Data Article

Dataset showing steel cold rolling process parameters for a 6-high cold rolling mill in Nigeria

Emmanuel O. Ayuba a,*, Christian.A. Bolua a, Temitope M. John b, Abiodun A. Abioye a

a Department of Mechanical Engineering, Covenant University, Ota, Nigeria
b Department of Electrical and Information Engineering, Covenant University, Ota, Nigeria

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A B S T R A C T

The data contained in this article was acquired from the automatic gauge control system for a steel cold rolling mill production line in Nigeria. Accuracy is one of the most important indices of productivity during a milling process. A total of 486 data points were obtained from selected feedback sensors located on the rolling mill machine via the control panel Human Machine Interface (HMI). The selected rolling parameters were gathered at different time intervals for different sample coils strips during the different milling stages. The data shows parameters such as actual thickness measured, x-ray gauge temperature, mill speed at both entry and exit and the mill power. This dataset could be used to analyze and improve the accuracy of the Automatic gauge control system and reduction in error in thickness variation.

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* Corresponding author.
E-mail address: emmanuel.ayuba@covenantuniversity.edu.ng (E.O. Ayuba).

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The rolling process parameters were gathered from the 6 high rolling mill of the steel cold rolling mill Line 1 via the Intelligent Mechatronics system (IMS) and Supervisory Control and Data (SCADA) program for the six milling passes to achieve the target thickness as final output.

The 486 data points were gathered from the rolling milling automatic gauge control system for a period of 400 h at different time intervals. The data were gathered for the six milling passes to determine the error and deviation in target exit thickness measurements as the X-ray temperature, mill speed and mill power varies.

A Steel Rolling Mill located in Abeokuta, Ogun State Nigeria

Data are available within this article in the supplementary material section.

1. Data

The following parameters were selected from the 6-high cold rolling mill of a steel cold rolling plant; located in Abeokuta, Ogun State, Nigeria. For each pass (thickness reduction stages in the milling process. Table 1 shows the description of the sensor (input) parameters retrieved from the HMI panel. Tables 2–10 show the first order descriptive statistics for the input parameters.

The data gathered from the various parameters were analyzed for each phases or stages of the rolling mill process. A pass is the defined as a phase/ stage in which the material is reduced to a predetermined range of thickness [3]. Each coil was subjected to six passes; the target exit thickness for each pass is given below:

**First Pass:** First stage of the milling process and the material is reduced from its initial thickness of 1.800 mm to a target thickness of 1.2600 mm;

**Second Pass:** Second stage of the milling process where the entry thickness is 1.260 mm and the target exit thickness is 0.806 mm;

**Third Pass:** Third stage of the milling process, its entry thickness is 0.806 mm and target exit thickness is 0.516 mm;

**Fourth pass:** Fourth stage of the milling process, its entry thickness is 0.516 mm and target exit thickness measurement is 0.330 mm;

**Fifth Pass:** Fifth stage of the milling process with 0.330 mm and exit target thickness measurement is 0.211 mm;

**Sixth Pass:** Final stage of milling with entry thickness measurement of 0.211 mm and exit thickness measurement is 0.135 mm.
Table 1
Description of input parameters.

| s/n | Parameter Code | Parameters          | Description                                                                                                                                 |
|-----|----------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | TTEn (mm)      | Target entry thickness (mm) | This is the thickness measurement preset by the operator at the entry side of the mill for each pass before the mill process starts; the mill is set to carry milling process for passes [1]. |
| 2   | TTEx (mm)      | Target Exit Thickness (mm) | This is the desired exit thickness for each pass, this measurement determines the thickness of the strip sheet after every pass.                                      |
| 3   | ATEn (mm)      | Actual Entry Thickness (mm) | This is the measurement derived from the X-ray sensing device positioned the entry point of the mill. This is the actual thickness of the sheet passing through the rolls. |
| 4   | ATEx (mm)      | Actual Exit Thickness (mm) | This is the thickness of the strip after a milling process as taken place. The measurement is taken by the X-ray sensing device positioned at the exit side of the mill [2]. |
| 5   | XTEx (°C)      | Exit X-ray Temperature (°C) | This is the temperature in degree Celsius of the cooling chamber unit connected to the exit side of the X-ray source.                               |
| 6   | XTEn (°C)      | Entry X-ray Temperature (°C) | This is the temperature in degree Celsius of the cooling chamber unit connected to the entry side of the X-ray source.                       |
| 7   | MP (kW)        | Mill Power (kW)      | This is the power in Kilowatts (kW) exerted on the backup rolls that cause a deformation in the strip sheet to be milled.                  |
| 8   | MSEn (mpm)     | Entry Mill Speed (mpm) | The speed of drive of the coiler called the Payup reel at the entry side of the mill, the mill speed sustains tension across the mill. Its unit of measurement is in metres per minutes (mpm). |
| 9   | MSEX (mpm)     | Exit Mill Speed (mpm) | The speed of the drive of the coiler called the Payoff reel at the exit side of the mill, this speed ensures that tension is maintained across the mill and ensures that the sheet are coiled up properly after the milling is completed. Its unit of measurement is in metres per minutes (mpm). |

