**Measuring Average luggage handling time data dispersion and central tendency**

| | T1 Average 2018 | T1 Average 2019 | T2 Average 2018 | T2 Average 2019 | T3 Average 2018 | T3 Average 2019 | T4 Average 2018 | T4 Average 2019 |
|---|---|---|---|---|---|---|---|---|
| Mode | 4.970[a] | 5.100[a] | 4.420[a] | 3.780[a] | 7.820[a] | 6.940[a] | 7.470[a] | 7.130[a] |
| Median | 4.800 | 5.000 | 4.300 | 3.820 | 7.640 | 6.710 | 7.230 | 7.180 |
| Mean | 4.769 | 4.952 | 4.274 | 3.809 | 7.604 | 6.670 | 7.170 | 7.137 |
| Std. Deviation | 0.173 | 0.193 | 0.165 | 0.129 | 0.285 | 0.251 | 0.257 | 0.255 |
| Coefficient of variation | 0.036 | 0.039 | 0.039 | 0.034 | 0.037 | 0.038 | 0.036 | 0.036 |
| Variance | 0.030 | 0.037 | 0.027 | 0.017 | 0.081 | 0.063 | 0.066 | 0.065 |
| Skewness | −0.841 | −1.011 | −0.896 | −0.758 | −0.828 | −1.166 | −1.064 | −0.762 |
| Std. Error of Skewness | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 |
| Kurtosis | 0.123 | 1.120 | 0.574 | 0.300 | 0.235 | 2.108 | 1.071 | 0.113 |
| Std. Error of Kurtosis | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 |
| Range | 0.770 | 1.210 | 0.880 | 0.630 | 1.400 | 1.670 | 1.310 | 1.210 |
| 25th percentile | 4.670 | 4.840 | 4.170 | 3.740 | 7.430 | 6.520 | 7.020 | 6.970 |
| 50th percentile | 4.800 | 5.000 | 4.300 | 3.820 | 7.640 | 6.710 | 7.230 | 7.180 |
| 75th percentile | 4.910 | 5.100 | 4.410 | 3.910 | 7.840 | 6.880 | 7.370 | 7.340 |

[a] The mode is computed assuming that variables are discreet.

*Figure 1 Average Luggage Handling Time in T1, T2, T3, T4 terminals for the Years 2018 and 2019*

## Measuring luggage handling data dispersion and central tendency:

| | T1 Luggages 2018 | T1 Luggages 2019 | T2 Luggages 2018 | T2 Luggages 2019 | T3 Luggages 2018 | T3 Luggages 2019 | T4 Luggages 2018 | T4 Luggages 2019 |
|---|---|---|---|---|---|---|---|---|
| Mode | 5024.000[a] | 3991.000[a] | 11815.000[a] | 10157.000[a] | 5445.000[a] | 4012.000[a] | 3429.000[a] | 2539.000[a] |
| Median | 4575.000 | 4676.000 | 14665.000 | 13057.000 | 4780.000 | 5284.000 | 3699.000 | 2819.000 |
| Mean | 4529.882 | 4699.263 | 14734.899 | 13112.847 | 4758.167 | 5307.622 | 3669.496 | 2798.962 |
| Std. Deviation | 581.900 | 579.710 | 2190.019 | 1950.932 | 649.776 | 742.802 | 446.438 | 325.841 |
| Coefficient of variation | 0.128 | 0.123 | 0.149 | 0.149 | 0.137 | 0.140 | 0.122 | 0.116 |
| Variance | 338607.362 | 336064.095 | $4.796\times10^{+6}$ | $3.806\times10^{+6}$ | 422208.563 | 551754.598 | 199306.718 | 106172.499 |
| Skewness | −0.183 | 0.070 | 0.052 | 0.061 | −0.079 | −0.010 | −0.038 | −0.046 |
| Std. Error of Skewness | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 |
| Kurtosis | −1.169 | −0.919 | −1.161 | −1.131 | −1.103 | −1.102 | −0.909 | −0.741 |
| Std. Error of Kurtosis | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 | 0.255 |
| Range | 2362.000 | 2687.000 | 7883.000 | 7402.000 | 2496.000 | 2814.000 | 2071.000 | 1421.000 |
| Minimum | 3334.000 | 3413.000 | 10806.000 | 9658.000 | 3459.000 | 3951.000 | 2698.000 | 2065.000 |
| Maximum | 5696.000 | 6100.000 | 18689.000 | 17060.000 | 5955.000 | 6765.000 | 4769.000 | 3486.000 |
| 25th percentile | 4019.000 | 4225.000 | 12766.000 | 11493.000 | 4236.000 | 4698.000 | 3281.000 | 2539.000 |
| 50th percentile | 4575.000 | 4676.000 | 14665.000 | 13057.000 | 4780.000 | 5284.000 | 3699.000 | 2819.000 |
| 75th percentile | 5035.000 | 5161.000 | 16578.000 | 14658.000 | 5323.000 | 5971.000 | 4032.000 | 3033.000 |
| Sum | $1.653\times10^{+6}$ | $1.715\times10^{+6}$ | $5.378\times10^{+6}$ | $4.786\times10^{+6}$ | $1.737\times10^{+6}$ | $1.937\times10^{+6}$ | $1.339\times10^{+6}$ | $1.022\times10^{+6}$ |

[a] The mode is computed assuming that variables are discreet.

