THE SAFEGUARD VALIDATION DATA SET – SGVDS2
A GUIDE TO THE DATA AND VALDIATION PROCEDURES

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1) TERMS OF USE

As part of the EU FP7 SAFEGUARD project (contract 218493), a series of five semi-unannounced full-scale assembly trials were conducted at sea on three different types of passenger vessel. From these trials five passenger response time data-sets were collected and two full-scale validation data-sets. The two Safeguard Validation Data-Sets (SGVDS) were generated from assembly trials conducted on a large RO-PAX ferry (RP1) operated by ColorLine AS and a Cruise Ship (CS) operated by Royal Caribbean – SGVDS1 and SGVDS2 respectively.

All the information related to the SGVDS1 and SGVDS2 can be downloaded from the FSEG website:

http://fseg.gre.ac.uk/validation/ship_evacuation

All members of the evacuation modelling community are invited to make use of both SGVDS1 and SGVDS2 to evaluate their evacuation modelling tool. By making use of this material you agree to abide by the following usage terms and conditions:

- Whenever work is published (typically, but not exclusively, in academic journals, conference proceedings and reports), which is based in-part or wholly on SGVDS1 or SGVDS2 the following citations to the validation datasets must be made:
    - Galea, E.R., Deere, S., Brown, R.,Filippidis, L., Two Evacuation Model Validation Data-sets for Large Passenger Ships, SNAME (The Society of Naval Architects and Marine Engineers) Journal of Ship Research, Vol 57, number 3, pp155-170, Sept 2013, http://dx.doi.org/10.5957/JOSR.57.3.120037.
    - Brown, R., Galea, E.R., Deere, S.J., Filippidis, L., Passenger Response Time Data-sets for Large Passenger Ferries and Cruise Ships Derived from Sea Trials, Transactions of the Royal Institution of Naval Architects, International Journal of Maritime Engineering, Vol 155, Part A1, pp 33-48, 2013.
    - Deere, S.J., Galea, E.R., Filippidis, L., Brown, R., Data Collection Methodologies Used in the Safeguard Project to Collect Human Factors Data, RINA SAFEGUARD Passenger Evacuation Seminar 30 November 2012, ISBN No: 978-1-909024-08-3.
    - http://www.safeguardproject.info
        - In addition, the following references to IMO INF papers concerning the data sets can also be made:

    - The SAFEGUARD Validation Data-Set and Recommendations to IMO to Update MSC Circ. 1238. IMO Committee on Fire Protection, 56th Session, FP56/INF.13, 14 November 2012.
    - Response Time Data for Large Passenger Ferries and Cruise Ships. IMO Committee on Fire Protection, 56th Session, FP56/INF.12, 14 November 2012.
- When the above noted work is published or reported in the public domain, an electronic copy of the publication should be forwarded to e.r.galea@gre.ac.uk within one month of it appearing in the public domain. Where available a DOI for the publication should also be provided.
- The provided publications will be cited on the VALIDATION web page, together with the DOI of the publication.
- If the software tool FSEG_VALIDATION_ASSESSOR is used to assess the degree of agreement with the validation data-set the following citation must be made in any work that is published (typically, but not exclusively, in academic journals, conference proceedings and reports) utilising the assessment:
    - Haasanen, S., Galea, E.R., and Deere, S., Computer Software, FSEG_VALIDATION_ASSESSOR. Download from http://fseg.gre.ac.uk/validation/ship_evacuation

2) INTRODUCTION

This document describes the SGVDS2 and the process of carrying out a validation assessment using the data-set. The document provides all the information to set up and run the validation scenario within the users evacuation software. In particular the document describes the layout of the CS vessel, the initial population distribution, the final destination of each of the passengers, the population response time distribution and the arrival times for each passenger. Other parameters to be used in the simulations, such as population gender, age distribution, travel speeds are derived from the IMO MSC Circ 1238 documentation. It is assumed that the user of this document has knowledge on how to use their evacuation software and so specific information on how to implement the validation scenario within the specific evacuation simulation software is not provided.

The material in this document is divided into nine sections each dealing with a specific aspect of the validation data or validation procedures. These sections are:

- **Geometry:** Describes the layout of the vessel and provides information concerning the autoCAD DXF files required to construct the geometry.

- **Population:** Describes the distribution of the population, in particularly the start and end location of each agent in the model.

- **Response Time Distribution:** Describes the response time distribution which should be applied to the population.

- **SGVDS2 Arrival Curves**: Provides the arrival times in each of the assembly stations for each agent and describes how this data should be presented.

- **The Validation Metric:** Provides the measures to assess how closely the simulation results agree with the validation data set.

- **Procedures for Running the SGVDS2 Scenario:** Describes the process of setting up and running the validation scenario. It also explains the process of selecting the appropriate simulation to be used in the validation analysis.

- **SGVDS2 Acceptance criteria:** Provides a set of suggested performance standards that the simulation results should meet in order to be deemed acceptable.

- **Regulatory Documentation:** Provides a set of suggested documentation that should be provided to regulatory bodies to demonstrate that their software has met the standard.

- **Additional Information:** Provides a summary of the files required, in addition to this document, to run and analyse the validation case.

3) GEOMETRY

This section describes the layout of the vessel and provides information concerning the autoCAD DXF files required to construct the geometry.

