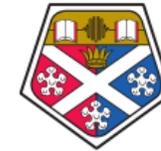




SAFEMODE

Strengthening synergies between Aviation and Maritime
in the area of Human Factors towards achieving more
efficient and resilient MODES of transportation.



UNIVERSITY OF STRATHCLYDE
**MARITIME HUMAN
FACTORS CENTRE**

Retrospective application of SAFEMODE risk models to maritime investigation reports

Yaser B. A. Farag

University of Strathclyde

**The 1st International
Maritime Human
Factors Symposium**

28-29 November 2022, Glasgow, UK.



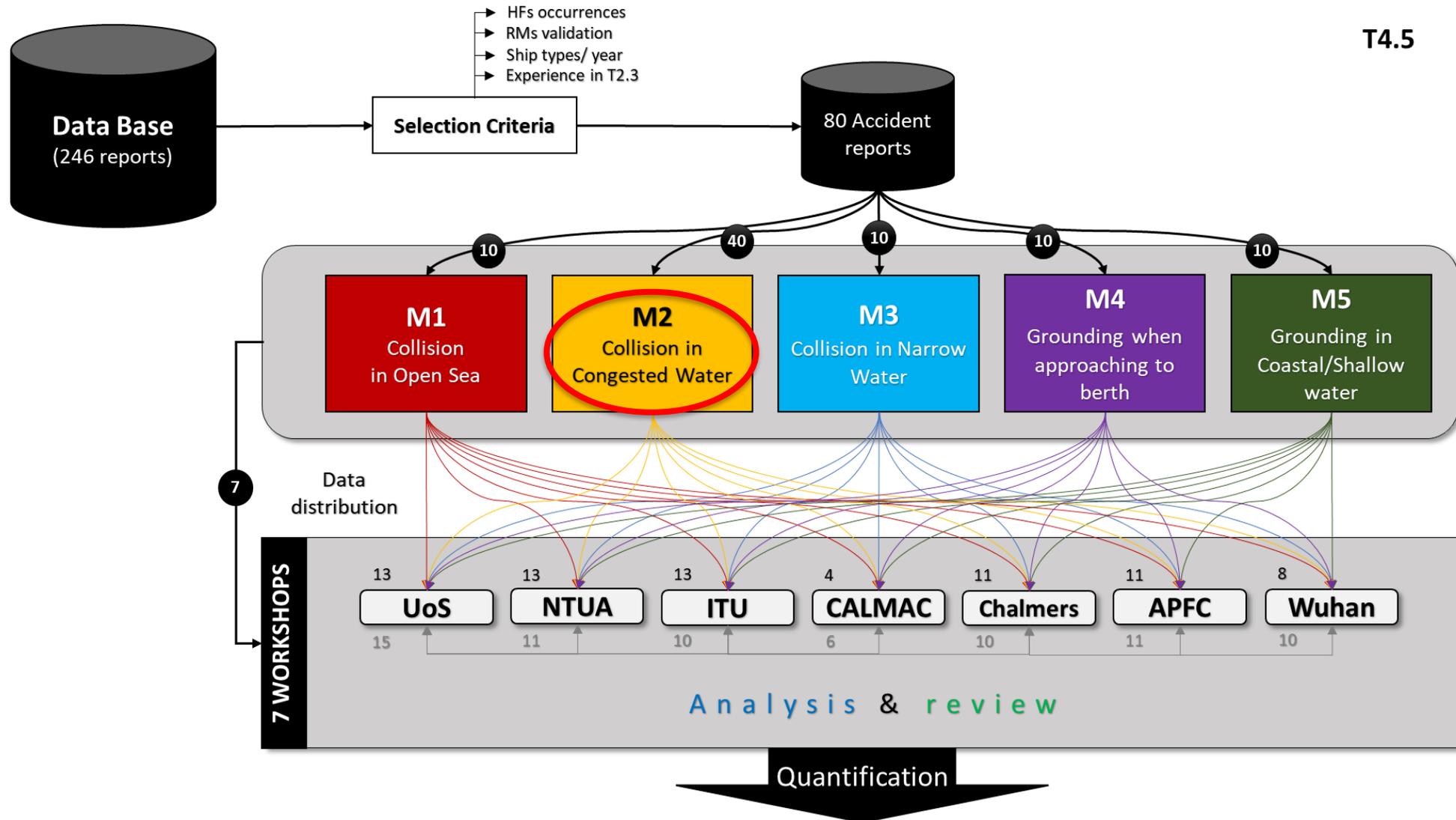
This project has received funding from European Union's Horizon 2020
Research and Innovation Programme under Grant Agreement N°814961.

Each risk model is developed for a **specific type of occurrence**, in a **specific operational context**, and considering specific services and systems preventing or contributing to the risk of the accident.

Code	Risk Model description
M1	Collision at open sea
M2	Collision in congested water
M3	Collision in narrow waters
M4	Grounding while approach to the berth
M5	Grounding in shallow waters

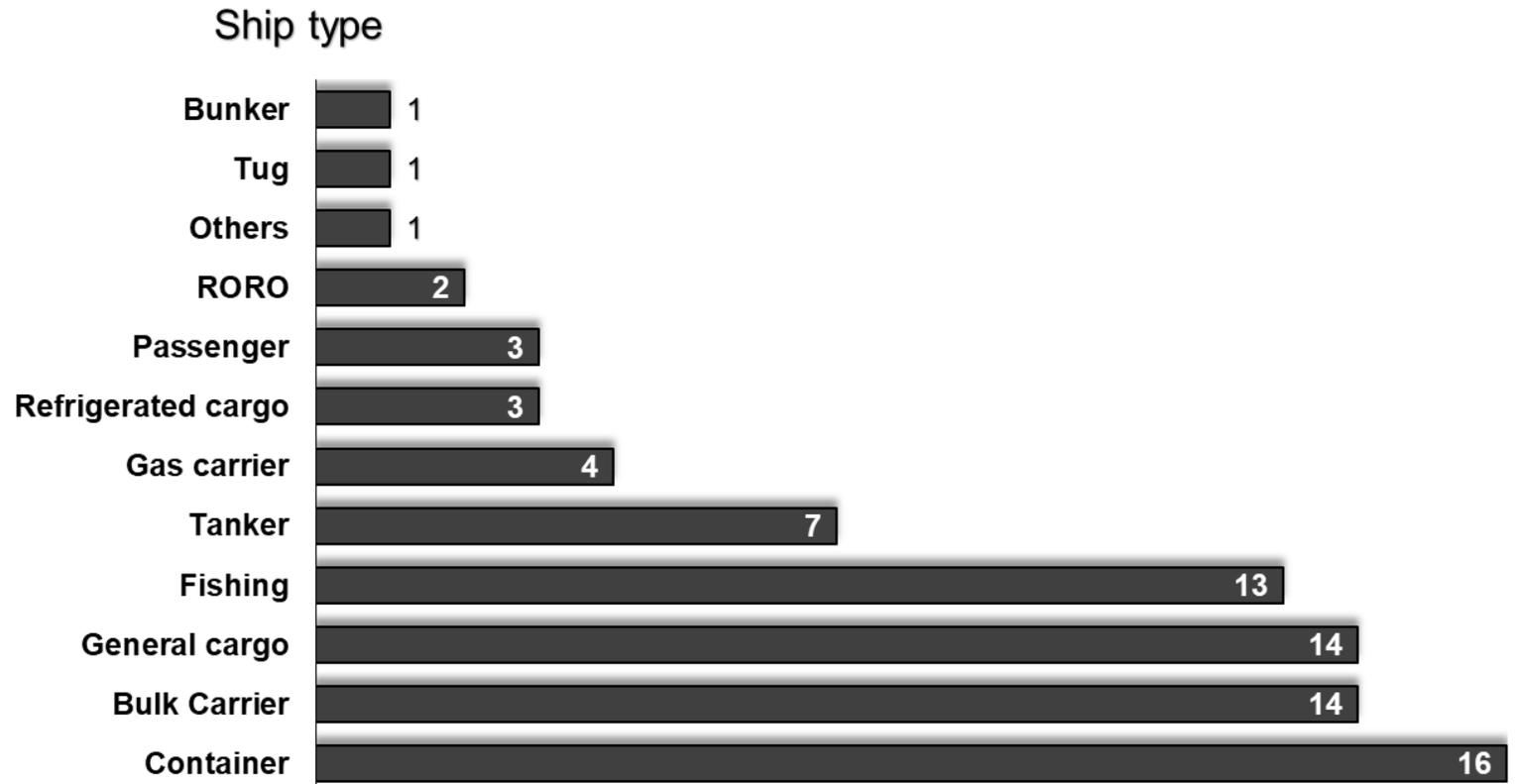
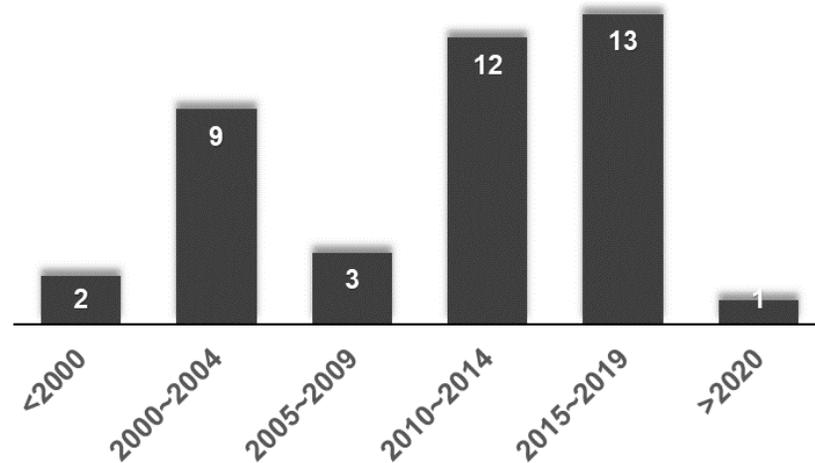
Activity	Date	Participants
1. Introductory meeting	18/06/2021	UoS, NTUA, CHALMERS, ITU, APFC, WUHAN
2. (M5) review-session	23/06/2021	UoS, NTUA
3. (M5) Workshop-I	23/06/2021	UoS, NTUA, CHALMERS, ITU, APFC, CALMAC
4. (M5) review-session	24/06/2021	UoS, NTUA, CHALMERS
5. (M5) Workshop-II	30/06/2021	UoS, NTUA, CHALMERS, ITU, APFC, WUHAN
6. (M4) review-session	05/07/2021	UoS, NTUA, CHALMERS
7. (M4) Workshop	07/07/2021	UoS, NTUA, CHALMERS, ITU, APFC, Kongsberg
8. (M2) review-session	12/07/2021	UoS, NTUA, CHALMERS, CALMAC
9. (M2) Workshop	14/07/2021	UoS, NTUA, CHALMERS, ITU, APFC, CALMAC
10. (M3) review-session	26/07/2021	UoS, NTUA, CHALMERS, CALMAC, ITU
11. (M3) Workshop	28/07/2021	UoS, NTUA, CHALMERS, ITU, APFC, CALMAC, WUHAN
12. (M1) review-session	02/08/2021	UoS, NTUA, CHALMERS, CALMAC
13. (M1) Workshop-I	04/08/2021	UoS, NTUA, CHALMERS, ITU, APFC, CALMAC, WUHAN
14. (M1) review-session	09/08/2021	UoS, NTUA, CHALMERS, CALMAC, ITU
15. (M1) Workshop-II	11/08/2021	UoS, NTUA, CHALMERS, ITU, APFC, CALMAC, WUHAN, Kongsberg
	01/03/2022	
16. Final revision of maritime risk models (deviation reports' remarks were addressed and RMs were updated)	08/03/2022	UoS, NTUA, CHALMERS, ITU
	09/03/2022	