Table 2
Descriptive information for target thickness at entry (mm).

| Coil no. | PASS | Mean | Median | Mode | Minimum | Maximum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 1.8  | 1.8    | 1.8  | 1.8     | 0       | 0                 | 0        | 2     |
| 2        | 1    | 2.66 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 2     |
| 3        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 6     |
| 4        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 4     |
| 5        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 6     |
| 6        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 8     |
| 2        | 1    | 1.8  | 1.8    | 1.8  | 1.8     | 0       | 0                 | 0        | 2     |
| 2        | 1.26 | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 5     |
| 3        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 4     |
| 4        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 6     |
| 5        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 6     |
| 6        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 9     |
| 3        | 1    | 1.8  | 1.8    | 1.8  | 1.8     | 0       | 0                 | 0        | 8     |
| 2        | 1.26 | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 8     |
| 3        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 15    |
| 4        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 12    |
| 5        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 11    |
| 6        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 30    |
| 4        | 1    | 1.8  | 1.8    | 1.8  | 1.8     | 0       | 0                 | 0        | 13    |
| 2        | 1.26 | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 9     |
| 3        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 10    |
| 4        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 14    |
Table 3
Descriptive Information for target thickness at exit (mm).

| Coil no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 2     |
| 2        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 5     |
| 3        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 6     |
| 4        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 4     |
| 5        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 6     |
| 6        | 0.14 | 0.14 | 0.14   | 0.14 | 0.14    | 0       | 0                 | 0        | 9     |
| 5        | 1    | 1.8  | 1.8    | 1.8  | 1.8     | 0       | 0                 | 0        | 11    |
| 6        | 1.26 | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 13    |

Table 2 (continued)

| Coil no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 2        | 1    | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 2     |
| 2        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 5     |
| 3        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 6     |
| 4        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 4     |
| 5        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 6     |
| 6        | 0.14 | 0.14 | 0.14   | 0.14 | 0.14    | 0       | 0                 | 0        | 9     |
| 3        | 1    | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 8     |
| 2        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 8     |
| 3        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 15    |
| 4        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 12    |
| 5        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 11    |
| 6        | 0.14 | 0.14 | 0.14   | 0.14 | 0.14    | 0       | 0                 | 0        | 30    |
| 4        | 1    | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 13    |
| 2        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 9     |
| 3        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 10    |
| 4        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 14    |
| 5        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 11    |
| 6        | 0.14 | 0.14 | 0.14   | 0.14 | 0.14    | 0       | 0                 | 0        | 19    |
| 5        | 1    | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 18    |
| 2        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 6     |
| 3        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 6     |
| 4        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 10    |
| 5        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 16    |
| 6        | 0.14 | 0.14 | 0.14   | 0.14 | 0.14    | 0       | 0                 | 0        | 20    |
| 6        | 1    | 1.26 | 1.26   | 1.26 | 1.26    | 0       | 0                 | 0        | 11    |
| 2        | 0.81 | 0.81 | 0.81   | 0.81 | 0.81    | 0       | 0                 | 0        | 12    |
| 3        | 0.52 | 0.52 | 0.52   | 0.52 | 0.52    | 0       | 0                 | 0        | 14    |
| 4        | 0.33 | 0.33 | 0.33   | 0.33 | 0.33    | 0       | 0                 | 0        | 19    |
| 5        | 0.21 | 0.21 | 0.21   | 0.21 | 0.21    | 0       | 0                 | 0        | 16    |
| 6        | 0.14 | 0.14 | 0.14   | 0.14 | 0.14    | 0       | 0                 | 0        | 19    |
Table 4
Descriptive information for actual thickness at entry (mm).