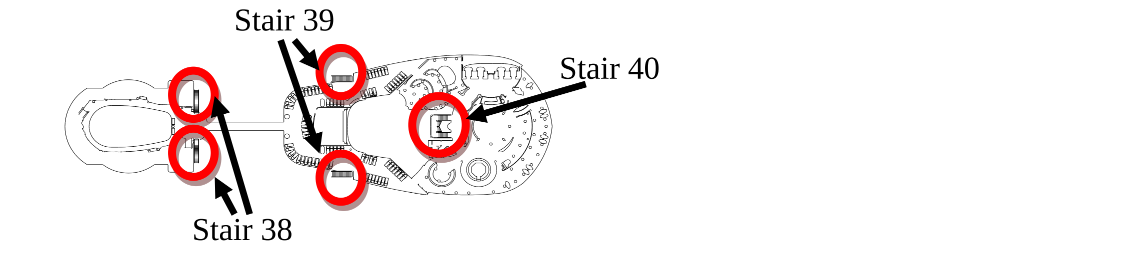
The populated decks used during the trial consisted of twelve decks described by twelve DXF files:

a) SGVDS2-Deck-1.dxf
b) SGVDS2-Deck-2.dxf
c) SGVDS2-Deck-3.dxf
d) SGVDS2-Deck-4.dxf
e) SGVDS2-Deck-5.dxf
f) SGVDS2-Deck-6.dxf
g) SGVDS2-Deck-7.dxf
h) SGVDS2-Deck-8.dxf
i) SGVDS2-Deck-9.dxf
j) SGVDS2-Deck-10.dxf
k) SGVDS2-Deck-11.dxf
l) SGVDS2-Deck-12.dxf

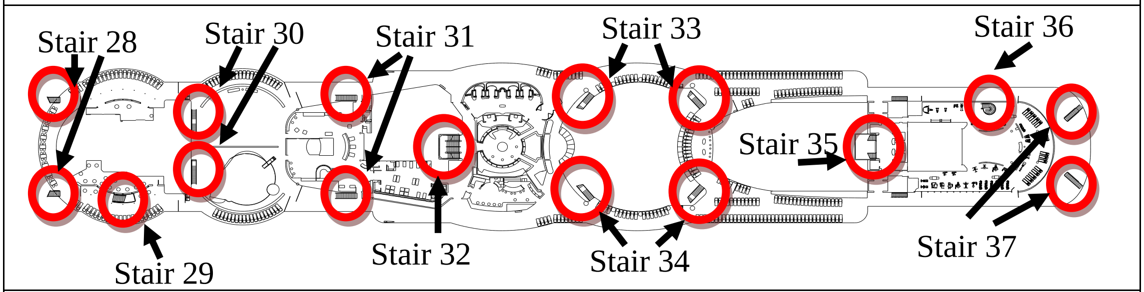
These files can be found on the internet at the following location:

http://fseg.gre.ac.uk/validation/ship_evacuation

Please note that the scales in the DXF files are set to metres. The vessel layout constructed using these autoCAD files is presented in Figure 1. Also shown in this diagram is the location of the twenty nine stairs used during the assembly drill.



SGVDS2-Deck-12.dxf



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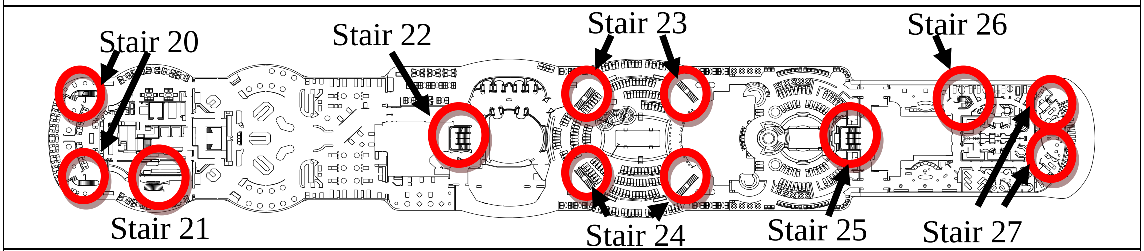
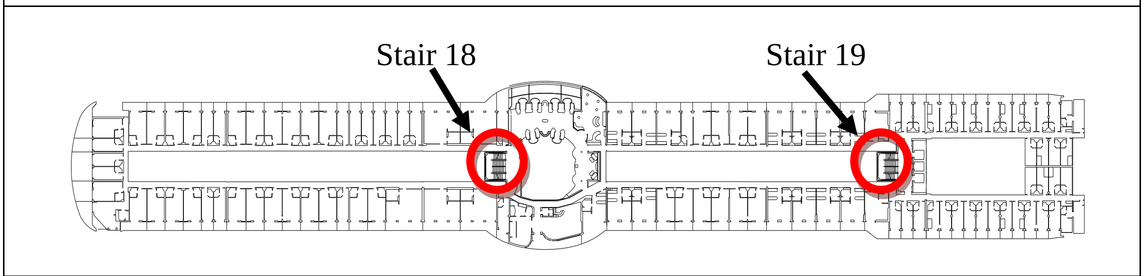


SGVDS2-Deck-10.dxf



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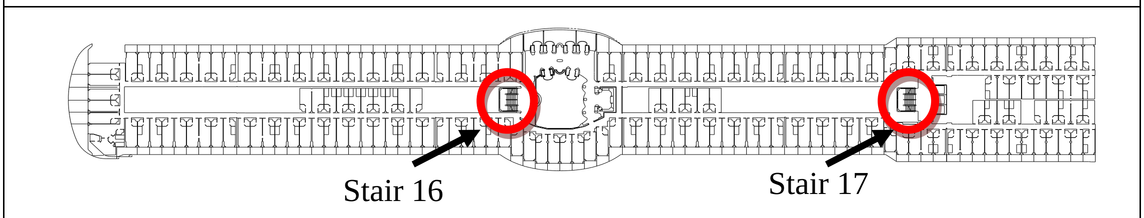
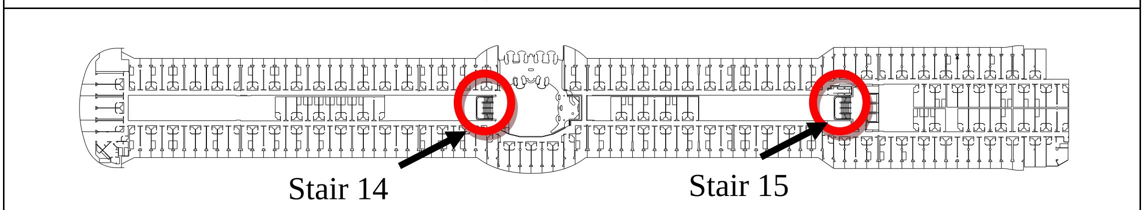