T4.5

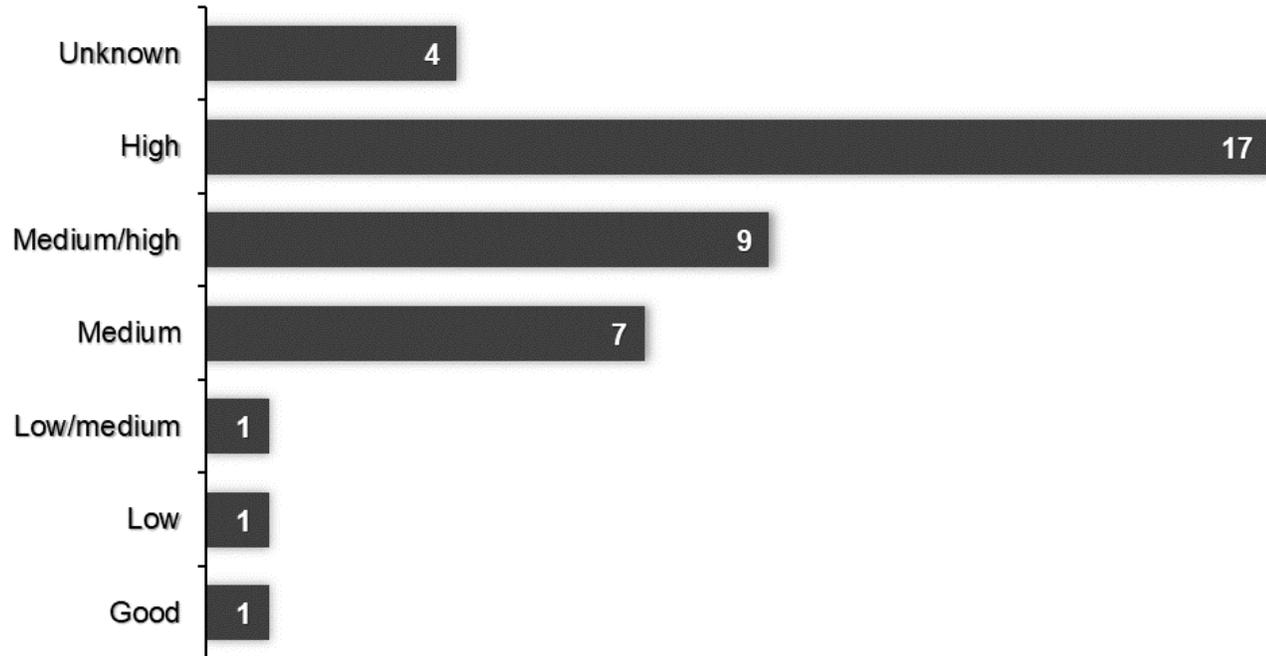


IRs

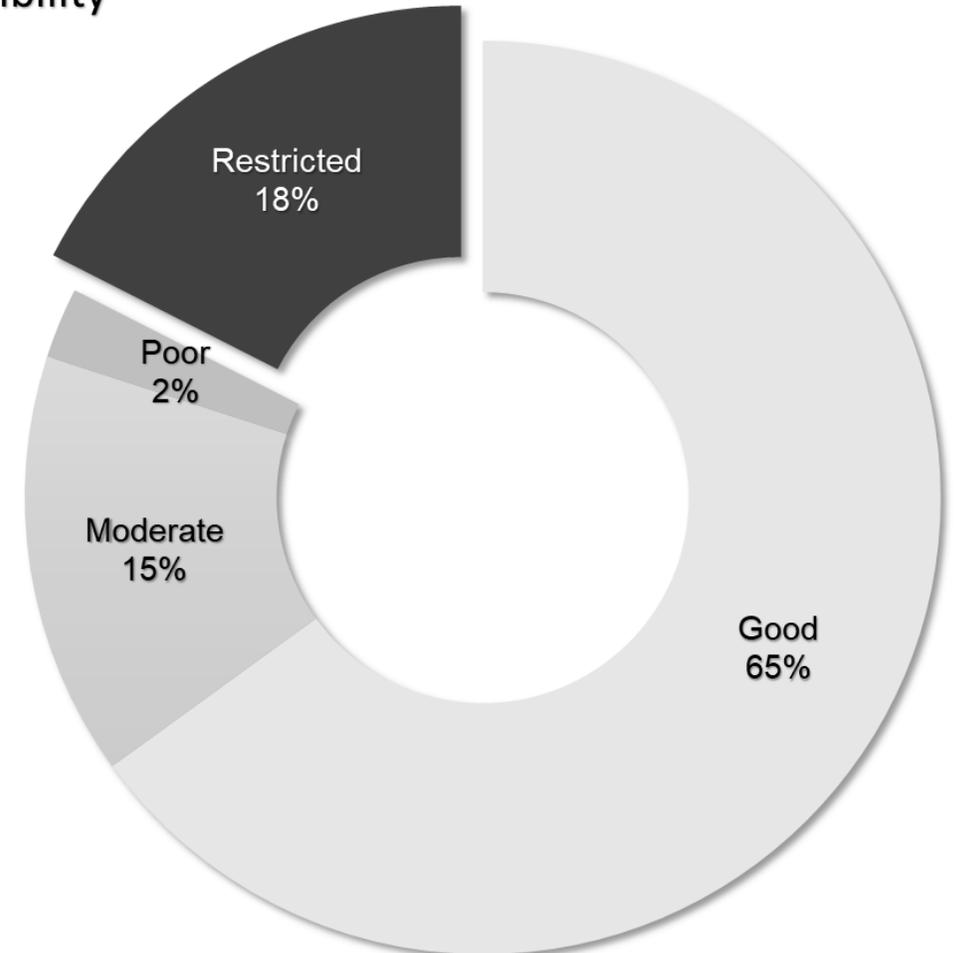
IR1	Hampoel and Atlantic Mermaid	IR21	Celtic King and De Bounty
IR2	ANL Wyong and King Arthur	IR22	Saint Jacques and Gudermes
IR3	Saetta and Conger	IR23	Philipp and Lynn Marie
IR4	CMA CGM Florida and Chou Shan	IR24	Polar Spirit and Zhe Xiang Yu 41020
IR5	Cepheus J and Ilekxa	IR25	Baltic Ace and Corvus J
IR6	Lykes Voyager and Washington Senator	IR26	Condor Vitesse and Les Marquises
IR7	Ash and Dutch Aquamarine	IR27	Dream and Ever Decent
IR8	Spring Bok and Gas Arctic	IR28	MV PERSENK and AHMET CAN
IR9	Daroja and Erin Wood	IR29	KANALA and LIAODANYU 23626
IR10	Rickmers Dubai with Walcon Wizard	IR30	MV DORIS and ZHE XIANG YU 24005
IR11	MSC Sabrina and Wintertide	IR31	NEPTUNE HELLAS and NUR
IR12	Scot Isles and Wadi Halfa	IR32	BRITANNICA HAV and Z121 DEBORAH
IR13	Boxford and Admiral Blake	IR33	MV SHARK and Mohammed Badry
IR14	Hyundai Discovery and ACX Hibiscus	IR34	MV ADAM ASNYK and MV DK IMAN
IR15	Millennium Time and tug Redoubt	IR35	Gortynia and DZ Quingdao
IR16	Pasadena Universal and Nordheim	IR36	Coulmbus Victoria and Sampet Hope
IR17	Huayang Endeavour and Seafreighter	IR37	Atlantic Hero and Oriental Pioneer
IR18	Hyundai Dominion and Sky Hope	IR38	Paula C and Darya Gayatri
IR19	Kinsale and EastFern	IR39	CLIPPER QUITO and LURONGYU
IR20	Scot Explorer and Dorthie Dalsoe	IR40	STAR KVARVEN and LULANYU



