

**Motor Yacht 19m-18112016**

Planing Hull Resistance

Razmik Baharyan

Report Time: 05 февруари 2018 г., 21:09:49

Model Name: C:\Users\Razmik\OneDrive\Documents\Letters and Publications\Motor Yacht 19m\Motor Yacht 19m,half hull,18112016-for planing analysis.3dm



| Prediction Parameter  | Value           | Vessel Data      | Value          |
|-----------------------|-----------------|------------------|----------------|
| Method                | Savitsky        | MaxPlaningLength | 17,362 m       |
| SpeedCheck            | Check           | MaxPlaningBeam   | 3,8677 m       |
| HullCheck             | OK              | DisplacementBare | 44,508 tonne-f |
| DesignMarginPercent   | 0               | LCGFwdTransom    | 6,8698 m       |
| DesignSpeed           | 40 kt           | VCGAboveBL       | 1,6949 m       |
| WaterType             | Salt            | ShaftAngle       | 7 deg          |
| WaterDensity          | 1025,9 kg/m3    | LCEFwdTransom    | 1,5988 m       |
| WaterViscosity        | 1,1883E-06 m2/s | VCEAboveBL       | -0,60505 m     |
| Propulsive Efficiency | 50 %            |                  |                |

| Parameter Check | Value      | Minimum | Maximum | Type     |
|-----------------|------------|---------|---------|----------|
| LcgBchRatio     | 1,7762     | 0,6     | 3       | Computed |
| FnBchMax        | 3,3413     | 1,43    | 13      | Computed |
| DeadriseMidLen  | 14,761 deg | 0       | 30      | Computed |
| CLBmax          | 0,13014    | 0       | 0,5     | Computed |

| Speed (kt) | Fnv   | Trim (deg) | Rbare (N) | Rtotal (N) | PEtotal (kW) | PPtotal (kW) |
|------------|-------|------------|-----------|------------|--------------|--------------|
| 12,000     | 1,052 | 3,672      | 66367,4   | 66367,4    | 409,7        | 819,4        |
| 13,000     | 1,139 | 3,973      | 69717,9   | 69717,9    | 466,3        | 932,5        |
| 14,000     | 1,227 | 4,259      | 71559,3   | 71559,3    | 515,4        | 1030,8       |
| 15,000     | 1,315 | 4,556      | 72132,5   | 72132,5    | 556,6        | 1113,2       |
| 16,000     | 1,402 | 4,840      | 72491,3   | 72491,3    | 596,7        | 1193,4       |
| 17,000     | 1,490 | 5,126      | 72551,1   | 72551,1    | 634,5        | 1269,0       |
| 18,000     | 1,577 | 5,408      | 72506,8   | 72506,8    | 671,4        | 1342,8       |
| 19,000     | 1,665 | 5,678      | 72581,9   | 72581,9    | 709,4        | 1418,9       |
| 20,000     | 1,753 | 5,937      | 72580,2   | 72580,2    | 746,8        | 1493,5       |
| 21,000     | 1,840 | 6,171      | 72593,1   | 72593,1    | 784,2        | 1568,5       |
| 22,000     | 1,928 | 6,374      | 72590,5   | 72590,5    | 821,6        | 1643,1       |
| 23,000     | 2,016 | 6,543      | 72442,5   | 72442,5    | 857,2        | 1714,3       |