*Figure 2 Luggage Handled in T1, T2, T3, T4 terminals for the Years 2018 and 2019*

**Performing the relevant statistical test**

The following table displays the results of the Kruskal-Wallis test conducted across four terminals in both 2018 and 2019.

| Terminal | N | Mean | SD | SE | Coefficient of variation |
|---|---|---|---|---|---|
| T1 | 730 | 4.860 | 0.205 | 0.008 | 0.042 |
| T2 | 730 | 4.042 | 0.276 | 0.010 | 0.068 |
| T3 | 730 | 7.137 | 0.539 | 0.020 | 0.075 |
| T4 | 730 | 7.154 | 0.256 | 0.009 | 0.036 |

*Figure 16 Descriptive statistics across all terminals.*

Kruskal-Wallis Test

| Factor | Statistic | df | p |
|---|---|---|---|
| Terminal | 2455.110 | 3 | < .001 |

*Figure 17 Result of Kruskal-Wallis test.*

Post Hoc Comparisons - Terminal ▼

| | | Mean Difference | SE | t | $p_{tukey}$ |
|---|---|---|---|---|---|
| T1 | T2 | 0.819 | 0.018 | 45.441 | < .001 |
| | T3 | −2.277 | 0.018 | −126.354 | < .001 |
| | T4 | −2.293 | 0.018 | −127.268 | < .001 |
| T2 | T3 | −3.096 | 0.018 | −171.795 | < .001 |
| | T4 | −3.112 | 0.018 | −172.709 | < .001 |
| T3 | T4 | −0.016 | 0.018 | −0.914 | 0.798 |

*Figure 18 Post hoc comparison among all terminals.*

## 3.2 Statistical test for hypothesis 2:

**Descriptive statistics:**

| | T2 Average 2018 | T2 Luggages 2018 | T2 Average 2019 | T2 Luggages 2019 | T3 Average 2018 | T3 Luggages 2018 | T3 Average 2019 | T3 Luggages 2019 |
|---|---|---|---|---|---|---|---|---|
| Mean | 4.274 | 14734.899 | 3.809 | 13112.847 | 7.604 | 4758.167 | 6.670 | 5307.622 |
| Shapiro-Wilk | 0.935 | 0.957 | 0.951 | 0.960 | 0.939 | 0.963 | 0.916 | 0.965 |
| P-value of Shapiro-Wilk | < .001 | < .001 | < .001 | < .001 | < .001 | < .001 | < .001 | < .001 |

*Figure 19 descriptive statistics for all 4 terminals average time and luggage handling dataset.*

The Shapiro-Wilk test yielded p-values less than 0.001, indicating non-normal distribution of the data. Therefore, non-parametric tests are warranted for further testing.

**Selection and Justification of Statistical Test required to test hypothesis 1**

*Selected Test*: The paired samples t-tests

*Justification*: Paired samples t-tests were chosen for their ability to compare means within related groups, like data collected from the same terminals over different years. With continuous data and no significant outliers, these tests efficiently analyse changes over time, making them suitable for assessing shifts in luggage handling efficiency.

**Performing the relevant statistical test**

Here's the paired sample t-test output:

| Measure 1 | | Measure 2 | t | df | p |
|---|---|---|---|---|---|
| T2 Average 2019 | - | T2 Average 2018 | −42.829 | 364 | < .001 |
| T3 Average 2019 | - | T3 Average 2018 | −47.002 | 364 | < .001 |
| T2 Luggages 2019 | - | T2 Luggages 2018 | −10.676 | 364 | < .001 |
| T3 Luggages 2019 | - | T3 Luggages 2018 | 10.460 | 364 | < .001 |

*Figure 20 Output of paired sample t-test for average time and luggage handling across platforms T2 and T3.*

**Performing the relevant statistical test**

ANOVA test for Terminal 1 for both 2018 and 2019:

| Cases | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Year | 6.122 | 1 | 6.122 | 182.682 | < .001 |
| Residuals | 24.396 | 728 | 0.034 | | |

*Figure 22 ANOVA test for T1 data in 2018 and 2019.*

Post hoc test for T1:

| | | Mean Difference | SE | t | $p_{tukey}$ |
|---|---|---|---|---|---|
| 2018 | 2019 | −0.183 | 0.014 | −13.516 | < .001 |

*Figure 23 Post hoc test for T1 data in 2018 and 2019.*

ANOVA test for terminal 2 for both 2018 and 2019:

| Cases | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Year | 0.192 | 1 | 0.192 | 2.927 | 0.088 |
| Residuals | 47.678 | 728 | 0.065 | | |

*Figure 24 ANOVA test for T2 data in 2018 and 2019.*

Post hoc test for T1:

| | | Mean Difference | SE | t | $p_{tukey}$ |
|---|---|---|---|---|---|
| 2018 | 2019 | 0.032 | 0.019 | 1.711 | 0.088 |

*Figure 25 Post hoc test for T2 data in 2018 and 2019.*