| Coil_no. | PASS Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------------|--------|------|---------|---------|--------------------|----------|-------|
| 1        | 1.00 1.80  | 1.79   | 1.81 | 1.79    | 0.02    | 0.00               | 2        |
|          | 2.00 1.24  | 1.23   | 1.26 | 1.23    | 0.03    | 0.00               | 2        |
|          | 3.00 0.80  | 0.80   | 0.82 | 0.80    | 0.01    | 0.00               | 6        |
|          | 4.00 0.52  | 0.51   | 0.53 | 0.51    | 0.01    | 0.00               | 4        |
|          | 5.00 0.33  | 0.32   | 0.34 | 0.32    | 0.01    | 0.00               | 6        |
|          | 6.00 0.21  | 0.21   | 0.21 | 0.21    | 0.00    | 0.00               | 8        |
| 2        | 1.00 1.78  | 1.77   | 1.78 | 1.77    | 0.00    | 0.00               | 2        |
|          | 2.00 1.27  | 1.27   | 1.27 | 1.27    | 0.00    | 0.00               | 5        |
|          | 3.00 0.80  | 0.79   | 0.81 | 0.79    | 0.01    | 0.00               | 4        |
|          | 4.00 0.52  | 0.50   | 0.57 | 0.50    | 0.03    | 0.00               | 6        |
|          | 5.00 0.33  | 0.33   | 0.34 | 0.33    | 0.00    | 0.00               | 6        |
|          | 6.00 0.21  | 0.21   | 0.22 | 0.21    | 0.00    | 0.00               | 9        |
| 3        | 1.00 1.78  | 1.78   | 1.79 | 1.78    | 0.01    | 0.00               | 8        |
|          | 2.00 1.26  | 1.25   | 1.28 | 1.24    | 0.01    | 0.00               | 8        |
|          | 3.00 0.81  | 0.80   | 0.83 | 0.79    | 0.01    | 0.00               | 15       |
|          | 4.00 0.52  | 0.51   | 0.53 | 0.50    | 0.01    | 0.00               | 12       |
|          | 5.00 0.33  | 0.32   | 0.34 | 0.32    | 0.01    | 0.00               | 11       |
|          | 6.00 0.21  | 0.21   | 0.22 | 0.21    | 0.00    | 0.00               | 30       |
| 4        | 1.00 1.78  | 1.78   | 1.78 | 1.77    | 0.00    | 0.00               | 13       |
|          | 2.00 1.26  | 1.25   | 1.28 | 1.25    | 0.01    | 0.00               | 9        |
|          | 3.00 0.81  | 0.80   | 0.83 | 0.79    | 0.01    | 0.00               | 10       |
|          | 4.00 0.52  | 0.51   | 0.53 | 0.51    | 0.01    | 0.00               | 14       |
|          | 5.00 0.33  | 0.33   | 0.34 | 0.33    | 0.00    | 0.00               | 11       |
|          | 6.00 0.21  | 0.21   | 0.22 | 0.21    | 0.00    | 0.00               | 30       |
| 5        | 1.00 1.78  | 1.78   | 1.78 | 1.78    | 0.01    | 0.00               | 18       |
|          | 2.00 1.26  | 1.25   | 1.28 | 1.25    | 0.01    | 0.00               | 9        |
|          | 3.00 0.81  | 0.80   | 0.83 | 0.79    | 0.01    | 0.00               | 10       |
|          | 4.00 0.52  | 0.51   | 0.53 | 0.51    | 0.01    | 0.00               | 14       |
|          | 5.00 0.33  | 0.33   | 0.34 | 0.32    | 0.01    | 0.00               | 16       |
|          | 6.00 0.21  | 0.21   | 0.22 | 0.21    | 0.00    | 0.00               | 19       |
| 6        | 1.00 1.78  | 1.78   | 1.78 | 1.78    | 0.01    | 0.00               | 11       |
|          | 2.00 1.25  | 1.25   | 1.28 | 1.22    | 0.02    | 0.00               | 12       |
|          | 3.00 0.81  | 0.80   | 0.82 | 0.79    | 0.01    | 0.00               | 14       |
|          | 4.00 0.51  | 0.51   | 0.53 | 0.50    | 0.01    | 0.00               | 19       |
|          | 5.00 0.33  | 0.33   | 0.34 | 0.32    | 0.01    | 0.00               | 16       |
|          | 6.00 0.21  | 0.21   | 0.22 | 0.21    | 0.00    | 0.00               | 19       |

Table 5
Descriptive information for actual thickness at exit (mm).

| Coil_no. | PASS Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------------|--------|------|---------|---------|--------------------|----------|-------|
| 1        | 1.27       | 1.27   | 1.26 | 1.26    | 0.01    | 0.00               | 2        |
|          | 0.8        | 0.8    | 0.8  | 0.8     | 0.01    | 0.00               | 2        |
|          | 0.52       | 0.52   | 0.51 | 0.51    | 0.01    | 0.00               | 6        |
|          | 0.33       | 0.33   | 0.33 | 0.33    | 0.01    | 0.00               | 4        |
|          | 0.21       | 0.21   | 0.21 | 0.21    | 0.01    | 0.00               | 6        |
|          | 0.14       | 0.14   | 0.14 | 0.13    | 0.01    | 0.00               | 8        |
| 2        | 1.24       | 1.24   | 1.23 | 1.23    | 0.02    | 0.00               | 2        |
|          | 0.81       | 0.82   | 0.8  | 0.8     | 0.01    | 0.00               | 5        |
|          | 0.52       | 0.52   | 0.54 | 0.52    | 0.01    | 0.00               | 4        |
|          | 0.33       | 0.32   | 0.35 | 0.32    | 0.01    | 0.00               | 6        |
|          | 0.21       | 0.21   | 0.21 | 0.21    | 0.01    | 0.00               | 6        |
|          | 0.14       | 0.15   | 0.16 | 0.13    | 0.01    | 0.00               | 9        |
| 3        | 1.26       | 1.26   | 1.25 | 1.24    | 0.01    | 0.00               | 8        |
|          | 1.00       | 0.81   | 0.79 | 0.79    | 0.01    | 0.00               | 8        |
|          | 0.51       | 0.51   | 0.53 | 0.5     | 0.01    | 0.00               | 15       |
|          | 0.33       | 0.33   | 0.34 | 0.32    | 0.01    | 0.00               | 12       |
Table 5 (continued)

