The shaft illustrated below is utilized as a chain idler. The shaft transmits a constant torque of 25 N-m from the right sprocket to the left sprocket. The shaft is machined from AISI 1020 cold rolled steel.

Estimate the factor of safety based on infinite life and 90% reliability.

\[
M_b (N-m) \begin{cases} 
0 < x < .05 : M_b = 250x \ (x \text{ in mm}; \ M_b \text{ in N-m}) \\
.05 < x < .125 : M_b = 100x + 7.5 \\
.125 < x < .175 : M_b = 70 - 400x 
\end{cases}
\]