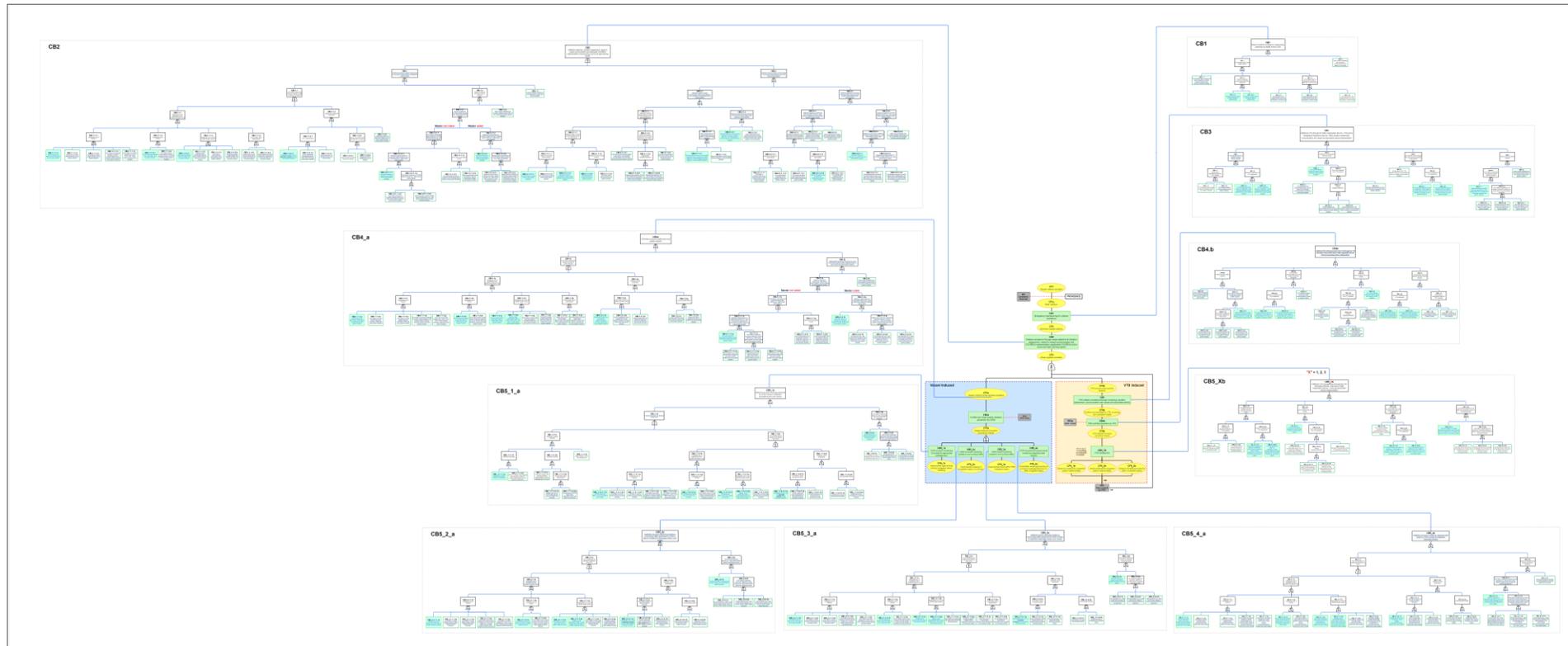
Traffic classification

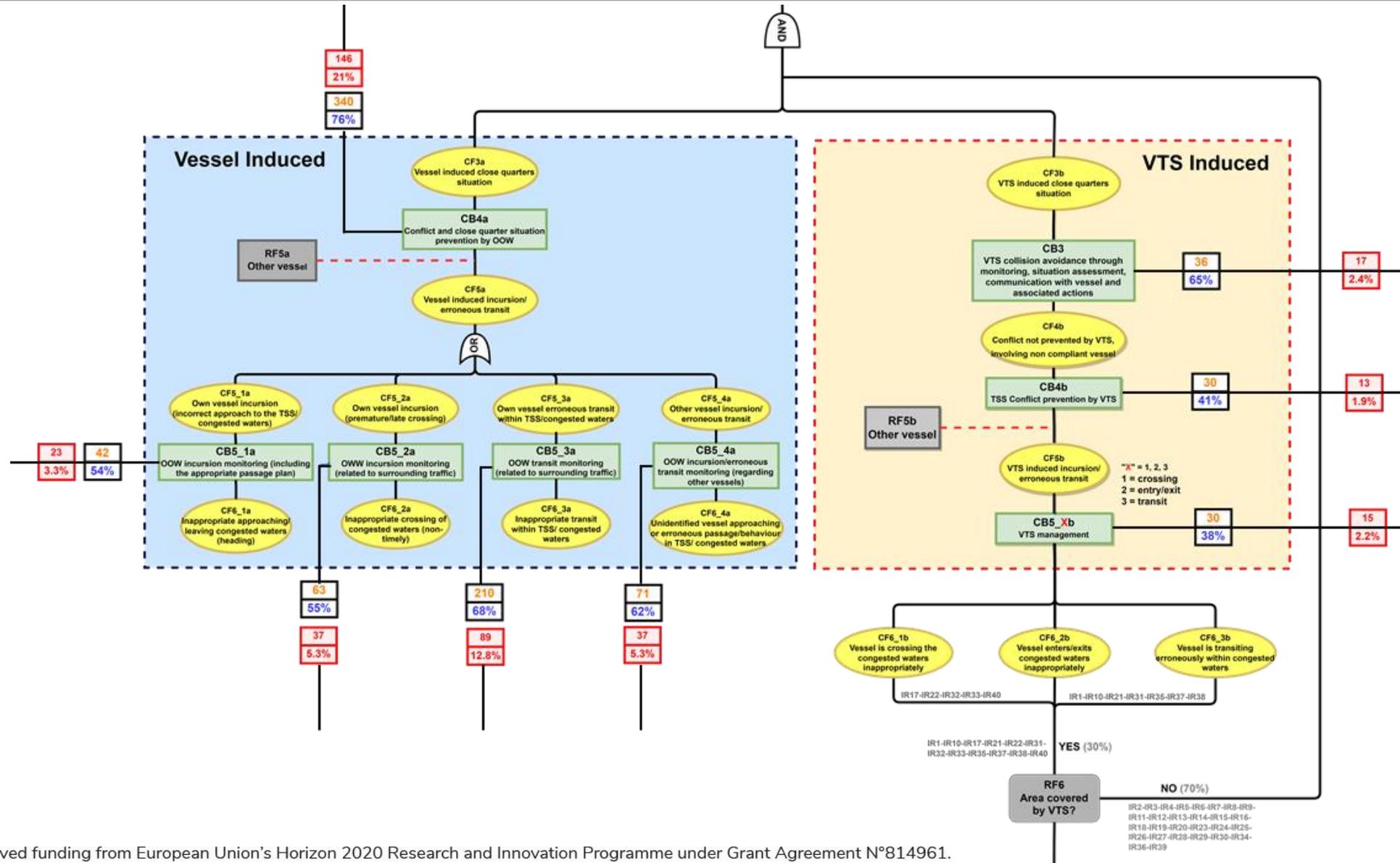


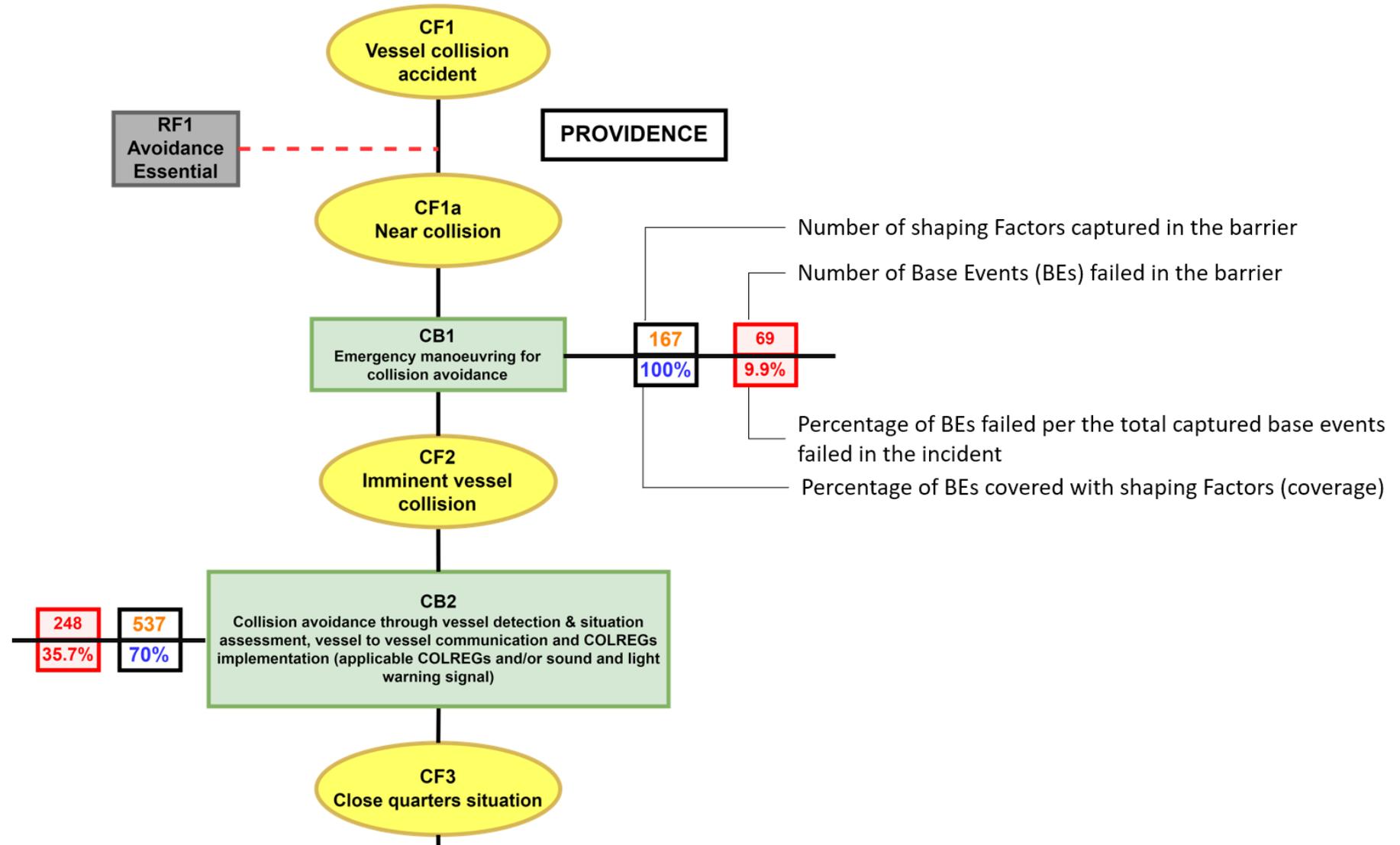
Visibility



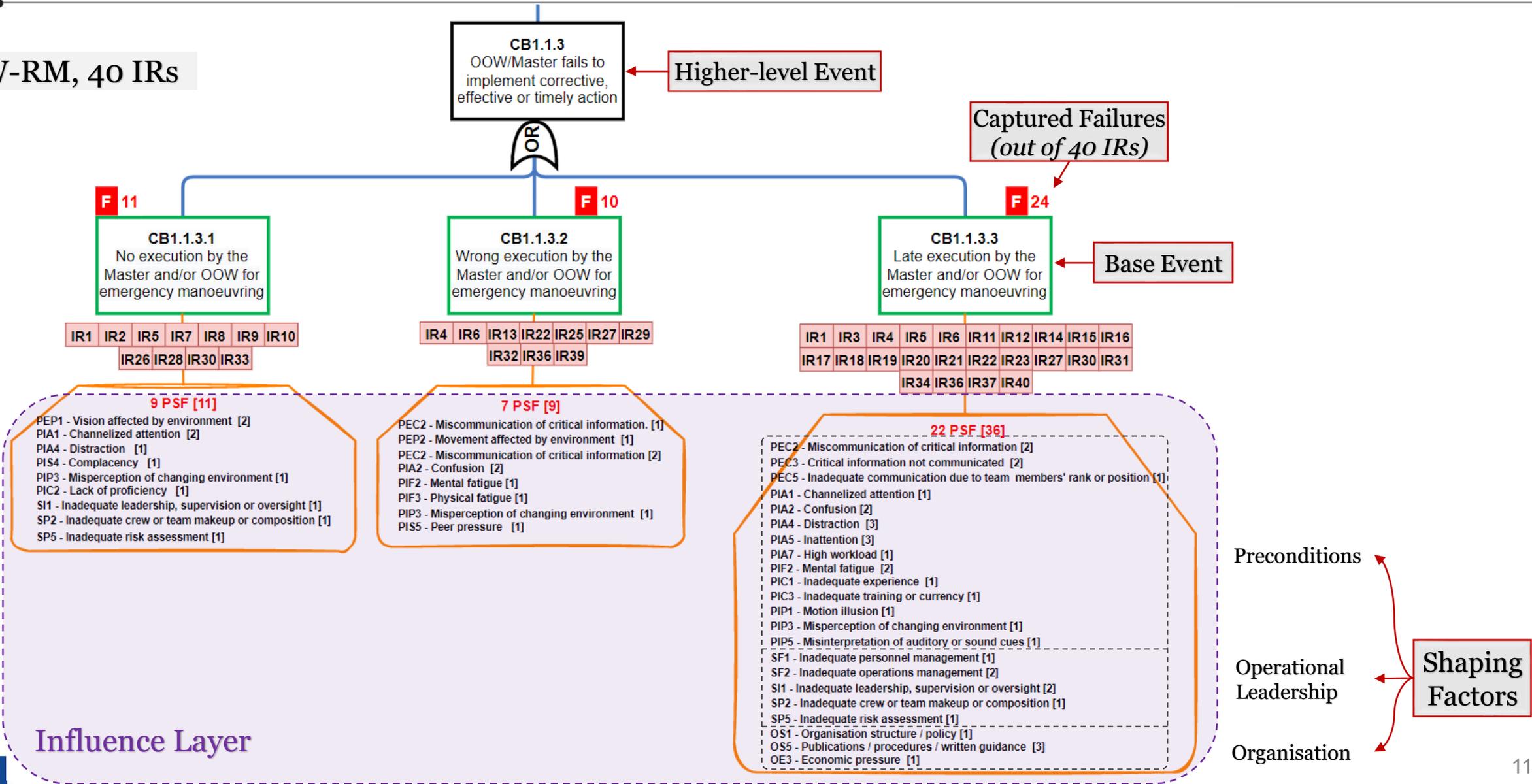
	Human	Technical	Total
BEs in the Risk Model	168 (76%)	53 (24%)	221
BEs seen in the Incidents	135 (80%)	8 (15%)	143 (65%)