| Coil_no | PASS | Mean  | Median | Mode  | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|-------|--------|-------|---------|---------|--------------------|----------|-------|
| 6       | 1    | 0.13  | 0.14   | 0.14  | 0.15    | 0.12    | 0                  | 0        | 30    |
| 1       | 1.26 | 1.26  | 1.27   | 1.28  | 1.24    | 1.21    | 0.01               | 0.01     | 13    |
| 2       | 0.8  | 0.8   | 0.8    | 0.81  | 0.79    | 0       | 0.01               | 0.01     | 9     |
| 3       | 0.51 | 0.52  | 0.52   | 0.52  | 0.5     | 0.01    | 0.01               | 0.01     | 10    |
| 4       | 0.33 | 0.33  | 0.33   | 0.34  | 0.33    | 0       | 0.01               | 0.01     | 14    |
| 5       | 0.19 | 0.21  | 0.21   | 0.22  | 0.03    | 0.06    | 0.01               | 0.01     | 11    |
| 6       | 0.14 | 0.14  | 0.13   | 0.16  | 0.13    | 0.01    | 0.01               | 0.01     | 19    |

Table 6
Descriptive information for X-ray Temp at entry (°C).

| Coil_no | PASS | Mean  | Median | Mode  | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|-------|--------|-------|---------|---------|--------------------|----------|-------|
| 1       | 1    | 30.6  | 30.6   | 30.6  | 30.6    | 30.6    | 0                  | 0        | 2     |
| 2       | 32.1 | 32.1  | 32     | 32.2  | 32      | 32      | 0.14               | 0.02     | 2     |
| 3       | 32.08| 32.4  | 32.4   | 32.6  | 30.3    | 31      | 0.88               | 0.77     | 6     |
| 4       | 31.38| 31.25 | 31     | 32    | 31      | 31      | 0.48               | 0.23     | 4     |
| 5       | 32.52| 32.55 | 32.6   | 32.7  | 32.3    | 32.9    | 0.15               | 0.02     | 6     |
| 6       | 31.8 | 31.8  | 30.9   | 32.7  | 30.9    | 31      | 0.96               | 0.93     | 8     |
| 2       | 1    | 31.3  | 31.3   | 31.6  | 31      | 31      | 0.42               | 0.18     | 2     |
| 2       | 33.14| 33.1  | 33     | 33.3  | 33      | 33      | 0.15               | 0.02     | 5     |
| 3       | 31.65| 31.3  | 31.3   | 33    | 31      | 31      | 0.91               | 0.83     | 4     |
| 4       | 31.98| 31.65 | 31.6   | 32.7  | 31.6    | 31.6    | 0.56               | 0.31     | 6     |
| 5       | 32.43| 32.45 | 32.5   | 32.7  | 32.2    | 32.2    | 0.18               | 0.03     | 6     |
| 6       | 32.82| 33    | 32     | 33.6  | 32      | 32      | 0.69               | 0.47     | 9     |
| 3       | 1    | 30.95 | 31.1   | 31.4  | 30.2    | 30.6    | 0.41               | 0.17     | 8     |
| 2       | 31.23| 31.6  | 31.6   | 31.6  | 30.6    | 30.6    | 0.52               | 0.27     | 8     |
| 3       | 30.92| 31.7  | 31.8   | 32    | 28.9    | 31.7    | 1.27               | 1.6      | 15    |
| 4       | 31.5 | 31.6  | 31.6   | 31.7  | 30.9    | 30.9    | 0.26               | 0.07     | 12    |
| 5       | 54.97| 29.5  | 28.8   | 30.8  | 28.8    | 28.8    | 0.83               | 0.07     | 11    |
| 6       | 30.76| 30.8  | 31     | 31.5  | 30.2    | 30.2    | 0.36               | 0.13     | 30    |
| 4       | 1    | 30.82 | 31.2   | 31.9  | 29.1    | 29.1    | 1.01               | 1.02     | 13    |
| 2       | 31.6 | 31.6  | 31.6   | 31.6  | 31.6    | 31.6    | 0                 | 0        | 9     |
| 3       | 29.95| 29.4  | 28.8   | 31.6  | 28.8    | 28.8    | 1.9                | 1.43     | 10    |
| 4       | 31.57| 31.6  | 31.6   | 31.6  | 31.3    | 31.3    | 0.08               | 0.01     | 14    |
| 5       | 30.17| 30    | 30.2   | 32.1  | 28.9    | 30.9    | 1.07               | 1.15     | 11    |
| 6       | 30.65| 30.5  | 31.6   | 31.6  | 29.9    | 29.9    | 0.7                | 0.5      | 19    |
| 5       | 1    | 30.84 | 31.05  | 31.9  | 31.9    | 28.9    | 1.17               | 1.37     | 18    |
| 2       | 30.83| 30.85 | 30.9   | 30.9  | 30.7    | 30.7    | 0.08               | 0.01     | 6     |
| 3       | 30.67| 31.05 | 31.9   | 32    | 28.9    | 31.4    | 1.46               | 2.12     | 6     |
| 4       | 31.04| 31    | 31.4   | 31.4  | 30.8    | 30.8    | 0.16               | 0.02     | 10    |
| 5       | 29.95| 29.6  | 28.9   | 31.3  | 28.7    | 31      | 1                 | 1        | 16    |
| 6       | 30.91| 31    | 31.2   | 31.2  | 30.4    | 30.4    | 0.26               | 0.07     | 20    |
| 6       | 1    | 31.43 | 31.6   | 31.6  | 31.9    | 30.4    | 0.57               | 0.33     | 11    |
| 2       | 29.76| 29.5  | 29.5   | 31.2  | 28.7    | 28.7    | 0.96               | 0.92     | 12    |
| 3       | 31.14| 31.5  | 31.9   | 32.1  | 29      | 29      | 1.08               | 1.16     | 14    |
| 4       | 31.48| 31.5  | 31.5   | 31.5  | 31.2    | 31.2    | 0.07               | 0.01     | 19    |
| 5       | 31.18| 30.9  | 30.9   | 32.2  | 30.2    | 30.2    | 0.64               | 0.41     | 16    |
| 6       | 31.53| 31.6  | 31.6   | 31.6  | 31      | 31      | 0.18               | 0.03     | 19    |
### Table 7
Descriptive information for X-ray Temp at exit (°C).