SGVDS2-Deck-8.dxf



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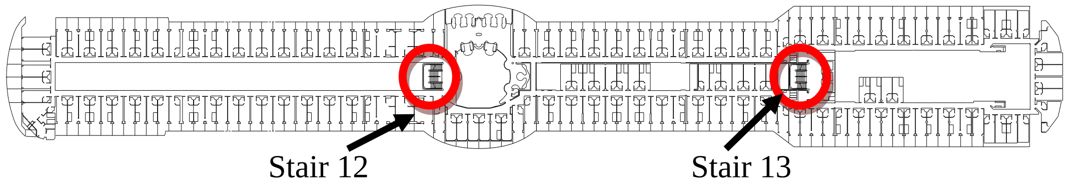
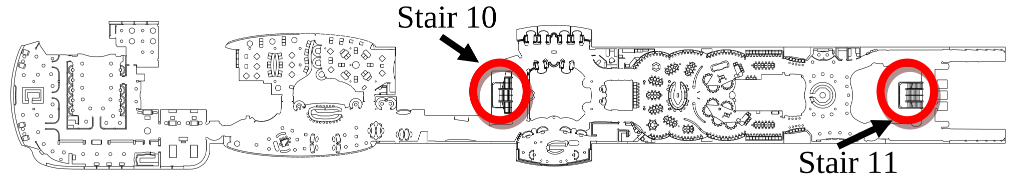
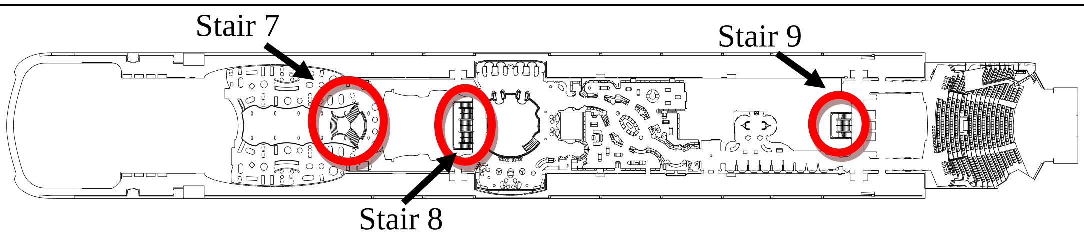


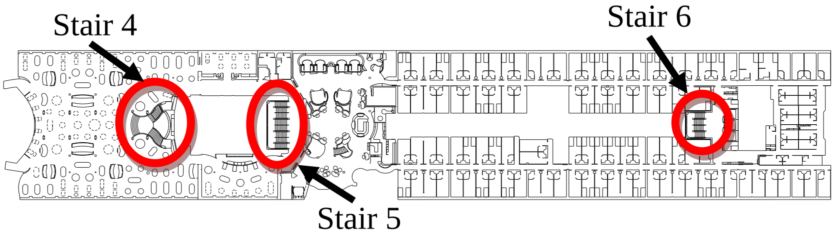
SGVDS2-Deck-6.dxf



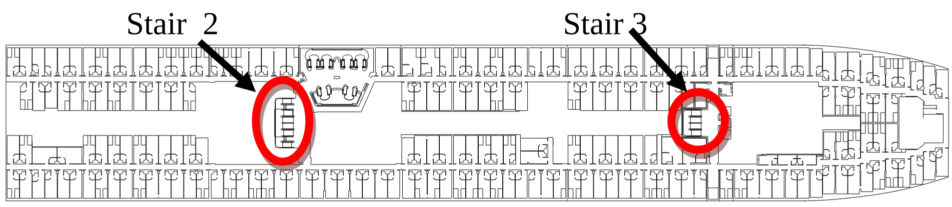
SGVDS2-Deck-5.dxf



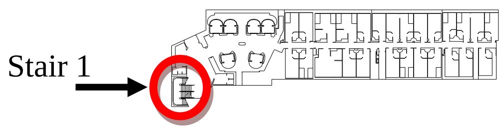
SGVDS2-Deck-4.dxf



SGVDS2-Deck-3.dxf



SGVDS2-Deck-2.dxf



SGVDS2-Deck-1.dxf

Figure 1 - the autoCAD drawings of the vessel layout showing the location of the stairs

In addition to the DXF files, the following geometry information is required in order to construct the ship geometry.

3.1 Deck Heights

The heights of the twelve decks are as follows:

Deck 1: 2.7 m high
Deck 2: 2.7 m high
Deck 3: 3.2 m high
Deck 4: 3.5 m high
Deck 5: 3.3 m high
Deck 6: 2.7 m high
Deck 7: 2.7 m high
Deck 8: 2.7 m high
Deck 9: 3.35 m high
Deck 10: 3.2 m high
Deck 11: 3.0 m high

3.2 Stair dimensions:

Each of the stairs shown in Figure 1 has dimensions outlined below. Please note that each stair width is measured from the inside of the handrail to the inside of the handrail and so represents clear stair width. The length of the stair also represents its horizontal length (i.e. it does not represent the length measured down the slope).