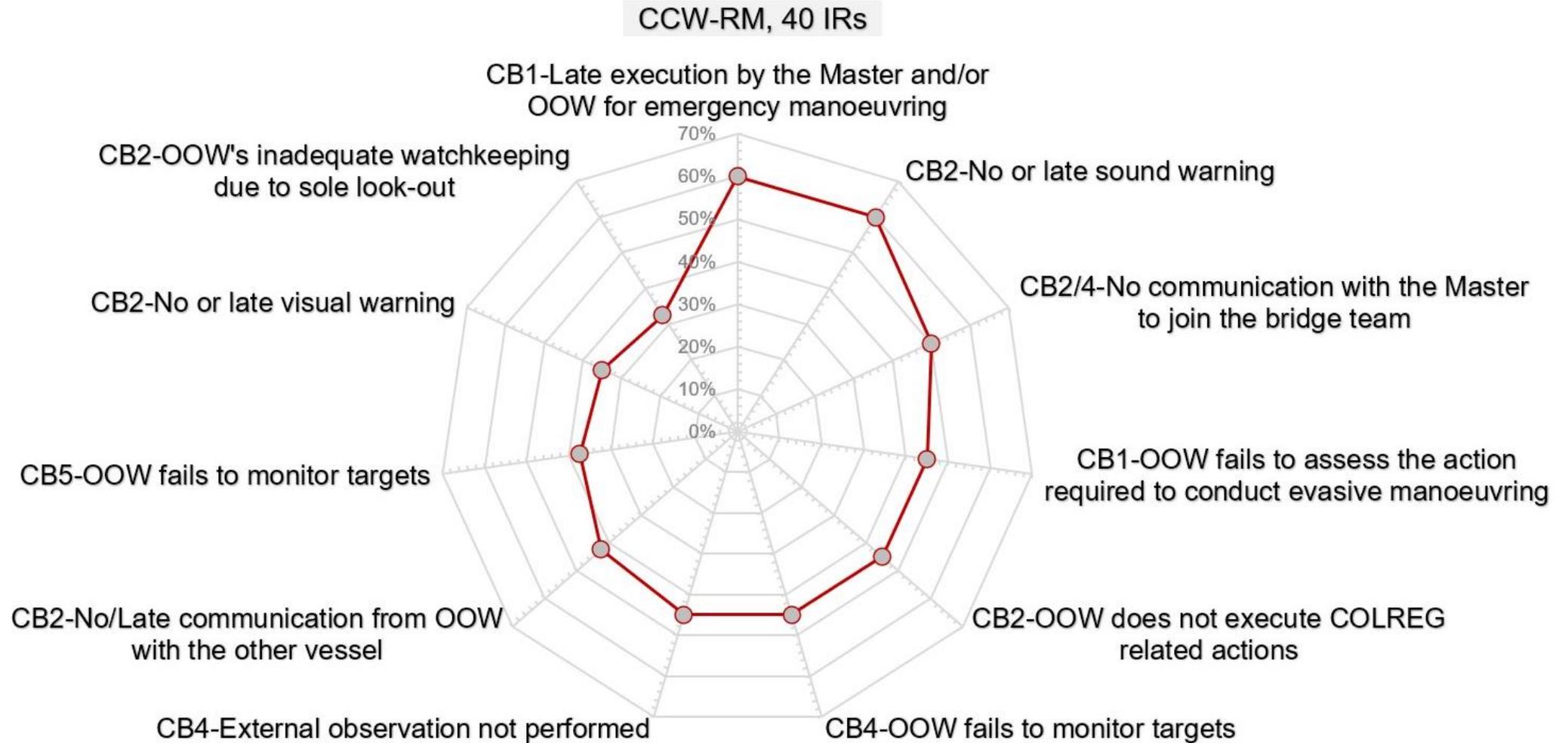


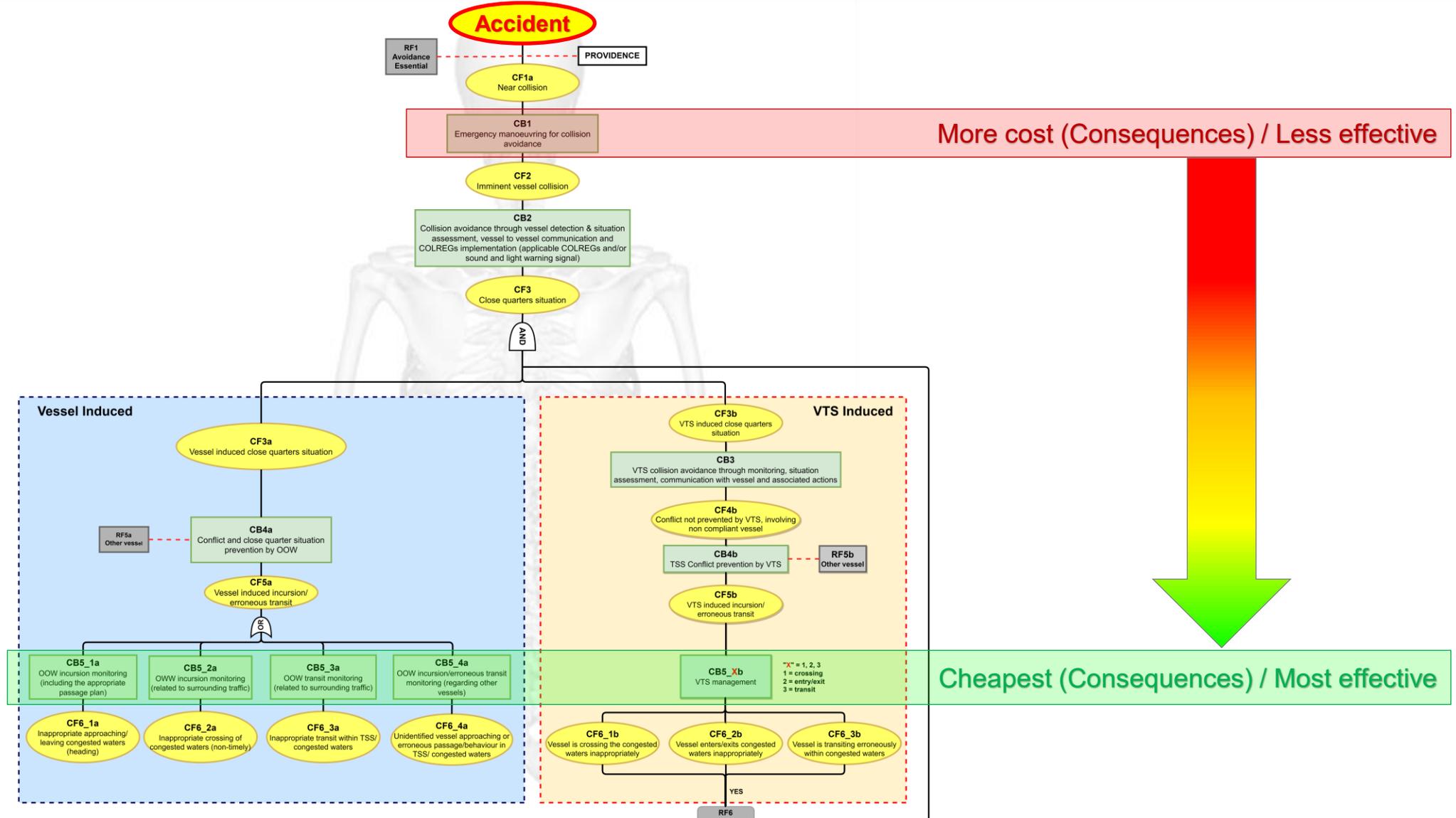




CCW-RM, 40 IRs





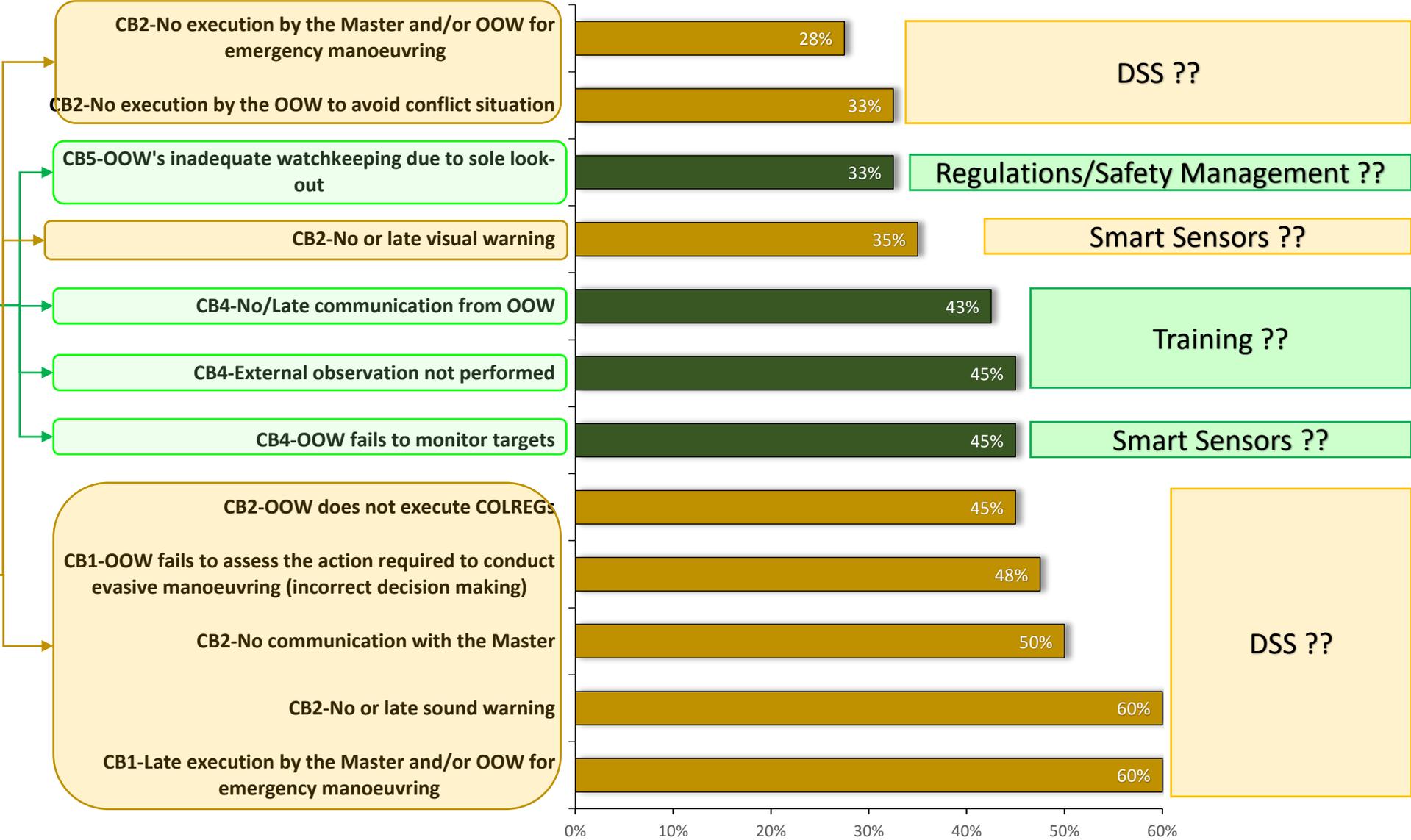


Initial assessment of new safety barriers/measures

Possible solutions?

Early contributing factors (WRT to events sequence)

