Calculating Roll Dimensions Manually (Roll Forming)

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Abstract— ***Roll forming is a flexible process. It has been proven several times that even rolling-up, seemingly impossible, rolling tasks can be accomplished, though it may take a longer time and a lot more money. On the other hand, it has also been shown that planning, calculating and designing roll in simple forms can produce catastrophic results if basic rules are not respected.***

Index terms - Deformation, forming, roll, line

I. INTRODUCTION

Roll forming has a very important and strange feature. The important aspect is that during the last half of the century, rull formation has developed as the most productive metal forming technology. For 35 to 45% of all cells made of flat surface from the steel mills in the world, they are processed through lines for the metal form.

II. REALIZATION OF PRACTICAL WORK

Realization of practical work has been done at the manufacturing company "Fatlumi", which has two two-line automatic profiles, produced by the well-known American company "Company Ronson". These lines serve to produce corrugated profiles for covering roofs, fences, etc.

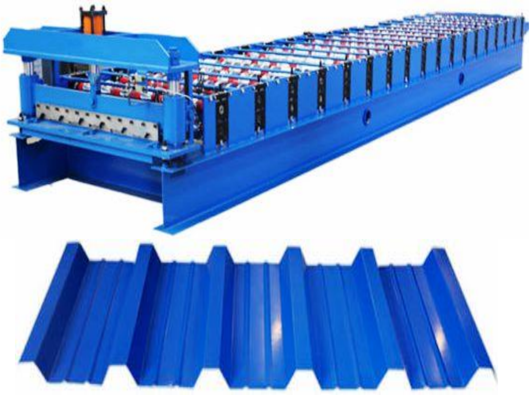

Fig. 1. Production Line at "Fatlumi"

The metal sheets used is from the manufacturer ARCELO MITAL SKOPJE LADO 1721246. The thickness of the sheet is from 0.45 mm to 0.75 mm, with the following characteristics:

Tab. 1. Type of dimensions

Nr.	Product	Thickness		Width		Length for sheets	
		Min.(mm)	Max.(mm)	Min.(mm)	Max.(mm)	Min.(mm)	Max.(mm)
1	Organic coated	0.45	0.75	1000	1250	-	-
2	Hot dip galvanized	0.45	0.75	1000	1250	610	4880
3	Cold rolled	0.45	0.75	1000	1250	610	4880

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III. CALCULATING ROLL DIMENSIONS MANUALLY

The flower diagram shows the cross-section of the partially formed strip at each pass. To start the roll design, the designer has to calculate the geometry of both the top and bottom surfaces of the strip and establish top and bottom roll pass diameters at each of the passes. The roll geometry calculations are similar to the calculation used to establish strip width. The main difference is that the roll geometry has to be established for both top and bottom roll surfaces at each pass including side-roll passes. Every roll designer has a slightly different approach to the calculations, which are sometimes augmented or shortcut by making drawings in large, usually a 10:1 scale. The following example shows one method of calculation of a "hat" section shown in Figure 2. In Figure 2a, the drawing shows the finished hat section, Figure 2b shows half of the cross-section with straight and curved element numbers starting at the centerline (vertical guide plane). Figure 2c shows the length of the straight elements. The inside radius and thickness are assumed to be 0.200 in. Figure 2d shows the flower diagram using 6 passes. Note that this example is designed for demonstration purposes only and does not reflect the optimum forming angles.

Blank Size (Strip Width) Calculation; Element #2 (and #4) use Equation 1:

$$L = 0.0174533\ (R_i + k_t) \cdot \alpha \qquad (1)$$

L =0.0174533 90(0.2+0.33 0.2) =1.570797 · 0.266 = 0.4178

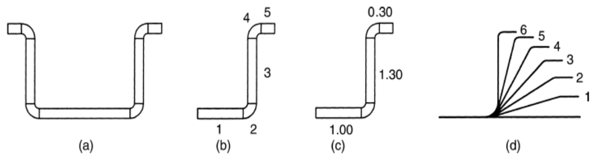

Fig. 2. Finished section is broken down to straight and curved elements

Tab. 4. Calculating Bending Radius for Constant Arc Bending

Nr.	6 passes		Element #	
1.		α_1 (15°) 15°	Element # 1	1.0000 (straight)
2.	t=0.20	α_2 (15°) 30°	Element # 2	0.4178
3.	k=0.33	α_3 (15°) 45°	Element # 3	1.3000 (straight)
4.		α_4 (15°) 60°	Element # 4	0.4178
5.	R=0.20	α_5 (15°) 75°	Element # 5	0.300 (straight)
6.		α_6 (15°) 90°	-	-