Table 1 shows the links between decks as illustrated in Figure 1. For example, the stairs in Figure 1 labelled 'stair 19' is connected to 'stair 25' according to Table 1.

Table 1 - Stair connections between the lower deck and the upper deck

Lower Stair Connection	Upper stair connection
1	2
2	5
3	6
4	7
5	8
6	9
8	10
9	11
10	12
11	13
12	14
13	15
14	16
15	17
16	18
17	19
18	22
19	25
20	28
21	29
22	32
23	33
24	34
25	35
26	36
27	37
30	38
31	39
32	40

The following dimensions are taken from the DXF autoCAD drawings accompanying this manual. All dimensions are approximate and should be checked by the user when implementing in their software tool.

The stair run from stair 3 to stair 35 (i.e. stair 3, stair 6, stair 9, stair 11, stair 13, stair 15, stair 17, stair 19, stair 25 and stair 35 – see Table 1) are located in the fore of the vessel and extend from deck 2 to deck 10. All of the stair runs for this staircase are 1.2 m wide and 1.89 m long. There are two stair runs, separated by a handrail, leading up to a landing which is 5.2m by 1.5m. From the landing there are two stair runs, separated by a handrail, leading up to the next deck.

The stair run from deck 1 to deck 11 (i.e. Stairs 1, stair 2, stair 5, stair 8, stair 10, stair 12, stair 14, stair 16, stair 18, stair 22,stair 32 and stair 40 – see Table 1) are located amidships next to the atrium area and extend from Deck 1 to Deck 11. All of the stair runs for this staircase are 1.15m wide and 1.9m long. There are two stair runs, separated by a handrail, leading up to a landing which is 5.2m by 1.5m. From the landing there are two stair runs, separated by a handrail, leading up to the next deck. The Landings between Deck 2 and Deck 5 have the dimensions of 10.1m by 1.5m.

Stair 4 / stair 7 is located within the restaurant area on deck 3. This staircase consists of three curved stairs. The first stair leads from deck 3 up to the landing and is 4.69m at its widest point and 3.55m at its narrowest point wide and 1.39m long. The landing is 3.67m at its widest point and 4.06m at its longest point. The two stairs leading from the landing up to deck 4 are 1.74m wide and 3.1m long on the inside of the stair and 3.5m on the outside of the stair (taking into account the curvature of the stairs).

Stair 20 / 28 has a single stair run which is 1.4m wide and 0.96m long up to the landing which is 0.4m (on its shortest side) and 1.63m (on its longest side) long and 1.4m wide. From the landing leading up to deck 10, there is a single stair run which is 3.6m long and 1.18m wide.

Stair 21 / 29 is located on the outer deck of deck 10, and has a single stair run which is 4.26m long on the outside and 3.71m long on the shorter side, allowing for the curvature of the stairs. The stairs are 1.4m wide and do not have a landing.

Stair 23 / stair 33 and stair 24 / stair 34 both consist of single stair runs which are 2.1m long and 1.18m wide, leading up to a landing of 1.7m x 1.7m. From the landing up to deck 10, both stairs consist of a single stair run which are also 2.1m long and 1.18m wide.

Stair 26 / stair 36 is a spiral staircase with steps 0.98m wide. The area encasing the spiral staircase is 2.65m long and 2.25m wide and does not have any landings.

Stair 27 / stair 37 are single stair runs leading from deck 9 to deck 10 and are 0.89m wide and 4.43m long and have no landing.

Stair 30 / stair 38 are single run staircases which are 0.88m wide and 2.0m long up to a landing which is 0.88m wide and 1.2m long. The stairs leading from the landing up to deck 11 is 0.88m wide and 2.0m long

Stair 31 / stair 39 are single stair runs leading from deck 10 to deck 11 and are 1.2m wide and 4.4m long and have no landings.

4) POPULATION

This section provides details of the population within the validation data set.

4.1 Number of Agents:

The model consists of a population of 1779 agents. These agents represent the passengers who wore the Infra-red (IR) tracking devices and so their starting position, end position and arrival time in the assembly station are known.

4.2 Population Attributes:

The population are assigned population attributes of age, gender and travel speeds according to those set out in the IMO MSC 1238 guidelines [1].

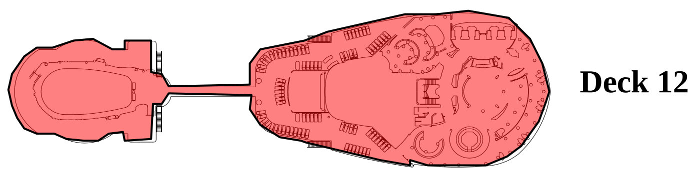
4.3 Population Starting Locations:

The starting locations of the population are distributed throughout the vessel e.g. Deck 3 seating area, Deck 2 restaurant, Deck 1 lockers, Deck 1 retail, etc. The location and extent of all the available starting locations are indicated in Figure 2. The starting location of the agents is shown in Table 2.

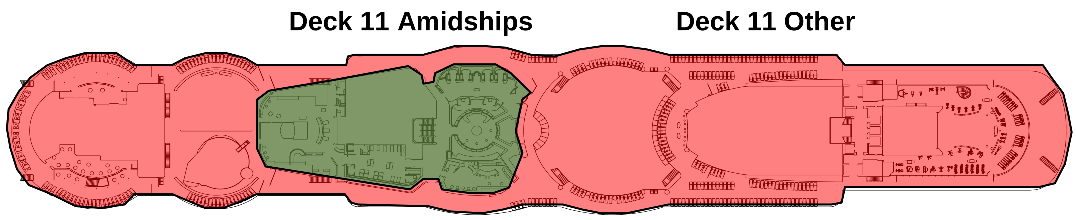
Table 2 describes how many agents should be placed in each of the highlighted areas in Figure 2. For example, from Table 2 a total of 56 agents started in the Deck 11-Other area.

