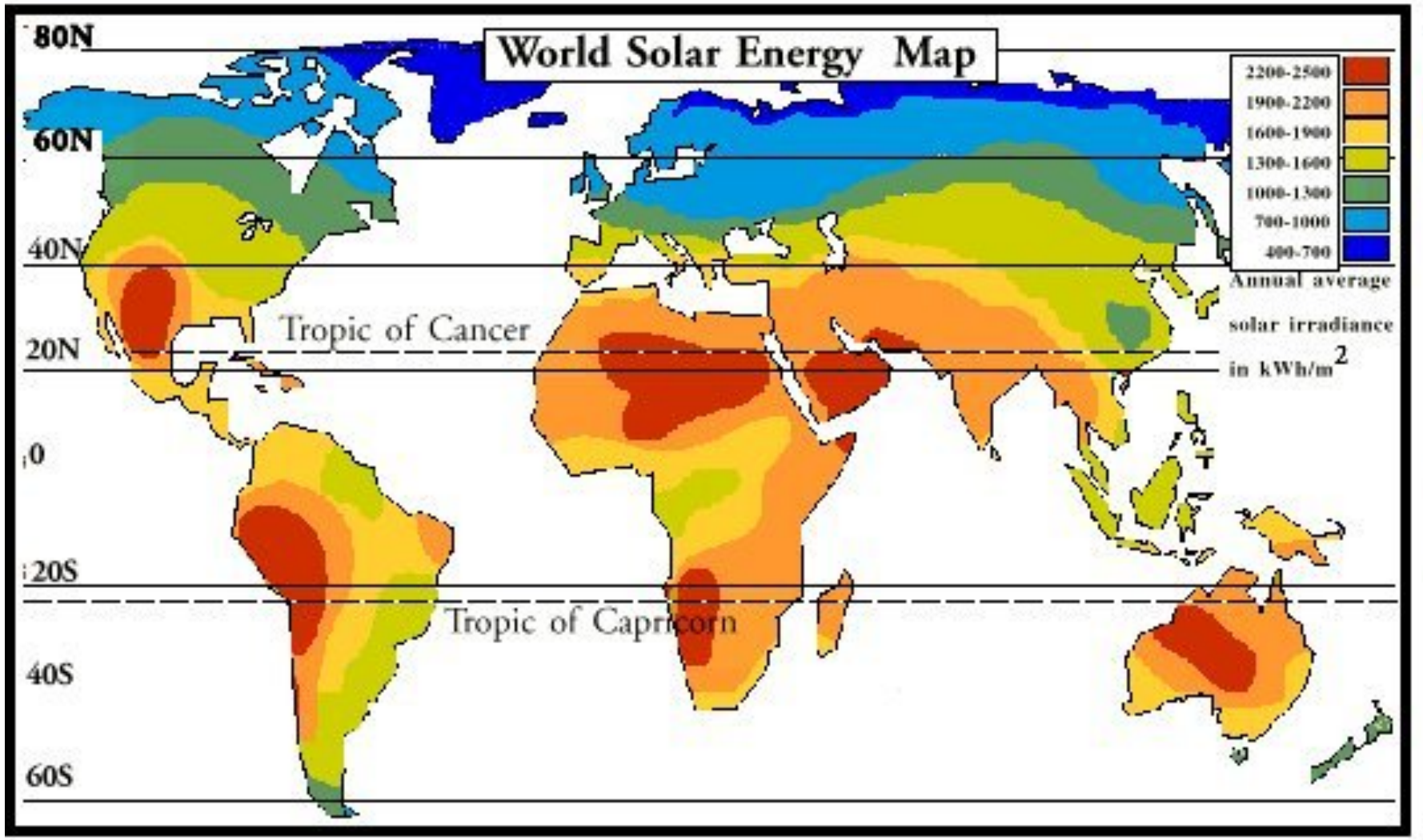
DETERMINISTIC DESIGN

SOLAR ENERGY DISTRIBUTION



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DESIGN FOR HUMAN USE
Safety factors

