Exercise
Ship Design
Introduction Roll On/Roll Off Ships

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Excercise 6

Introduction Roll On/Roll Off Ships

1. Which are the typical areas of operation of RoRo ships?
2. Please state the major design drivers for RoRo ships.
3. Please explain the specialities in the design of the lines of RoRo ships.
4. Please state the most relevant cargo unit for RoRo ships. Which other typical cargo unit do you know for this shiptype?
5. Please state, by which characteristics RoRo ships can be subdivided into different classes.
6. Please state the typical propulsion concept for RoRo ships and explain, why this concept is mostly used for this shiptype.
7. Which intact stability rules have to be applied for RoRo ships and where do you find them?
8. Which damage stability rules are applicable for newbuild RoRo ships and in which guideline do you find them?
9. Please sketch a typical righting lever arm curve (stillwater) for a RoRo- and a Containership. Please explain the differences.
10. Which parts of a vessel may be considered for the calculation of the righting lever arm curve? Where is this defined?
11. At which point does the righting level arm curve mandatorily end? Where is this defined?
12. Which is the typical limiting stability criterion for a RoRo-Ship with three, four and five decks?
13. Please explain why it is reasonable to design the vehicle deck of a RoRo-Ship at least 20 m wide?
14. Why are anti-heeling and anti-rolling system important on RoRo ships? What is the difference between anti-heeling and anti-rolling systems?
15. What is the difference between a RoRo-Ship and a Pure-Car-Carrier (PCC)?
RO - RO 2700

22 KNOTS, 2700 LANE METERS,
14,200 t DEADWEIGHT,
12 DRIVERS
Flensburger’s new RoRo carriers are state-of-the-art designs for fast and economic services. Because these vessels represent the best possible solution for maximum cargo area, high service speed and lowest fuel consumption, they are the logical choice for every operator and every route. It was the competitive price and value for money which for example convinced the Turkish shipping company UND RoRo to order 6 vessels for their Istanbul-Trieste service.

**MAIN DIMENSIONS**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (overall)</td>
<td>193.00 m</td>
</tr>
<tr>
<td>Length (between perpendiculars)</td>
<td>182.39 m</td>
</tr>
<tr>
<td>Breadth</td>
<td>26.00 m</td>
</tr>
<tr>
<td>Depth to main deck</td>
<td>8.60 m</td>
</tr>
<tr>
<td>Depth to upper deck</td>
<td>16.70 m</td>
</tr>
<tr>
<td>Draught (summer load)</td>
<td>7.40 m</td>
</tr>
<tr>
<td>Draught (design)</td>
<td>5.70 m</td>
</tr>
</tbody>
</table>

**DEADWEIGHT / TONNAGE**

<table>
<thead>
<tr>
<th>Tonnage Type</th>
<th>Value (abt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>7,730 t</td>
</tr>
<tr>
<td>Summer load</td>
<td>14,200 t</td>
</tr>
<tr>
<td>Gross tonnage</td>
<td>22,900 GT</td>
</tr>
<tr>
<td>Net tonnage</td>
<td>8,670 NT</td>
</tr>
</tbody>
</table>

**CLASSIFICATION**

DNV + 1 A1 General Cargo Carrier RoRo, EO, ICS, DG-P, W1

**MAIN ENGINE**

Two (2) four-stroke medium speed diesel engines
2 x MAK 9M 43
MCR 8,100 KW each, 500 rpm
Fuel: 380 cSt at 50° C or MDO

**SPEED & F.O. CONSUMPTION**

Service Speed 21.6 Knots
(at design draught of 5.70 m, 90% MCR (14,580 KW), 10% sea margin and shaft generators engaged (abt. 800 KW))
Max. cruising range abt. 10,000 sea miles
Consumption 61.2 t/day
## DRIVER AND CREW CABINS / BEDS

<table>
<thead>
<tr>
<th>Deck</th>
<th>Driver cabins</th>
<th>Driver beds</th>
<th>Crew cabins</th>
<th>Crew beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 House deck</td>
<td>10 officer class</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 House deck</td>
<td>9 single crew</td>
<td>9</td>
<td>6 single crew</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>6 cabins</td>
<td>12</td>
<td>25 cabins</td>
<td>25</td>
</tr>
</tbody>
</table>

## CARGO CAPACITY

<table>
<thead>
<tr>
<th>trailer / lm</th>
<th>lanes</th>
<th>trailer (13.6+0.4m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper deck</td>
<td>1,200</td>
<td>82</td>
</tr>
<tr>
<td>Main deck</td>
<td>955</td>
<td>64</td>
</tr>
<tr>
<td>Tank top</td>
<td>485</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>2,640</td>
<td>180</td>
</tr>
</tbody>
</table>
CARGO HOLD VENTILATION
Cargo hold ventilation will be 20 air changes per hour in harbour condition and 10 air changes per hour in sea condition.