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|        |       |       |         |         |        |        |
|--------|-------|-------|---------|---------|--------|--------|
| 24,000 | 2,103 | 6,669 | 72221,2 | 72221,2 | 891,7  | 1783,4 |
| 25,000 | 2,191 | 6,758 | 71854,7 | 71854,7 | 924,1  | 1848,3 |
| 26,000 | 2,279 | 6,802 | 71376,7 | 71376,7 | 954,7  | 1909,4 |
| 27,000 | 2,366 | 6,813 | 70777,2 | 70777,2 | 983,1  | 1966,2 |
| 28,000 | 2,454 | 6,788 | 70112,5 | 70112,5 | 1009,9 | 2019,9 |
| 29,000 | 2,541 | 6,738 | 69377,1 | 69377,1 | 1035,0 | 2070,1 |
| 30,000 | 2,629 | 6,663 | 68607,7 | 68607,7 | 1058,8 | 2117,7 |
| 31,000 | 2,717 | 6,570 | 67836,8 | 67836,8 | 1081,8 | 2163,7 |
| 32,000 | 2,804 | 6,460 | 67041,2 | 67041,2 | 1103,6 | 2207,3 |
| 33,000 | 2,892 | 6,340 | 66277,7 | 66277,7 | 1125,2 | 2250,4 |
| 34,000 | 2,980 | 6,214 | 65561,6 | 65561,6 | 1146,7 | 2293,5 |
| 35,000 | 3,067 | 6,080 | 64868,0 | 64868,0 | 1168,0 | 2336,0 |
| 36,000 | 3,155 | 5,943 | 64213,8 | 64213,8 | 1189,2 | 2378,5 |
| 37,000 | 3,243 | 5,806 | 63611,6 | 63611,6 | 1210,8 | 2421,6 |
| 38,000 | 3,330 | 5,666 | 63067,9 | 63067,9 | 1232,9 | 2465,8 |
| 39,000 | 3,418 | 5,525 | 62563,4 | 62563,4 | 1255,2 | 2510,5 |
| 40,000 | 3,505 | 5,387 | 62115,1 | 62115,1 | 1278,2 | 2556,4 |
| 41,000 | 3,593 | 5,252 | 61727,9 | 61727,9 | 1302,0 | 2604,0 |
| 42,000 | 3,681 | 5,120 | 61394,8 | 61394,8 | 1326,5 | 2653,1 |
| 43,000 | 3,768 | 4,989 | 61120,7 | 61120,7 | 1352,1 | 2704,1 |
| 44,000 | 3,856 | 4,860 | 60887,1 | 60887,1 | 1378,2 | 2756,4 |
| 45,000 | 3,944 | 4,737 | 60720,9 | 60720,9 | 1405,7 | 2811,4 |
| 46,000 | 4,031 | 4,616 | 60604,7 | 60604,7 | 1434,2 | 2868,4 |
| 47,000 | 4,119 | 4,500 | 60538,1 | 60538,1 | 1463,7 | 2927,5 |
| 48,000 | 4,207 | 4,385 | 60507,8 | 60507,8 | 1494,1 | 2988,3 |
| 49,000 | 4,294 | 4,277 | 60544,7 | 60544,7 | 1526,2 | 3052,4 |
| 50,000 | 4,382 | 4,169 | 60619,4 | 60619,4 | 1559,3 | 3118,5 |

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| Speed (kt) | FnBch | Eff Planing Beam (m) | Eff Deadrise (deg) | Rbare/W | Porpoising | Prediction Check |
|------------|-------|----------------------|--------------------|---------|------------|------------------|
| 12,000     | 1,008 | 3,828                | 14,782             | 0,152   | Check      | Check=1,2,3      |
| 13,000     | 1,092 | 3,828                | 14,776             | 0,160   | Check      | Check=1,2,3      |
| 14,000     | 1,175 | 3,829                | 14,771             | 0,164   | Check      | Check=1,2,3      |
| 15,000     | 1,259 | 3,829                | 14,767             | 0,165   | Check      | Check=1,2,3      |
| 16,000     | 1,343 | 3,829                | 14,763             | 0,166   | Check      | Check=1,2,3      |
| 17,000     | 1,427 | 3,830                | 14,759             | 0,166   | Check      | Check=1,2,3      |
| 18,000     | 1,511 | 3,830                | 14,755             | 0,166   | Check      | Check=3          |
| 19,000     | 1,595 | 3,830                | 14,751             | 0,166   | Check      | Check=3          |
| 20,000     | 1,679 | 3,830                | 14,747             | 0,166   | Check      | Check=3          |
| 21,000     | 1,763 | 3,831                | 14,744             | 0,166   | Check      | OK               |
| 22,000     | 1,847 | 3,831                | 14,741             | 0,166   | Check      | OK               |
| 23,000     | 1,930 | 3,831                | 14,739             | 0,166   | Check      | OK               |
| 24,000     | 2,014 | 3,831                | 14,737             | 0,166   | Check      | OK               |
| 25,000     | 2,098 | 3,831                | 14,736             | 0,165   | Check      | OK               |
| 26,000     | 2,182 | 3,831                | 14,736             | 0,164   | Check      | OK               |
| 27,000     | 2,266 | 3,831                | 14,736             | 0,162   | Check      | OK               |
| 28,000     | 2,350 | 3,831                | 14,737             | 0,161   | Check      | OK               |
| 29,000     | 2,434 | 3,831                | 14,738             | 0,159   | Check      | OK               |
| 30,000     | 2,518 | 3,831                | 14,739             | 0,157   | Check      | OK               |
| 31,000     | 2,602 | 3,831                | 14,741             | 0,155   | Check      | OK               |
| 32,000     | 2,686 | 3,831                | 14,743             | 0,154   | Check      | OK               |
| 33,000     | 2,770 | 3,831                | 14,745             | 0,152   | Check      | OK               |
| 34,000     | 2,854 | 3,830                | 14,747             | 0,150   | Check      | OK               |
| 35,000     | 2,938 | 3,830                | 14,749             | 0,149   | Check      | OK               |
| 36,000     | 3,022 | 3,830                | 14,752             | 0,147   | Check      | OK               |
| 37,000     | 3,106 | 3,830                | 14,754             | 0,146   | Check      | OK               |
| 38,000     | 3,190 | 3,830                | 14,756             | 0,145   | Check      | OK               |