Later contributing factors



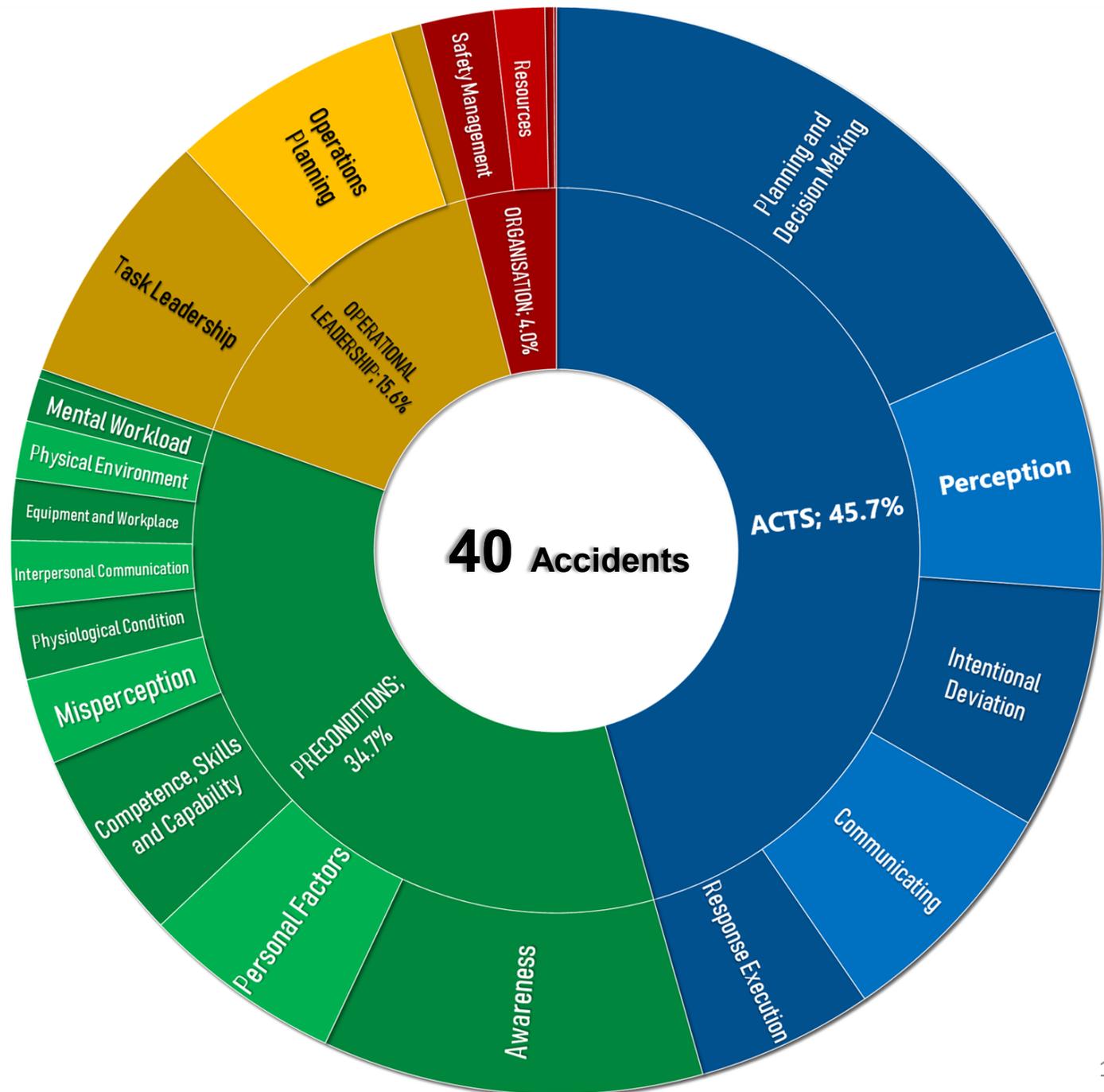
0% 10% 20% 30% 40% 50% 60%

% of the Incident Reports

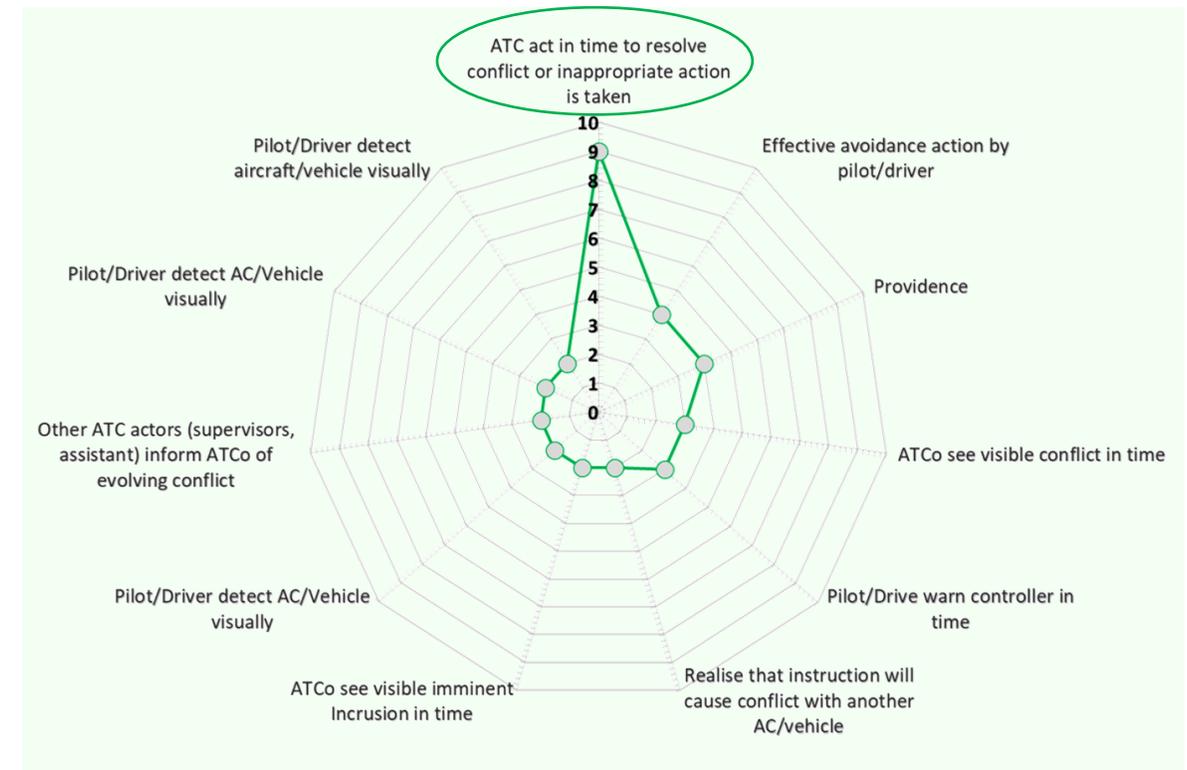
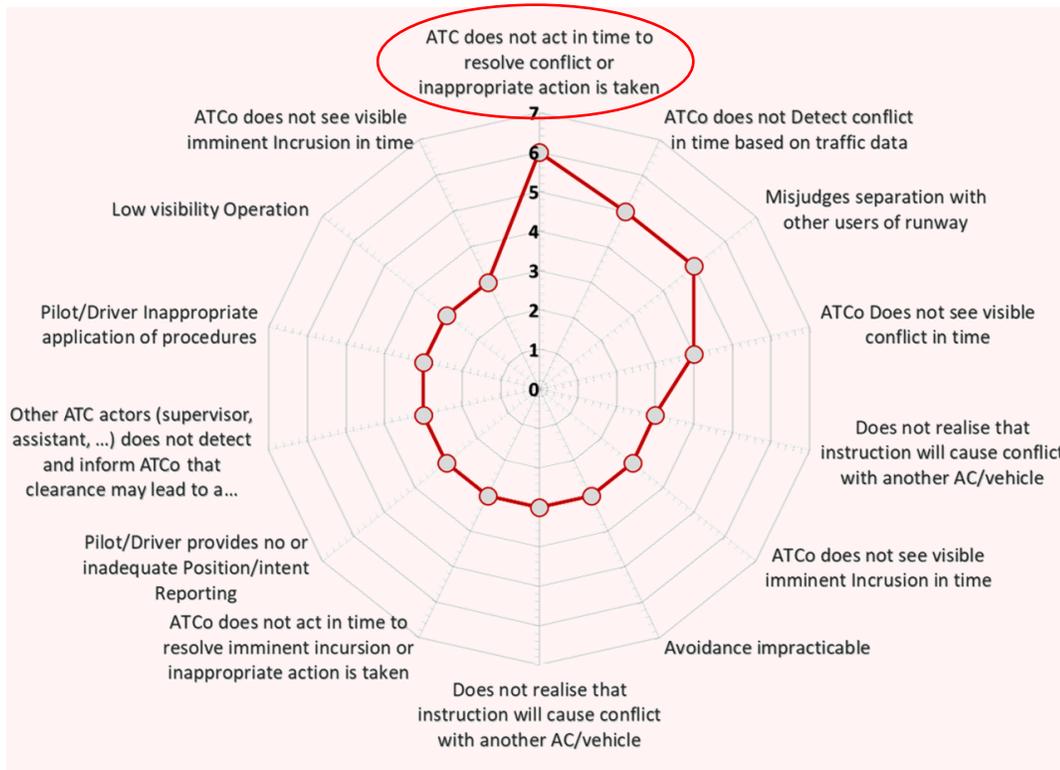
Layer	Category	Count
ACTS 697	Planning and Decision Making	281
	Perception	118
	Intentional Deviation	110
	Communicating	108
	Response Execution	80
PRECONDITIONS 530	Awareness	172
	Personal Factors	91
	Competence, Skills and Capability	87
	Misperception	39
	Physiological Condition	33
	Interpersonal Communication	30
	Physical Environment	26
	Equipment and Workplace	28
	Mental Workload	20
	Memory	4
	Team/Group	0
	Drugs and Nutrition	0
OPERATIONAL LEADERSHIP 238	Task Leadership	118
	Operations Planning	106
	Personnel Leadership	14
ORGANISATION 61	Safety Management	33
	Resources	23
	Culture	4
	Economy and Business	1

Layer	With RM	SHIELD only
ACTS	697	264
PRECONDITIONS	530	164
OPERATIONAL LEADERSHIP	238	87
ORGANISATION	61	35
TOTAL	1526	550

Layer	Category	Count
ACTS 697	Planning and Decision Making	281
	Perception	118
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	Drugs and Nutrition	0
	OPERATIONAL LEADERSHIP 238	Task Leadership
Operations Planning		106
Personnel Leadership		14
ORGANISATION 61	Safety Management	33
	Resources	23
	Culture	4
	Economy and Business	1



RWY-RM (A1)



Runway collision RM ([SAFEMODE](#)-Aviation)

38 near miss-reports

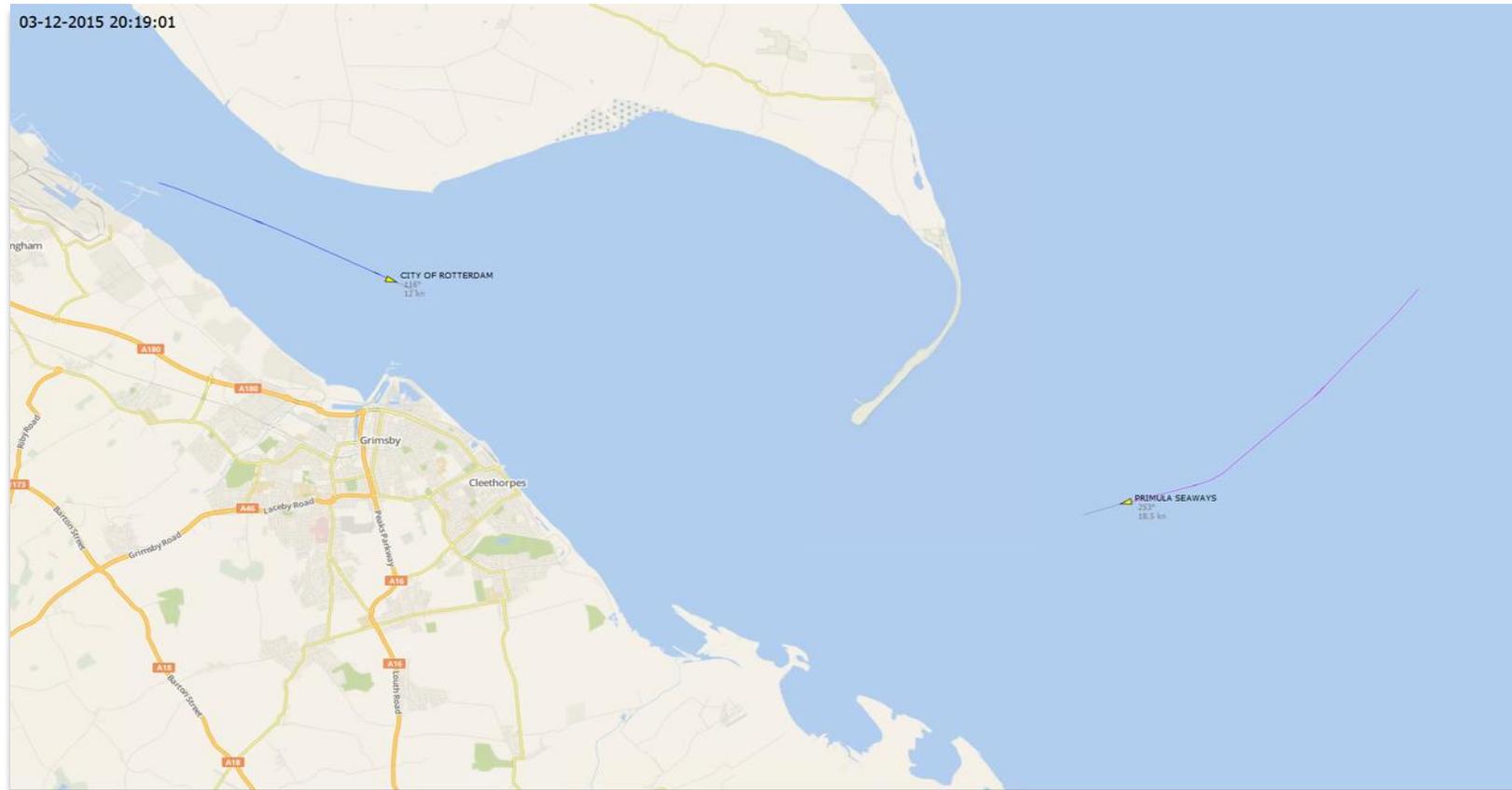
Collision between the **City of Rotterdam** and the **Primula Seaways**



Source: <https://assets.publishing.service.gov.uk/media/58984f60ed915d06e1000025/MAIBInvReport3-2017.pdf>

	City of Rotterdam (link)	Primula Seaways (link)	Comments
Year of Built	2011 (4 yrs. age)	2004 (11 yrs. age)	Both ships are relatively newly built.
Flag	(FOC: Flag of Convenience)	Denmark (Int. register)	Int. register: Some countries maintain an international register to compete with FOC.
Class	Bureau Veritas	Lloyd's Register	Both are IACS members
