

## DAFTAR PUSTAKA

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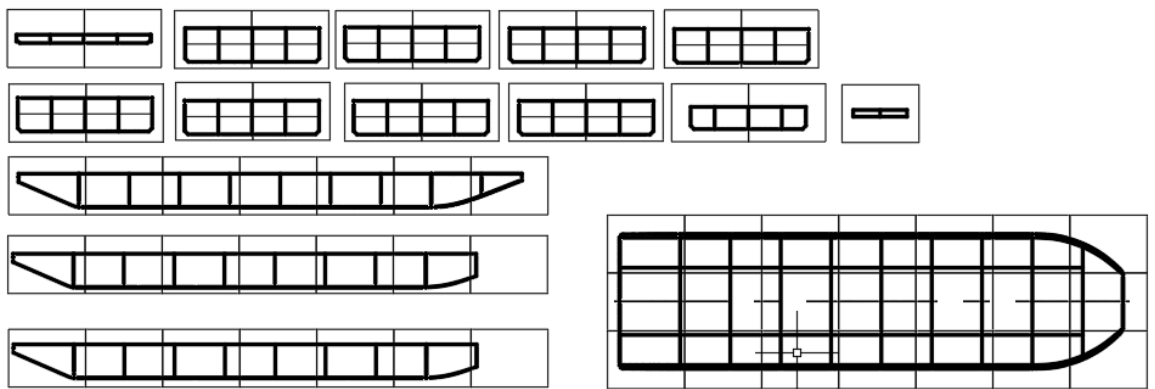
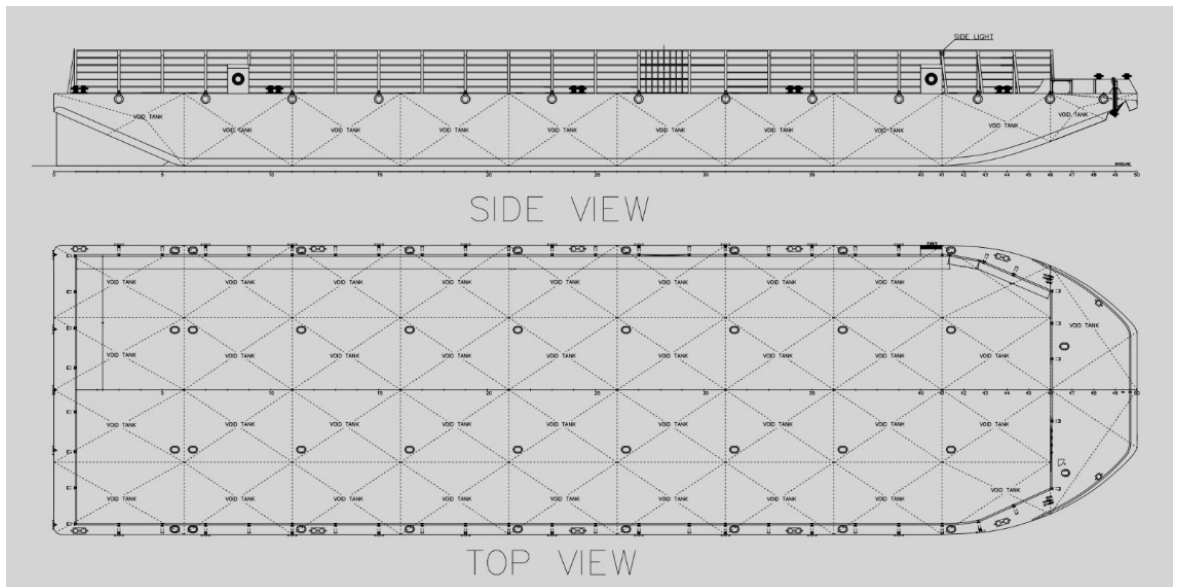
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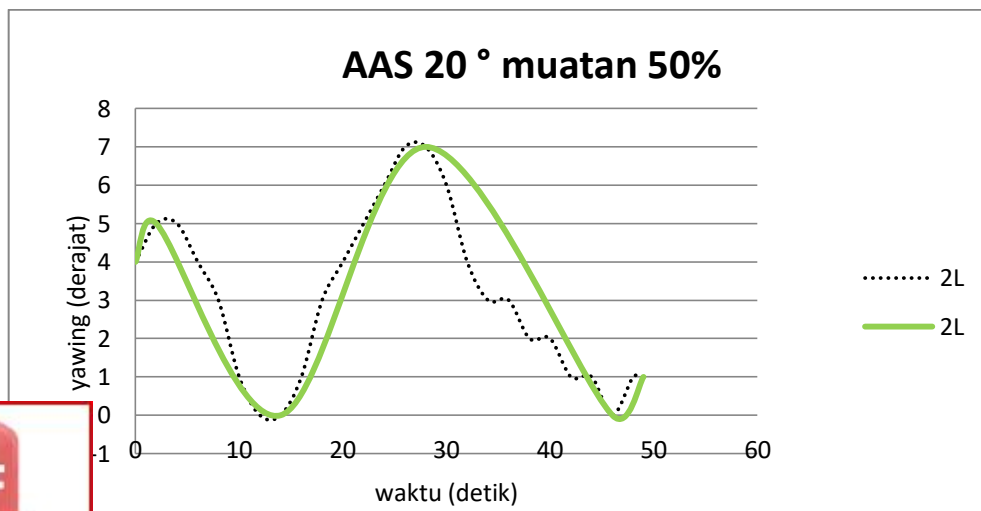
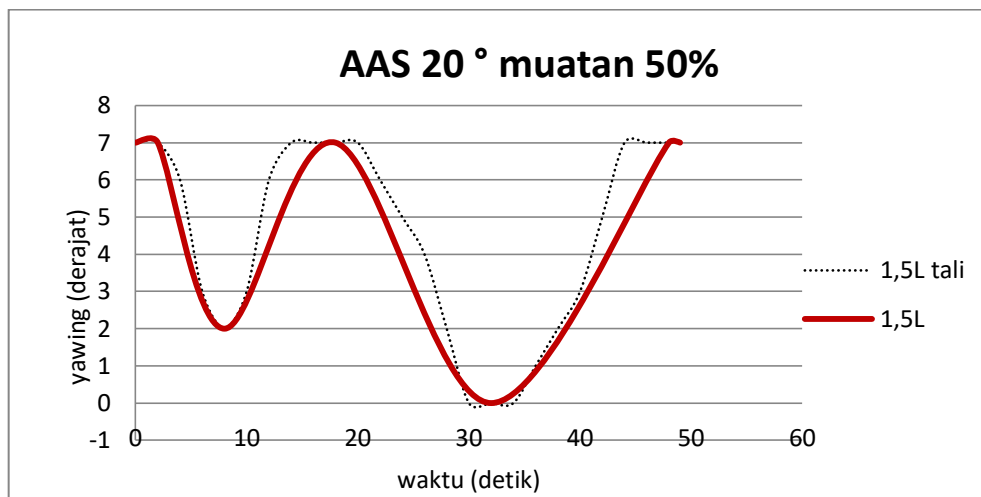
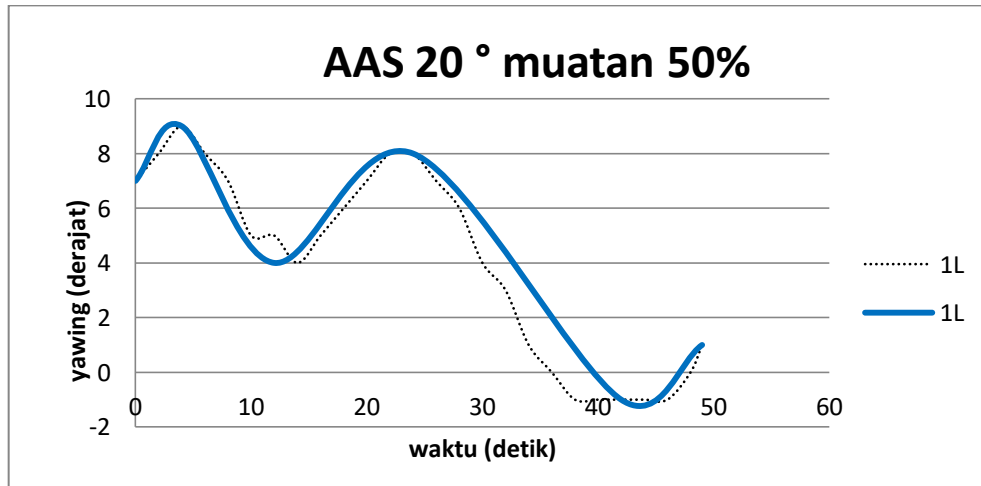
# LAMPIRAN



Lampiran 1. Gambar GA dan Lines Plan Tongkang

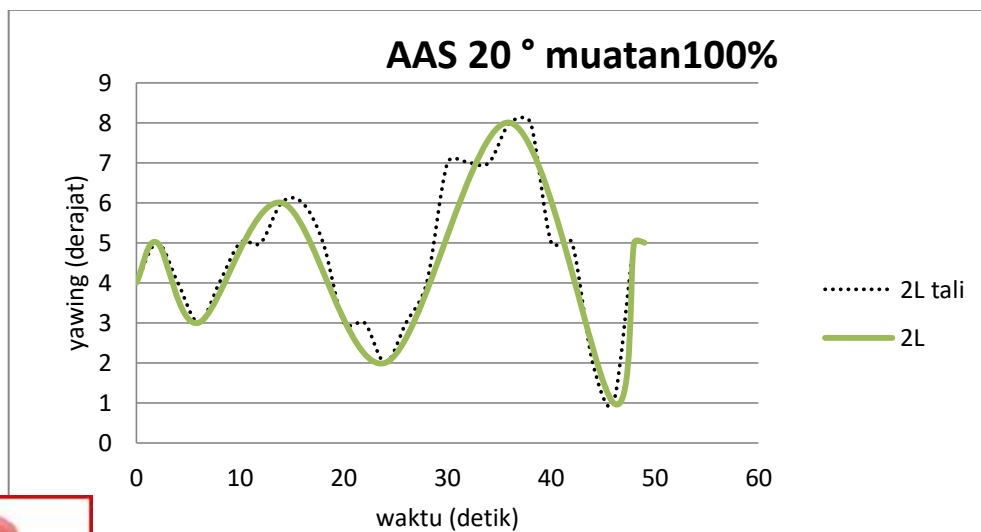
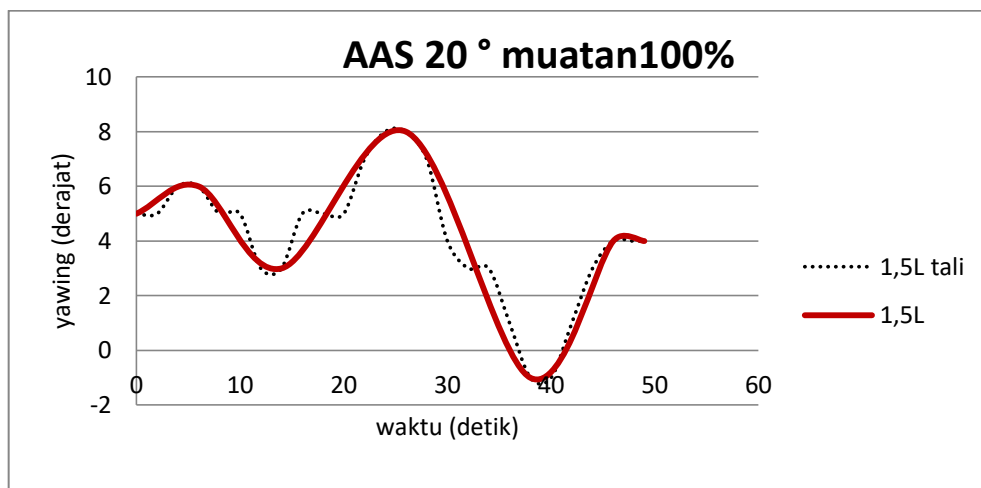
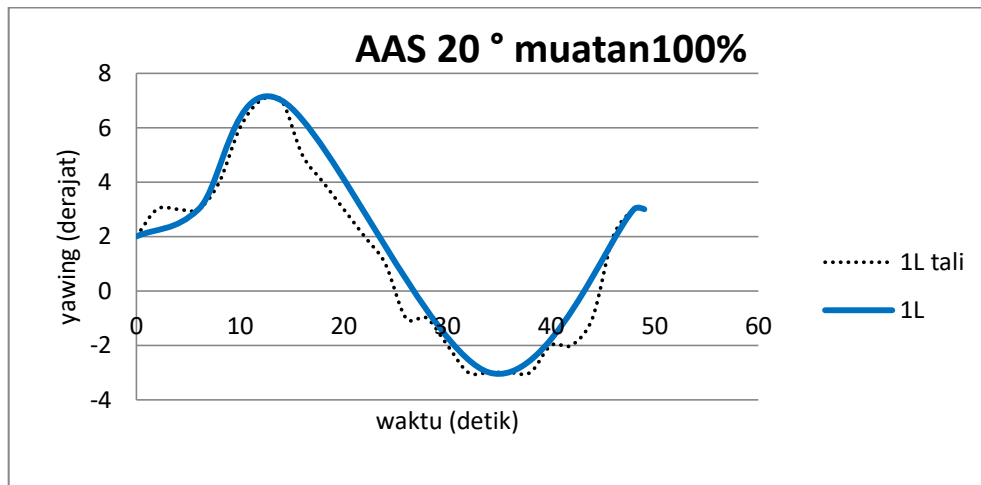


Lampiran 2. Tabel dan kurva data pengujian di setiap jenis skeg

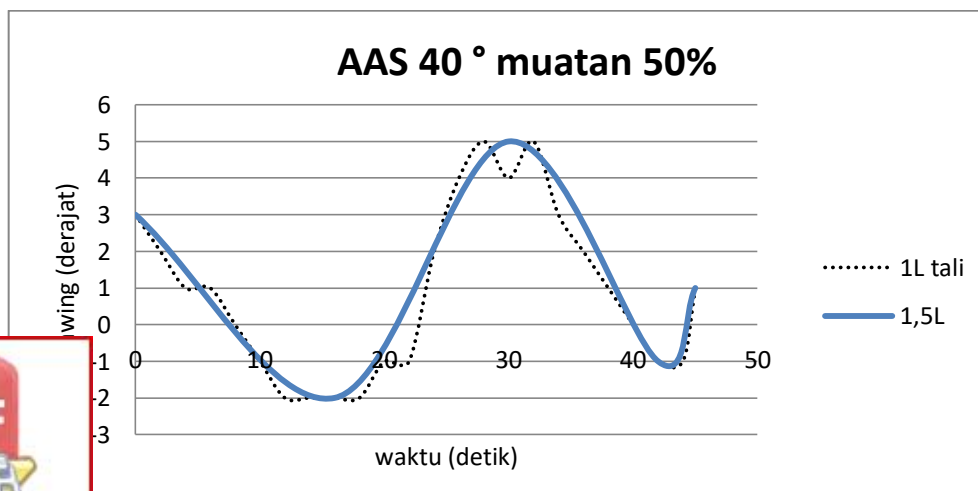


| Yawing AAS 20 ° muatan 100% |                     |                       |                     |
|-----------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)               | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                           | 2                   | 5                     | 4                   |
| 2                           | 3                   | 5                     | 5                   |
| 4                           | 3                   | 6                     | 4                   |
| 6                           | 3                   | 6                     | 3                   |
| 8                           | 4                   | 5                     | 4                   |
| 10                          | 6                   | 5                     | 5                   |
| 12                          | 7                   | 3                     | 5                   |
| 14                          | 7                   | 3                     | 6                   |
| 16                          | 5                   | 5                     | 6                   |
| 18                          | 4                   | 5                     | 5                   |
| 20                          | 3                   | 5                     | 3                   |
| 22                          | 2                   | 7                     | 3                   |
| 24                          | 1                   | 8                     | 2                   |
| 26                          | -1                  | 8                     | 3                   |
| 28                          | -1                  | 7                     | 4                   |
| 30                          | -2                  | 4                     | 7                   |
| 32                          | -3                  | 3                     | 7                   |
| 34                          | -3                  | 3                     | 7                   |
| 36                          | -3                  | 1                     | 8                   |
| 38                          | -3                  | -1                    | 8                   |
| 40                          | -2                  | -1                    | 5                   |
| 42                          | -2                  | 1                     | 5                   |
| 44                          | -1                  | 3                     | 2                   |
| 46                          | 2                   | 4                     | 1                   |
| 48                          | 3                   | 4                     | 5                   |
| 49                          | 3                   | 4                     | 5                   |

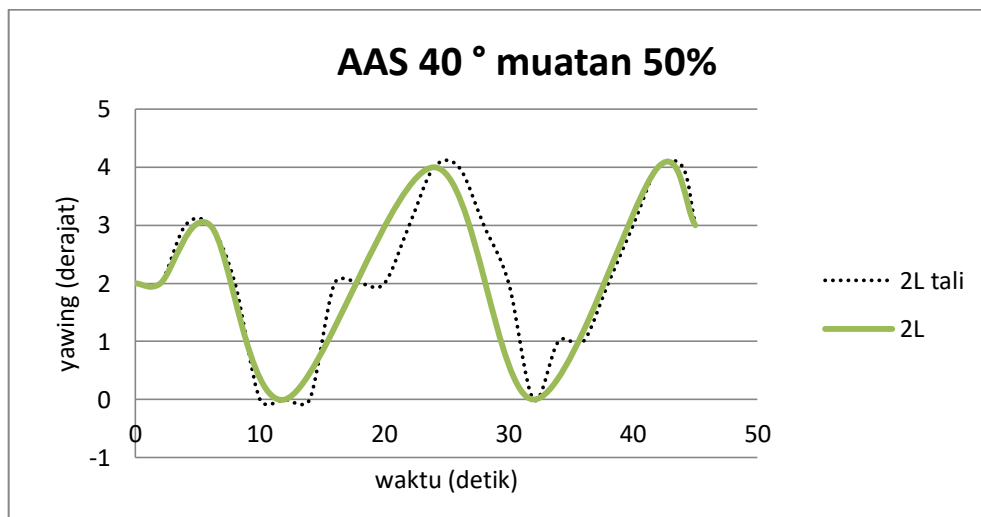
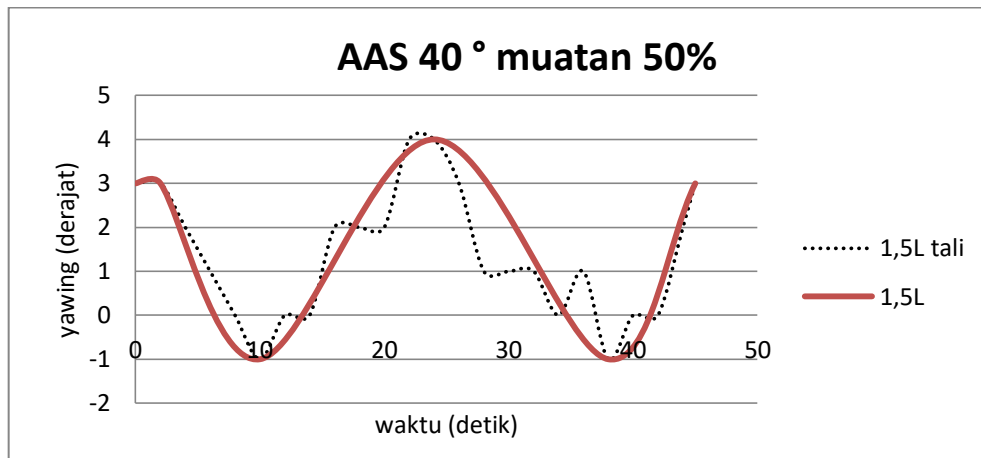




| yawing AAS 40° muatan 50% |                     |                       |                     |
|---------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)             | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                         | 3                   | 3                     | 2                   |
| 2                         | 2                   | 3                     | 2                   |
| 4                         | 1                   | 2                     | 3                   |
| 6                         | 1                   | 1                     | 3                   |
| 8                         | 0                   | 0                     | 2                   |
| 10                        | -1                  | -1                    | 0                   |
| 12                        | -2                  | 0                     | 0                   |
| 14                        | -2                  | 0                     | 0                   |
| 16                        | -2                  | 2                     | 2                   |
| 18                        | -2                  | 2                     | 2                   |
| 20                        | -1                  | 2                     | 2                   |
| 22                        | -1                  | 4                     | 3                   |
| 24                        | 2                   | 4                     | 4                   |
| 26                        | 4                   | 3                     | 4                   |
| 28                        | 5                   | 1                     | 3                   |
| 30                        | 4                   | 1                     | 2                   |
| 32                        | 5                   | 1                     | 0                   |
| 34                        | 3                   | 0                     | 1                   |
| 36                        | 2                   | 1                     | 1                   |
| 38                        | 1                   | -1                    | 2                   |
| 40                        | 0                   | 0                     | 3                   |
| 42                        | -1                  | 0                     | 4                   |
| 44                        | -1                  | 2                     | 4                   |
| 45                        | 1                   | 3                     | 3                   |