Uncertainties in strength

$\sigma_p = \sigma_y / n_s$

Where σ_p = permissible stress,
σ_y = yield strength,
n_s = strength factor of safety (typically 1.2 to 1.4)

Uncertainties in Loading

$F_p = F_y / n_L$

Where F_p = permissible load,
F_y = max load,
n_L = strength factor of safety

$$n_{total} = n_s n_L$$

For machines that can cause injury or death, n_{total} is typically 4 to 10+

When choosing a safety factor, consider:

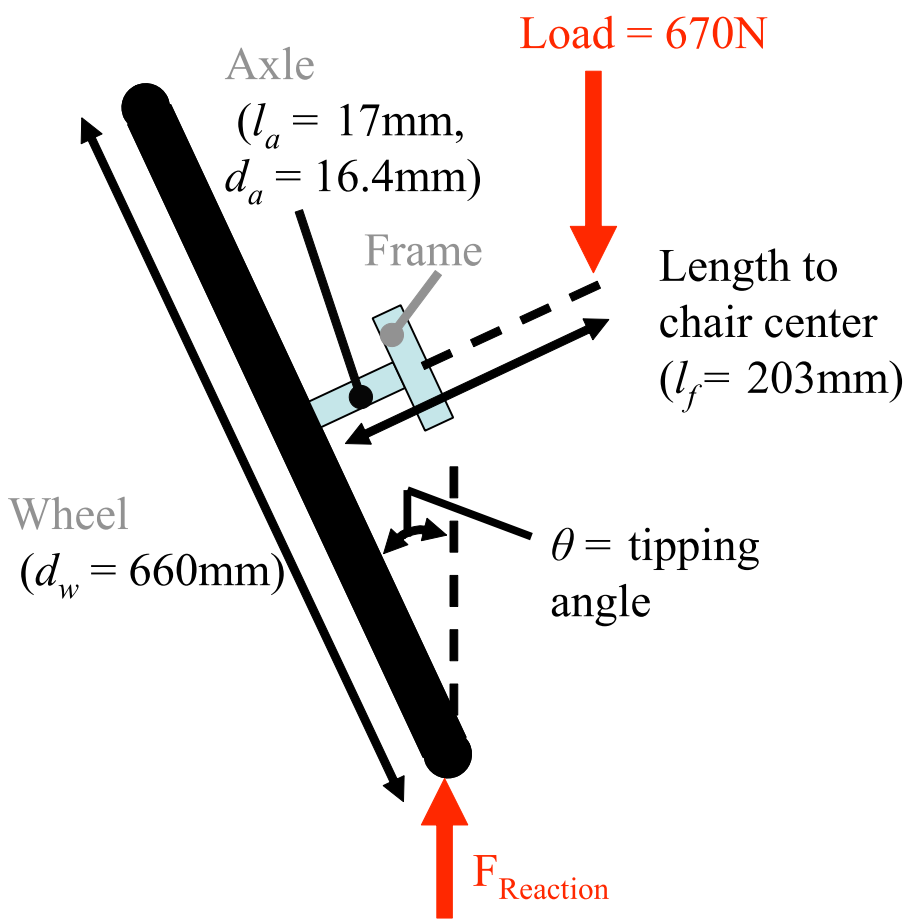
- Does the load come from human activity
- Does loading come from natural sources (terrain, etc)
- What are the consequences of failure?
- Is the loading due to a prelaod?
- Does the load come from a power source (ex. starting vs. steady torque)?
- Does the load come from driven machinery that can change its output?

