSOF EXPERIMENTS

DESIGN CONSIDERATIONS



- **Having the Right Roller Material**
- **Having the Right Roller Diameter**
- **Having the Right Roller Bearings**
- **Having the Right Roller Spacing**
- **The Challenges of Air Greasing**
- **Web Handling Roller Alignment**

ROLL MATERIALS

- **Chrome Plated Steel-** ***Normally Used with Paper & Paperboard***
- **Anodized Aluminum-** ***Used for Films, Light Paper & Aluminum Foils***

The cost of Steel and Aluminum are about equal

- **Carbon Fiber Composite**

Roll Materials for Special Applications ***i.e. Thin Films & Non-wovens***

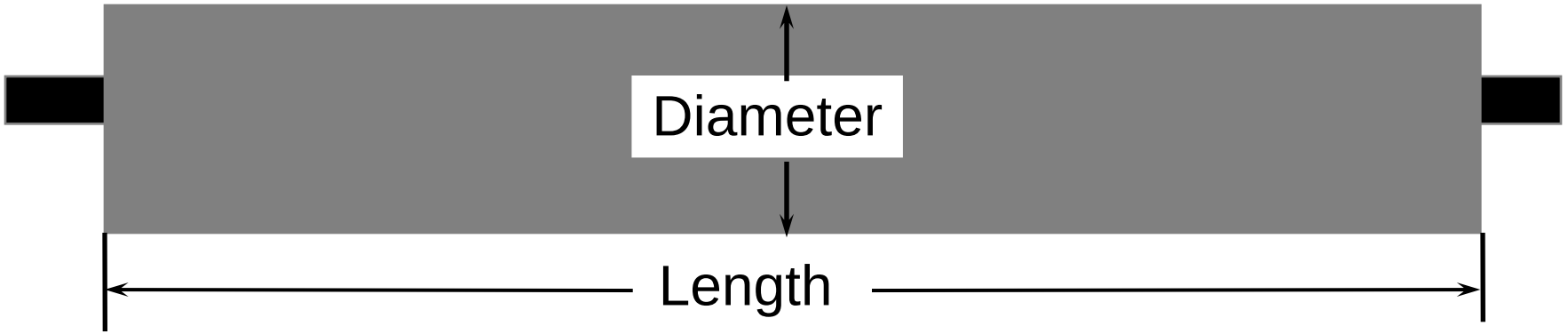
+ Less weight & inertia than Aluminum

- Less Durable than Metal

- More Difficult to Manufacture, therefore more Expensive

However Costs are Coming Down

IDLER ROLL DIAMETER



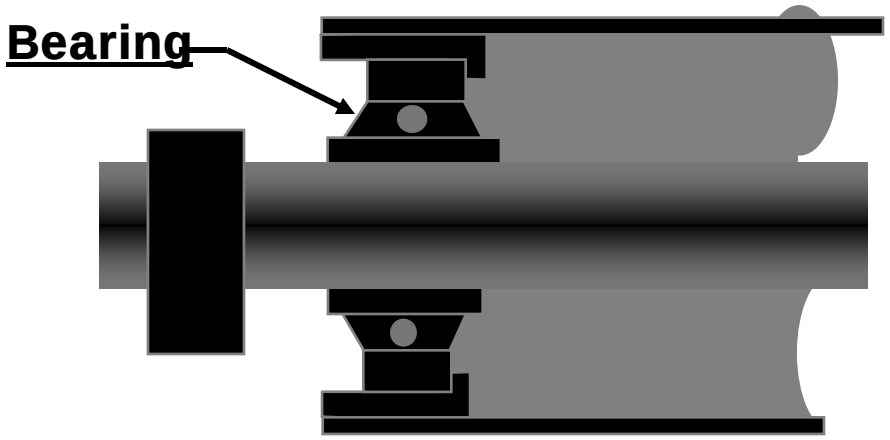
Roll Diameter

- **Generally** $\frac{\text{LENGTH}}{\text{DIAMETER}}$ = **16 or Less**, i.e. @ 64” = 4”
- **Paperboard or Stiff Material, Consider Bend Radius**
- **Roll Deflection, *Rule of Thumb*:**
  - **Generally .010” per each 100” of Roll Face**
  - **Less… If Handling Unsupported Foil**
  - **More… If Handling Extensible Web Materials**

IDLER ROLL BEARINGS

Low friction seals & Keep brg. size to Min.