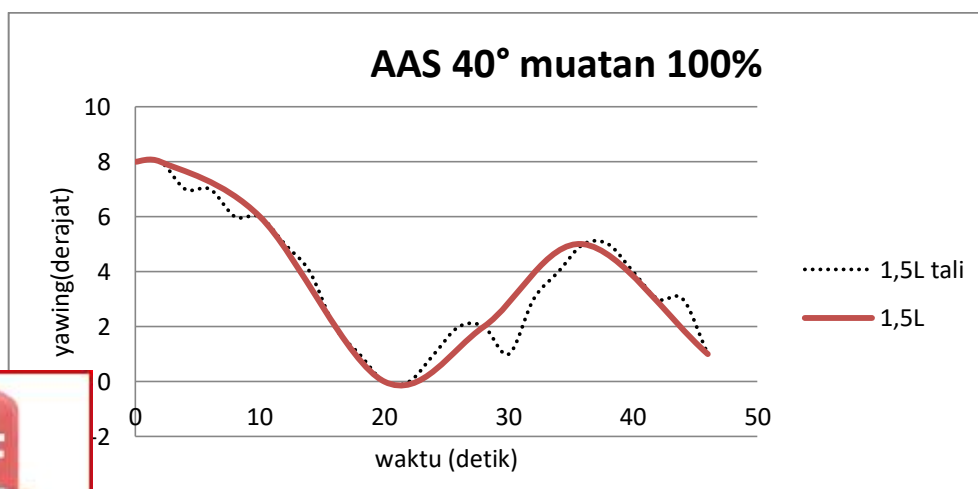
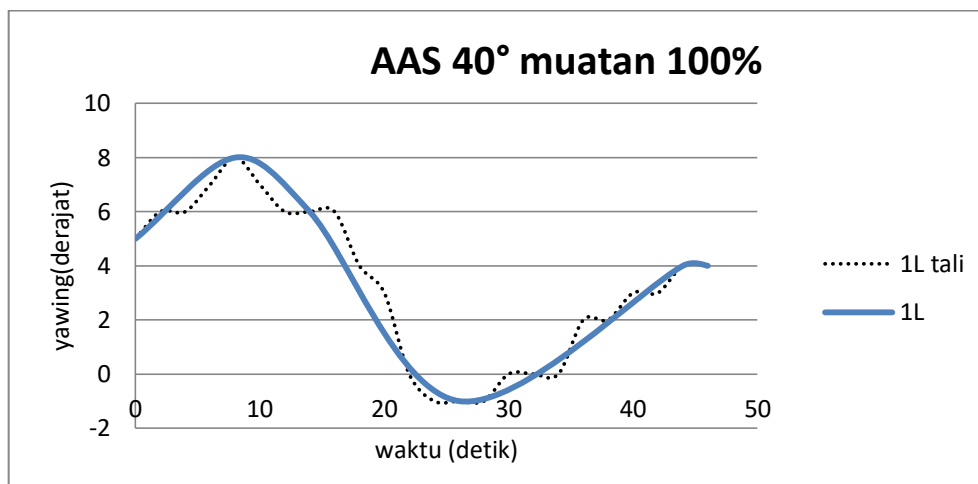


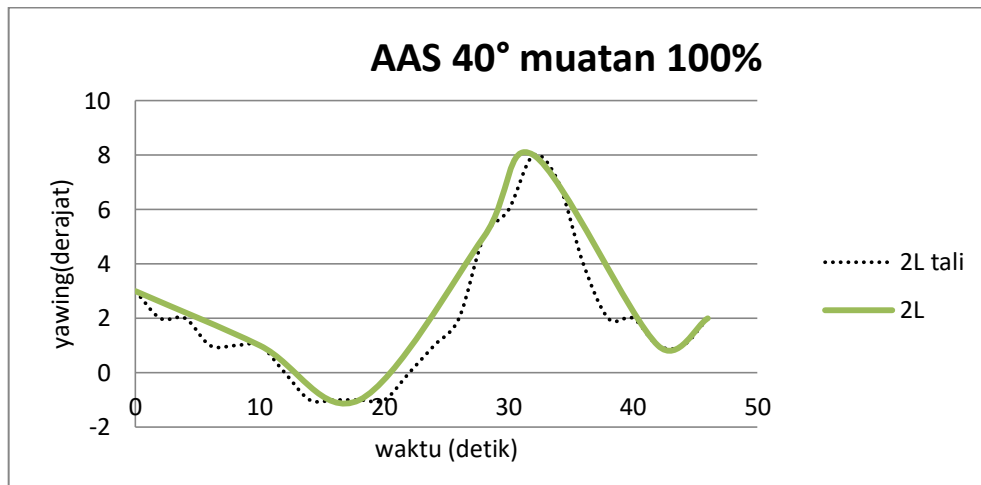


| yawing AAS 40 muatan 100% |                     |                       |                     |
|---------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)             | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                         | 5                   | 8                     | 3                   |
| 2                         | 6                   | 8                     | 2                   |
| 4                         | 6                   | 7                     | 2                   |
| 6                         | 7                   | 7                     | 1                   |
| 8                         | 8                   | 6                     | 1                   |
| 10                        | 7                   | 6                     | 1                   |
| 15                        | 6                   | 5                     | 0                   |
| 20                        | 6                   | 4                     | -1                  |
| 25                        | 6                   | 2                     | -1                  |
| 30                        | 4                   | 1                     | -1                  |
| 35                        | 3                   | 0                     | -1                  |



| waktu (detik) | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
|---------------|---------------------|-----------------------|---------------------|
| 22            | 0                   | 0                     | 0                   |
| 24            | -1                  | 1                     | 1                   |
| 26            | -1                  | 2                     | 2                   |
| 28            | -1                  | 2                     | 5                   |
| 30            | 0                   | 1                     | 6                   |
| 32            | 0                   | 3                     | 8                   |
| 34            | 0                   | 4                     | 7                   |
| 36            | 2                   | 5                     | 4                   |
| 38            | 2                   | 5                     | 2                   |
| 40            | 3                   | 4                     | 2                   |
| 42            | 3                   | 3                     | 1                   |
| 44            | 4                   | 3                     | 1                   |
| 46            | 4                   | 1                     | 2                   |

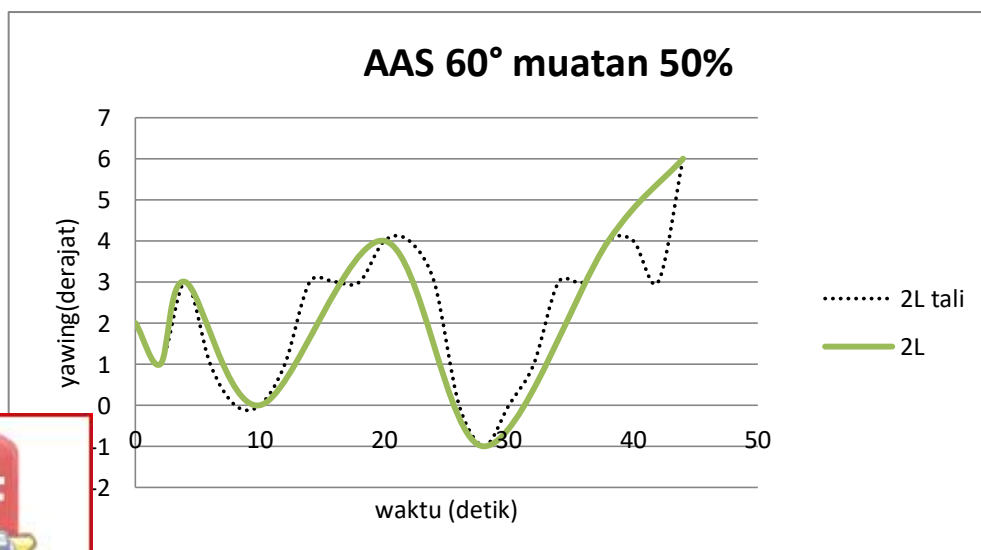
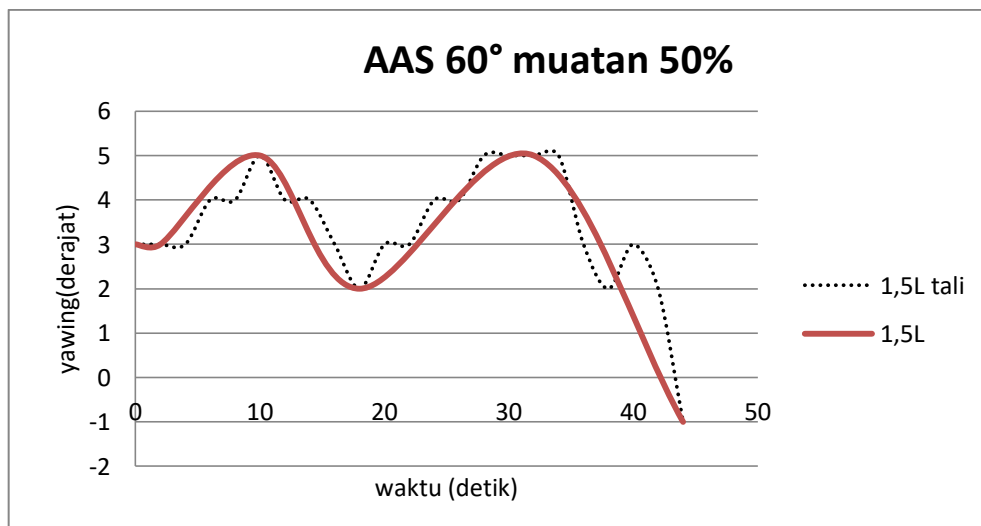
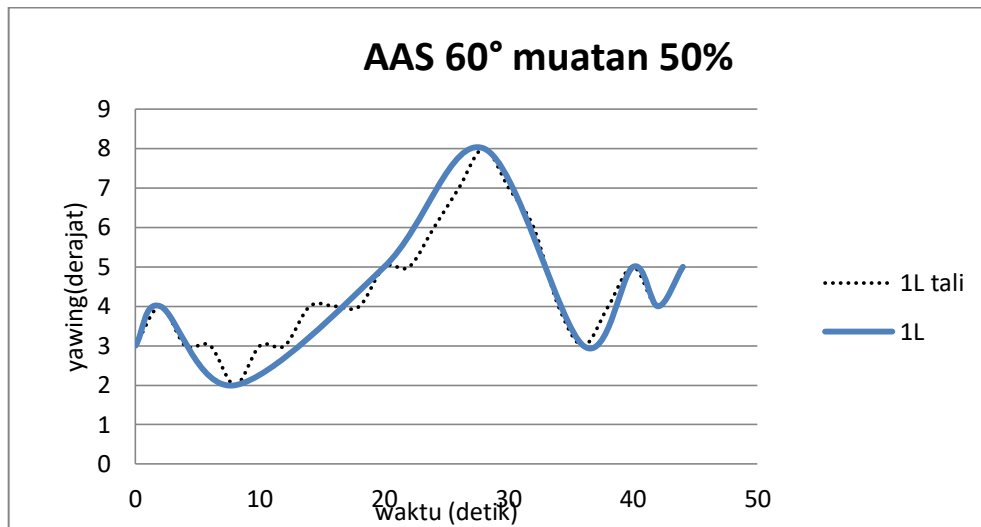




### yawing AAS 60° muatan 50%

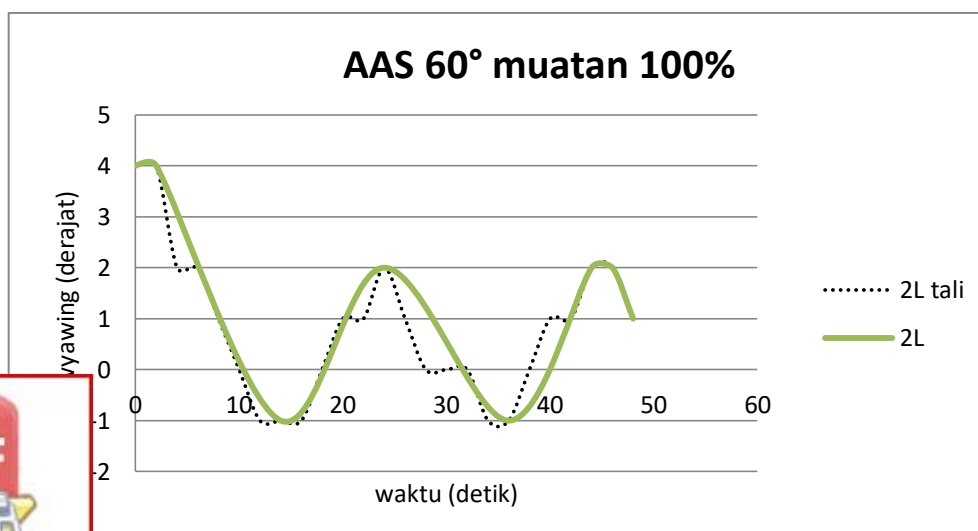
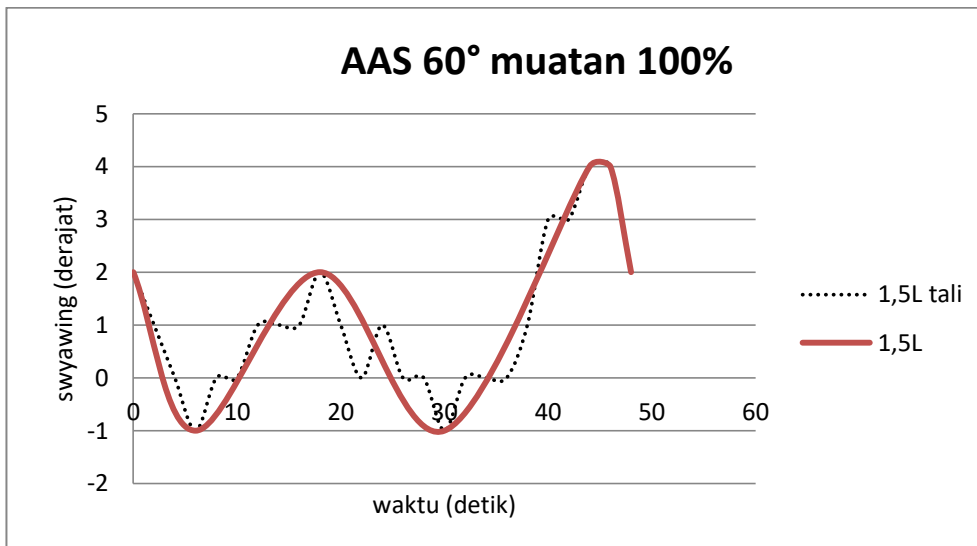
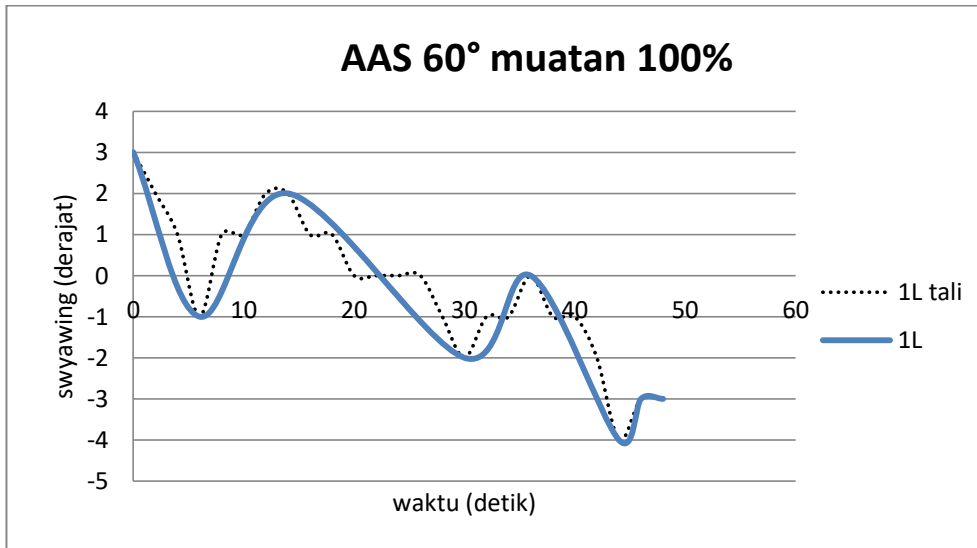
| waktu (detik) | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
|---------------|---------------------|-----------------------|---------------------|
| 0             | 3                   | 3                     | 2                   |
| 2             | 4                   | 3                     | 1                   |
| 4             | 3                   | 3                     | 3                   |
| 6             | 3                   | 4                     | 1                   |
| 8             | 2                   | 4                     | 0                   |
| 10            | 3                   | 5                     | 0                   |
| 12            | 3                   | 4                     | 1                   |
| 14            | 4                   | 4                     | 3                   |
| 16            | 4                   | 3                     | 3                   |
| 18            | 4                   | 2                     | 3                   |
| 20            | 5                   | 3                     | 4                   |
| 22            | 5                   | 3                     | 4                   |
| 24            | 6                   | 4                     | 3                   |
| 26            | 7                   | 4                     | 0                   |
| 28            | 8                   | 5                     | -1                  |
| 30            | 7                   | 5                     | 0                   |
| 32            | 6                   | 5                     | 1                   |
| 34            | 4                   | 5                     | 3                   |
| 36            | 3                   | 3                     | 3                   |
| 38            | 4                   | 2                     | 4                   |
| 40            | 5                   | 3                     | 4                   |
| 42            | 4                   | 2                     | 3                   |
| 44            | 5                   | -1                    | 6                   |