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 31   | 31     | 31   | 31      | 0       | 0.61             | 0.38     | 2     |
| 2        | 3.125 | 31.25 | 30.4 | 32.1 | 30.4 | 1.2 | 1.45 | 2 |
| 3        | 3.185 | 31.7 | 31.6 | 32.7 | 31 | 0.61 | 0.38 | 6 |
| 4        | 3.245 | 32.45 | 32.4 | 32.5 | 32.4 | 0.06 | 0 | 4 |
| 5        | 32   | 32   | 32    | 32   | 32   | 0    | 0   | 6 |
| 6        | 30.85 | 30.8 | 30.6 | 31.5 | 30.5 | 0.34 | 0.11 | 8 |

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 31   | 31     | 31   | 31      | 0       | 0.61             | 0.38     | 2     |
| 2        | 31.25 | 31.25 | 31.25 | 31   | 31.5 | 0.35 | 0.13 | 2 |
| 3        | 31.66 | 31.66 | 31.66 | 31   | 31.5 | 0.5  | 0.25 | 4 |
| 4        | 32.18 | 32.18 | 32.18 | 32   | 31.9 | 0.25 | 0.06 | 6 |
| 5        | 32.88 | 32.88 | 32.88 | 32   | 31.8 | 0.53 | 0.28 | 6 |
| 6        | 31.69 | 31.69 | 31.69 | 31   | 30.5 | 1.22 | 1.5 | 9 |

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 31   | 31     | 31   | 31      | 0       | 0.61             | 0.38     | 2     |
| 2        | 31.13 | 31.13 | 31.13 | 31   | 31.5 | 0.35 | 0.13 | 8 |
| 3        | 31.36 | 31.36 | 31.36 | 31   | 31.5 | 0.31 | 0.09 | 15 |
| 4        | 30.01 | 30.01 | 30.01 | 31   | 31.5 | 1.05 | 0.11 | 12 |
| 5        | 30.09 | 30.09 | 30.09 | 31   | 29.8 | 0.45 | 0.2 | 11 |
| 6        | 30.91 | 30.91 | 30.91 | 31   | 28.9 | 0.85 | 0.72 | 30 |

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 31   | 31     | 31   | 31      | 0       | 0.61             | 0.38     | 2     |
| 2        | 29.84 | 29.84 | 29.84 | 31   | 28.9 | 0.94 | 0.88 | 8 |
| 3        | 31.36 | 31.36 | 31.36 | 31   | 31.5 | 0.31 | 0.09 | 15 |
| 4        | 30.01 | 30.01 | 30.01 | 31   | 29.8 | 1.05 | 0.11 | 12 |
| 5        | 30.09 | 30.09 | 30.09 | 31   | 29.8 | 0.45 | 0.2 | 11 |
| 6        | 30.91 | 30.91 | 30.91 | 31   | 28.9 | 0.85 | 0.72 | 30 |

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 31   | 31     | 31   | 31      | 0       | 0.61             | 0.38     | 2     |
| 2        | 29.66 | 29.66 | 29.66 | 31   | 28.8 | 0.74 | 0.54 | 9 |
| 3        | 31    | 31    | 31     | 31   | 31    | 0     | 0    | 10 |
| 4        | 50.64 | 50.64 | 50.64 | 39.9 | 28.9 | 0.74 | 0.55 | 14 |
| 5        | 31.26 | 31.26 | 31.26 | 31.1 | 30.7 | 0.42 | 0.18 | 11 |
| 6        | 30.79 | 30.79 | 30.79 | 30.8 | 28.9 | 1.09 | 1.18 | 19 |