Theory adapted from: Shigley, 1983, Wikipedia, 2007

EXAMPLE
Estimating loading factor in bicycles (drop case)

http://www.youtube.com/watch?v=tMmiN6M7GXs&feature=PlayList&p=AE40D5B0BDD7EE81&playnext=1&index=9

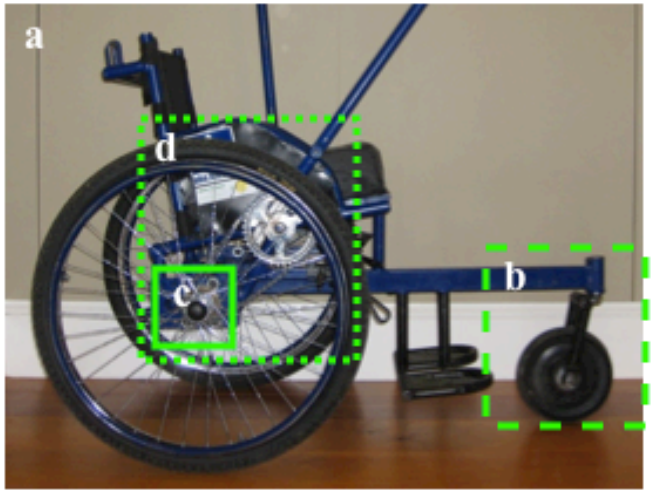
EXAMPLE
Estimating stress in wheelchair axle during tip-over



EXAMPLE
Stress in cantilevered Cannondale front shock

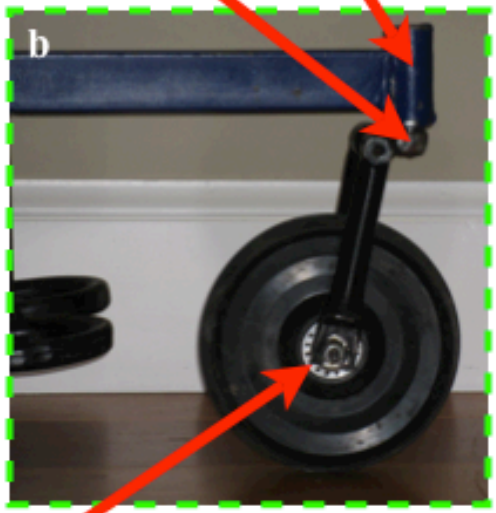
MOBILITY LAB

LFC
Critical loading and design for manufacturing



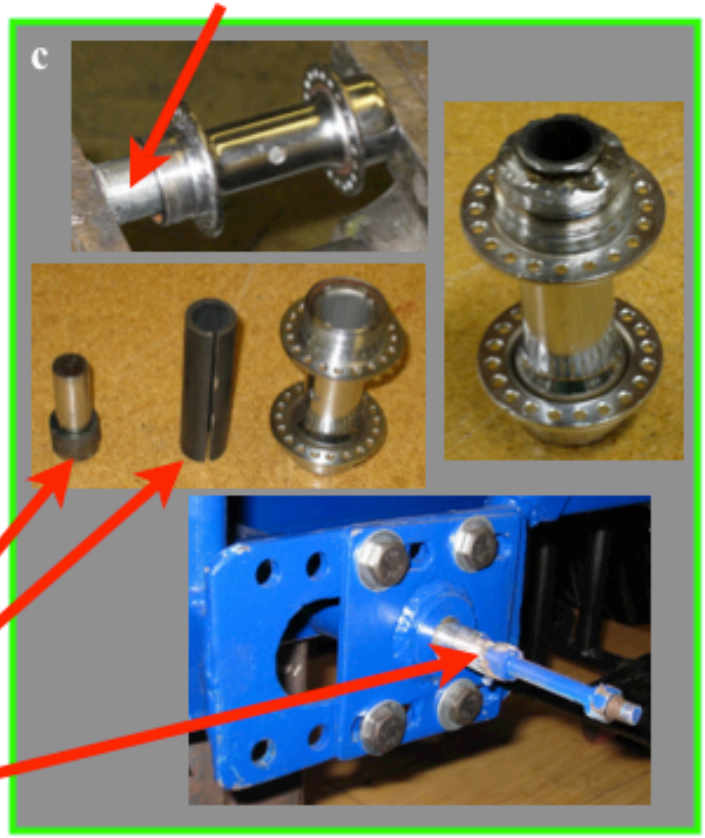
Crank arm head

Bottom bracket



Front hub

Electrical conduit



Bottom bracket axle section

Water pipe

Bottom bracket axle with bolt and stop nut

Chainring

Brake bar

Freewheel

Key

Water pipe