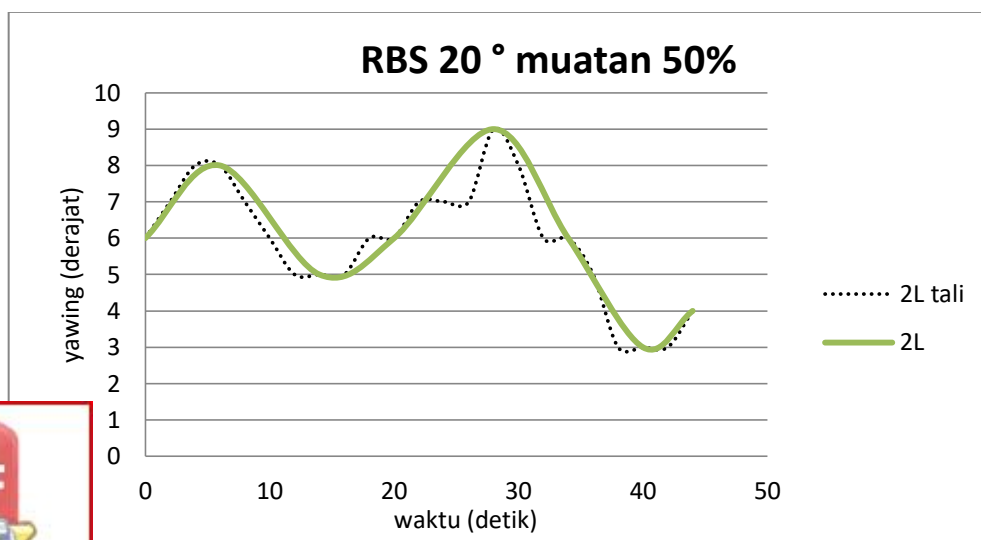
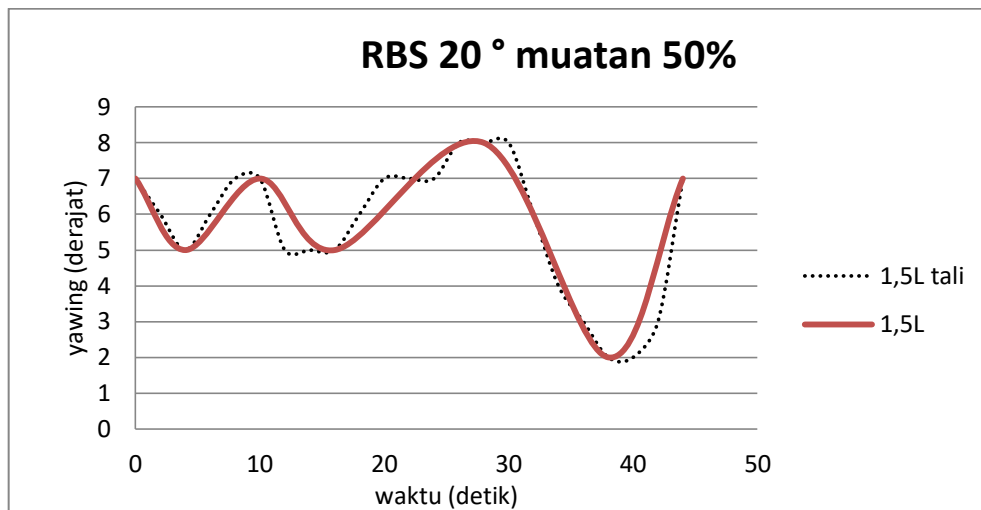
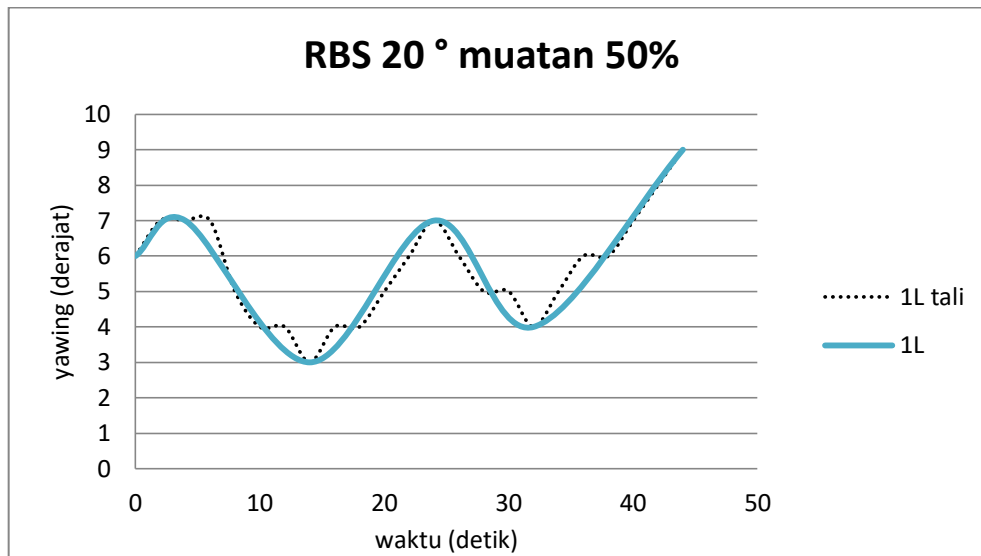
| yawing AAS 60° muatan 100% |                     |                       |                     |
|----------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)              | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                          | 3                   | 2                     | 4                   |
| 2                          | 2                   | 1                     | 4                   |
| 4                          | 1                   | 0                     | 2                   |
| 6                          | -1                  | -1                    | 2                   |
| 8                          | 1                   | 0                     | 1                   |
| 10                         | 1                   | 0                     | 0                   |
| 12                         | 2                   | 1                     | -1                  |
| 14                         | 2                   | 1                     | -1                  |
| 16                         | 1                   | 1                     | -1                  |
| 18                         | 1                   | 2                     | 0                   |
| 20                         | 0                   | 1                     | 1                   |
| 22                         | 0                   | 0                     | 1                   |
| 24                         | 0                   | 1                     | 2                   |
| 26                         | 0                   | 0                     | 1                   |
| 28                         | -1                  | 0                     | 0                   |
| 30                         | -2                  | -1                    | 0                   |
| 32                         | -1                  | 0                     | 0                   |
| 34                         | -1                  | 0                     | -1                  |
| 36                         | 0                   | 0                     | -1                  |
| 38                         | -1                  | 1                     | 0                   |
| 40                         | -1                  | 3                     | 1                   |
| 42                         | -2                  | 3                     | 1                   |
| 44                         | -4                  | 4                     | 2                   |
| 46                         | -3                  | 4                     | 2                   |
| 48                         | -3                  | 2                     | 1                   |





| Yawing RBS 20° muatan 50% |                     |                       |                     |
|---------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)             | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                         | 6                   | 7                     | 6                   |
| 2                         | 7                   | 6                     | 7                   |
| 4                         | 7                   | 5                     | 8                   |
| 6                         | 7                   | 6                     | 8                   |
| 8                         | 5                   | 7                     | 7                   |
| 10                        | 4                   | 7                     | 6                   |
| 12                        | 4                   | 5                     | 5                   |
| 14                        | 3                   | 5                     | 5                   |
| 16                        | 4                   | 5                     | 5                   |
| 18                        | 4                   | 6                     | 6                   |
| 20                        | 5                   | 7                     | 6                   |
| 22                        | 6                   | 7                     | 7                   |
| 24                        | 7                   | 7                     | 7                   |
| 26                        | 6                   | 8                     | 7                   |
| 28                        | 5                   | 8                     | 9                   |
| 30                        | 5                   | 8                     | 8                   |
| 32                        | 4                   | 6                     | 6                   |
| 34                        | 5                   | 4                     | 6                   |
| 36                        | 6                   | 3                     | 5                   |
| 38                        | 6                   | 2                     | 3                   |
| 40                        | 7                   | 2                     | 3                   |
| 42                        | 8                   | 3                     | 3                   |
| 44                        | 9                   | 7                     | 4                   |

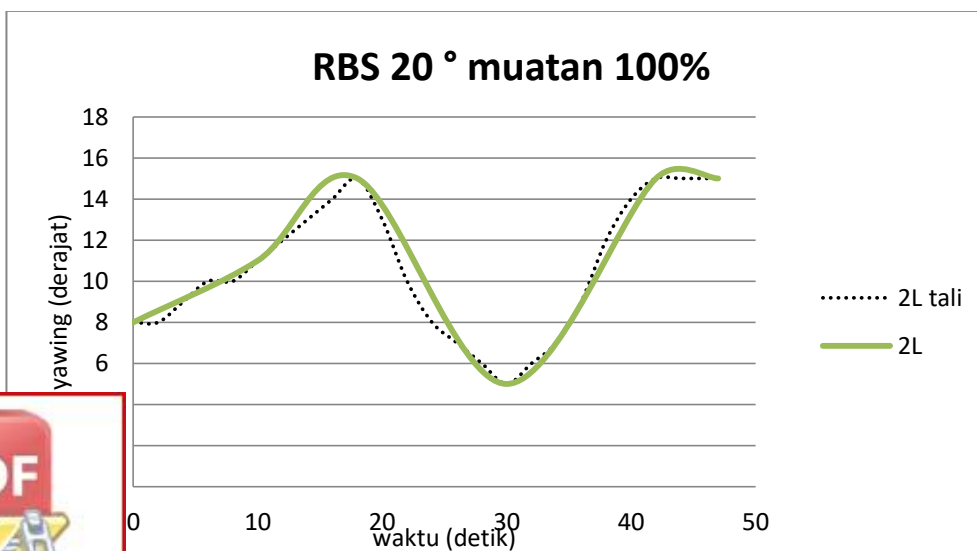
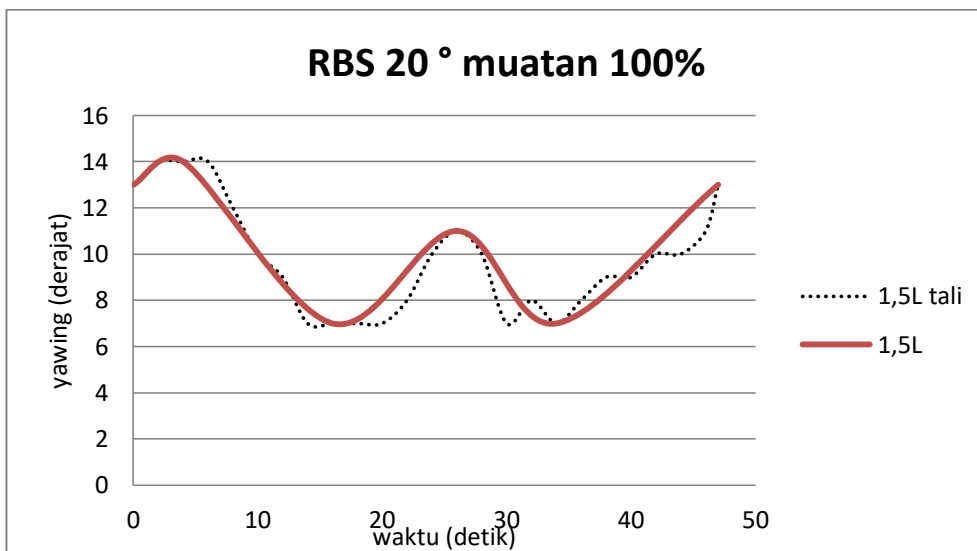
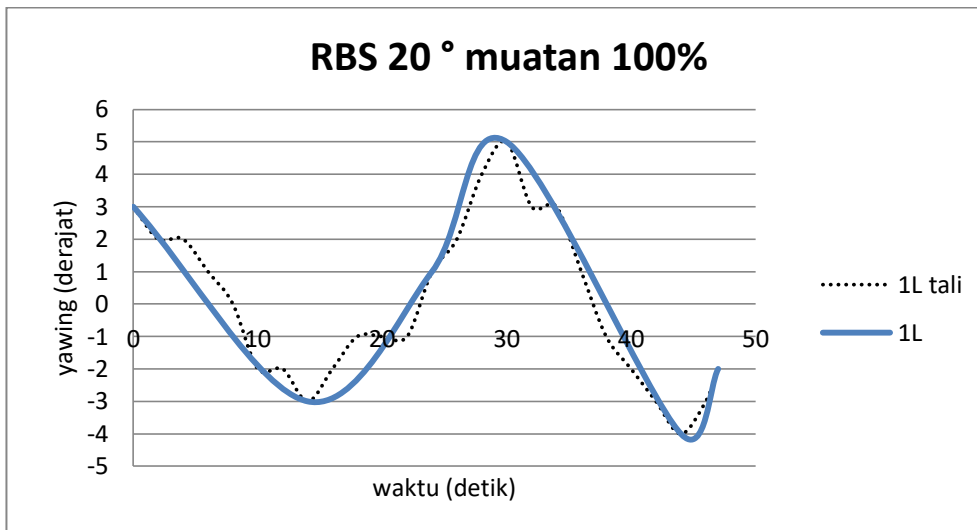




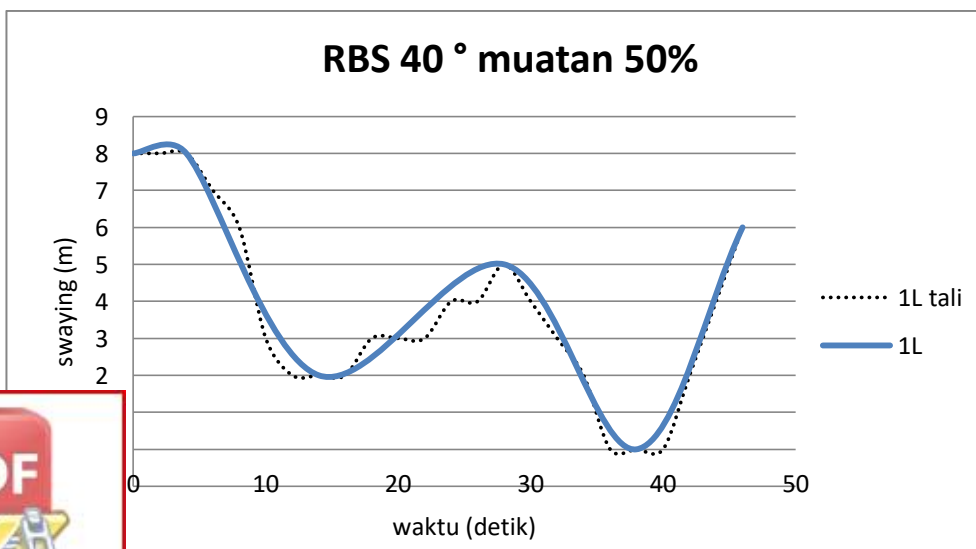


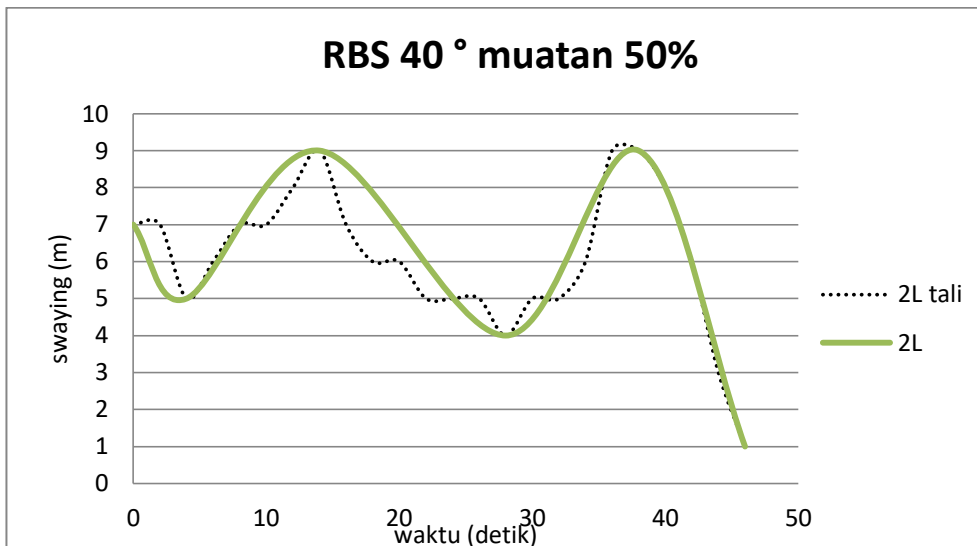
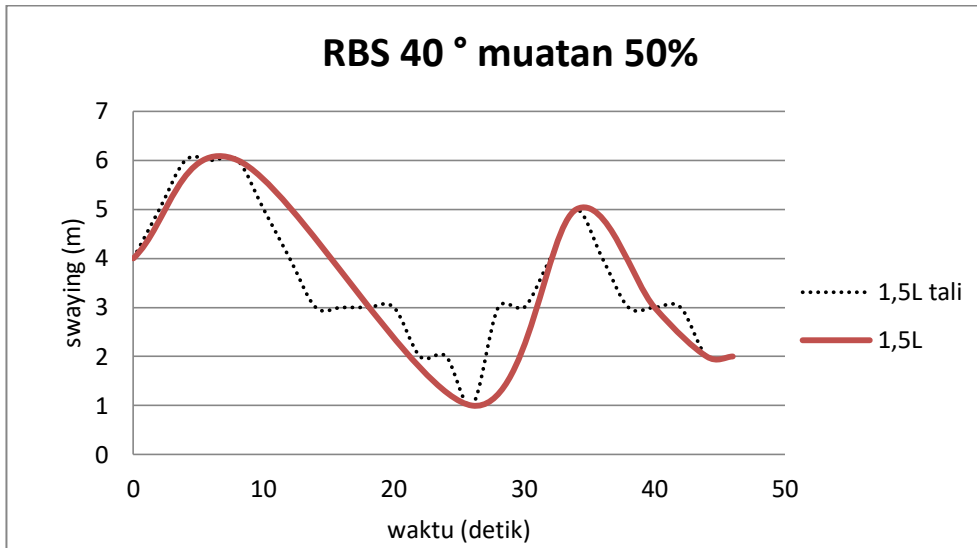
| Yawing RBS 20° muatan 100% |                     |                       |                     |
|----------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)              | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                          | 3                   | 13                    | 8                   |
| 2                          | 2                   | 14                    | 8                   |
| 4                          | 2                   | 14                    | 9                   |
| 6                          | 1                   | 14                    | 10                  |
| 8                          | 0                   | 12                    | 10                  |
| 10                         | -2                  | 10                    | 11                  |
| 12                         | -2                  | 9                     | 12                  |
| 14                         | -3                  | 7                     | 13                  |
| 16                         | -2                  | 7                     | 14                  |
| 18                         | -1                  | 7                     | 15                  |
| 20                         | -1                  | 7                     | 13                  |
| 22                         | -1                  | 8                     | 10                  |
| 24                         | 1                   | 10                    | 8                   |
| 26                         | 2                   | 11                    | 7                   |
| 28                         | 4                   | 10                    | 6                   |
| 30                         | 5                   | 7                     | 5                   |
| 32                         | 3                   | 8                     | 6                   |
| 34                         | 3                   | 7                     | 7                   |
| 36                         | 1                   | 8                     | 9                   |
| 38                         | -1                  | 9                     | 12                  |
| 40                         | -2                  | 9                     | 14                  |
| 42                         | -3                  | 10                    | 15                  |
| 44                         | -4                  | 10                    | 15                  |
| 46                         | -3                  | 11                    | 15                  |
| 47                         | -2                  | 13                    | 15                  |





| Yawing RBS 40° muatan 50% |                     |                       |                     |
|---------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)             | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                         | 8                   | 4                     | 7                   |
| 2                         | 8                   | 5                     | 7                   |
| 4                         | 8                   | 6                     | 5                   |
| 6                         | 7                   | 6                     | 6                   |
| 8                         | 6                   | 6                     | 7                   |
| 10                        | 3                   | 5                     | 7                   |
| 12                        | 2                   | 4                     | 8                   |
| 14                        | 2                   | 3                     | 9                   |
| 16                        | 2                   | 3                     | 7                   |
| 18                        | 3                   | 3                     | 6                   |
| 20                        | 3                   | 3                     | 6                   |
| 22                        | 3                   | 2                     | 5                   |
| 24                        | 4                   | 2                     | 5                   |
| 26                        | 4                   | 1                     | 5                   |
| 28                        | 5                   | 3                     | 4                   |
| 30                        | 4                   | 3                     | 5                   |
| 32                        | 3                   | 4                     | 5                   |
| 34                        | 2                   | 5                     | 6                   |
| 36                        | 0                   | 4                     | 9                   |
| 38                        | 0                   | 3                     | 9                   |
| 40                        | 0                   | 3                     | 8                   |
| 42                        | 2                   | 3                     | 6                   |
| 44                        | 4                   | 2                     | 3                   |
| 46                        | 6                   | 2                     | 1                   |

