Parametric Study

The verified, calibrated, and validated CON1D model is being applied to investigate a range of mould thermal phenomena, including high-speed casting, mould powder properties, scale formation in the water channels and breakout prediction. The effect of mould plate thickness on interfacial gap phenomena is investigated in the following section.

The effect of casting speed and mould plate thickness on various parameters at mould exit are shown in Figure 19 to Figure 22. Increasing casting speed naturally increases the mould hot face temperature and decreases the shell thickness. This causes the slab surface temperature to increase, although the increased heat flux with increasing casting speed tends to counter this trend. Slag layer thickness decreases with casting speed, owing to the smaller slag consumption rate, but the opposing effect of lower solid slag velocity ratio tends to lessen this trend.

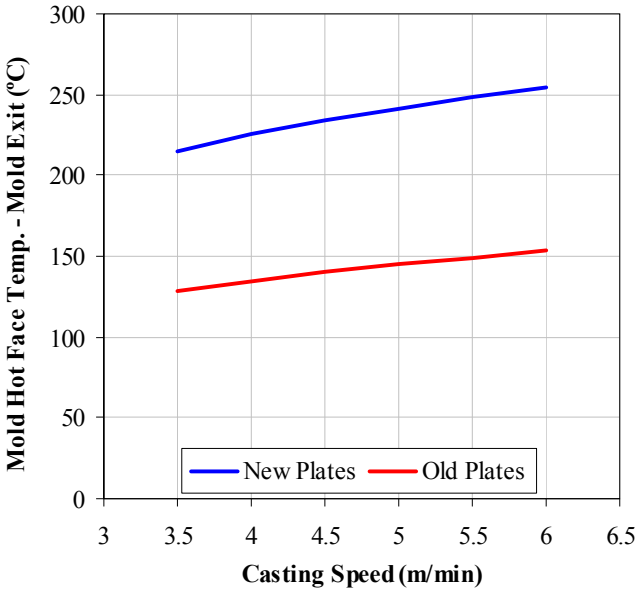

Figure 19. Effect of casting speed on mould hot face temp.

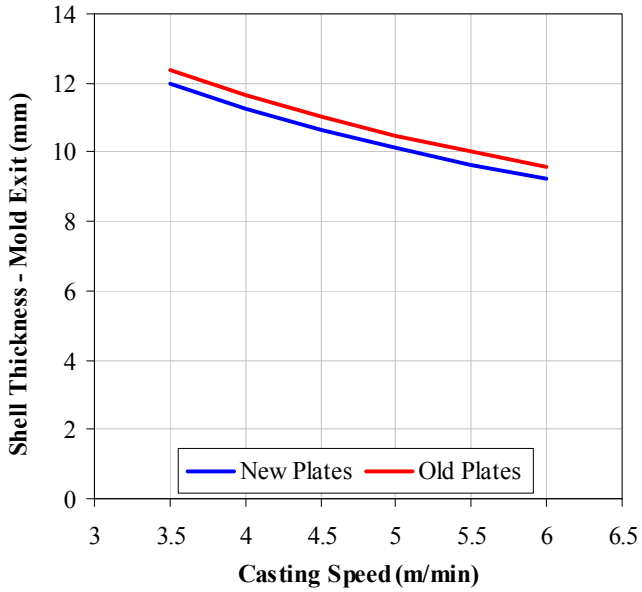

Figure 20. Effect of casting speed on shell thickness

Increasing the mould plate thickness (with new plates) naturally increases the hot face temperature. This lowers the solid slag layer velocity, (Figure 16), which produces a thicker slag layer, as shown in Figure 22. Together with the extra resistance of the thicker mould plate, this decreases the heat flux. This causes the shell thickness to decrease and slab surface temperature to increase.

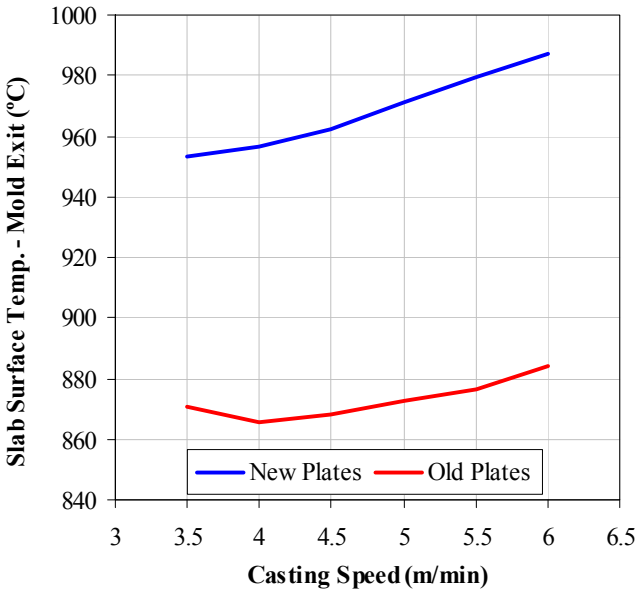

Figure 21. Effect of casting speed on slab surface temperature

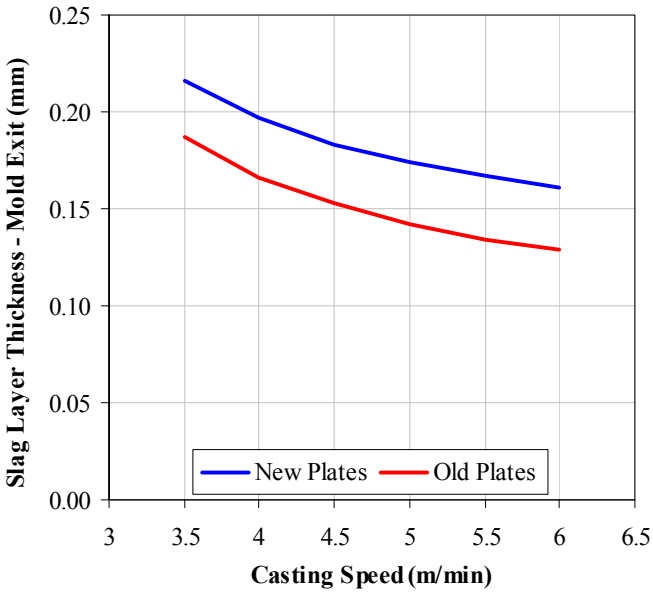

Figure 22. Effect of casting speed on slag layer thickness

CONCLUSIONS

This work summarizes the development of an accurate computational tool for modelling heat transfer in the thin-slab continuous casting mould at the Corus DSP. Work towards this end includes model verification with a complete thermal 3-D analysis of the entire complex mould geometry, model calibration using the offset method to match thermocouple measurements and model validation with over 700 sets of plant data from an instrumented mould. The CON1D model is then applied together with plant measurements to gain a new insight into the effects of casting speed and mould plate thickness on mould heat transfer. Project findings include:

1. Increasing casting speed causes a thinner solidified steel shell, higher heat flux, higher mould hot face temperature, a thinner slag layer and lower solid slag layer velocity.
2. Increasing mould plate thickness increases hot face temperature, lowers solid slag layer velocity, increases slag layer thickness, and lowers mould heat flux.

The CON1D model is being applied to gain further insight into continuous casting of thin slabs, including the extrapolation of model predictions of heat transfer and interfacial phenomena to higher casting speed and the optimisation of mould taper, mould distortion, and funnel design.

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