4.4 Population End Locations:

The end locations of the population are distributed between the four Assembly Stations (AS), A, B, C and D. The location and extent of the four ASs are indicated in Figure 2. The end location of the agents is shown in Table 2.



SGVDS2-Deck-12.dxf



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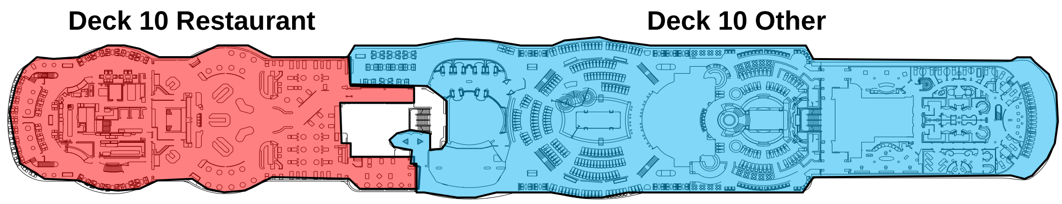

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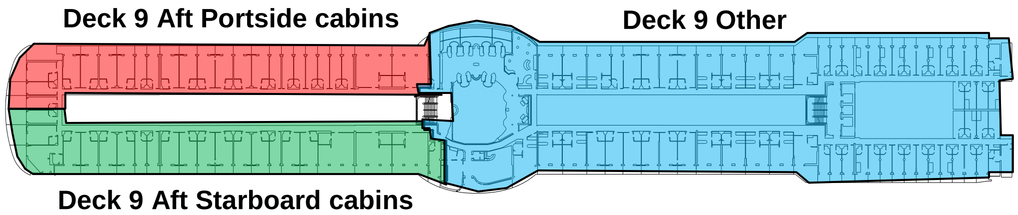

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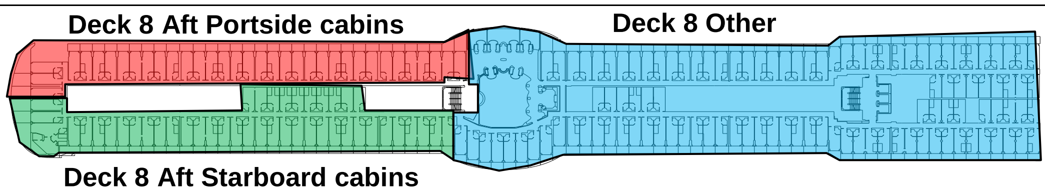

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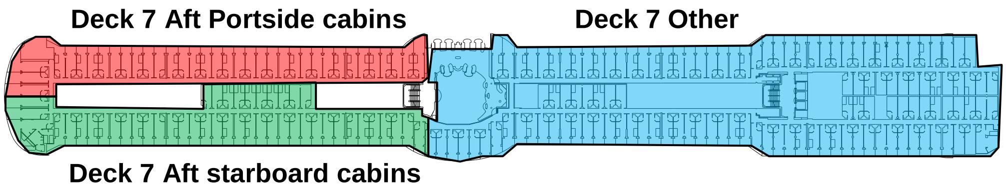

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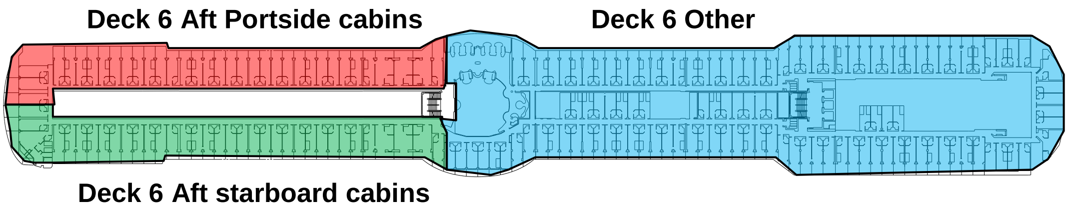

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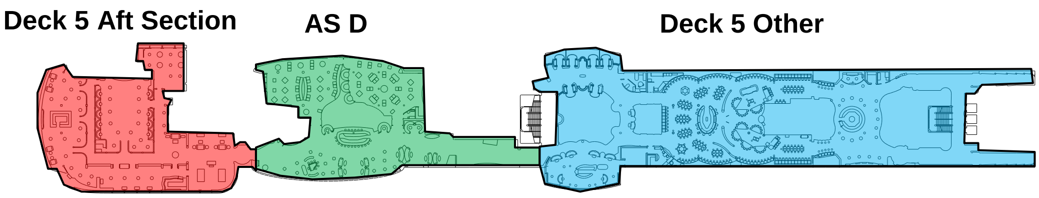
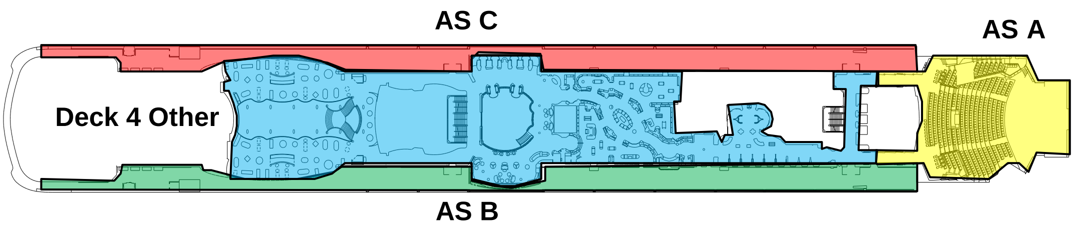
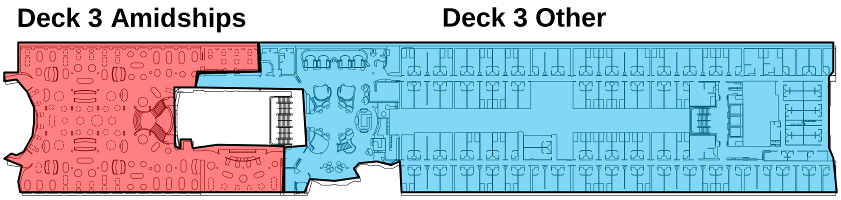