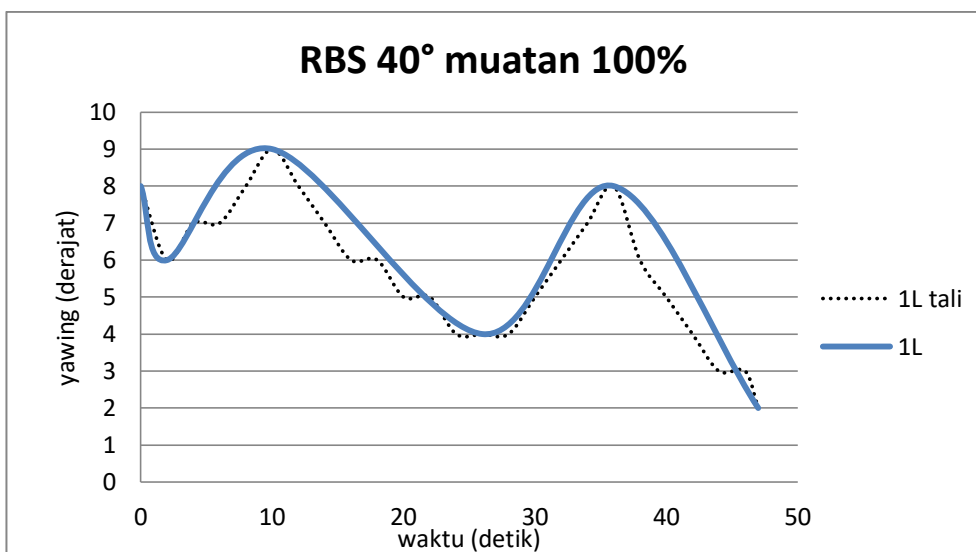


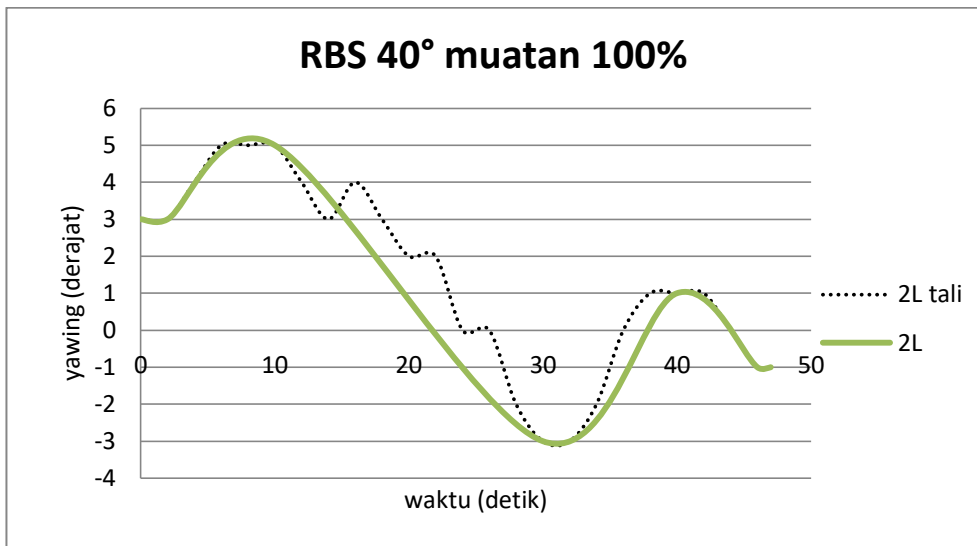
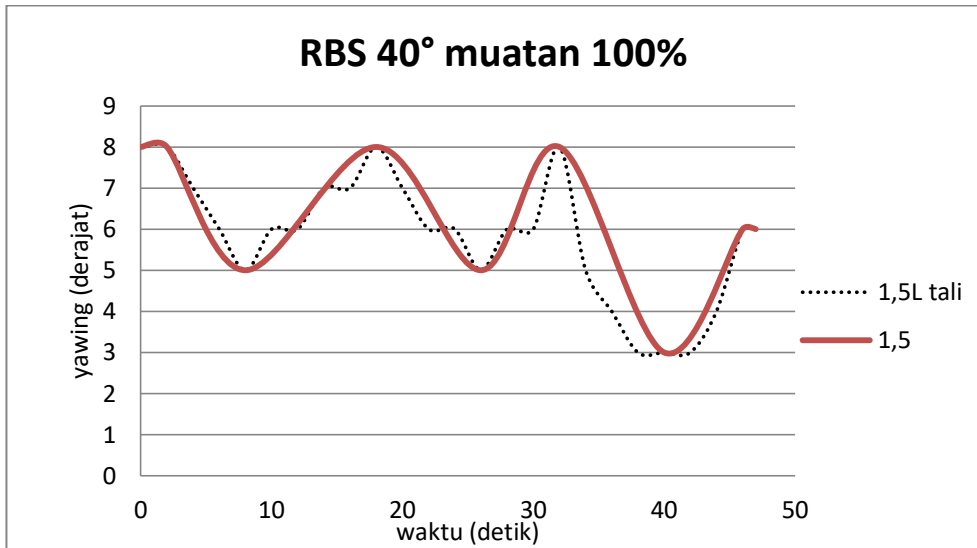


| Yawing RBS 40° muatan 100% |                     |                       |                     |
|----------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)              | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                          | 8                   | 8                     | 3                   |
| 2                          | 6                   | 8                     | 3                   |
| 4                          | 7                   | 7                     | 4                   |
| 6                          | 7                   | 6                     | 5                   |
| 8                          | 8                   | 5                     | 5                   |
| 10                         | 9                   | 6                     | 5                   |
| 12                         | 8                   | 6                     | 4                   |
| 14                         | 7                   | 7                     | 3                   |
| 16                         | 6                   | 7                     | 4                   |
| 18                         | 6                   | 8                     | 3                   |
| 20                         | 5                   | 7                     | 2                   |



| waktu (detik) | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
|---------------|---------------------|-----------------------|---------------------|
| 22            | 5                   | 6                     | 2                   |
| 24            | 4                   | 6                     | 0                   |
| 26            | 4                   | 5                     | 0                   |
| 28            | 4                   | 6                     | -2                  |
| 30            | 5                   | 6                     | -3                  |
| 32            | 6                   | 8                     | -3                  |
| 34            | 7                   | 5                     | -2                  |
| 36            | 8                   | 4                     | 0                   |
| 38            | 6                   | 3                     | 1                   |
| 40            | 5                   | 3                     | 1                   |
| 42            | 4                   | 3                     | 1                   |
| 44            | 3                   | 4                     | 0                   |
| 46            | 3                   | 6                     | -1                  |
| 47            | 2                   | 6                     | -1                  |

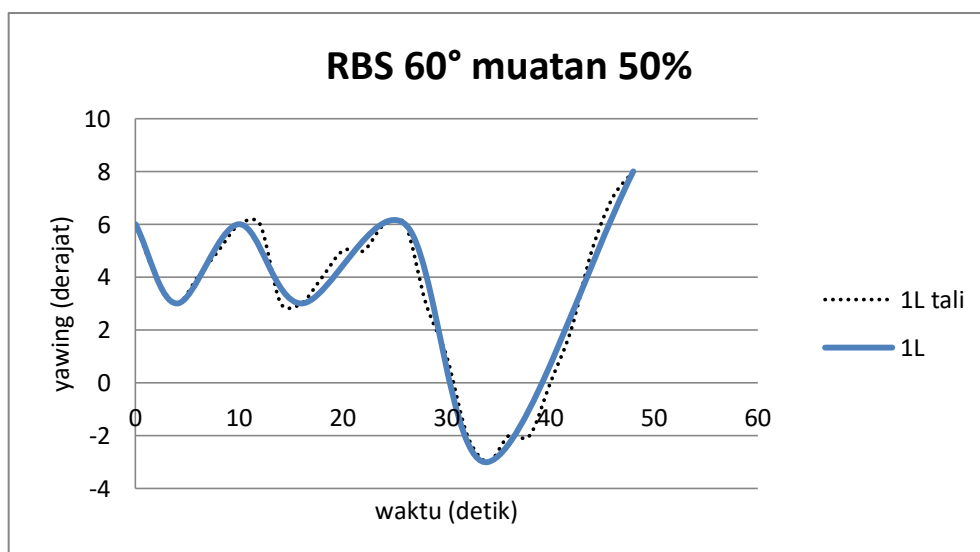


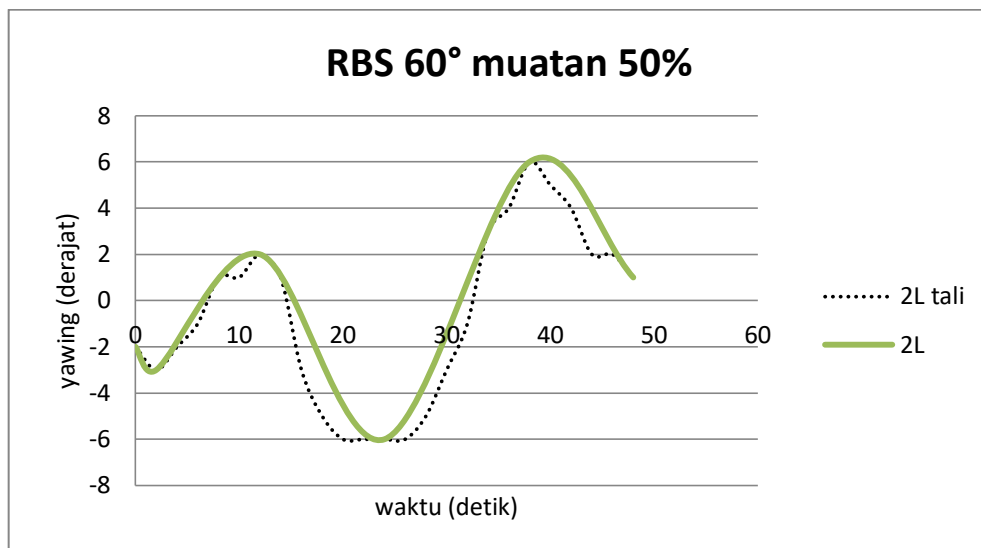
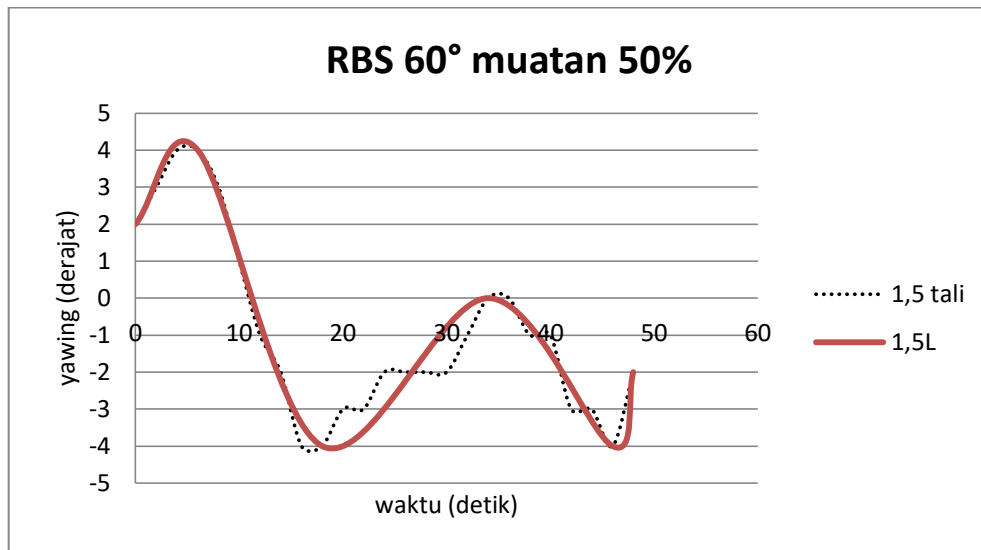


| Yawing RBS 60° muatan 50% |                     |                       |                     |
|---------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)             | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                         | 6                   | 2                     | -2                  |
| 2                         | 4                   | 3                     | -3                  |
| 4                         | 3                   | 4                     | -2                  |
| 6                         | 4                   | 4                     | -1                  |
| 8                         | 5                   | 3                     | 1                   |
| 10                        | 6                   | 1                     | 1                   |
| 12                        | 6                   | -1                    | 2                   |
| 14                        | 3                   | -2                    | 1                   |
| 16                        | 3                   | -4                    | -3                  |
| 18                        | 4                   | -4                    | -5                  |
| 20                        | 5                   | -3                    | -6                  |



| waktu (detik) | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
|---------------|---------------------|-----------------------|---------------------|
| 22            | 5                   | -3                    | -6                  |
| 24            | 6                   | -2                    | -6                  |
| 26            | 6                   | -2                    | -6                  |
| 28            | 3                   | -2                    | -5                  |
| 30            | 1                   | -2                    | -3                  |
| 32            | -2                  | -1                    | -1                  |
| 34            | -3                  | 0                     | 3                   |
| 36            | -2                  | 0                     | 4                   |
| 38            | -2                  | -1                    | 6                   |
| 40            | 0                   | -1                    | 5                   |
| 42            | 2                   | -3                    | 4                   |
| 44            | 5                   | -3                    | 2                   |
| 46            | 7                   | -4                    | 2                   |
| 48            | 8                   | -2                    | 1                   |



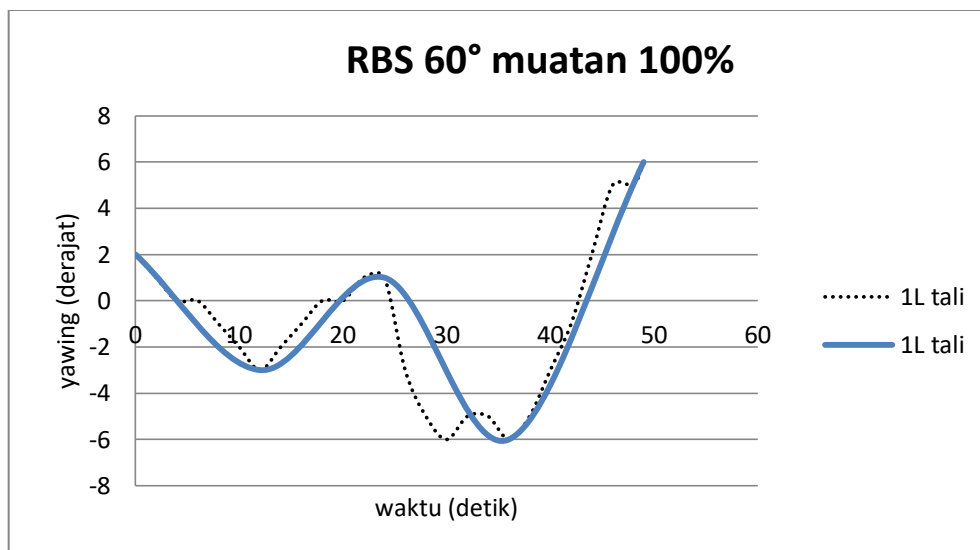


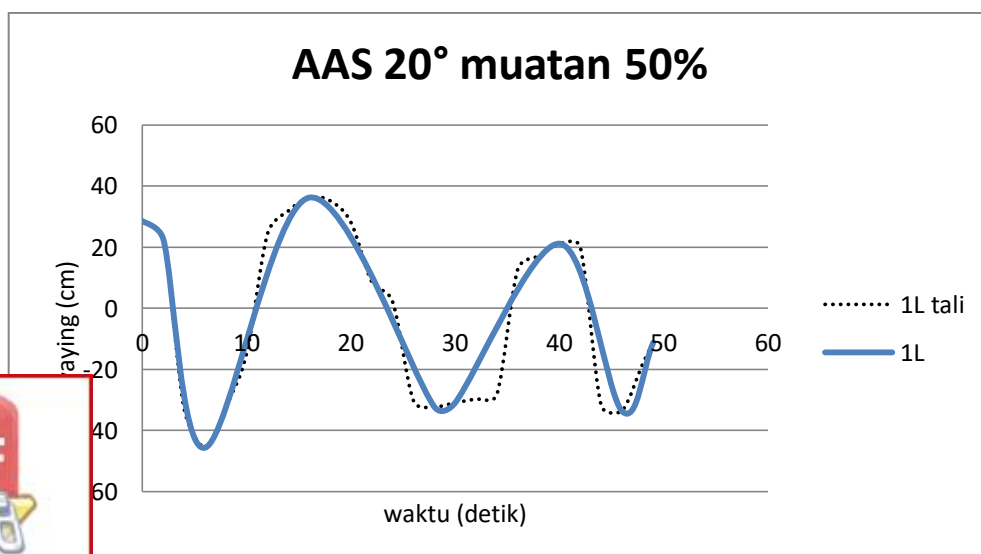
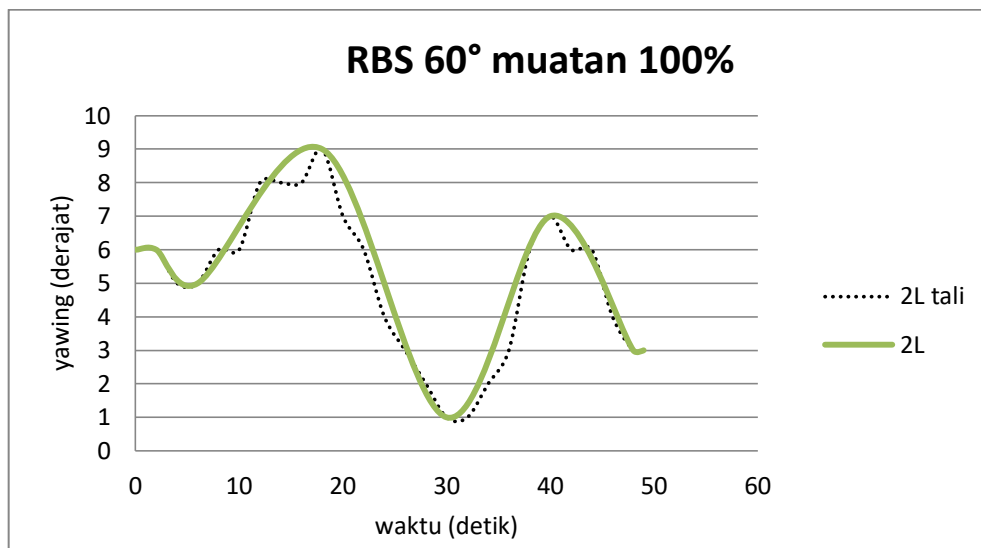
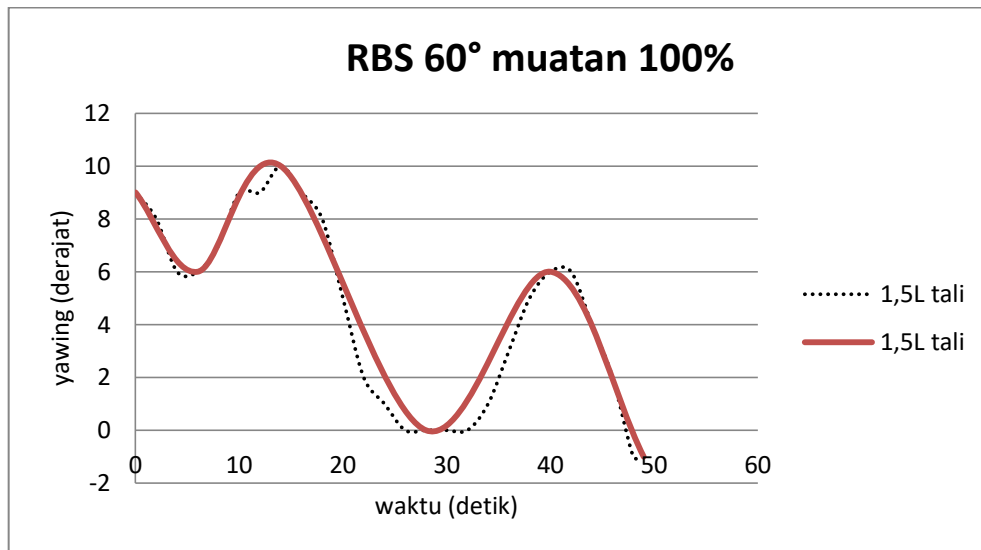
| Yawing RBS 60° muatan 100% |                     |                       |                     |
|----------------------------|---------------------|-----------------------|---------------------|
| waktu (detik)              | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
| 0                          | 2                   | 9                     | 6                   |
| 2                          | 1                   | 8                     | 6                   |
| 4                          | 0                   | 6                     | 5                   |
| 6                          | 0                   | 6                     | 5                   |
| 8                          | -1                  | 7                     | 6                   |
| 10                         | -2                  | 9                     | 6                   |
| 12                         | -3                  | 9                     | 8                   |
| 14                         | -2                  | 10                    | 8                   |
| 16                         | -1                  | 9                     | 8                   |
| 18                         | 0                   | 8                     | 9                   |
| 20                         | 0                   | 5                     | 7                   |

