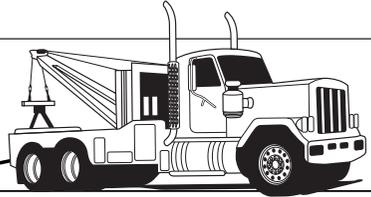


# Level & Incline Planes

Legend	Formulas
W = Weight of load	Level: $DFxW=F$
CR = Coefficient of Friction	Uphill: $[CFxWx(R/L)] + [(H/L)xW] = F$
H = Height in feet	Downhill: $[CFxWx(R/L)] - [(H/L)xW] = F$
R = Run, horizontal distance in feet	
L = Length of ramp in ft.	



Winch line



## Example

$$\begin{aligned} \text{Uphill: } & [.15 \times 28,000 \times (10/10.44)] + [(3/10.44) \times 28,000] = F \\ & 4,032 + 8,120,120 = F \\ & 12,152 \text{ lbs.} = F \end{aligned}$$

## Coefficients of Friction

Concrete on concrete	.65	Wood on metal	.30	Steel on steel	.10
Metal on concrete	.60	Cast iron on steel	.25	Load on wheels	.05
Wood on wood	.50	Continuous lubricated		Load on ice	.01
Wood on concrete	.45	Surface	.15	Load on air	.002

## Care, Use And Inspection Of Overhead Lifting Slings

### Lifting Sling Care:

- Store chains on an A-frame in a clean, dry place, and oil chains before extended storage.
- Do not heat alloy chain. Heating alters the thermal treatment that has been applied to the chain.
- Do not plate or change the surface finish of a chain.
- Store nylon and round slings on an A-frame in a clean dry place.
- Avoid contact with oil, acids or other substances that may degrade nylon or polyester.

### Lifting Sling Use:

Before each use, inspect the chain or webbing and attachments for damage and defects.

Avoid any of the following situations, as they will decrease the working load limit of the sling:

- Acceleration in rate of load application (shock loading).
- Variation in the lifting angle of the sling. As the lifting angle decreases, the working load decreases dramatically.
- Twisting, knotting or kinking of the sling will cause uneven wear and drastic reduction in working load limit.
- Center load in hook(s), if applicable. Latches are not designed to support the weight of a load.
- Avoid sudden jerks when lifting or lowering.
- Balance all loads. Uneven loading will reduce working load limit.
- Use wear pads around sharp corners.
- Never drop load on chain, nylon or round lifting slings.
- For overhead lifting, use only certified alloy chain and attachments, or certified nylon and round lifting slings.

**IMPORTANT:** Do not exceed working load limits. Do not use worn or damaged slings. Always inspect lifting slings before each use. The life and strength of any lifting sling depends on proper use, maintenance and regular inspection.

### Lifting Sling Inspection:

It is important to inspect slings and attachments before each use. All slings, all fastenings, and all attachments should be thoroughly inspected for any signs of defect or damage. Additional inspections should be performed on a regular basis. Damaged or defective slings should be removed from service immediately. Additionally, OSHA requires that slings and attachments be inspected and certified on an annual basis.

### Chain Sling Removal Criteria:

Remove a chain from service immediately if any of the following conditions exist:

- Twists or bends of a link
- Nicks or gouges in a link
- Excessive wear or stretch of a link
- Distorted or damaged master link
- Distorted or damaged coupling links or attachments

### Nylon And Round Sling Removal Criteria:

Remove a nylon or round sling from service immediately if any of the following conditions exist:

- Acid or caustic burns
- Melting or charring of any part of the sling
- Holes, tears, cuts or snags
- Broken or worn stitches in load bearing splices
- Excessive abrasive wear
- Knots in any part of the sling
- Excessive pitting, corrosion, cracking or distortion in end fittings
- Other visible damage that causes doubt as to the strength of the sling

**For Additional Information, Please visit these Industry Links:**

[http://csa.fmcsa.dot.gov/Stay\\_Connected.aspx](http://csa.fmcsa.dot.gov/Stay_Connected.aspx)  
<http://www.fmcsa.dot.gov/rules-regulations/truck/vehicle/cs-policy.htm>  
<http://www.fmcsa.dot.gov/documents/cargo/cs-policy.pdf>