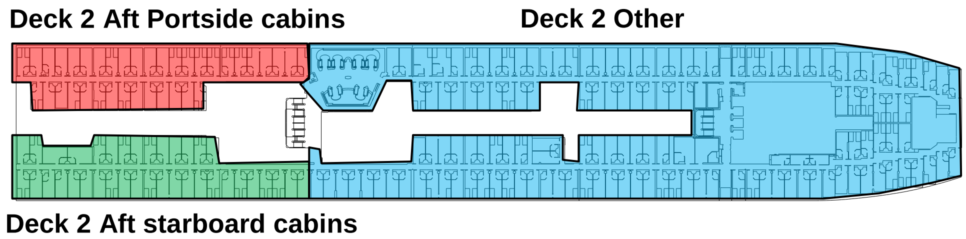
SGVDS2-Deck-5.dxf



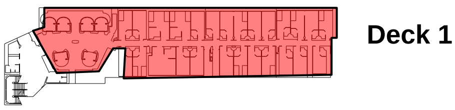
SGVDS2-Deck-4.dxf



SGVDS2-Deck-3.dxf



SGVDS2-Deck-2.dxf



SGVDS2-Deck-1.dxf

Figure 2 - highlighted areas labelled on vessel layout

Table 2 describes how many agents go to each of the ASs. For example, from Table 2, of the 56 agents that started in the Deck 11 - Other area, 16 go to AS A, 14 go to AS B, 14 go to AS C and 12 go to AS D.

Table 2 - Distribution of population starting and end locations

	AS A	AS B	AS C	AS D
Deck 12	0	6	2	0
Deck 11 Amidships	6	11	7	10
Deck 11 Other	16	14	14	12
Deck 10 Restaurant	129	126	103	65
Deck 10 Other	24	52	30	16
Deck 9 Aft Portside cabins	1	5	12	13
Deck 9 Aft starboard cabins	0	10	2	14
Deck 9 Other	11	25	10	1
Deck 8 Aft Port side cabins	0	4	14	35
Deck 8 Aft starboard cabins	0	17	8	22
Deck 8 other	25	21	7	0
Deck 7 Aft Port side cabins	1	5	10	24
Deck 7 Aft starboard cabins	0	22	3	6
Deck 7 other	30	11	14	0
Deck 6 Aft Port side cabins	0	4	11	22
Deck 6 Aft starboard cabins	0	13	4	11
Deck 6 Other	33	19	20	2
AS D	4	3	6	14
Deck 5 other	9	4	5	7
AS C	2	0	3	0
AS B	1	14	0	0
Deck 4 other	18	31	28	25
AS A	5	0	0	0
Deck 3 Restaurant	46	43	56	52
Deck 3 Other	13	58	15	0
Deck 2 Aft Port side cabins	0	0	18	7
Deck 2 Aft starboard cabins	1	11	8	1
Deck 2 other	25	45	15	2
Deck 1	2	1	12	4

5) Response Time Curve

The passenger response time distribution (RTD) was established from video footage and determined as a global response time distribution for the vessel.

The response time distribution described below should be applied to all agents in the model.

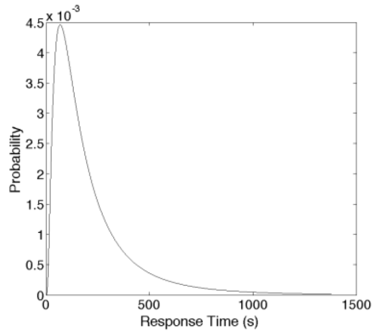


Figure 3 - Global response time distribution to be applied to all agents in the SGVDS2 scenario

$$y = \frac{1}{\sqrt{2\pi}(0.89)x} \exp\left[-\frac{(\ln(x) - 5.012)^2}{2(0.89)^2}\right] \qquad (1)$$

min = 0 max = 1379 mean (μ) = 50.12 standard deviation (σ) = 0.89

6) THE SGVDS2 ARRIVAL CURVES

An assembly curve is available for each of the four ASs and the overall assembly. The detailed data describing each of these assembly curves is provided in the EXCEL SPREADSHEET SGVDS2.XLS. This spreadsheet is available on the same website that this document was downloaded from [2].

Note that all the assembly graphs associated with the SGVDSs are configured so that they present the Assembly Time (in seconds) versus the number of passengers assembled. Thus the X-axis represents the number of passengers assembled while the Y-axis represents the assembly time (in seconds). This orientation is required for the data analysis described in Section 7.