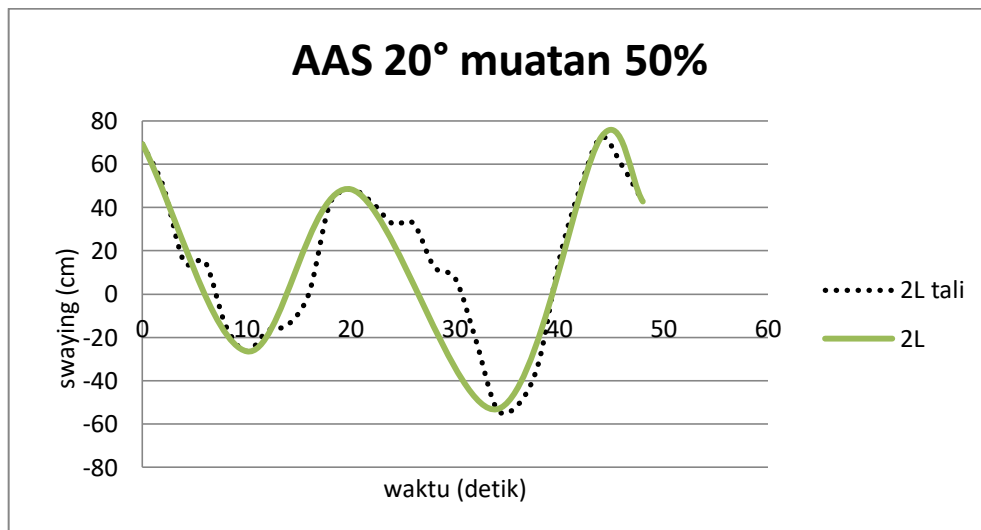
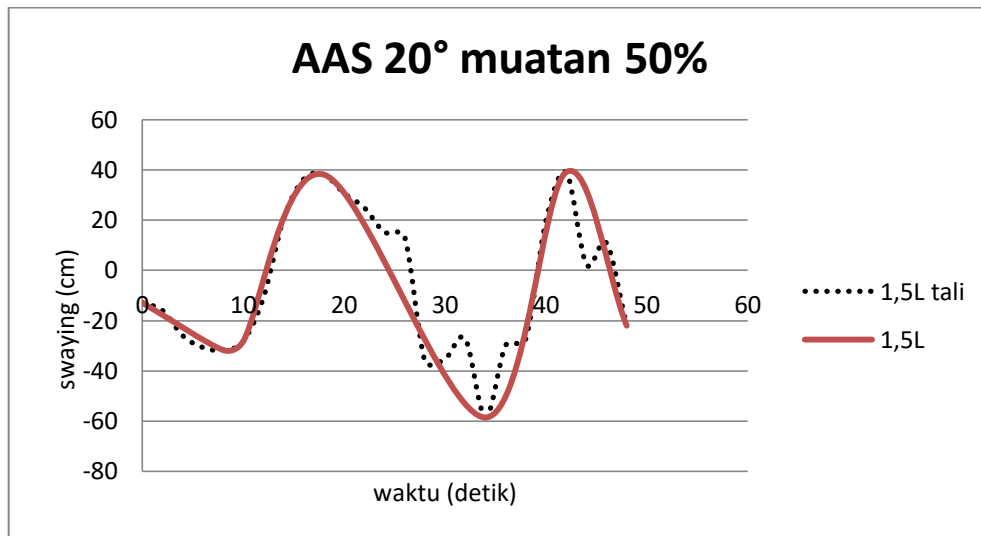




| waktu (detik) | 1L panjang tali (°) | 1,5L panjang tali (°) | 2L panjang tali (°) |
|---------------|---------------------|-----------------------|---------------------|
| 22            | 1                   | 2                     | 6                   |
| 24            | 1                   | 1                     | 4                   |
| 26            | -3                  | 0                     | 3                   |
| 28            | -5                  | 0                     | 2                   |
| 30            | -6                  | 0                     | 1                   |
| 32            | -5                  | 0                     | 1                   |
| 34            | -5                  | 1                     | 2                   |
| 36            | -6                  | 3                     | 3                   |
| 38            | -5                  | 5                     | 6                   |
| 40            | -3                  | 6                     | 7                   |
| 42            | -1                  | 6                     | 6                   |
| 44            | 2                   | 4                     | 6                   |
| 46            | 5                   | 2                     | 4                   |
| 48            | 5                   | -1                    | 3                   |
| 49            | 6                   | -1                    | 3                   |



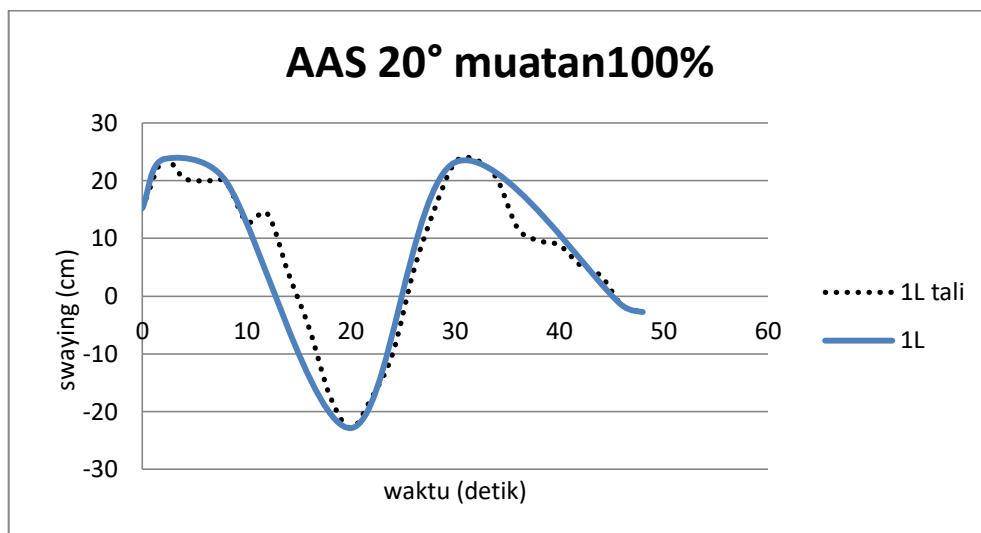


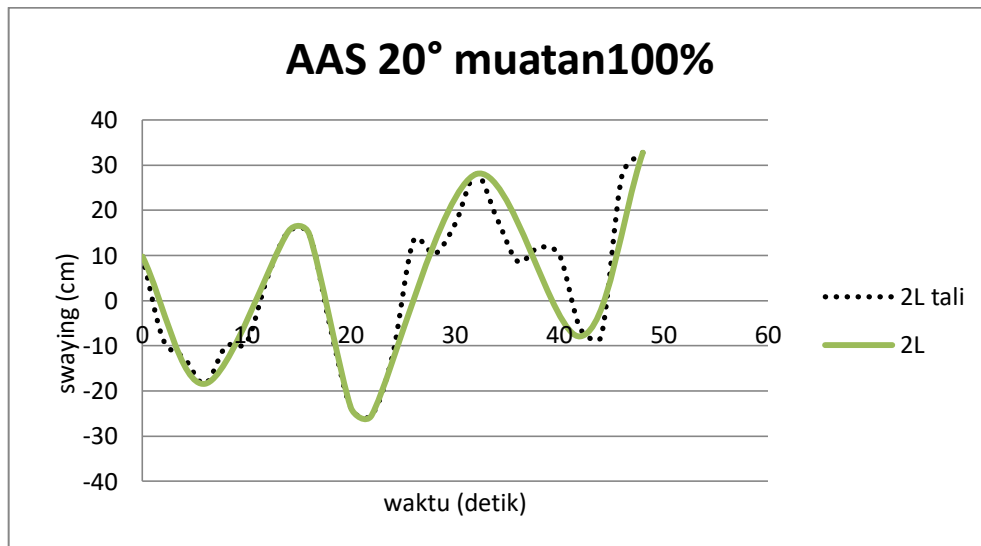
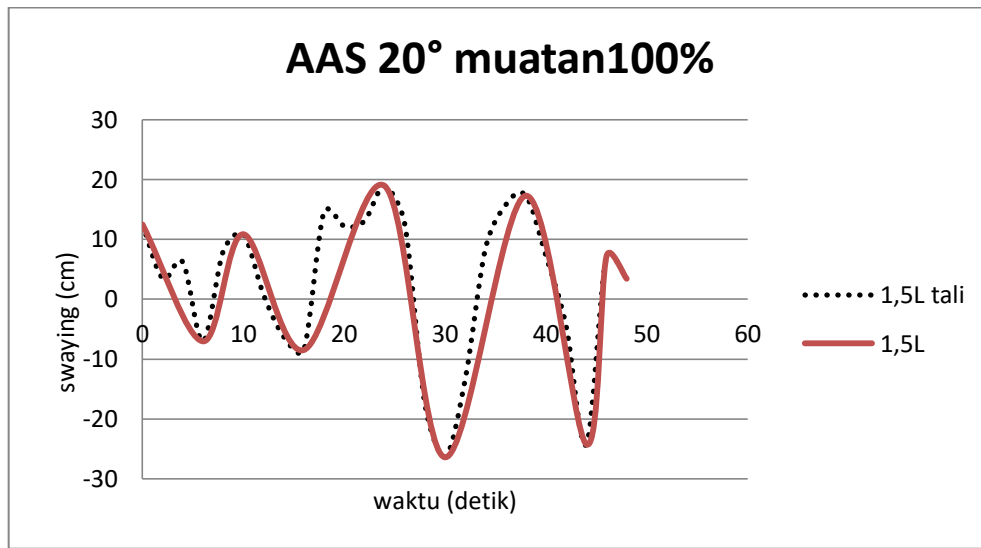


| Swaying AAS 20° muatan 100% |                      |                        |                      |
|-----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)               | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                           | 15.28                | 12.49                  | 9.76                 |
| 2                           | 23.69                | 3.5                    | -8.71                |
| 4                           | 20.4                 | 6.18                   | -12.68               |
| 6                           | 19.92                | -7.03                  | -18.4                |
| 8                           | 19.69                | 8.02                   | -10.07               |
| 10                          | 12.9                 | 10.87                  | -9.2                 |
| 12                          | 14.23                | 0.75                   | 5.18                 |
| 14                          | 3.95                 | -6.25                  | 15.32                |
| 16                          | -5.58                | -8.48                  | 14.71                |
| 18                          | -17.34               | 14.63                  | -5.79                |
| 20                          | -22.84               | 12.18                  | -23.72               |
| 22                          | -17.52               | 13.08                  | -25.33               |



| waktu (detik) | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
|---------------|----------------------|------------------------|----------------------|
| 24            | -9.95                | 18.94                  | -12.05               |
| 26            | 4.31                 | 12.57                  | 13.28                |
| 28            | 14.97                | -17.53                 | 10.27                |
| 30            | 23.18                | -26.41                 | 16.99                |
| 32            | 23.59                | -13.32                 | 28                   |
| 34            | 20.33                | 8.46                   | 18.24                |
| 36            | 11.75                | 15.75                  | 8.67                 |
| 38            | 9.61                 | 17.31                  | 11.8                 |
| 40            | 8.82                 | 7.22                   | 10.09                |
| 42            | 5.36                 | -4.51                  | -6.25                |
| 44            | 3.48                 | -24.24                 | -7.92                |
| 46            | -1.57                | 7.17                   | 27.7                 |
| 48            | -2.74                | 3.43                   | 32.75                |

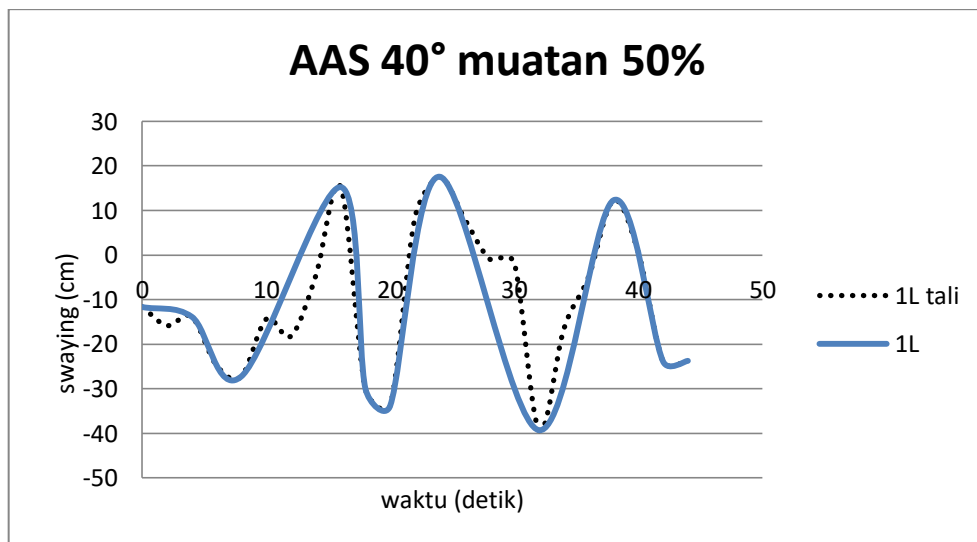


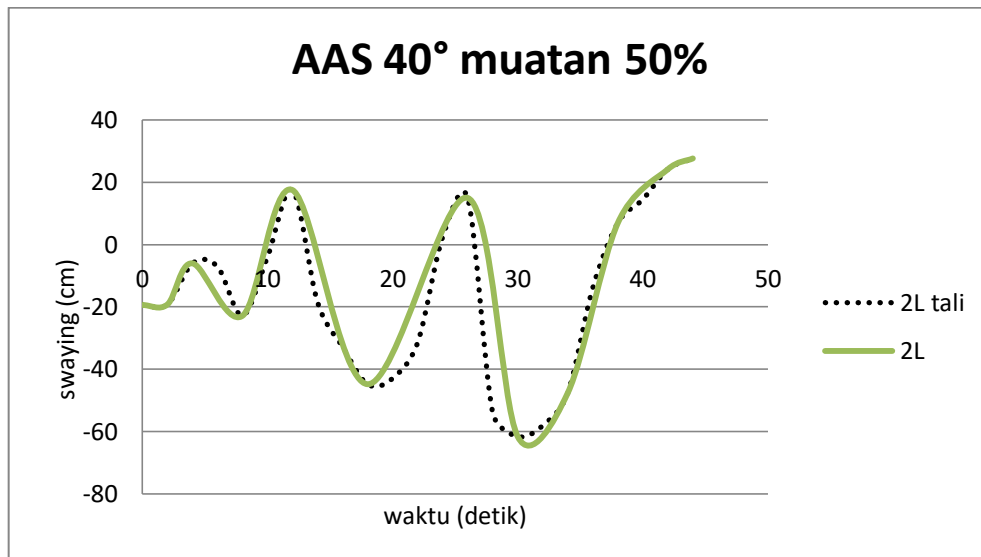
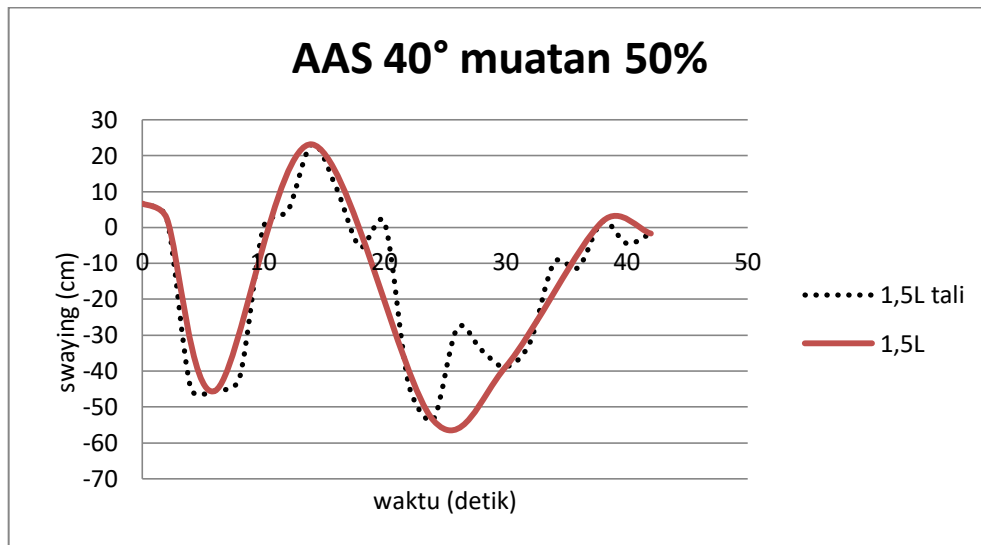


| Swaying AAS 40° muatan 50% |                      |                        |                      |
|----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)              | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                          | -11.666              | 6.654                  | -19.3966             |
| 2                          | -15.816              | 2.571                  | -19.1901             |
| 4                          | -13.862              | -44.9146               | -6.0295              |
| 6                          | -24.808              | -45.4915               | -7.0941              |
| 8                          | -27.227              | -42.1425               | -22.8297             |
| 10                         | -14.391              | 0.1733                 | -3.8741              |
| 12                         | -18.166              | 4.5519                 | 17.4664              |
|                            | -4.608               | 23.1448                | -18.5477             |
|                            | 15.24                | 11.1562                | -32.8382             |
|                            | -30.034              | -5.5317                | -44.8041             |
|                            | -33.789              | 1.3212                 | -42.9286             |



| waktu (detik) | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
|---------------|----------------------|------------------------|----------------------|
| 22            | 8.453                | -43.8646               | -31.4608             |
| 24            | 17.56                | -53.6035               | 2.4729               |
| 26            | 8.096                | -28.1054               | 14.968               |
| 28            | -0.885               | -34.1311               | -53.9988             |
| 30            | -1.765               | -38.8284               | -61.6088             |
| 32            | -39.307              | -32.1241               | -58.073              |
| 34            | -16.593              | -9.8182                | -47.6022             |
| 36            | -4.865               | -11.1672               | -13.8908             |
| 38            | 12.281               | 1.6585                 | 6.9052               |
| 40            | 0.617                | -4.4304                | 14.4852              |
| 42            | -23.89               | -1.69                  | 24.1521              |
| 44            | -23.746              |                        | 27.6339              |