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 31   | 31     | 31   | 31      | 0       | 0.61             | 0.38     | 2     |
| 2        | 29.65 | 29.65 | 29.65 | 31   | 28.9 | 0.8   | 0.65 | 6 |
| 3        | 30.82 | 30.82 | 30.82 | 31.6 | 30.6 | 0.44 | 0.19 | 6 |
| 4        | 29.83 | 29.83 | 29.83 | 31.6 | 27.8 | 1.31 | 1.71 | 10 |
| 5        | 30.91 | 30.91 | 30.91 | 31.4 | 29.8 | 0.83 | 0.68 | 16 |
| 6        | 31.02 | 31.02 | 31.02 | 30.95| 29.7 | 0.86 | 0.74 | 20 |

### Table 8
Descriptive information for mill speed at entry in (mpm).

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 98   | 98     | 98   | 165     | 31      | 94.75             | 8978     | 2     |
| 2        | 183.5 | 183.5 | 124   | 243  | 31.5    | 31      | 84.15             | 7080.5   | 2     |
| 3        | 326   | 326   | 322   | 331  | 322     | 31      | 3.16              | 10       | 6     |
| 4        | 597.25 | 597.25 | 594   | 600  | 594     | 31      | 2.5               | 6.25     | 4     |
| 5        | 606   | 606   | 607   | 610  | 603     | 31      | 2.53              | 6.4      | 6     |
| 6        | 597.5 | 597.5 | 610   | 617  | 490     | 31      | 43.51             | 1892.86  | 8     |

| Coil_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1        | 1    | 98   | 98     | 98   | 165     | 31      | 94.75             | 8978     | 2     |
| 2        | 223.5 | 223.5 | 225   | 231  | 217     | 217     | 2.12              | 4.5      | 2     |
| 3        | 265.47 | 265.47 | 265   | 265  | 265     | 265     | 90.73             | 8231.7   | 15    |
| 4        | 340   | 340   | 340   | 386  | 340     | 340     | 75.26             | 5663.45  | 12    |
### Table 8 (continued)

| Coi_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 5       | 384.55 | 408 | 411 | 413 | 278 | 47.17 | 2225.47 | 11       |
| 6       | 353.42 | 393 | 289 | 431 | 29.7 | 91.34 | 8342.74 | 30       |
| 4       | 185.02 | 212 | 199.8 | 253.6 | 30.9 | 81.88 | 6703.64 | 13       |
| 2       | 228.11 | 228 | 233 | 224 | 2.67 | 71.11 | 9                   |
| 3       | 314.6 | 314.5 | 318 | 309 | 2.84 | 8.04 | 4699.76 | 19       |
| 4       | 353.29 | 384.5 | 390 | 384.5 | 282 | 44.2 | 1954.07 | 14       |
| 5       | 381.82 | 400 | 391 | 318 | 9.14 | 34.91 | 1218.96 | 11       |
| 6       | 338.26 | 374 | 401 | 200 | 68.55 | 4699.76 | 19       |

### Table 9

Descriptive information for mill speed at exit in (mpm).

| Coi_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1       | 98.95 | 98.95 | 30.9 | 167 | 30.9 | 96.24 | 9261.61 | 2        |
| 2       | 270.5 | 270.5 | 169 | 372 | 169 | 143.54 | 20604.5 | 2        |
| 3       | 509 | 509 | 506 | 512 | 506 | 2.37 | 5.6 | 6        |
| 4       | 381.25 | 381 | 379 | 384 | 379 | 2.22 | 4.92 | 4        |
| 5       | 389.67 | 390.5 | 382 | 394 | 382 | 4.13 | 17.07 | 6        |
| 6       | 379.38 | 388.5 | 390 | 393 | 316 | 25.82 | 6665.5 | 8        |

| Coi_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1       | 337.5 | 337.5 | 333 | 342 | 333 | 6.36 | 40.5 | 2        |
| 2       | 335.58 | 357.2 | 251.7 | 360 | 251.7 | 47.05 | 2214.01 | 5        |
| 3       | 515.93 | 500.2 | 498.4 | 564.9 | 498.4 | 32.68 | 1067.7 | 4        |
| 4       | 611.68 | 633.2 | 633.2 | 643.7 | 558 | 41.04 | 1684.63 | 6        |
| 5       | 603 | 603 | 603 | 605 | 601 | 1.41 | 2 | 6        |
| 6       | 470.89 | 379 | 369 | 669 | 368 | 143.43 | 20572.86 | 9        |

| Coi_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1       | 170.15 | 174.5 | 183 | 183 | 145.2 | 14.81 | 219.27 | 8        |
| 2       | 350.75 | 351 | 351 | 353 | 349 | 1.39 | 1.93 | 8        |
| 3       | 402.33 | 488 | 493 | 493 | 493 | 1.93 | 20355.38 | 15       |
| 4       | 530.59 | 593.5 | 596 | 600.1 | 190 | 126.13 | 15909.16 | 12       |
| 5       | 598.09 | 634 | 643 | 643 | 431 | 73.44 | 5392.89 | 11       |
| 6       | 568.9 | 618 | 460 | 666 | 325 | 109.85 | 12066.16 | 30       |