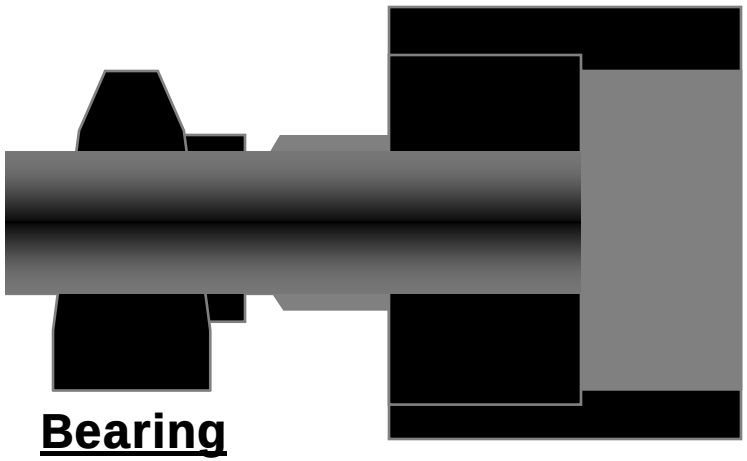
Dead Shaft Type



+ Usually Less Expensive
+ Lower Inertia

- Greater Deflection (Not for Wide, High Tension Applications)
- No Bearing Re-Lubrication
- Difficult Bearing Replacement
- Requires Larger Diameter bearings (journal sag w/ sm. dia.)

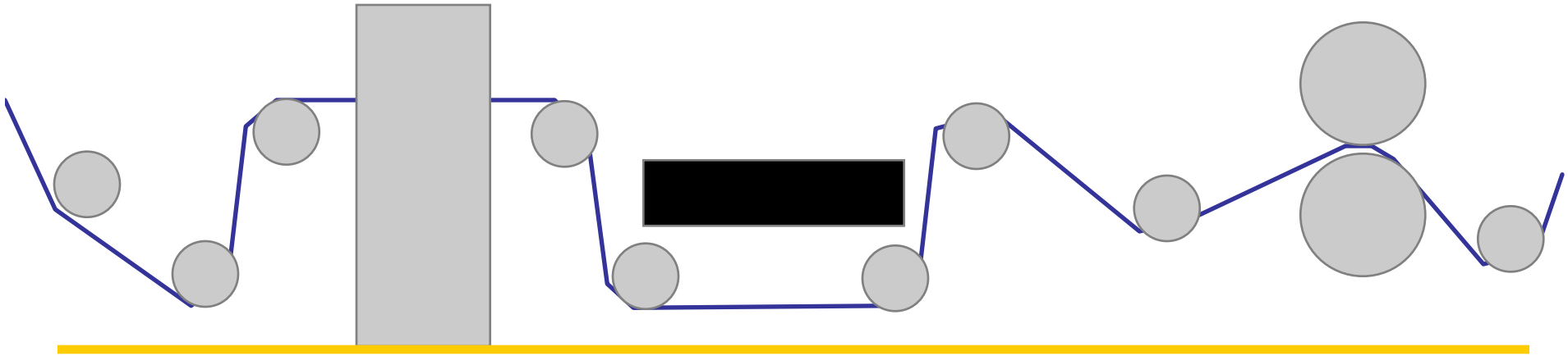
Live Shaft Type



+ Less Deflection due to Head Stiffness and Larger Journals
+ Bearings Out in the Open
+ Bearing Size Not Limited
+ Bearings Easily Lubricated