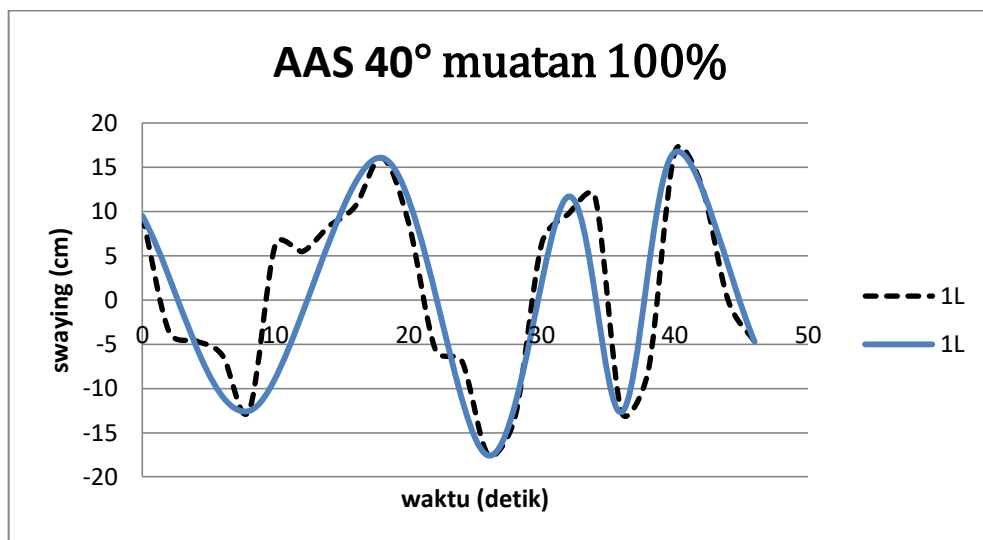




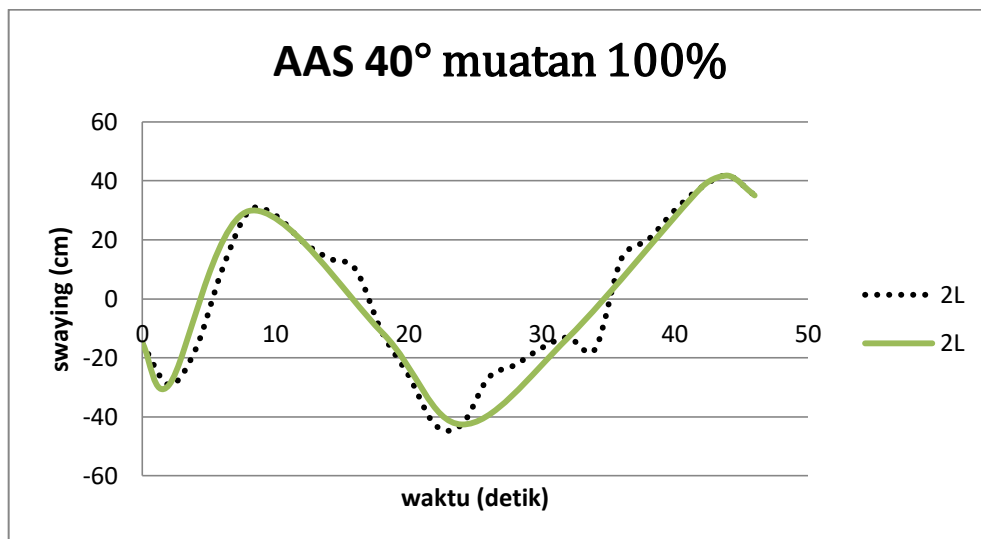
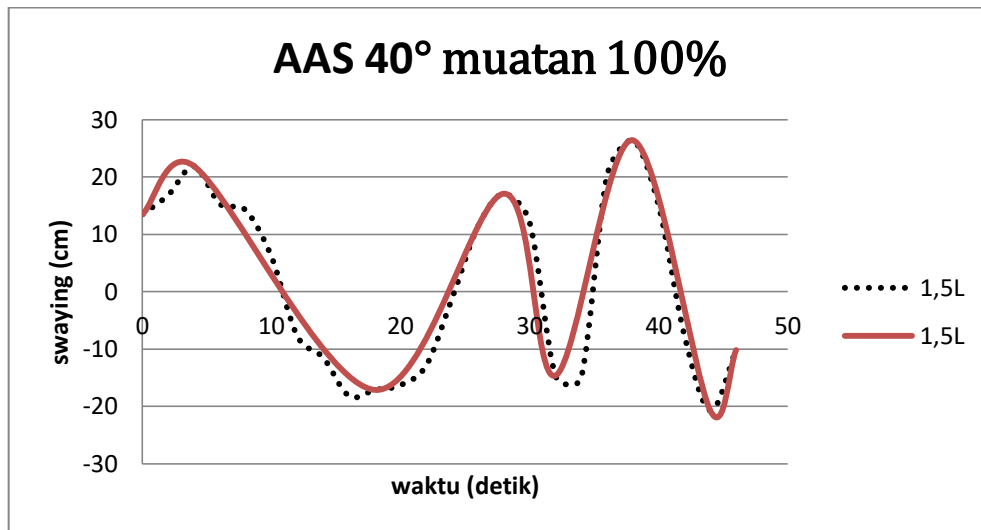
| Swaying AAS 40° muatan 100% |                      |                        |                      |
|-----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)               | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                           | 9.47                 | 13.5                   | -15.13               |
| 2                           | -3.62                | 16.87                  | -29.14               |
| 4                           | -4.62                | 21.89                  | -17.03               |
| 6                           | -6.26                | 15.31                  | 10.07                |
| 8                           | -12.55               | 14.19                  | 29.8                 |
| 10                          | 6.34                 | 6.07                   | 28.26                |
| 12                          | 5.46                 | -7.78                  | 19.54                |
| 14                          | 8.31                 | -11.47                 | 13.75                |
| 16                          | 10.61                | -18.17                 | 10.07                |
| 18                          | 16.06                | -17.12                 | -11.37               |
| 20                          | 8.69                 | -16.29                 | -25.94               |



| waktu (detik) | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
|---------------|----------------------|------------------------|----------------------|
| 22            | -5.58                | -12.82                 | -42.8                |
| 24            | -6.91                | -1.09                  | -42.56               |
| 26            | -17.59               | 11.41                  | -26.74               |
| 28            | -13.22               | 17.1                   | -22.38               |
| 30            | 6.38                 | 12.1                   | -16.63               |
| 32            | 9.7                  | -14.63                 | -13.06               |
| 34            | 11.68                | -14.95                 | -17.1                |
| 36            | -12.68               | 20.23                  | 13.71                |
| 38            | -8.07                | 26.42                  | 20.07                |
| 40            | 16.69                | 15                     | 30.08                |
| 42            | 13                   | -7.64                  | 37.8                 |
| 44            | 0                    | -20.72                 | 41.78                |
| 46            | -4.73                | -10.18                 | 35.07                |



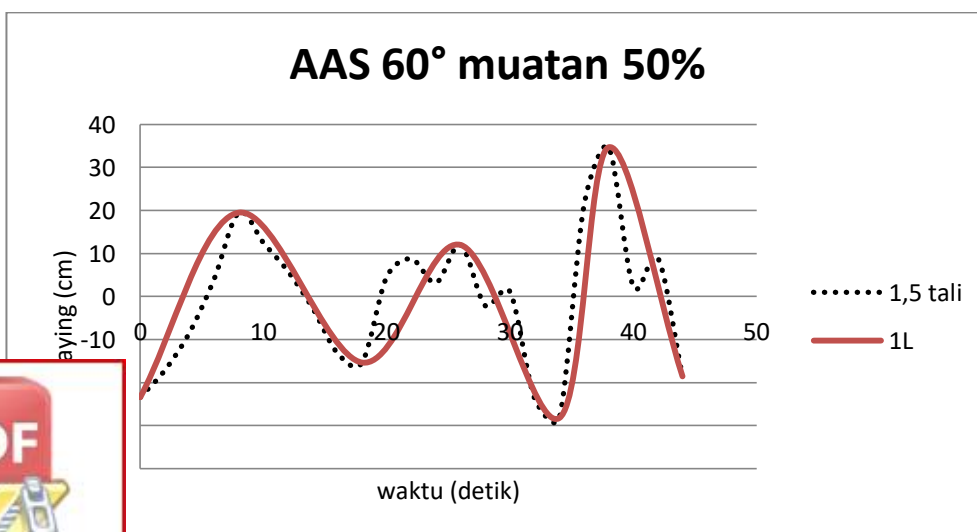
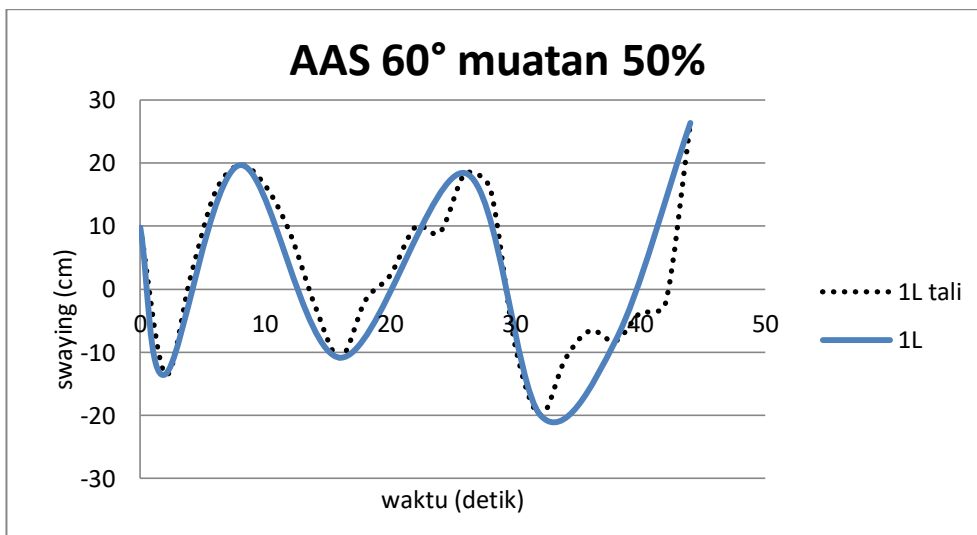


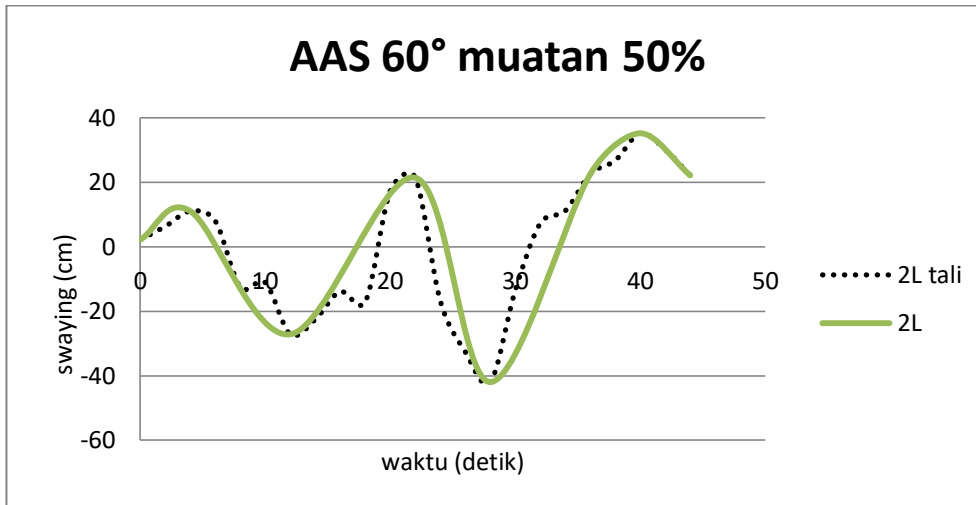


| Swaying AAS 60° muatan 50% |                      |                        |                      |
|----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)              | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                          | 9.7623               | swaying                | swaying              |
| 2                          | -13.5015             | -23.4293               | 2.1889               |
| 4                          | 1.757                | -17.131                | 6.2958               |
| 6                          | 15.4081              | -8.3661                | 11.033               |
| 8                          | 19.6806              | 4.094                  | 7.9685               |
| 10                         | 16.4146              | 19.5057                | -12.5214             |
| 12                         | 8.7839               | 12.4655                | -11.1171             |
|                            | -2.755               | 5.7923                 | -27.144              |
|                            | -10.8708             | -2.7675                | -22.522              |
|                            | -1.795               | -13.1832               | -13.7877             |
|                            | 2.2425               | -15.3655               | -17.164              |
|                            | 9.8464               | 4.5824                 | 17.3164              |



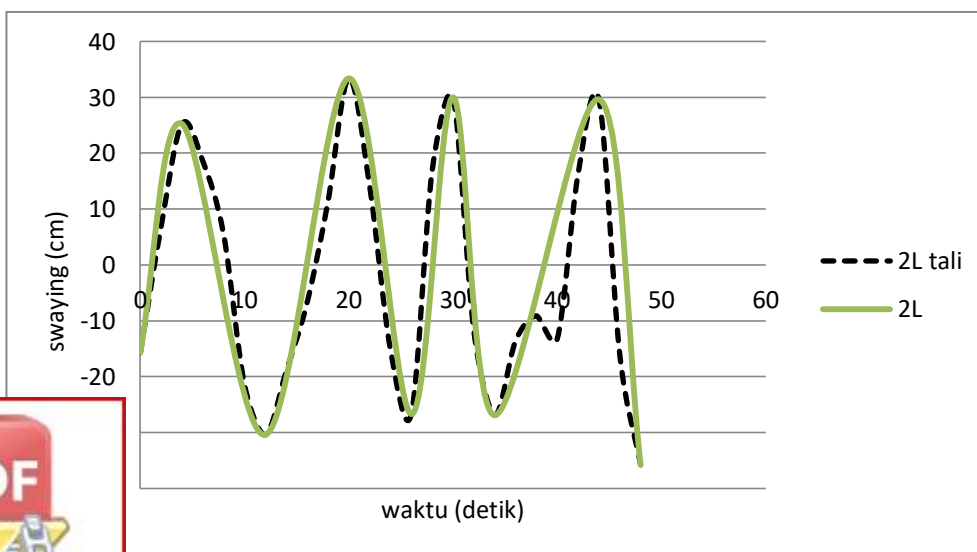
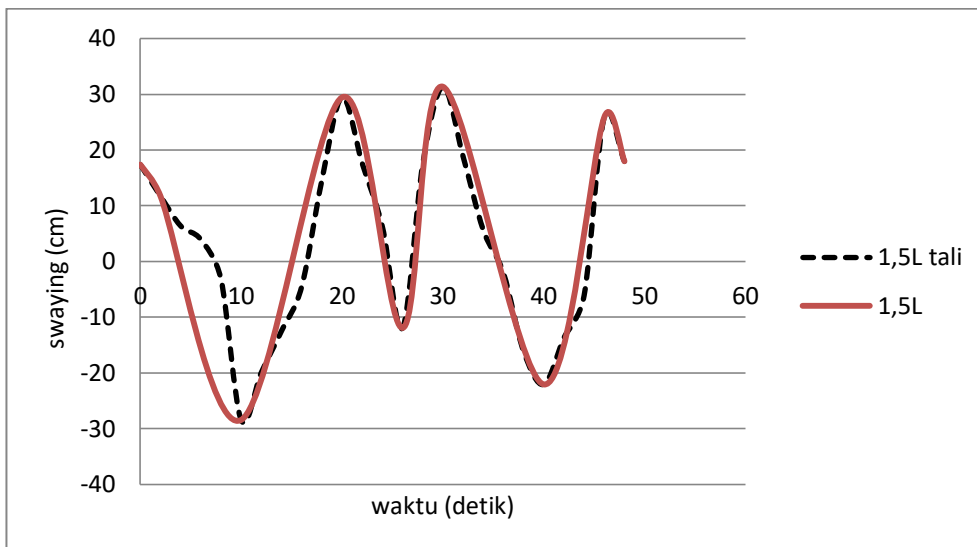
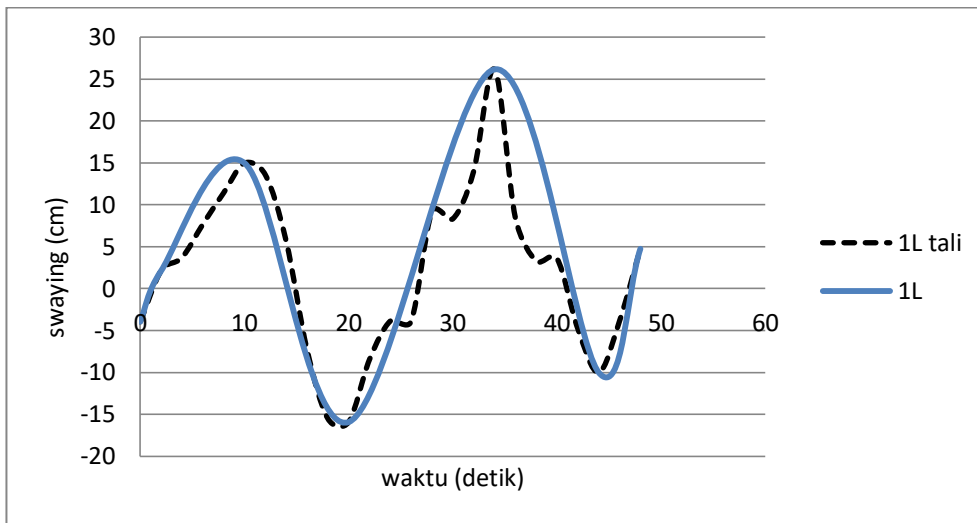
| waktu (detik) | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
|---------------|----------------------|------------------------|----------------------|
| 24            | 9.1019               | 8.7588                 | 21.421               |
| 26            | 18.391               | 3.1783                 | -16.757              |
| 28            | 15.8666              | 11.9791                | -32.5873             |
| 30            | -9.1197              | -2.1566                | -41.9615             |
| 32            | -19.975              | 1.0812                 | -13.5019             |
| 34            | -11.057              | -23.7317               | 7.2157               |
| 36            | -6.5659              | -28.2665               | 11.135               |
| 38            | -8.2135              | 21.0943                | 22.5242              |
| 40            | -3.7156              | 34.6923                | 26.7584              |
| 42            | -2.3003              | 2.3622                 | 35.1726              |
| 44            | 26.3581              | 8.9497                 | 30.0932              |
| 46            |                      | -18.5753               | 22.1189              |