| Coi_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1       | 188.05 | 199 | 187 | 254 | 30.7 | 78.93 | 6230.72 | 13       |
| 2       | 360.33 | 360 | 359 | 363 | 358 | 1.58 | 2.5 | 9        |
| 3       | 491.8 | 490.5 | 490 | 497 | 488 | 3.12 | 9.73 | 10       |
| 4       | 547.64 | 602.5 | 603 | 606 | 603 | 32.68 | 1067.7 | 4        |
| 5       | 564.27 | 624 | 627 | 631 | 405 | 90.79 | 8242.22 | 11       |
| 6       | 535.05 | 598 | 598 | 620 | 321 | 107.93 | 11649.72 | 19       |

| Coi_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1       | 115.44 | 102.5 | 85 | 207 | 55 | 45.5 | 2069.91 | 18       |
| 2       | 302.83 | 301.5 | 301 | 310 | 299 | 3.87 | 14.97 | 6        |
| 3       | 414.67 | 485.5 | 489 | 489 | 209 | 118.8 | 14113.07 | 6        |
| 4       | 480.4 | 475 | 409 | 596 | 256 | 114.46 | 13101.82 | 10       |
| 5       | 463.25 | 539 | 350 | 546 | 224 | 104.28 | 11942.87 | 16       |
| 6       | 432.1 | 423 | 330 | 563 | 327 | 89.74 | 8052.62 | 20       |

| Coi_no. | PASS | Mean | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|---------|------|------|--------|------|---------|---------|-------------------|----------|-------|
| 1       | 256 | 257 | 257 | 258 | 253 | 1.55 | 2.4 | 11       |
| 2       | 321.67 | 349.5 | 148 | 487 | 148 | 87.42 | 7641.88 | 12       |
| 3       | 474.5 | 489.5 | 492 | 493 | 378 | 38.87 | 1511.19 | 14       |
| 4       | 562.11 | 597 | 606 | 608 | 400 | 68.06 | 4631.65 | 19       |
| 5       | 433.31 | 449 | 508 | 516 | 313 | 82.29 | 6771.16 | 16       |
| 6       | 508.84 | 537 | 542 | 627 | 377 | 85.63 | 7332.14 | 19       |
Table 10
Descriptive information for mill power (kW).

| Coil_no. | PASS | Mean    | Median | Mode | Maximum | Minimum | Standard deviation | Variance | Count |
|----------|------|---------|--------|------|---------|---------|--------------------|----------|-------|
| 1        | 1    | 1179    | 1178   | 1180 | 1178    | 1178    | 1.41               | 2        | 2     |
| 2        | 1    | 1185    | 1183   | 1187 | 1183    | 1183    | 2.83               | 8        | 2     |
| 3        | 1    | 1693    | 1711.5 | 1760 | 1561    | 1561    | 79.08              | 6253.47  | 6     |
| 4        | 1    | 1557    | 1556.5 | 1554 | 1554    | 1554    | 2.08               | 4.33     | 4     |
| 5        | 1    | 1217    | 1217.5 | 1227 | 1207    | 1207    | 6.65               | 44.24    | 4     |
| 6        | 2    | 978     | 1000   | 1000 | 1015    | 803     | 71.29              | 5082.86  | 8     |
| 2        | 1    | 37.5    | 37.5   | 42   | 33      | 42      | 6.36               | 40.5     | 2     |
| 2        | 1    | 1711    | 1667   | 1804 | 1632    | 1632    | 82.79              | 6854.8   | 5     |
| 3        | 1    | 1611    | 1780   | 1102 | 1782    | 1102    | 339.34             | 115148.67| 4     |
| 4        | 1    | 1513    | 1504   | 1521 | 1504    | 1504    | 6.77               | 45.77    | 6     |
| 5        | 1    | 1258    | 1254   | 1263 | 1254    | 1254    | 3.58               | 12.8     | 6     |
| 6        | 1    | 1100    | 1108   | 1108 | 1090    | 1090    | 6.8                | 46.28    | 9     |
| 3        | 1    | 795.3   | 739    | 937  | 739     | 937     | 86.63              | 7505.36  | 8     |
| 2        | 1    | 1698    | 1689   | 1711 | 1689    | 1689    | 7.4                | 54.7     | 8     |
| 3        | 1    | 1381    | 1692   | 1705 | 110     | 110     | 551.84             | 304525.11| 15    |
| 4        | 1    | 1428    | 811    | 1563 | 811     | 811     | 273.19             | 74635.15 | 12    |
| 5        | 1    | 1181    | 1266   | 1275 | 703     | 703     | 182.31             | 33237.36 | 11    |
| 6        | 1    | 921.9   | 1000   | 996  | 1077    | 542     | 172.67             | 29816.4  | 30    |
| 4        | 1    | 1113    | 1145   | 899  | 1198    | 1198    | 100.1              | 10019.92 | 13    |
| 2        | 1    | 1715    | 1718   | 1700 | 1725    | 1700    | 8.24               | 67.94    | 9     |
| 3        | 1    | 1693    | 1694.5 | 1694 | 1700    | 1684    | 4.99               | 24.93    | 10    |
| 4        | 1    | 1397    | 1555   | 1556 | 1576    | 1019    | 207.7              | 43138.26 | 14    |
| 5        | 1    | 1217    | 1250   | 1256 | 1016    | 73.43   | 73.43              | 5391.62  | 11    |
| 6        | 1    | 855.9   | 952    | 969  | 1011    | 610     | 152.09             | 23436.1  | 19    |
| 5        | 1    | 522.1   | 405    | 310  | 1135    | 180     | 285.86             | 81713.4  | 18    |
| 2        | 1    | 1480    | 1481.5 | 1463 | 1495    | 1463    | 14.68              | 215.37   | 6     |
| 3        | 1    | 1448    | 1646   | 798  | 1772    | 798     | 393.93             | 155178.57| 6     |
| 4        | 1    | 1041    | 1123   | 1142 | 1175    | 572     | 185.6              | 34447.82| 10    |
| 5        | 1    | 909.9   | 1110   | 1110 | 1125    | 409     | 290.14             | 84181.93| 16    |
| 6        | 1    | 709.9   | 746    | 516  | 934     | 516     | 157.35             | 24760.34| 20    |