- More Expensive
- Greater Inertia

ROLL SPACING

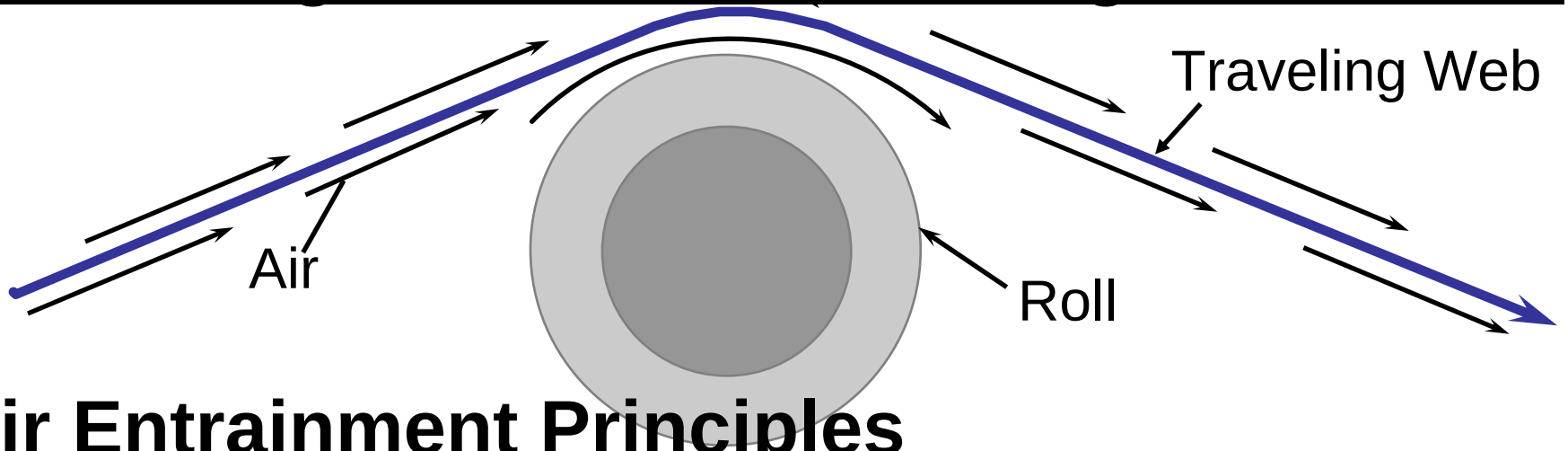


"***Rule of Thumb***"- Roll to roll spacing -2/3 Web Width

- *Thin (.0003) Aluminum Foils*, use 24" max.
  Longer spans if a Spreader roll is used after the longer span.
- Roll Spacing is Speed / Tension Influenced;
  Web Flutter - Shorter distances between rolls

AIR GREASING

Tracking & Web Scratching Problems



Air Entrainment Principles

- **Roll's and Web's Surface Do Not Affect Air Layer**
- **Larger Roll Diameters Entrap More Air**
- **Smoother Rolls Will Lose Traction Easier & Scratch Web**

Possible Solutions

- **Rougher Roll's Surface**
- **VentAir Groove Roll's Surface**

Web Handling
Roller Alignment

Rule of Thumb-

Rollers Should be Level & Tram within .010”/ 100” (.001”/ foot)

Greater Allowable Misalignment for Extensible Materials (stretchy films)

Less Allowable Misalignment for Non-Extensible Materials (aluminum foil)

Other Web Handling Roller Considerations:

- **Roundness (TIR)**
- **Roller Straightness**
- **Dynamic Balance**

Reference Book

"***The Mechanics Of Rollers***"

Dr. David Roisum

TAPPI Press

Challenges in Web Handling

- **Easy to Align Web Handling Rollers to 1 PART IN 10,000 (.010” / 100”)**
- **Difficult to Manufacture Webs to 1 PART IN 100 (1% Across Sheet)**

Web Producer’s Challenge

Make Web Basis Wg. Profile as Flat as Possible

Basis Wg. = f(thickness & moisture)

Web Handling Challenge

Pull Sufficient Tension to
Convey Imperfect Web Materials
Straight Through the Process
Without Wrinkles