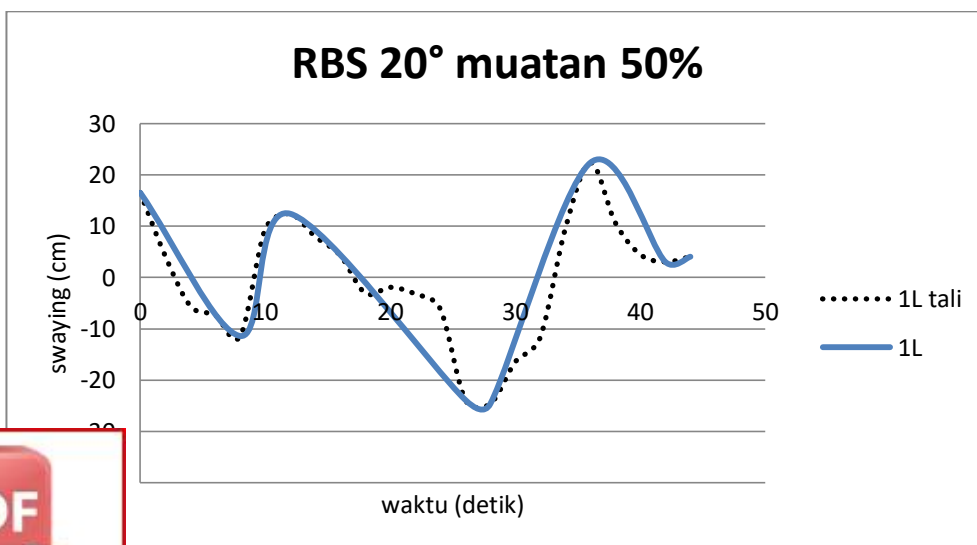


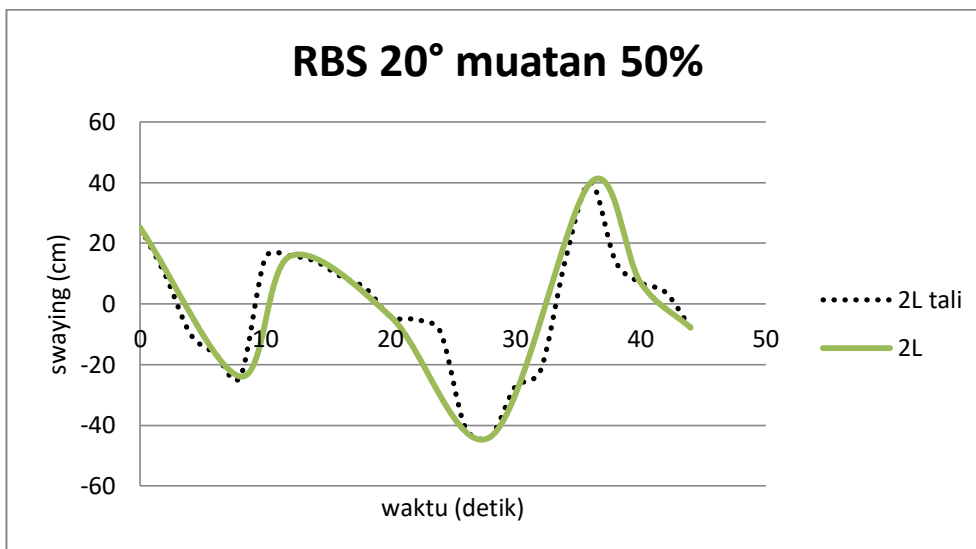
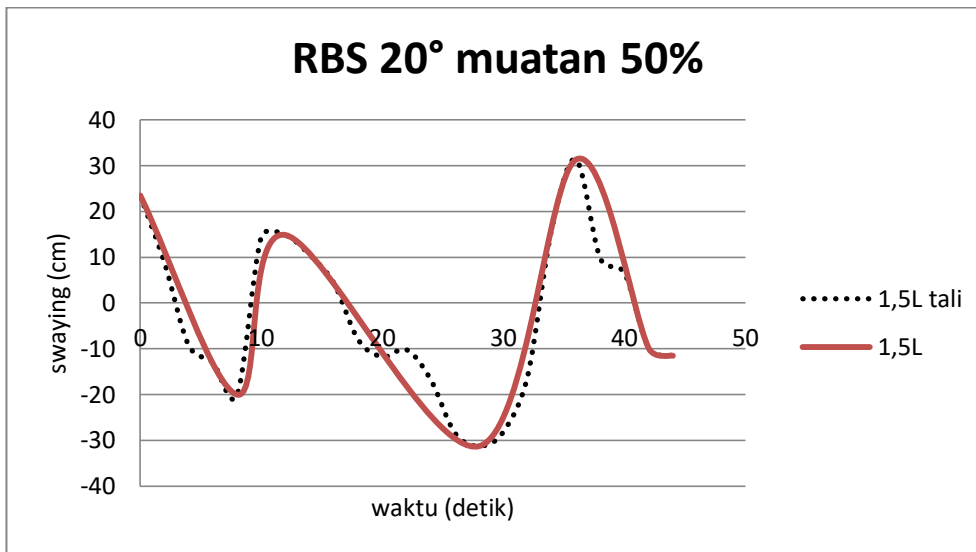
| Swaying AAS 60° muatan 100% |                      |                        |                      |
|-----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)               | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                           | -3.95                | 17.39                  | -15.73               |
| 2                           | 2.12                 | 11.74                  | 6.89                 |
| 4                           | 3.7                  | 6.39                   | 25.23                |
| 6                           | 7.67                 | 3.95                   | 18.56                |
| 8                           | 11.42                | -3.17                  | 5.39                 |
| 10                          | 14.98                | -28.42                 | -21.45               |
| 12                          | 13.58                | -19.91                 | -30.41               |
| 14                          | 5.68                 | -12.46                 | -19.05               |
| 16                          | -7.27                | -4.52                  | -6.79                |
| 18                          | -15.5                | 14.56                  | 11.27                |
| 20                          | -15.92               | 29.45                  | 33.39                |
| 22                          | -8.46                | 17.62                  | 14.17                |
| 24                          | -3.87                | 6.23                   | -15.14               |
| 26                          | -3.9                 | -11.92                 | -26.7                |
| 28                          | 9.22                 | 17.43                  | 16.84                |
| 30                          | 8.32                 | 31.36                  | 29.99                |
| 32                          | 14.01                | 18.86                  | -11.81               |
| 34                          | 26.15                | 5.66                   | -26.9                |
| 36                          | 8.45                 | -2.04                  | -13.65               |
| 38                          | 3.26                 | -16.1                  | -9.12                |
| 40                          | 3.57                 | -22.05                 | -13.26               |
| 42                          | -4.8                 | -13.69                 | 16.24                |
| 44                          | -10                  | -6.1                   | 29.62                |
| 46                          | -3.85                | 25.89                  | -16.02               |
| 48                          | 4.75                 | 17.98                  | -35.78               |





| Swaying RBS 20° muatan 50% |                      |                        |                      |
|----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)              | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                          | 16.5179              | 23.4482                | 25.0478              |
| 2                          | 4.1703               | 8.7803                 | 9.5373               |
| 4                          | -5.5416              | -9.2579                | -9.8766              |
| 6                          | -7.3582              | -13.0282               | -16.4456             |
| 8                          | -11.4112             | -20.0077               | -23.9457             |
| 10                         | 9.4604               | 14.449                 | 15.1972              |
| 12                         | 12.419               | 14.8334                | 15.7901              |
| 14                         | 7.9606               | 10.4752                | 14.0576              |
| 16                         | 4.2856               | 4.2847                 | 9.1112               |
| 18                         | -3.0805              | -7.9972                | 5.198                |
| 20                         | -1.9096              | -11.7369               | -4.1076              |
| 22                         | -3.2268              | -10.2091               | -5.2015              |
| 24                         | -6.1679              | -16.7644               | -9.2536              |
| 26                         | -23.8732             | -28.3868               | -40.9043             |
| 28                         | -24.6137             | -31.2391               | -43.8172             |
| 30                         | -16.4428             | -28.1022               | -27.1649             |
| 32                         | -11.606              | -15.9799               | -21.9524             |
| 34                         | 9.5634               | 16.3079                | 14.6855              |
| 36                         | 22.3765              | 31.3078                | 39.9998              |
| 38                         | 10.6606              | 9.7387                 | 13.9552              |
| 40                         | 4.4544               | 6.5686                 | 6.9813               |
| 42                         | 3.0396               | -9.853                 | 3.7815               |
| 44                         | 4.0484               | -11.5192               | -7.8743              |

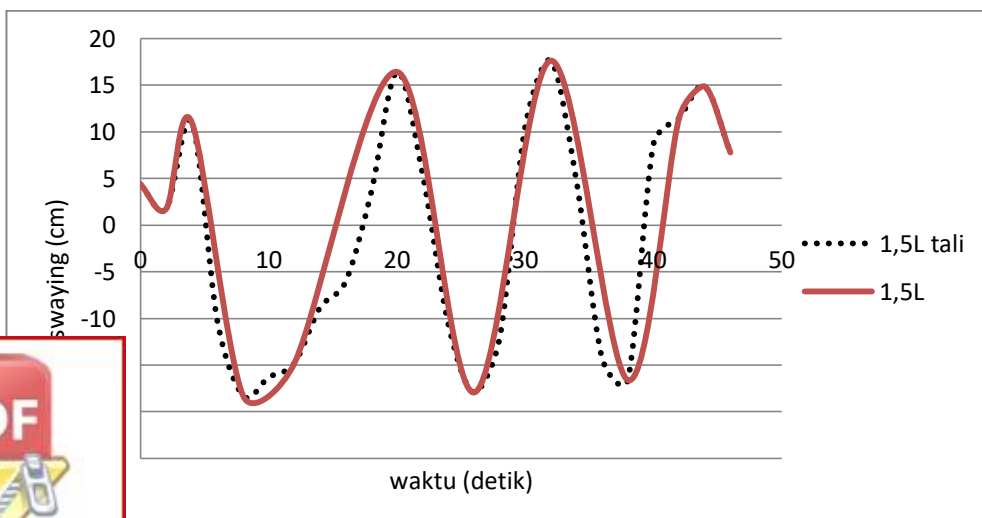
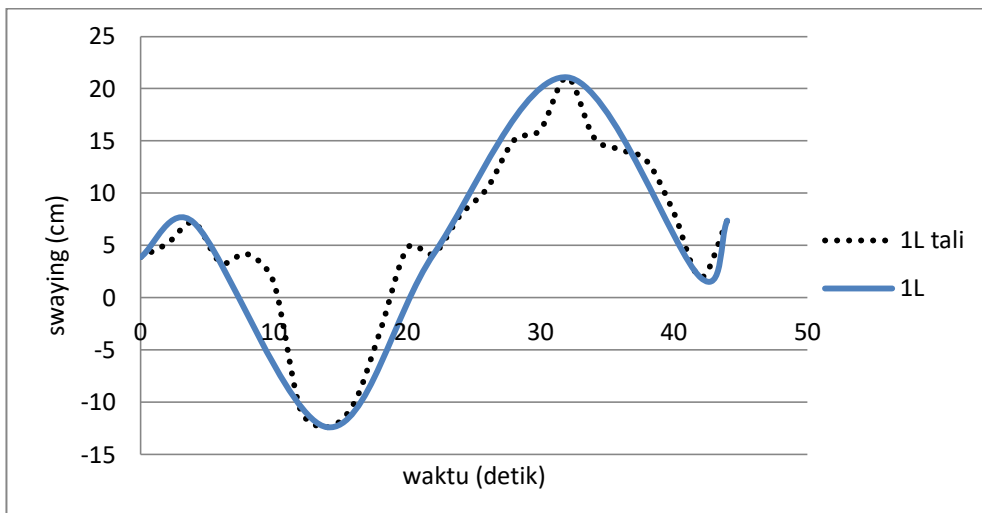


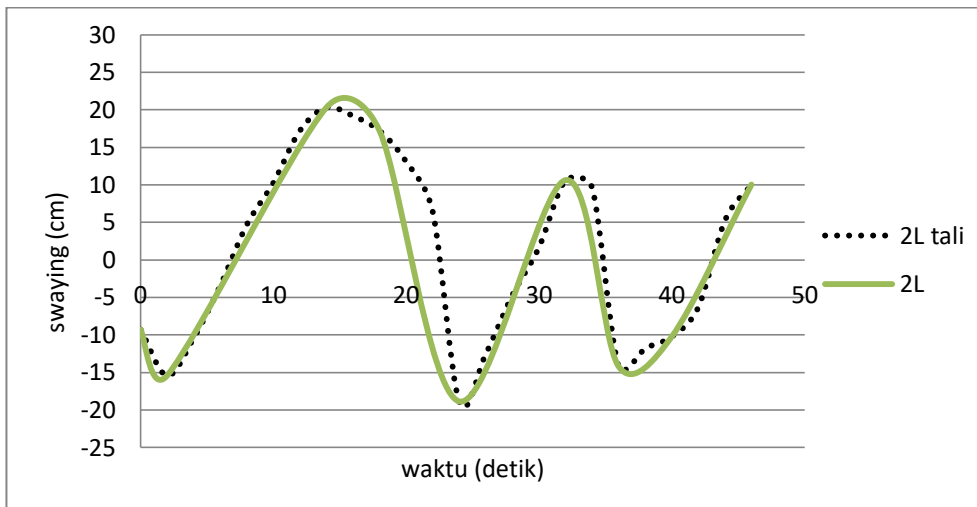


| Swaying RBS 20° muatan 100% |                      |                        |                      |
|-----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)               | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                           | 3.88                 | 4.35                   | -9.28                |
| 2                           | 5.18                 | 1.74                   | -15.42               |
| 4                           | 7.18                 | 10.99                  | -10.42               |
| 6                           | 3.37                 | -10.34                 | -3.44                |
| 8                           | 4.18                 | -18.3                  | 4.69                 |
| 10                          | 1.42                 | -16.31                 | 10.27                |
| 12                          | -10.75               | -14.8                  | 17.23                |
| 14                          | -12.39               | -8.83                  | 20.32                |
| 16                          | -10.13               | -6.04                  | 19.19                |
| 18                          | -3.09                | 3.57                   | 17.21                |
| 20                          | 4.73                 | 16.42                  | 13.1                 |



| waktu (detik) | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
|---------------|----------------------|------------------------|----------------------|
| 22            | 4.21                 | 5.44                   | 6.44                 |
| 24            | 7.94                 | -10.58                 | -18.86               |
| 26            | 10.48                | -17.94                 | -12.53               |
| 28            | 15.05                | -12.13                 | -4.69                |
| 30            | 16.09                | 10.54                  | 1.66                 |
| 32            | 21.09                | 17.62                  | 10.64                |
| 34            | 15.34                | 4.69                   | 9.63                 |
| 36            | 14.16                | -14.3                  | -14.19               |
| 38            | 13.03                | -16.61                 | -11.78               |
| 40            | 8.13                 | 8.64                   | -10.23               |
| 42            | 1.93                 | 11.46                  | -6.31                |
| 44            | 7.38                 | 14.86                  | 5.22                 |
| 46            |                      | 7.78                   | 10.05                |

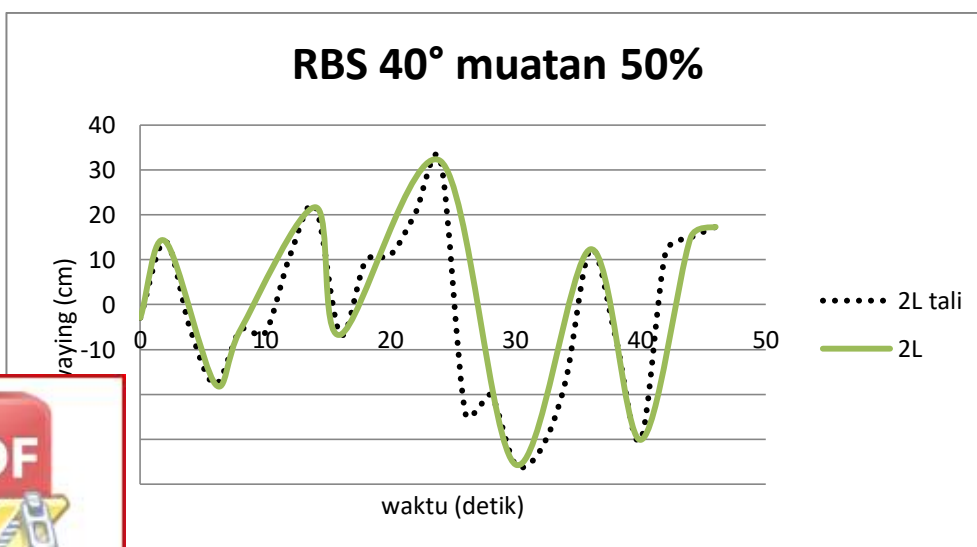
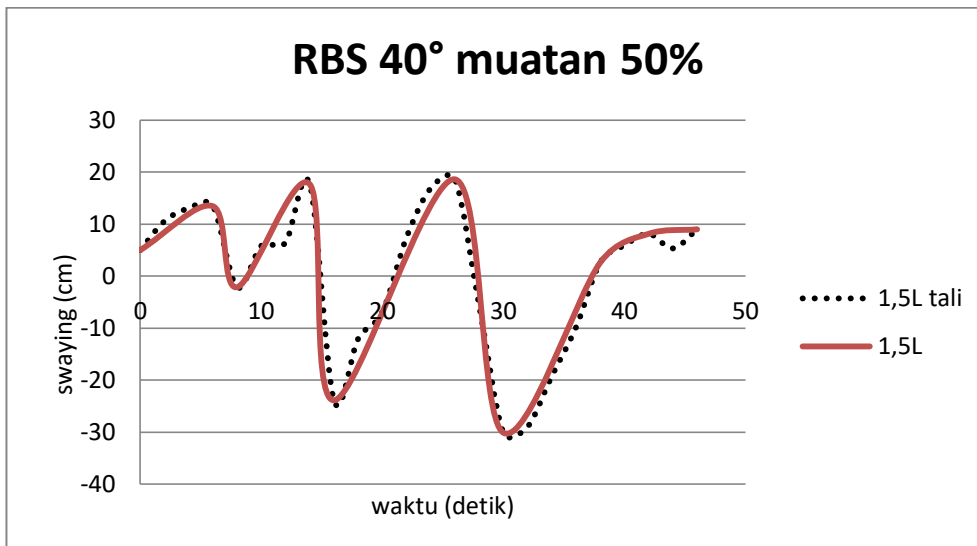
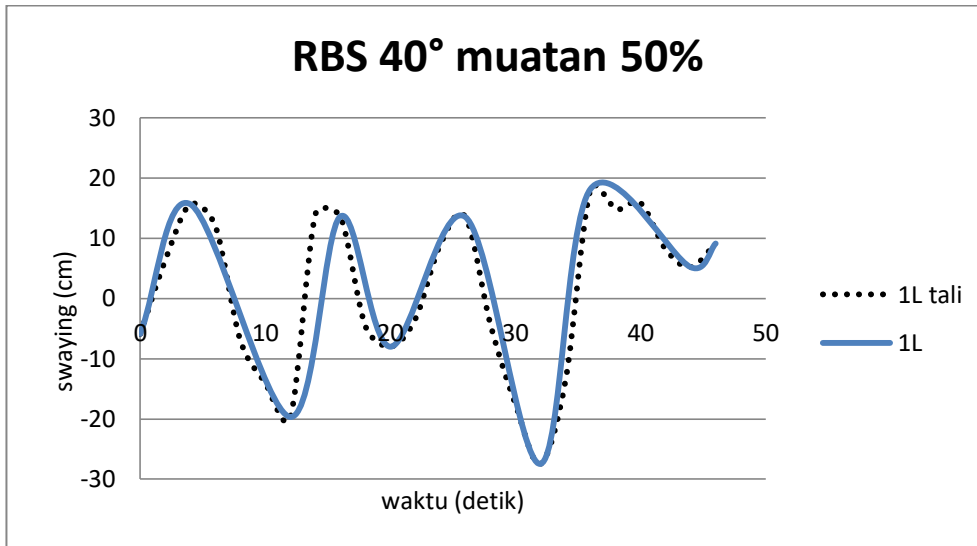




| Swaying RBS 40° muatan 50% |                      |                        |                      |
|----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)              | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                          | -5.87                | 5.03                   | -2.94                |
| 2                          | 6.35                 | 10.58                  | 14.11                |
| 4                          | 15.65                | 13.06                  | -5.48                |
| 6                          | 12.01                | 13.45                  | -17.73               |
| 8                          | -6.95                | -2.12                  | -5.64                |
| 10                         | -14.05               | 5.84                   | -6.19                |
| 12                         | -19.67               | 6.48                   | 11.15                |
| 14                         | 13.96                | 17.68                  | 21.7                 |
| 16                         | 13.62                | -23.87                 | -6.7                 |
| 18                         | -4.61                | -12.04                 | 9.6                  |
| 20                         | -8.01                | -6.88                  | 11.03                |
| 22                         | -3.36                | 7.5                    | 20.41                |
| 24                         | 9.02                 | 16.91                  | 32                   |
| 26                         | 13.51                | 18.62                  | -24.31               |
| 28                         | -4.33                | -5.72                  | -20.08               |
| 30                         | -17.6                | -30.11                 | -35.63               |
| 32                         | -27.45               | -28.94                 | -32.38               |
| 34                         | -13.58               | -19.2                  | -17.09               |
| 36                         | 18.18                | -9.83                  | 12.34                |
| 38                         | 14.79                | 2.62                   | -7.25                |
| 40                         | 15.83                | 5.94                   | -30.14               |
| 42                         | 8.17                 | 8.14                   | 11.61                |
|                            | 5.2                  | 5.34                   | 14.93                |
|                            | 9.12                 | 9.01                   | 17.31                |