Operator	Owned by Picer Marine S.A. (Panama) and was on long-term time charter to Nissan Motor Car Carrier (NMCC), Japan. Last internal audit identified only minor non-conformities.	DFDS Seaways , The vessel's last external and internal audits under the ISM Code didn't identify any non-conformities or made any observations concerning navigation or bridge procedures.	No findings related to both companies safety management.
Master	62 yrs., Bulgarian, 2 yrs. as a master for this ship	53 yrs. old, Swedish, 7 yrs. as a master, joined 3 days before the accident	Both ships' masters can be considered as experienced Captains.
OOW	34 yrs., Filipino, He had been on board the vessel for 4 months.	64 yrs., British, 3.5 yrs. experience onboard	Not significantly contributed to the accident
Pilot	61 yrs., British, Humber (the river) pilot for 14 years.	Master held a Pilotage Exemption Certificate (PEC)	Pilotage was compulsory in the Humber for all vessels 60m or over in length
Crew Certification	The members of City of Rotterdam's and Primula Seaways' bridge teams held the STCW certificates of competency required for their positions on board and met the Convention's requirements concerning hours of work and rest.		
Work load			
VTS	The duty VTS operators were all British nationals. The watch manager was 33 years of age and had been a VTS operator for 7 years.	Three levels of VTS are available: an information service (INS), a traffic organisation service (TOS), and a navigation assistance service (NAS).	
Environment	Wind: south-south-west gusting to 40kts . It was dark with clear skies. The visibility was good and the tidal stream was flooding at about 1.5kts		

Collision between the **City of Rotterdam** and the **Primula Seaways**



VesselFinder: <https://www.youtube.com/watch?v=g2q8-J-dQH4>

CITY OF ROTTERDAM

The pilot primarily monitored the vessel's position by eye.

There was a potential for relative motion illusion when looking through an off-axis window.

There were no visual clues, e.g., a forward structure, and the illusion would have been compelling.

The master and the third officer left the responsibility for the vessel's safe passage predominantly to the pilot onboard City of Rotterdam.