SPECIAL FEATURES
- Maximum cargo capacity
- Excellent speed - power performance
- Low fuel oil consumption
- Excellent seakeeping behaviour
- Flume stabilisation system
- Maximum deadweight capacity
- Low noise and vibration levels

AUXILIARY ENGINES
- Auxiliary diesel engines: 2 pcs. 1,500 KW
- Generators (diesel driven): 2 pcs. 1,800 KVA
- Shaft generator: 2 pcs. 2,000 KVA
- EM. generator (diesel driven): 1 set 450 KW

TANK CAPACITIES
- Water ballast tanks: abt. 3,650 m³
- Fresh water tanks: abt. 160 m³
- Heavy fuel oil tanks: abt. 1,300 m³
- Diesel oil tanks: abt. 160 m³

STEERING EQUIPMENT
Steering gear of ram type, two high lift rudders of spade type, max rudder angle 45°
1 bow thruster 1,400 KW controllable pitch prop.

CARGO ACCESS EQUIPMENT
- Access ramp aft: 1 pc. 17 m wide x 15 m + 3 m flap
- Internal fixed ramp: 1 pc. main deck to upper deck with watertight guillotine door, 7 m wide
- Internal fixed ramp: 1 pc. main deck to tank top with watertight cover, 3.5 m wide
RO - RO 3750

22 KNOTS, 3,750 LANE METERS, 11,200 t DEADWEIGHT, 12 DRIVERS
Flensburger designers never stop. Not content with having built a highly successful 4-deck RoRo carrier, we have made it even better. With over 500 lane meters more the benefits for the owner speak for themselves.

**MAIN DIMENSIONS**

- Length (overall) : 193.00 m
- Length (between perpendiculars) : 182.39 m
- Breadth : 26.00 m
- Depth to main deck : 8.60 m
- Depth to upper deck : 16.70 m
- Draught (summer load) : 7.00 m
- Draught (design) : 6.45 m

**DEADWEIGHT / TONNAGE**

- Design abt. 9,050 t
- Summer load abt. 11,200 t
- Gross tonnage abt. 28,870 GT
- Net tonnage abt. 8,660 NT

**CLASSIFICATION**

DNV + 1 A1 General Cargo Carrier RoRo, EO, ICS, DG-P, W1

**MAIN ENGINE**

- Two (2) four-stroke medium speed diesel engines
- 2 x MAK 9M 43
- MCR 8,100 kW each, 500 rpm
- Fuel: 380 cSt at 50°C or MDO

**SPEED & F.O. CONSUMPTION**

- Service speed 21.5 knots
- (at design draught of 6.45 m, 90% MCR (14,580 kW), 10% sea margin and shaft generators engaged (abt. 800 kW))
- Max. cruising range abt. 10,000 sea miles
- Consumption 61.2 t/day
CARGO CAPACITY

<table>
<thead>
<tr>
<th>Trailers / lm</th>
<th>Lanes</th>
<th>Trailers (13.6+0.4m)</th>
<th>Top deck 4.3 m high / 3.0 m wide</th>
<th>1,151 lm</th>
<th>77</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Upper deck 4.3 m high / 3.0 m wide</td>
<td>1,130 lm</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Main deck 6.8 m high / 2.9 m wide</td>
<td>960 lm</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tank top 5.0 m high / 2.9 m wide</td>
<td>485 lm</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>3,726 lm</td>
<td>254</td>
</tr>
</tbody>
</table>

DRIVER AND CREW CABINS / BEDS

<table>
<thead>
<tr>
<th>Deck</th>
<th>Driver cabins</th>
<th>Driver beds</th>
<th>Crew cabins</th>
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</thead>
<tbody>
<tr>
<td>2 house deck</td>
<td>10 officer class</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 house deck</td>
<td>6 two bed cabins</td>
<td>12</td>
<td>6 single crew</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>6 cabins</td>
<td>12</td>
<td>25 cabins</td>
<td>25</td>
</tr>
</tbody>
</table>
CARGO HOLD VENTILATION
Cargo hold ventilation will be 20 air changes per hour in harbour condition and 10 air changes per hour in sea condition.

