THE MAIN PARAMETERS IN ROLLING

The parameters are:

- Roll diameter
- Friction between rolls and work piece
- Deformation resistance of the metal as influenced by metallurgy, temperature and strain rate Presence of roll tensions

Roll Diameter:

*Rolling load increases with roll diameter at a rate greater than D1/2
*We know Rolling load P = p.b.√R.Δt but R=D/2 Therefore P = p.b.√D/2.Δt or P α√D
*As roll diameter decreases both rolling load and length of arc of contact decreases.
*Small diameter rolls supported by large back up rolls can produce greater reduction and keep the work flat.

Friction:

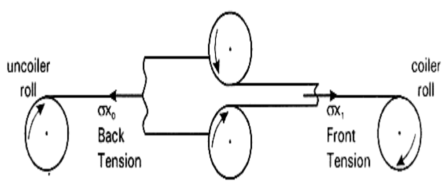
*Frictional force is needed to pull the metal into the rolls.*Large fraction of rolling load comes from the frictional force.*Friction varies from point to point along the arc of contact of the roll, it will be acting from entry to neutral point long the direction of roll rotation and from neutral point to exit point it will be opposing the direction of roll rotation.
High friction results in high rolling load and a steep friction hill will be realized.
*Since it is very difficult to measure the variation in coefficient of friction 'μ' it is assumed that 'μ' is constant. For cold rolling it is taken as 0.05-0.1 and for hot rolling it is taken as >= 0.2.*Coeff.of friction is inversely proportional to
the rolling speed. As μ decreases rolling speed increases. From F= μ/N μ = F/N
Thinner gage sheet can be produced in cold rolling as coeff.of friction is smaller.

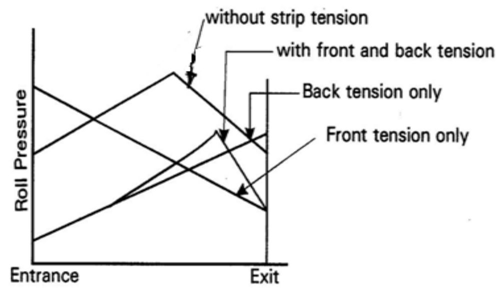
Deformation resistance of metal:

Deformation resistance indicate how much a given metal offers resistance to deformation.
Deformation resistance is the resistance offered by the metal for external load.
Higher the deformation resistance higher is the difficulty to deform.
Coarser grains in the metal offer less resistance for deformation and vice versa.
Higher the dislocation density higher is the deformation resistance.
Higher the working temperature lesser is the deformation resistance.

Strip Tension:

The presence of tension in the plane of the sheet can reduce the rolling load. Front tension can be controlled by the coiler where as back tension can be created by controlling the speed of the uncoiler relative to the roll speed.





Variation of Roll Pressure

Tension reduces wear of the rolls. Improves flatness in the sheet, induces uniform thickness across the width of the sheet. Tension is used to shift the neutral point towards the exit plane.

Pressure Distribution in Rolling:

*The roll pressure 'p' increases continuously from the entry to the neutral point there after it decreases continuously.*The peak pressure at the neutral point is normally called as the "Friction Hill"*This peak pressure increases with increasing coefficient of friction.

It can be concluded that as the roll tension is increased at the front and back the roll pressure can be reduced along the arc of contact. *Peak pressure is reduced and shifted towards the entry side. *As a result the load required for rolling gets reduced.

Source : http://elearningatria.files.wordpress.com/2013/10/vtu-e-notes-mpiii-18.pdf