City of Rotterdam's bridge team over-relied on the pilot, and thus, there was a lack of effective monitoring of the vessel's progress.

PRIMULA SEAWAYS

There was confidence in the bridge team onboard Primula Seaways that City of Rotterdam's Pilot would turn the ship to the south.

A more substantial reduction of speed should have warranted for Primula Seaways.

VTS The VTS intervention could have been more effective in alerting the bridge teams.

Image courtesy of Tomas Østberg-Jacobsen

Unconventional bridge design



Relative motion illusion

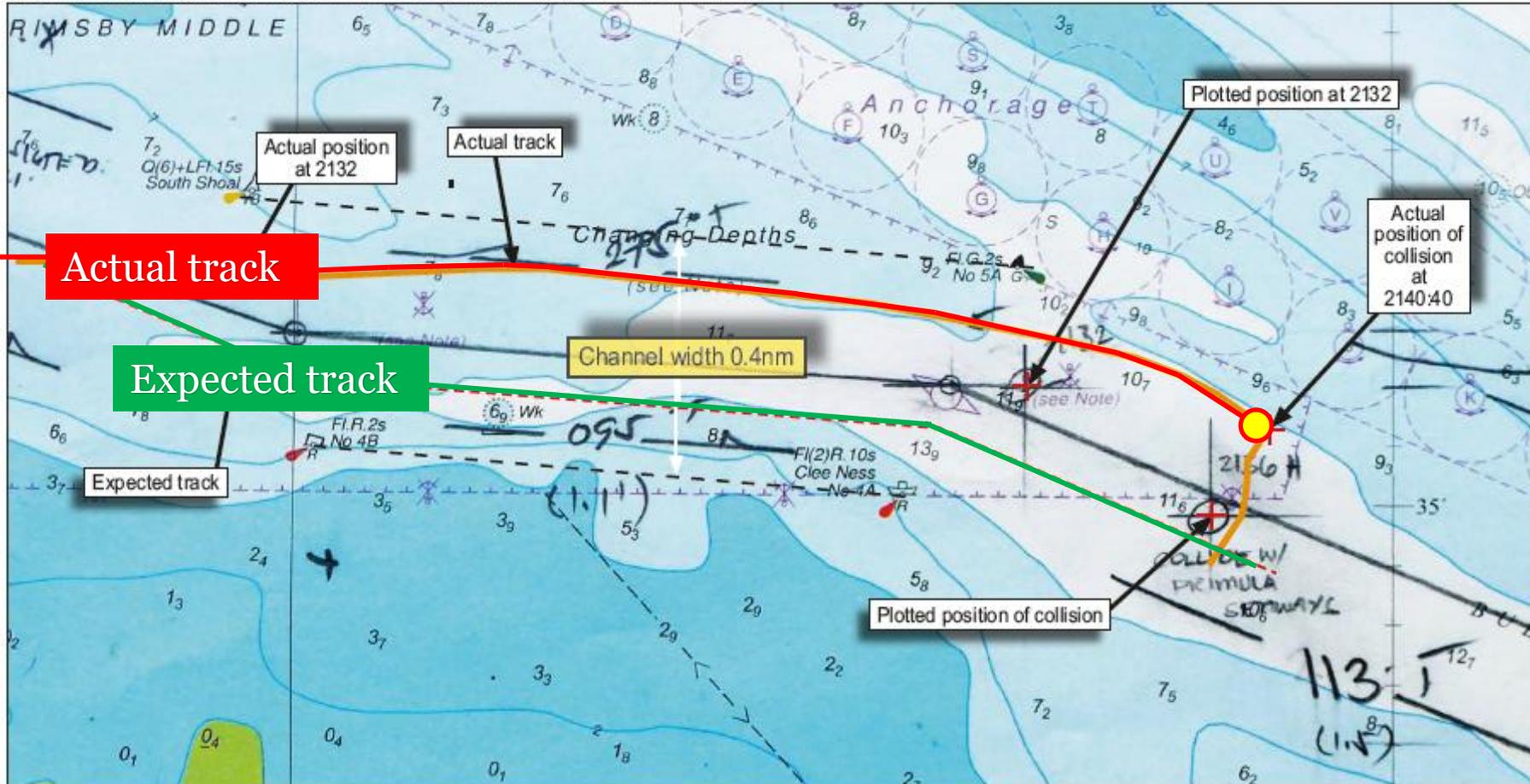
- errors in judgement from ‘relative motion illusion’ may occur if objects are viewed through side windows on the curved section of this wheelhouse.
- ‘relative motion illusion’ is a phenomenon in which objects appear to move as though the ship was heading in the direction of view through the window. it is more likely to occur during periods of darkness

City of Rotterdam’s **hemispherical** bow was designed to reduce wind resistance and carbon emissions and to provide better fuel economy (*without considering HFs in design*). A consequence of the bow’s shape was that **the vessel’s bridge was of unconventional design**.

Source: <https://assets.publishing.service.gov.uk/media/58984f60ed915d06e1000025/MAIBInvReport3-2017.pdf>



Reproduced from Admiralty Chart BA 109 by permission of the Controller of HMSO and the UK Hydrographic Office

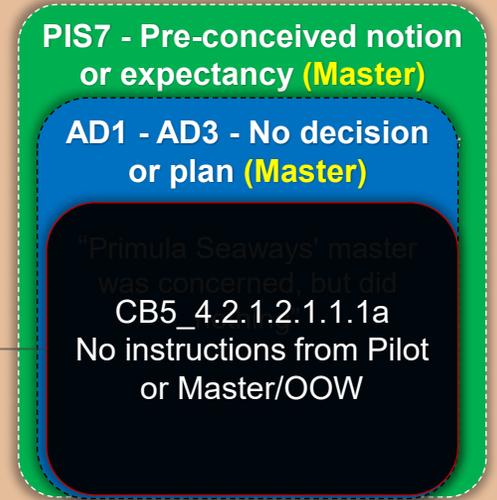
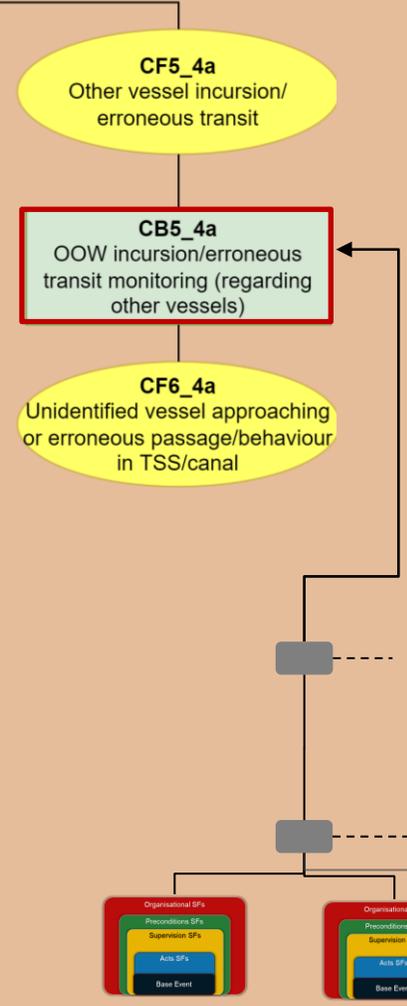
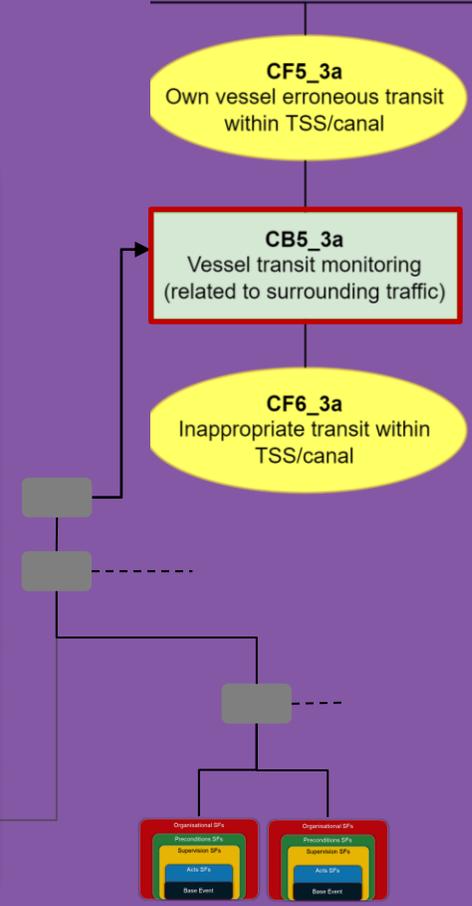
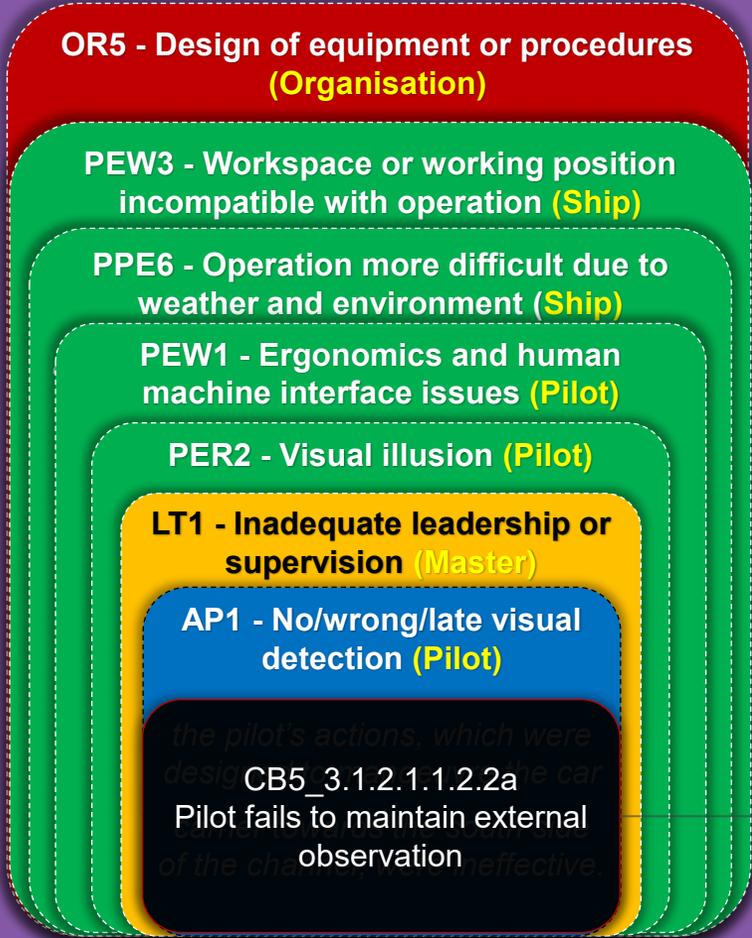