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|        |       |       |        |       |        |    |
|--------|-------|-------|--------|-------|--------|----|
| 39,000 | 3,274 | 3,830 | 14,758 | 0,143 | Check  | OK |
| 40,000 | 3,358 | 3,829 | 14,760 | 0,142 | Check  | OK |
| 41,000 | 3,442 | 3,829 | 14,762 | 0,141 | Check  | OK |
| 42,000 | 3,526 | 3,829 | 14,764 | 0,141 | Stable | OK |
| 43,000 | 3,610 | 3,829 | 14,766 | 0,140 | Stable | OK |
| 44,000 | 3,694 | 3,829 | 14,768 | 0,140 | Stable | OK |
| 45,000 | 3,778 | 3,829 | 14,770 | 0,139 | Stable | OK |
| 46,000 | 3,862 | 3,829 | 14,771 | 0,139 | Stable | OK |
| 47,000 | 3,946 | 3,828 | 14,773 | 0,139 | Stable | OK |
| 48,000 | 4,030 | 3,828 | 14,775 | 0,139 | Stable | OK |
| 49,000 | 4,114 | 3,828 | 14,776 | 0,139 | Stable | OK |
| 50,000 | 4,198 | 3,828 | 14,777 | 0,139 | Stable | OK |

| Sensitivity Analysis | Index    | To Reduce Drag |
|----------------------|----------|----------------|
| Eff planing beam     | 0,29399  | Increase       |
| Eff deadrise         | 0,29033  | Decrease       |
| LCG fwd transom      | 0,51987  | Increase       |
| Shaft angle to BL    | 0,073025 | Increase       |

|                          |
|--------------------------|
| <b>Prediction Checks</b> |
|--------------------------|

1. A wetted keel length greater than the boat length indicates that the boat is running at small trim and the bow will be immersed. In this condition, the prismatic analysis of the Savitsky prediction will be unreliable and can significantly under-predict the actual drag. However, as this condition typically occurs at pre-planing speeds, the internal hump speed correction accounts for this in the prediction of drag. There is no correction for trim.
2. The Froude number based on chine beam ( $Fn_{Bch}$ ) is a good indicator of the development of the spray root and the magnitude of the planing lift coefficient. Results for speeds outside of the Savitsky data set (most often for low speeds below the range) may be unreliable.
3. The lift coefficient ( $CL_b$ ) is a ratio of displacement to the square of speed and chine beam, with a correction for deadrise. This coefficient is a measure of the weight loading for the given planing geometry. We caution against using this method for hulls that produce this data range error.
4. The original testing of the models used in the Savitsky analysis were limited to a given range of trim values. Predicted trim values that are beyond the range of the original data set may be unreliable.

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**Notes**

A Sensitivity index with a higher value has a greater influence on drag. Sensitivity values greater than 1.0 are considered significant.

PPtotal represents the total propulsive power. Its precise definition depends on how the user specified the propulsive efficiency. If the user input the quasi-propulsive efficiency, then PPtotal is the total delivered power. If the user specified overall propulsive efficiency then PPtotal is the brake power.