(b) Calculating Bending Radius for Constant Arc Bending (use Equation 2).

$$R_i = 57.2958 \cdot \frac{L}{\alpha} - k_t \qquad (2)$$

For simplicity, only Pass # 2, Pass # 4, and Pass # 6 are calculated.

For Pass # 2, α_2=30 ° $R_2=\left(\frac{180}{\pi}\right)\cdot\left(\frac{0.4178}{30}\right) - (0.33 \cdot 0.20) =$ 0.732

For Pass # 4, α_2=60 ° $R_4=\left(\frac{180}{\pi}\right)\cdot\left(\frac{0.4178}{60}\right)-(0.33\cdot 0.20)=$ 0.333

For Pass # 6, α_2=90 (final section) R_6=0.200

(c) Calculating Roll Surface Geometry of Bottom Roll in Pass #2. For details, see Figure 3.

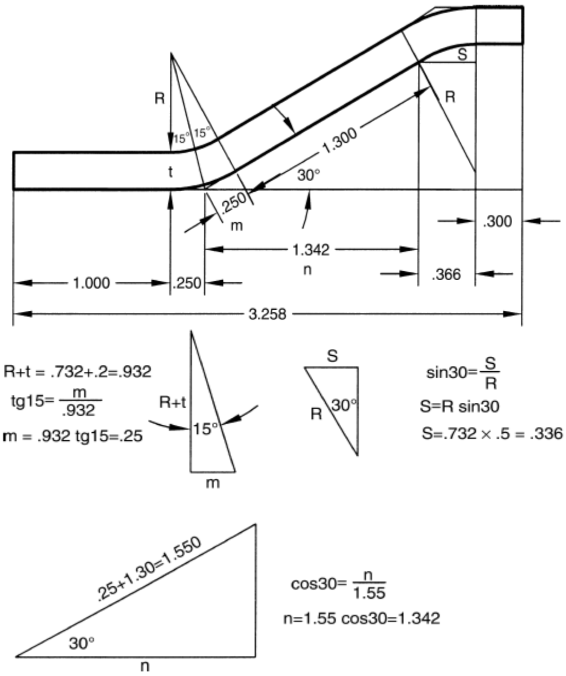

Fig. 3. Manual calculation of cross-section.

Fig. 4 shows the final dimensioned roll drawing for the right half of the second pass bottom roll.

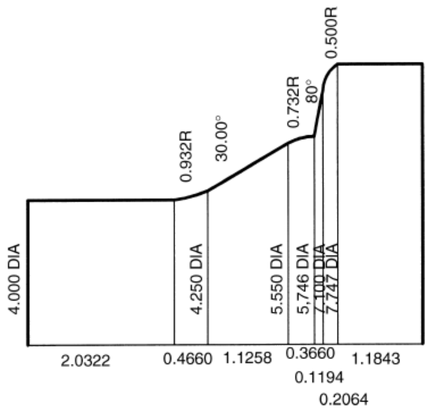

Fig. 4. Fully dimensioned rolls

CONCLUZION

The purpose of this paper is to fill this gap with knowledge and provide complete information on roller shaping equipment, operators, supervisors, engineers, instrument and instrument projectors as well as interested students in this field. The work is based on the experience of the leaders of the company "FATLUMI", the workers of this enterprise, enriched with the experience of other individuals willing to share their knowledge, and the scarce international literature. Roll forming is a complex subject. It is possible that readers will seek and can not find any security because the details are missing. As the author of this paper, with whom the enterprise in which we conducted the practical and research work, are extremely excited, because there is a lack of necessary literature on these lines since their installation, maintenance, calculations needed for design, lubrication, work safety, efficiency and productivity, we chose to include this part that we thought was most important for experienced beginners and practitioners.

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