AUXILIARY ENGINES
- Auxiliary diesel engines: 2 pcs., 1,500 kW
- Generators (diesel driven): 2 pcs., 1,800 kVA
- Shaft generator: 2 pcs., 2,000 kVA
- EM. generator (diesel driven): 1 set, 450 kW

TANK CAPACITIES
- Water ballast tanks: abt. 3,650 m³
- Fresh water tanks: abt. 160 m³
- Heavy fuel oil tanks: abt. 1,300 m³
- Diesel oil tanks: abt. 160 m³

SPECIAL FEATURES
- Maximum cargo capacity
- Excellent speed - power performance
- Low fuel oil consumption
- Excellent seakeeping behaviour
- Flume stabilisation system
- Maximum deadweight capacity
- Low noise and vibration levels

STEERING EQUIPMENT
- Steering gear of ram type,
  2 high lift rudders of spade type, max. rudder angle 45°
- 1 bow thruster 1,400 kW, controllable pitch propeller

CARGO ACCESS EQUIPMENT
- Access ramp aft: 1 pc. 17 m wide x 15 m + 3 m flap
- Internal fixed ramp: 1 pc. main deck to upper deck with watertight guillotine door, 7 m wide
- Internal fixed ramp: 1 pc. main deck to tank top with watertight cover, 3.5 m wide
- Internal fixed ramp: 1 pc. upper deck to top deck, 4.0 m wide
RoRo 3900
23 knots, 3831 lane meters
10,400 t deadweight
CLASSIFICATION
LR + 100 A1 Roll on - Roll off cargo ship, IWS, NAV 1, IBS, ke Class 1D + LMC, UMS

MAIN DIMENSIONS
Length (overall) 199.80 m
Length (between perpendiculars) 190.29 m
Breadth 26.50 m
Depth to main deck 9.40 m
Depth to upper deck 16.95 m
Draught (scantling) 7.35 m
Draught (design) 6.95 m

DEADWEIGHT / TONNAGE
Design 8,780 t
Scantling 10,407 t
Gross tonnage 32,289 GT
Net tonnage 9,686 NT

MAIN ENGINE
One (1) two-stroke marine diesel engine
MAN B&W 9L60 MC-C
MCR 20,070 kW, 123 rpm
Fuel: 700 cSt at 50° C or MDO

SPEED & F. O. CONSUMPTION
Service speed 23 knots
(at design draught of 6.95 m, 90% MCR (18,063 kW), 15% sea margin)
Max. cruising range abt. 8,300 sea miles
Consumption 73.70 t/day

AUXILIARY ENGINES
Auxiliary diesel engines 4 pcs. 1,720 kW
Generators (diesel driven) 4 pcs. 2,060 kVA
EM. generator (diesel driven) 1 set 450 kW

TANK CAPACITIES
Water ballast tanks abt. 4,020 m³
Fresh water tanks abt. 1,100 m³
Heavy fuel oil tanks abt. 2,035 m³
Diesel oil tanks abt. 130 m³

STEERING EQUIPMENT
Steering gear (electric hydraulic)
1 twist flow rudder
2 bow thrusters, 1,100 kW each, controllable prop.
2 stern thrusters, 880 kW each, controllable pitch prop.

SPECIAL FEATURES
Quick loading and discharge capability
Maximum cargo capacity
Excellent speed / power performance
Low fuel oil consumption
Excellent seakeeping behaviour
Maximum deadweight capacity
Low noise and vibration levels
Interim stabilisation system
SAT Lashing System
Auxiliary engines fitted with SCR (Selective Catalytic Reduction)

CARGO ACCESS EQUIPMENT
Access ramp aft 1 pc. 18.10 m wide x 14 m + 3 m flap
Internal fixed ramp 1 pc. main deck to upper deck with watertight door, 4 m wide
Internal fixed ramp 1 pc. main deck to tank top with watertight cover, 4 m wide
Internal hoistable ramp 2 pcs. hydraulically operated, 4.3 m x 4.90 m
Side doors 2 levels, 3,772 m²
Hoistable car decks