Suggested Amounts of Web Tension

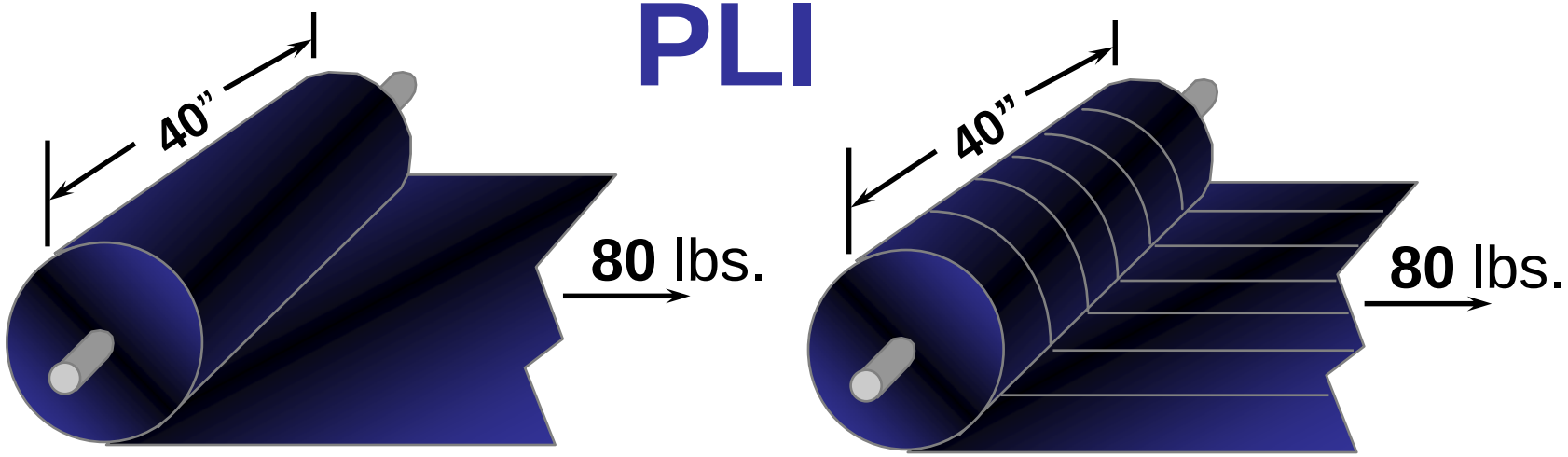
"Rule of Thumb"

10 - 25% of Machine Direction Tensile Strength of Web Mat'l.

TENSION TERMS –

Unit Tension –Pounds / Linear Inch

PLI



Per 1” Width = $\frac{80\#}{40”}$ = 2 Pounds Per Linear Inch (PLI)

Unit Tension Conversion - 1 PLI = .571 newtons/cm

TYPICAL TENSION VALUES - Films & Foil

FILMS	TENSION LEVELS
• Polyester	0.5 to 1.5 lbs./inch/mil
• Polypropylene	0.25 to 0.5 lbs./inch/mil
• Polyethylene	0.10 to 0.25 lbs./inch/mil
• Polystyrene	0.25 to 1.0 lbs./inch/mil
• Vinyl	0.05 to 0.2 lbs./inch/mil
• Aluminum Foils	0.5 to 1.5 lbs./inch/mil
• Cellophane	0.5 to 1.0 lbs./inch/mil
• Nylon	0.10 to 0.25 lbs./inch/mil

1 lbs./inch/mil = 7.03 kg./cm/mm

TYPICAL TENSION VALUES - Paper

PAPER, Basis Wgt.	TENSION LEVELS
15 lbs./ream (3000 sq.ft.)	0.5 pli
20 lbs./ream	0.75 pli
30 lbs./ream	1.0 pli
40 lbs./ream	1.5 pli
60 lbs./ream	2.0 pli
80 lbs./ream	2.5 pli

Unwinding Tension (pli) = basis weight x 0.035

Winding Tension (pli) = paper basis weight x 0.055

.035 X 1.5 (50% greater) = Approx .055

TYPICAL TENSION VALUES - Paperboard

BOARD THICKNESS	TENSION LEVELS
8 point	3.0 pli
12 point	4.0 pli
15 point	5.0 pli
20 point	7.0 pli
25 point	9.0 pli
30 point	11.0 pli
40 point	14.0 pli
50 point	16.0 pli
60 point	18.0 pli

1 point = .001” = 25.4 microns

SOURCE

TAPPI

2010 PLACE Extrusion Coating Short Course

Charleston, SC

April 24th – 26th, 2010

Challenges of

WEB HANDLING AND WINDING

by

R. Duane Smith

Product Manager
Specialty Winding
Black Clawson Converting Machinery / Davis-Standard LLC