Table 11
X-ray gauge specifications.

| Measurement range | 3500–8000 μm |
|-------------------|--------------|
| Source            | 160 KV       |
| Operating values  | 85 KV, 2 mA   |
| Sensitivity       | 0.1%         |
| Max high voltage  | 100 KV       |
| Maximum tube current | 10 mA    |
| Maximum continuous output | 1 kW |
| Resolution        | 0.001 μm     |
| Mill Type & direction configuration | Cold, Reversible |
| Maximum cooling chamber temperature | 35 °C |
| Cooling chamber flow rate | 4litres/Min |
### Table 12
ANOVA analysis of rolling parameters mill speed at entry and exit.

|                          | Sum of squares     | df | Mean square      | F         | Sig.  |
|--------------------------|--------------------|----|-----------------|-----------|-------|
| Mill_Speed_entry_mpm      | Between Groups     | 2252428.224 | 5     | 450485.645 | 52.539 | 0.000 |
|                          | Within Groups      | 3266827.338 | 381   | 8574.350   |        |       |
|                          | Total              | 5519255.562 | 386   |           |        |       |
| Mill_Speed_exit_mpm       | Between Groups     | 5472997.442 | 5     | 1094599.488| 110.776| 0.000 |
|                          | Within Groups      | 3764746.031 | 381   | 9881.223  |        |       |
|                          | Total              | 9237743.473 | 386   |           |        |       |

### Table 13
ANOVA analysis of parameters X-ray Temp at entry and exit.

|                          | Sum of squares     | df | Mean square      | F         | Sig.  |
|--------------------------|--------------------|----|-----------------|-----------|-------|
| Xray_Temp_at_entry       | Between Groups     | 786.378  | 5     | 157.276   | 0.788  | 0.559 |
|                          | Within Groups      | 76090.613 | 381   | 199.713  |        |       |
|                          | Total              | 76876.991 | 386   |           |        |       |
| Xray_Temp_at_exit        | Between Groups     | 947.494   | 5     | 189.499   | 0.941  | 0.454 |
|                          | Within Groups      | 76724.734 | 381   | 201.377  |        |       |
|                          | Total              | 77672.228 | 386   |           |        |       |

### Table 14
ANOVA analysis of parameters actual thickness at entry and exit.

|                          | Sum of squares     | df | Mean square      | F         | Sig.  |
|--------------------------|--------------------|----|-----------------|-----------|-------|
| Actual_Thickness_at_entry_mm | Between Groups    | 113.717  | 5     | 22.743    | 203031.301 | 0.000 |
|                          | Within Groups      | 0.043   | 381   | 0.000    |        |       |
|                          | Total              | 113.760 | 386   |           |        |       |
| Actual_Thickness_at_exit_mm | Between Groups    | 13973.476 | 5     | 2795.095  | 1.731  | 0.127 |
|                          | Within Groups      | 615260.434 | 381  | 1614.857 |        |       |
|                          | Total              | 629235.911 | 386  |           |        |       |

### Table 15
ANOVA analysis of parameters Mill power.

|                          | Sum of squares     | df | Mean square      | F         | Sig.  |
|--------------------------|--------------------|----|-----------------|-----------|-------|
| Between Groups           | 32150337.441      | 5  | 6430067.488     | 81.468    | 0.000 |
| Within Groups            | 30071288.745      | 381| 78927.267       |          |       |
| Total                    | 62221626.186      | 386|           |          |       |
2. Experimental design, materials, and methods

This data were manually collected from the Supervisory Control and Data Acquisition (SCADA) via the operators Human Machine Interface (HMI). The Supervisory Control and Data Acquisition system (SCADA) provides a detailed real time monitoring of the numerous feedback parameters [4,5] from installed sensors during the manufacturing process [6,7]. An average of three readings was recorded for each pass with minimum time interval of 3 minutes for the various parameters [8]. The X-ray thickness gauge sensor specifications are presented in Table 11. The tolerance range for thickness measurement for the reversible cold rolling mill is $\pm 0.001 \mu m$ [1]. The Analysis of Variance (ANOVA) for rolling parameters are given in Tables 12–15.

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Transparency document. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2018.03.081.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2018.03.081.

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