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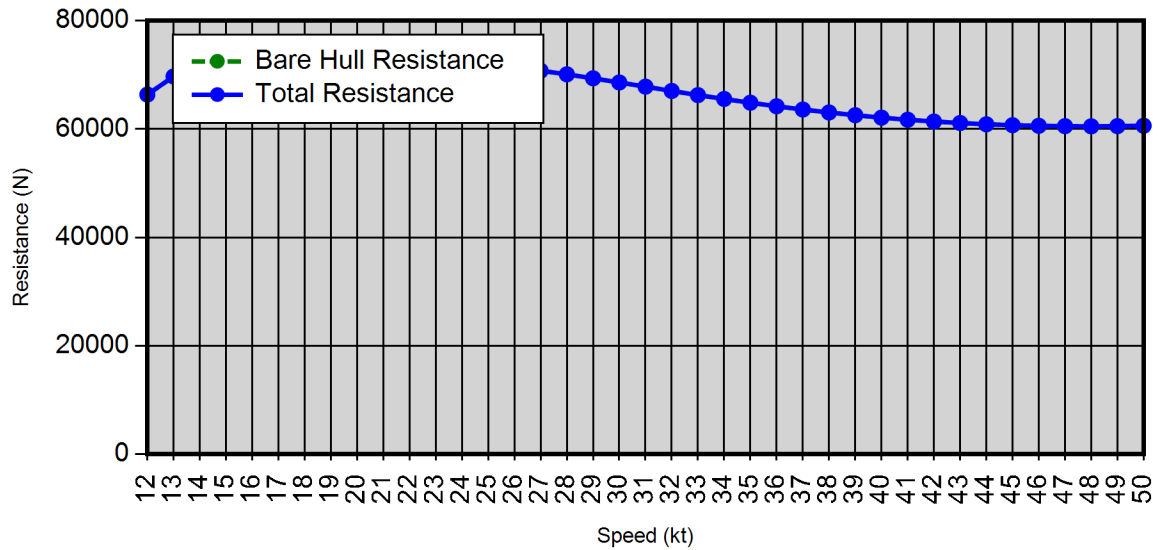
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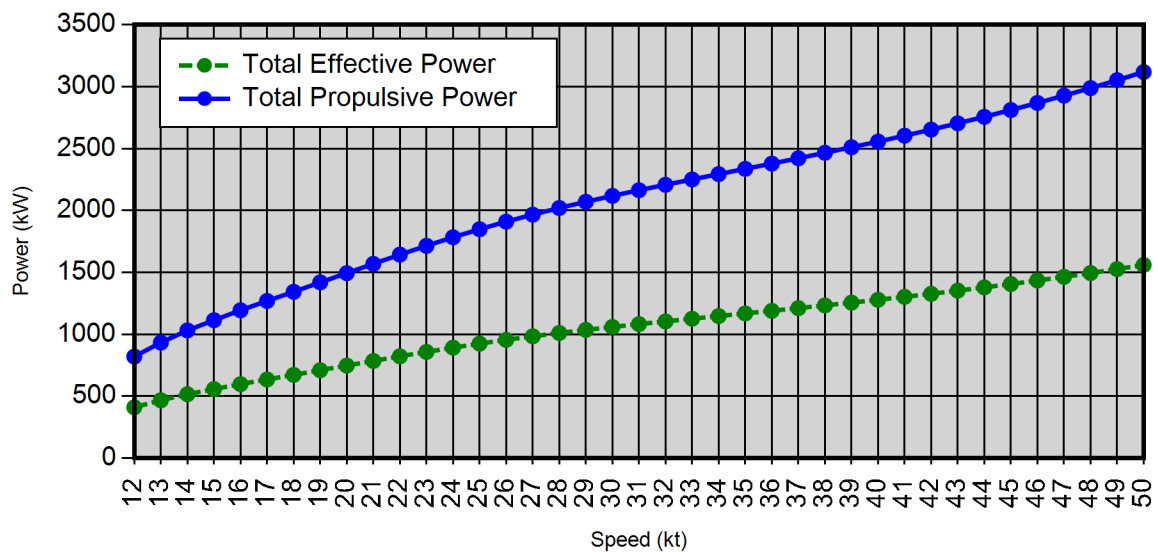
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### Orca3D Planing Analysis (Resistance)



### Orca3D Planing Analysis (Power)



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Orca3D Planing Analysis (Trim Angle)