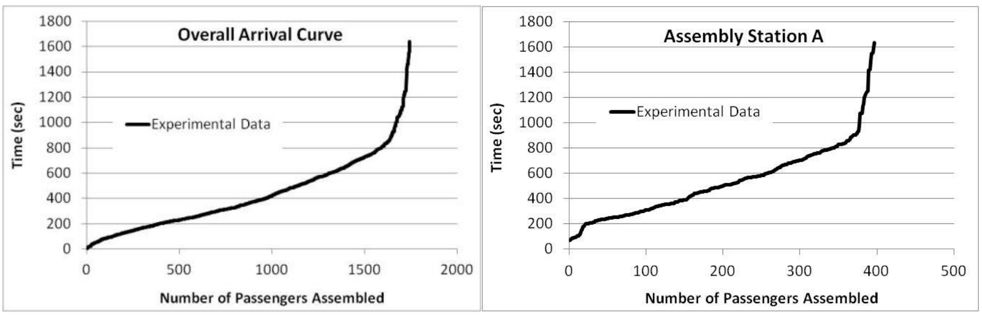


Figure 4 – Overall assembly curve and AS A assembly curve for SGVDS2

7) THE VALIDATION METRIC

It is desirable to have objective measures of the level of agreement between predicted and measured performance rather than subjective assessments based on visual inspection of how well the predicted and measured curves agree. This is particularly important if the validation analysis is to be used by regulatory authorities to determine the suitability of an evacuation modelling tool. Thus it is necessary to quantify the level of agreement between predicted and measured performance. This is achieved using a validation metric based on quantifiable differences between the predicted and measured curves. The metric consists of the Euclidean Relative Difference, Euclidean Projection Coefficient and the Secant Cosine. These measures compare the shape of the model prediction to the experimental data as well as the distance apart.

- **The Euclidean Relative Difference (ERD)**

$$\frac{\|E-m\|}{\|E\|}=\frac{\sqrt{\sum_{i=1}^{n}(E_i-m_i)^2}}{\sqrt{\sum_{i=1}^{n}E_i^2}} \qquad (2)$$

This is used to assess the distance between the experimental data (E_i) and the model data (m_i). This value should return a value of 0 if the two curves are identical in magnitude. The smaller the value for the ERD, the better the overall agreement. An ERD of 0.2 suggests that the average difference between the model and experimental data points, taken over all the data points is 20%.

- **The Euclidean Projection Coefficient (EPC).**

$$\frac{\langle E,m\rangle}{\|m\|^2}=\frac{\sum_{i=1}^{n}E_i m_i}{\sum_{i=1}^{n}m_i^2} \qquad (3)$$

The EPC calculates a factor which when multiplied by each model data point (mi) reduces the distance between the model (m) and experimental (E) vectors to its minimum. Thus the EPC provides a measure of the best possible level of agreement between the model (m) and experimental (E) curves. An EPC of 1.0 suggests that the difference between the model (m) and experimental (E) vectors are as small as possible.

- **The Secant Cosine (SC)**

$$\frac{\langle E,m\rangle}{\|E\|\|m\|}=\frac{\sum_{i=s+1}^{n}\frac{(E_i-E_{i-s})(m_i-m_{i-s})}{s^2(t_i-t_{i-1})}}{\sqrt{\sum_{i=s+1}^{n}\frac{(E_i-E_{i-s})^2}{s^2(t_i-t_{i-1})}\sum_{i=s+1}^{n}\frac{(m_i-m_{i-s})^2}{s^2(t_i-t_{i-1})}}} \qquad (4)$$

Unlike the other two measures, it provides a measure of how well the shape of the model data curve matches that of the experimental data curve. It makes use of the first derivative of both curves. The SC measure includes a ‘smoothing’ term, s, which attempts to remove in noise in both the experimental data and the model prediction.

Selecting an appropriate value of *s* is dependent on the number of data points in the data-set, given by *n*. It is desirable to keep the ratio *s/n* as low as possible. Typically the value of S/n should fall in the range 0.01 to 0.05 with steps of 0.01. An SC of 1.0 suggests that the shape of the model (m) curve is identical to that of the experimental (E) curve.

A computer programme has been provided that determines the metric values for any two data-sets. This computer programme can be used to compare the predicted assembly curves with SGVDS2. This programme is called FSEG_VALIDATION_ASSESSOR and is freely available from the same website that this document was downloaded from [3].

Another parameter which is used in the validation metric is the percentage difference between the predicted Total Assembly Time (TAT) and the measured TAT.

$$\% \text{ TAT} = (\text{Measured TAT} - \text{Predicted TAT}) * 100 / \text{Measured TAT} \qquad (5)$$

8) PROCEDURES FOR RUNNING THE SGVDS2 SCENARIO

8.1 SGVDS2 Summary

The following information summarises the nature of the SGVDS2.

- SGVDS2 is based on a semi-unannounced full-scale ship assembly trial conducted at sea using actual ship passengers.
- Of the 2292 passengers on board, 1779 were tracked during the assembly exercise – identified as the main population.
- SGVDS2 includes the following information:
    i. Vessel layout (Section 3).
    ii. Starting locations for the population (Section 4.3).
    iii. End locations for population (Section 4.4).
    iv. Response time distributions for the main and secondary population which are location specific (Section 5).
    v. Arrival times for each member of the population in each of the four ASs (Section 6).

8.2 SGVDS2 Validation Protocol

The validation analysis should proceed as follows:

- Construct vessel geometry using the autoCAD files described in Section 3.
- Construct a population consisting of 1779 agents and distribute them around the vessel as described in Section 4.3.
    - The population demographics must follow that prescribed by IMO MSC Circ 1238 i.e. using the age, gender and travel speeds described in the regulations. This includes the number of passengers with reduced mobility.
    - DO NOT use the RTD specified in IMO MSC Circ 1238. The RTD specified in Section 5 must be used.
    - Each agent should be assigned to the assembly stations specified in Section 4.4.