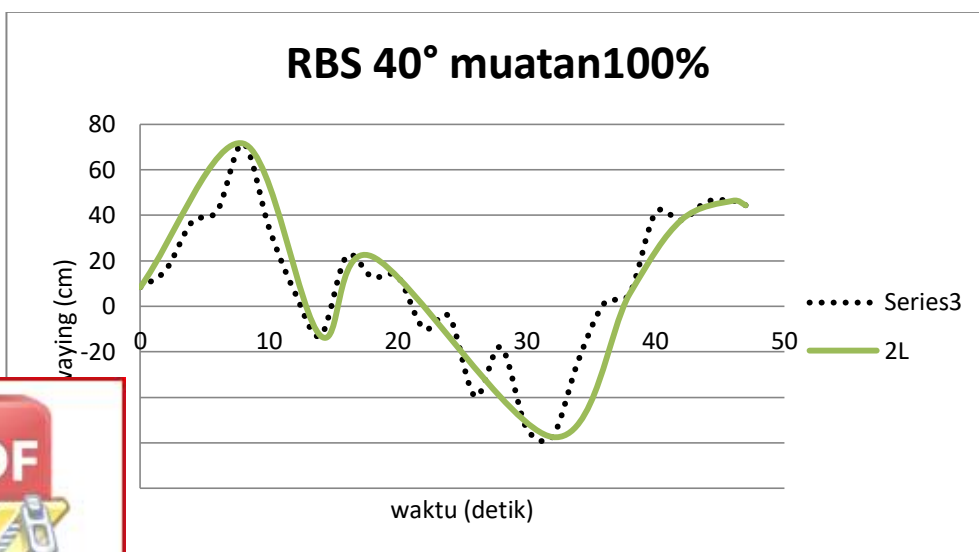
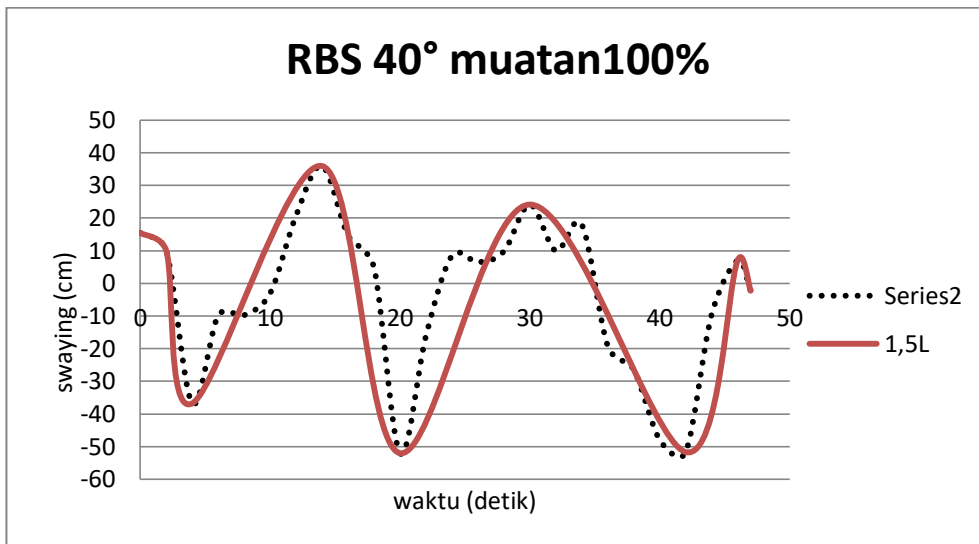
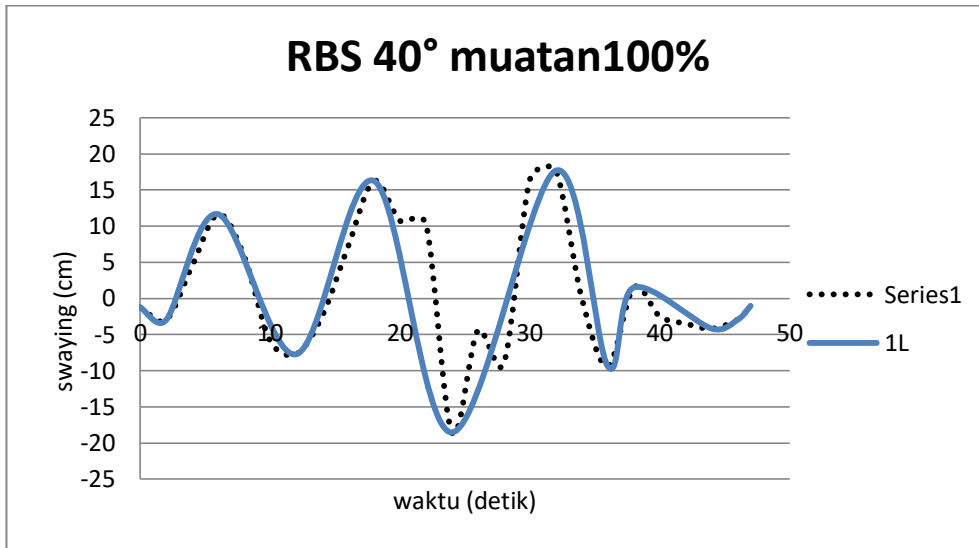






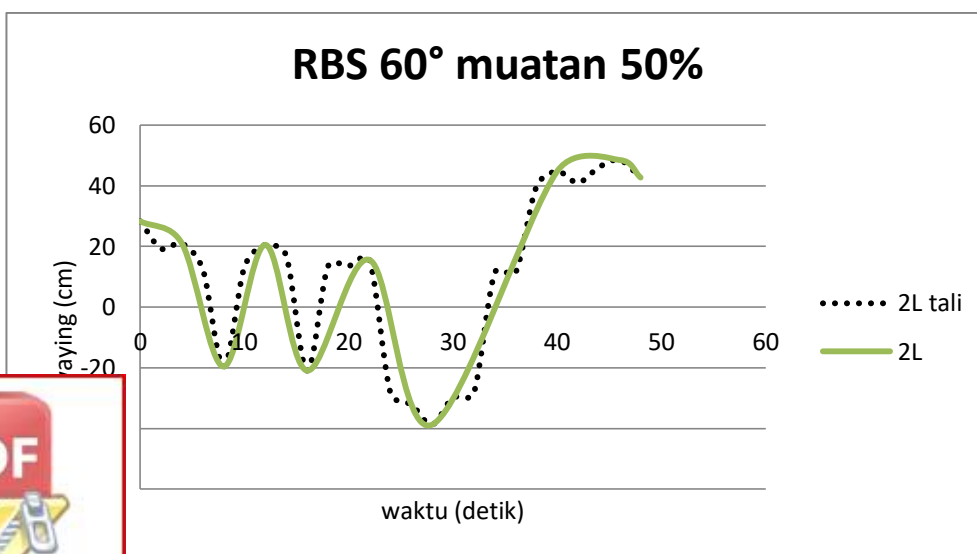
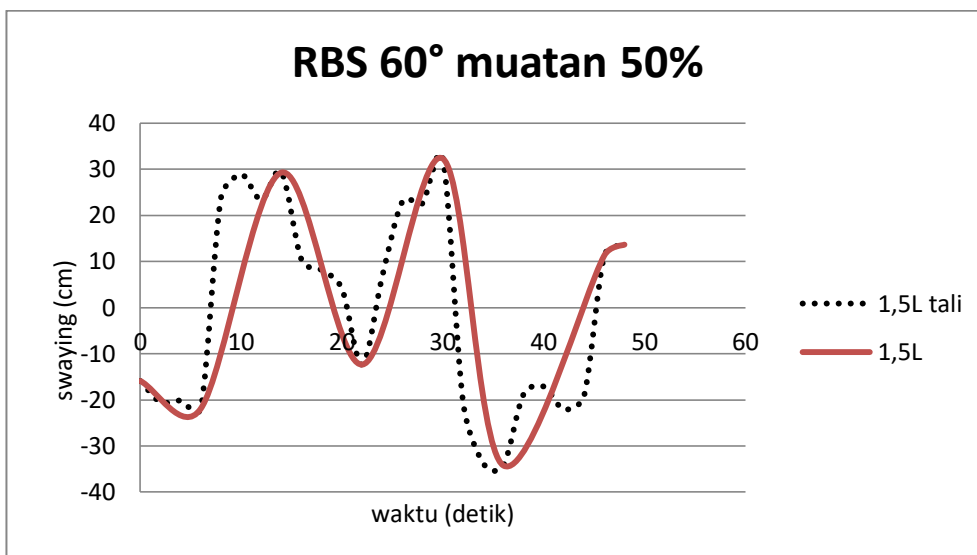
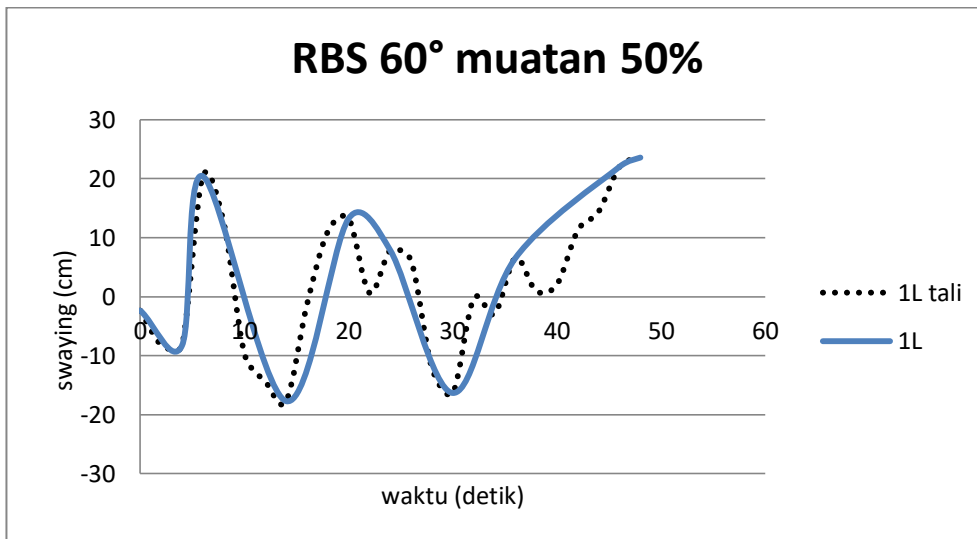
| Swaying RBS 40° muatan 100% |                      |                        |                      |
|-----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)               | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                           | -1.25                | 15.454                 | 8.41                 |
| 2                           | -2.9563              | 10.0063                | 16.129               |
| 4                           | 4.5417               | -36.7652               | 37.014               |
| 6                           | 11.6517              | -9.8755                | 42.1705              |
| 8                           | 5.8325               | -9.7399                | 71.5614              |
| 10                          | -5.8938              | -3.0148                | 34.4758              |
| 12                          | -7.7213              | 20.8014                | 6.1294               |
| 14                          | -2.4541              | 35.9531                | -12.9567             |
| 16                          | 7.1718               | 14.6184                | 21.8995              |
| 18                          | 16.2585              | 4.7038                 | 12.8492              |
| 20                          | 10.7284              | -52.0041               | 12.9889              |
| 22                          | 10.3334              | -16.0579               | -9.7576              |
| 24                          | -18.5289             | 8.4416                 | -4.6473              |
| 26                          | -4.4109              | 6.4783                 | -39.6                |
| 28                          | -8.9785              | 9.8229                 | -17.9286             |
| 30                          | 16.4362              | 24.1509                | -53.6773             |
| 32                          | 17.6902              | 9.952                  | -57.4374             |
| 34                          | 0.031                | 17.9407                | -24.0176             |
| 36                          | -9.3817              | -19.2027               | 1.1872               |
| 38                          | 1.513                | -26.4396               | 5.5392               |
| 40                          | -2.477               | -47.9738               | 41.0977              |
| 42                          | -3.4836              | -51.6795               | 37.8846              |
| 44                          | -4.1666              | -9.5233                | 46.0449              |
| 46                          | -2.9324              | 7.0254                 | 46.3954              |
| 47                          | -1.0236              | -2.2531                | 44.4239              |





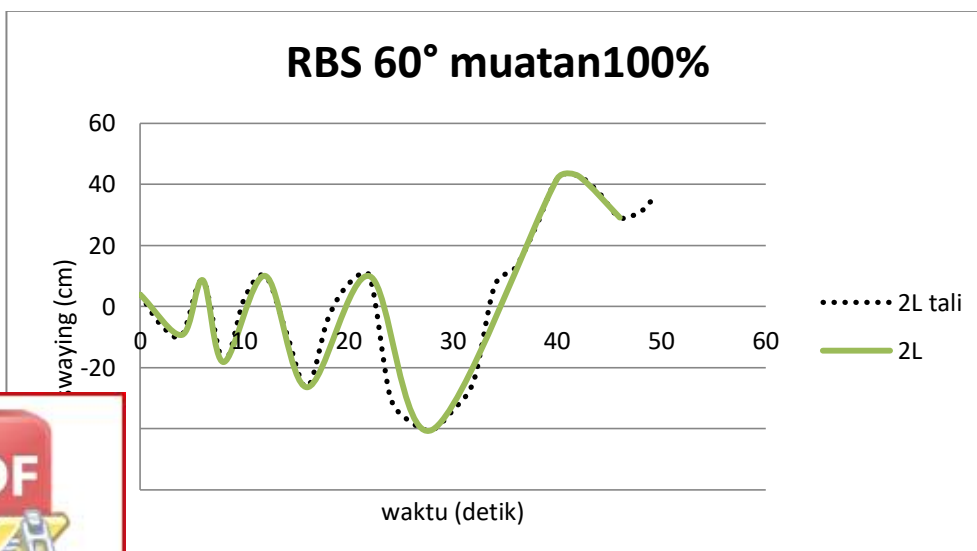
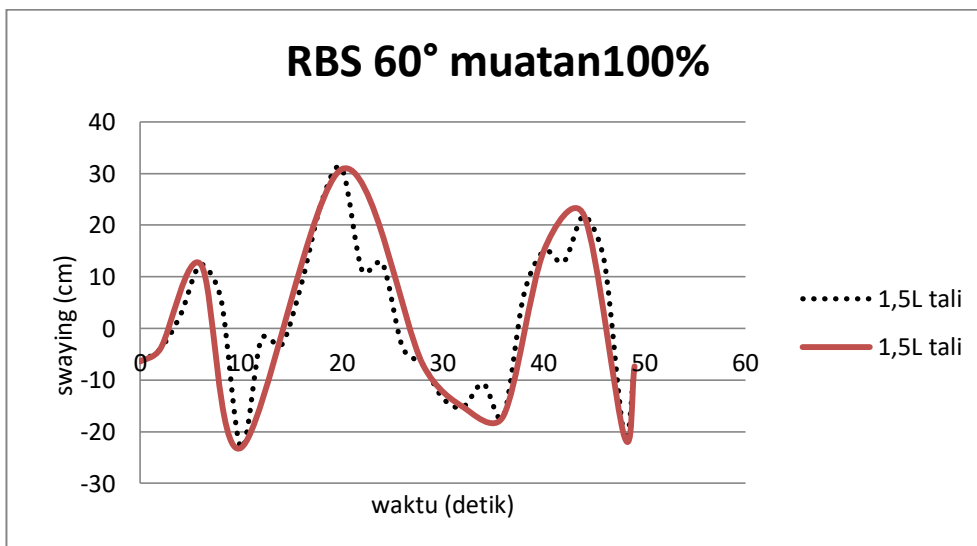
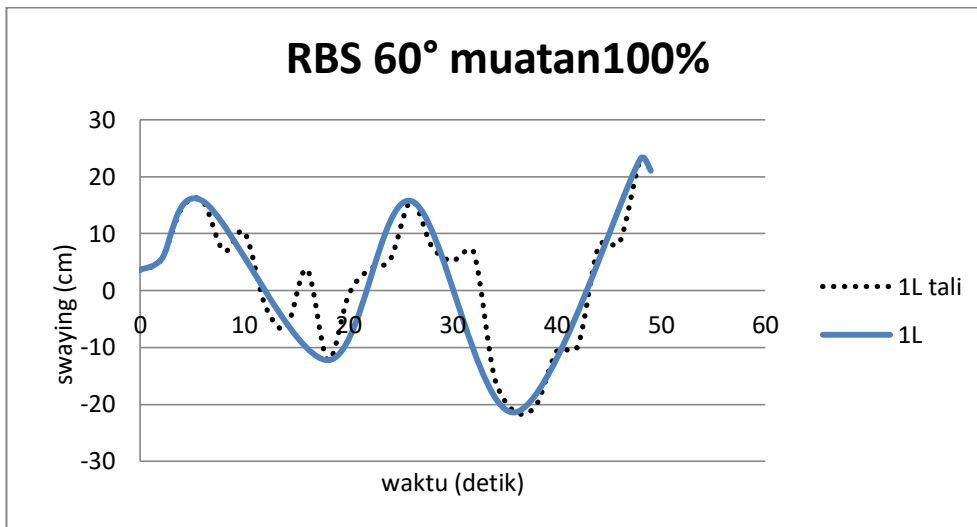
| Swaying RBS 60° muatan 50% |                      |                        |                      |
|----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)              | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                          | -2.3538              | -15.8995               | 28.2701              |
| 2                          | -8.1501              | -20.475                | 19.2768              |
| 4                          | -8.2963              | -20.172                | 20.9595              |
| 6                          | 20.4354              | -21.9019               | 12.3581              |
| 8                          | 12.6207              | 23.8445                | -19.6049             |
| 10                         | -9.6662              | 28.9323                | 13.2939              |
| 12                         | -14.3489             | 23.3901                | 20.5213              |
| 14                         | -17.6963             | 29.2983                | 16.9477              |
| 16                         | -1.321               | 10.3008                | -20.9379             |
| 18                         | 11.0458              | 8.1375                 | 13.3551              |
| 20                         | 13.247               | 4.0552                 | 13.4588              |
| 22                         | 0.6502               | -12.3419               | 15.5335              |
| 24                         | 7.8576               | 6.8786                 | -28.2491             |
| 26                         | 6.0962               | 23.0598                | -31.9895             |
| 28                         | -12.1283             | 22.6756                | -38.7556             |
| 30                         | -16.3121             | 32.3127                | -29.6664             |
| 32                         | -0.2883              | -20.4377               | -28.2546             |
| 34                         | -2.9438              | -33.7661               | 11.2883              |
| 36                         | 6.5456               | -34.2385               | 11.3213              |
| 38                         | 0.9517               | -18.7685               | 39.6019              |
| 40                         | 2.0984               | -17.1118               | 44.7651              |
| 42                         | 11.2713              | -22.1292               | 40.9893              |
| 44                         | 14.4476              | -19.0942               | 46.1066              |
| 46                         | 22.0327              | 11.299                 | 48.4691              |
| 48                         | 23.5848              | 13.6576                | 42.6897              |





| Swaying RBS 60° muatan 100% |                      |                        |                      |
|-----------------------------|----------------------|------------------------|----------------------|
| waktu (detik)               | 1L panjang tali (cm) | 1,5L panjang tali (cm) | 2L panjang tali (cm) |
| 0                           | 3.6381               | -6.375                 | 3.927                |
| 2                           | 5.4198               | -3.9125                | -6.0234              |
| 4                           | 14.5698              | 2.6733                 | -9.2771              |
| 6                           | 15.7131              | 12.4031                | 8.6437               |
| 8                           | 6.9658               | 5.7075                 | -18.1571             |
| 10                          | 10.2218              | -23.0939               | 2.7454               |
| 12                          | -2.7121              | -2.0099                | 10.0513              |
| 14                          | -6.6457              | -3.2291                | -8.3164              |
| 16                          | 3.7131               | 8.7933                 | -26.4081             |
| 18                          | -12.2312             | 24.63                  | -4.0237              |
| 20                          | -0.7648              | 30.8725                | 7.518                |
| 22                          | 3.7628               | 11.1579                | 9.9582               |
| 24                          | 5.4582               | 12.6926                | -29.8199             |
| 26                          | 15.7291              | -3.6524                | -37.8625             |
| 28                          | 7.704                | -6.9495                | -40.344              |
| 30                          | 5.1722               | -13.5276               | -33.8794             |
| 32                          | 6.7317               | -15.2114               | -24.2298             |
| 34                          | -15.3048             | -10.6839               | 6.8992               |
| 36                          | -21.3919             | -16.9446               | 12.8332              |
| 38                          | -20.1192             | 6.339                  | 26.4531              |
| 40                          | -10.5822             | 14.9936                | 41.8427              |
| 42                          | -9.7434              | 12.9262                | 42.8413              |
| 44                          | 7.8153               | 21.8281                | 37.2617              |
| 46                          | 8.4158               | 13.0086                | 29.15                |
| 48                          | 23.1211              | -20.9918               | 31.1453              |
| 49                          | 21.0334              | -7.3342                | 34.5371              |





Lampiran 3.skenario pengujian

| No. | Jenis skeg            | sudut (°) | sarat(%) | gerak        |
|-----|-----------------------|-----------|----------|--------------|
| 1   | Acute Angel skeg(AAS) | 20        | 50       | yaw dan sway |
| 2   | Acute Angel skeg(AAS) | 40        | 50       | yaw dan sway |
| 3   | Acute Angel skeg(AAS) | 60        | 50       | yaw dan sway |
| 4   | Round Bend Skeg(RBS)  | 20        | 50       | yaw dan sway |
| 5   | Round Bend Skeg(RBS)  | 40        | 50       | yaw dan sway |
| 6   | Round Bend Skeg(RBS)  | 60        | 50       | yaw dan sway |
| 7   | Acute Angel skeg(AAS) | 20        | 100      | yaw dan sway |
| 8   | Acute Angel skeg(AAS) | 40        | 100      | yaw dan sway |
| 9   | Acute Angel skeg(AAS) | 60        | 100      | yaw dan sway |
| 10  | Round Bend Skeg(RBS)  | 20        | 100      | yaw dan sway |
| 11  | Round Bend Skeg(RBS)  | 40        | 100      | yaw dan sway |
| 12  | Round Bend Skeg(RBS)  | 60        | 100      | yaw dan sway |