CARGO CAPACITY
Trailer slots: 14.40 m x 2.9 m / 3.0 m

Trailer fms 14.40 m x 2.9 m / 3.0 m

Free height
Weather deck 1,272 80 4.70 m
Upper deck 1,317 74 4.70 m
Main deck 1,046 68 6.2-6.8 m
Tank top 319 25 5.20 m
Total 3,831 253

RoRo 3900
This spacious RoRo carrier represents a unique solution regarding
- extreme cargo space
- high service speed
- low fuel consumption
- premium quality

This convincing and reliable RoRo concept offers highest flexibility, enabling a wide scale of cargo alternatives.

RoRo 3900
For further information please contact Peter Sierk or Uwe Otto at
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Germany
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RoRo 5200
22 knots, 5,156 lane metres, 12,750 t deadweight
RoRo 5200

Flensburger designers never stop. Not content with having built a highly successful 4-deck RoRo carrier, we have made it even better. With over 5000 lane meters on 5 cargo decks and space for more than 350 trailers, the benefits for the owner speak for themselves.

For further information please contact Peter Sierk or Uwe Otto at Flensburger Schiffbau-Gesellschaft mbH & Co. KG
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CLASSIFICATION
DNV + 1 A1 General Cargo Carrier Ro/Ro, EO, DG-P, NAUT-AW, ICS, LCS

MAIN DIMENSIONS
Length (overall) 199.80 m
Length (between perpendiculars) 189.63 m
Breadth (moulded) 29.50 m
Depth to main deck 12.75 m
Depth to upper deck 18.85 m
Draught (design) 6.85 m
Draught (scantling) 6.95 m

DEADWEIGHT/TONNAGE
Design 12,750 t
Gross tonnage 38,000 GT
Net tonnage 11,400 NT

MAIN ENGINE
Two (2) four-stroke medium speed diesel engines
MCR 21,600 kW, 500rpm
Fuel: 380 cSt at 50°C or MDO

AUXILIARY ENGINES
Auxiliary diesel engines 2 pcs. 1,360 kW
Generators (diesel driven) 2 pcs. 1,550 kVA
Shaft generators 2 pcs. 1,750 kVA
EM generator (diesel driven) 1 set 380 kW

TANK CAPACITIES
Water ballast tanks abt. 5,700 m³
Fresh water tanks abt. 100 m³
Heavy fuel oil tanks abt. 1,600 m³
Diesel oil tanks abt. 180 m³

SPEED & FUEL CONSUMPTION
Service speed 22,0 knots
(at design draught of 6.85 m, 90% MCR (19,440 kW),
10% sea margin)
Max. cruising range abt. 10,000 sea miles
Consumption 81.60 t/day

STEERING EQUIPMENT
2 Steering gears (electric hydraulic)
2 twist flow rudders
2 bow thrusters, 1,100 kW, controllable pitch prop.

CARGO ACCESS EQUIPMENT
Access ramps aft 1 pc. 3.70 m wide (SB) x 15.0 m x 3.0 m flap
1 pc. 10.50 m / 3.70 wide (PS) x 15.0 m x 3.0 m flap
1 pc. main deck to upper deck, 3.70 m wide, 7° incline
Internal fixed ramp 1 pc. main deck to lower deck, 3.70 m wide, 7° incline
Internal fixed/hoistable ramp 1 pc. upper deck to weather deck, 3.70 m wide, 7° incline
Internal tiltable ramp 1 pc. weather deck, 3.70 m wide, 7° incline

CARGO HOLD VENTILATION
20 air changes per hour in harbour condition
10 air changes per hour in sea condition

CARGO CAPACITY
Trailer slots: 13.60 m x 2.95 m / 3.0 m
Trailer lm  Trailers Free height
Weather deck 1,387 96 4.40 m
Upper deck 1,350 93 4.40 m
Main deck 1,270 86 4.70 m
Twen deck 834 45 4.40 m
Tank top 105 33 4.40 m
Total 5,156 353

RoRo 5200
Flensburger designers never stop. Not content with having built a highly successful 4-deck RoRo carrier, we have made it even better. With over 5000 lane meters on 5 cargo decks and space for more than 350 trailers, the benefits for the owner speak for themselves.

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