- Run the validation scenario 50 times, changing the population after every 5 simulation runs as stipulated in the IMO MSC Circ 1238.
- Agents who are initially located in and remain in the assembly stations should have their arrival time removed from the analysis.
- The arrival data for each simulation run is separated into the overall arrival data and the arrival data for each assembly station.
- The overall arrival data from each simulation is compared to the measured overall arrival data using the Euclidean Relative Difference (ERD) i.e. equation 6 (as explained in Section 7).
    - The computer programme FSEG_VALIDATION_ASSESSOR can be used to simplify the assessment.
- Rank each simulation according to the ERD determined for the overall assembly data.
- Select the simulation producing the smallest ERD which will be the basis of the validation comparison.
- For the selected simulation case go through the two phase assessment process which consists of the following:
    - **Phase 1**: For the predicted total assembly curve, determine ERD, EPC, SC (see equations 2, 3 and 4) and % TAT (equation 5).
    - Determine if all four predicted parameters satisfy the acceptance criteria (Section 9). If so go to Phase 2. If not, the software has failed the assessment.
    - **Phase 2**: For the predicted assembly curve for each of the four assembly stations, determine ERD, EPC and SC.
    - Determine which of the 12 predicted parameters (three for each assembly station) satisfy the acceptance criteria. At least 9 out of 12 criteria must be met for SGVDS2 to satisfy the criteria and it is not acceptable to have two or more failed criteria in any one assembly station.
    - The computer programme FSEG_VALIDATION_ASSESSOR can be used to simplify the assessment.
    - An example results matrix generated from the metric analysis of the overall assembly data and the AS assembly data is presented in Table 2. In Table 3 “n” represents the number of data points in the assembly data-sets for the overall assembly and each AS.

Table 3 - Example validation metric results table

	SC					n	ERD	EPC	% diff TAT
s/n	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**				
Overall	**0.9**	**1.0**	**1.0**	**1.0**	**1.0**	**1743**	**0.08**	**1.1**	**-2.2**
AS A	**0.8**	**0.9**	**0.9**	**0.9**	**0.9**	**397**	**0.13**	**1.1**	**-18.0**
AS B	**0.8**	**0.9**	**0.9**	**0.9**	**1.0**	**561**	**0.10**	**1.0**	**-5.7**
AS C	**0.8**	**0.8**	**0.9**	**0.9**	**0.9**	**434**	**0.10**	**1.1**	**9.5**
AS D	**0.8**	**0.9**	**0.9**	**0.9**	**0.9**	**351**	**0.15**	**1.0**	**8.7**

9) SGVDS2 ACCEPTANCE CRITERIA:

If the validation protocol is applied as described in Section 8.2 and the software meets the acceptance criteria, it demonstrates that the software is capable of producing an acceptable level of agreement with the experimental data for the entire assembly process. The suggested acceptance criteria are as follows:

(i) ERD $\leq$ 0.25
(ii) 0.8 $\leq$ EPC $\leq$ 1.2
(iii) SC $\geq$ 0.8 with s/n = 0.03
(iv) Predicted TAT for the overall assembly to be within 15% of the measured value. This criterion is only applied to step 1 of the acceptance process.

10) REGULATORY DOCUMENTATION

If the results of the SGVDS2 are to be presented to a regulatory authority to demonstrate that the software is suitable to use in certification analysis it is suggested that the following information is included in the submission:

i. Software name and version number.
ii. Input files to generate 50 cases (should be complete to the point that the authority could re-run the cases).
iii. Complete output files for the 50 cases with time stamp showing date and time generated.
iv. If software permits, provide replay file for all 50 cases (with date and time of generation).
v. Metric analysis
    1. Metric analysis to identify the Best ERD – spread sheet showing all 50 overall assembly time data sets, each associated with an ERD.
    2. Spread sheet with the complete data-set associated with the Best ERD i.e. assembly times for each AS and for the overall assembly. Spread sheet should be arranged so that it can be read by the FSEG_VALIDATION_ASSESSOR software.
    3. Table showing metric analysis for the Best ERD case.
    4. Spread sheet with graph showing the SGVDS and the Best ERD prediction for overall and each assembly station.

11) **ADDITIONAL INFORMATION**

This section provides a summary of the files, in addition to this document, that are required to define and analyse the validation scenario. All of the files are available from the following download area:

http://fseg.gre.ac.uk/validation/ship_evacuation

- DXF files describing each deck.
    - SGVDS2-Deck-1.dxf
    - SGVDS2-Deck-2.dxf
    - SGVDS2-Deck-3.dxf
    - SGVDS2-Deck-4.dxf
    - SGVDS2-Deck-5.dxf
    - SGVDS2-Deck-6.dxf
    - SGVDS2-Deck-7.dxf
    - SGVDS2-Deck-8.dxf
    - SGVDS2-Deck-9.dxf
    - SGVDS2-Deck-10.dxf
    - SGVDS2-Deck-11.dxf
    - SGVDS2-Deck-12.dxf

  Please note that the scales in the DXF files are set to metres.

- Spreadsheet containing 5 worksheets:
    - SGVDS2.xls

  Each worksheet contains the data required to construct the assembly curve for the overall assembly, assembly station A, assembly station B, assembly station C and assembly station D. Note that the arrival data ignores the passengers who were in the assembly station at the start of the assembly process (these passengers have a zero assembly time).

- Validation Metric Calculator:
    - FSEG_VALIDATION_ASSESSOR.exe

  Software produced by FSEG to calculate the three components of the validation metric, ERD, EPC and SC.

12) References

1. "Guidelines for Evacuation Analysis for New and Existing Passenger Ships", IMO MSC/Circ 1238, 30 Oct 2007.
2. SGVDS2.XLS. Download from http://fseg.gre.ac.uk/validation/ship_evacuation
3. Haasanen, S., Galea, E.R., and Deere, S., Computer Software, FSEG_VALIDATION_ASSESSOR. Download from http://fseg.gre.ac.uk/validation/ship_evacuation