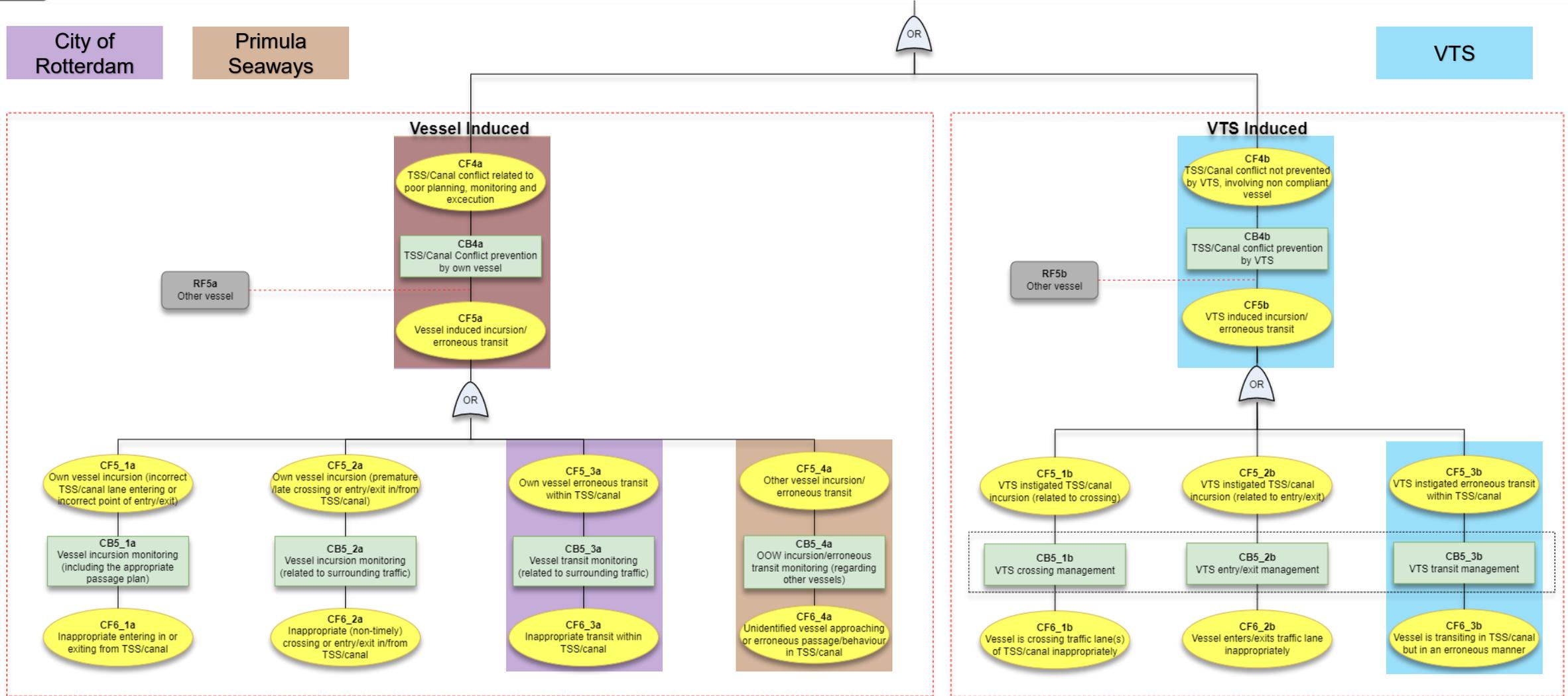
- City of Rotterdam's pilot's relative motion illusion **deceived** him into thinking that his view from the window above the starboard VHF radio, which was 33° off the vessel's centreline axis, was the vessel's direction of travel.
- As it was **dark**, the inward slope of the window **removed all objects** in the pilot's periphery, and there were **no visual clues** such as a forward structure or bow tip, the illusion would have been compelling.

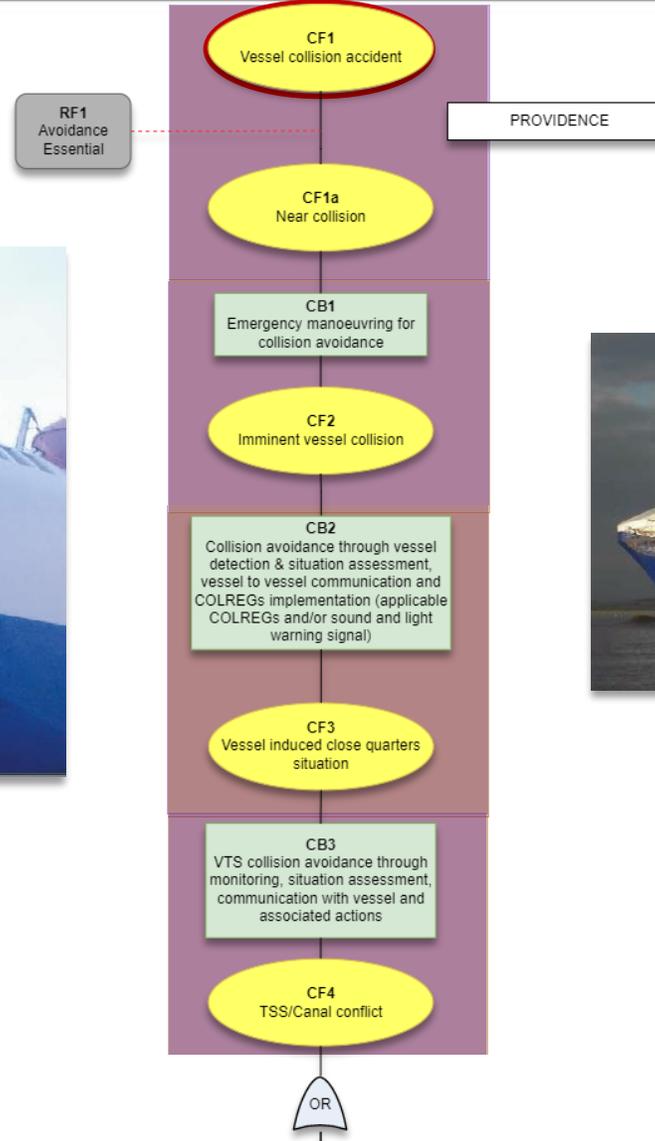
Source: <https://assets.publishing.service.gov.uk/media/58984f60ed915d06e1000025/MAIBInvReport3-2017.pdf>

City of Rotterdam

Primula Seaways

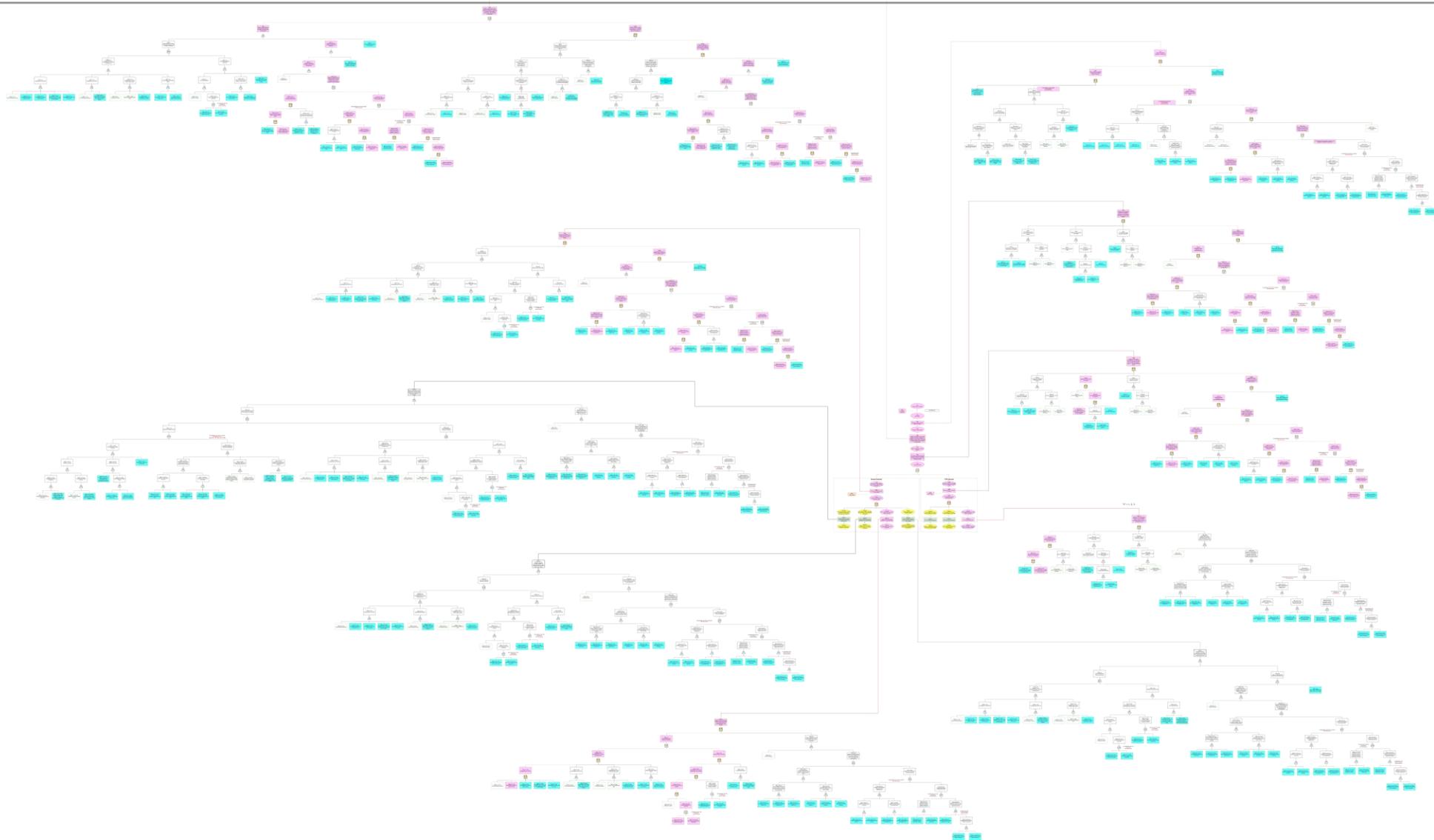






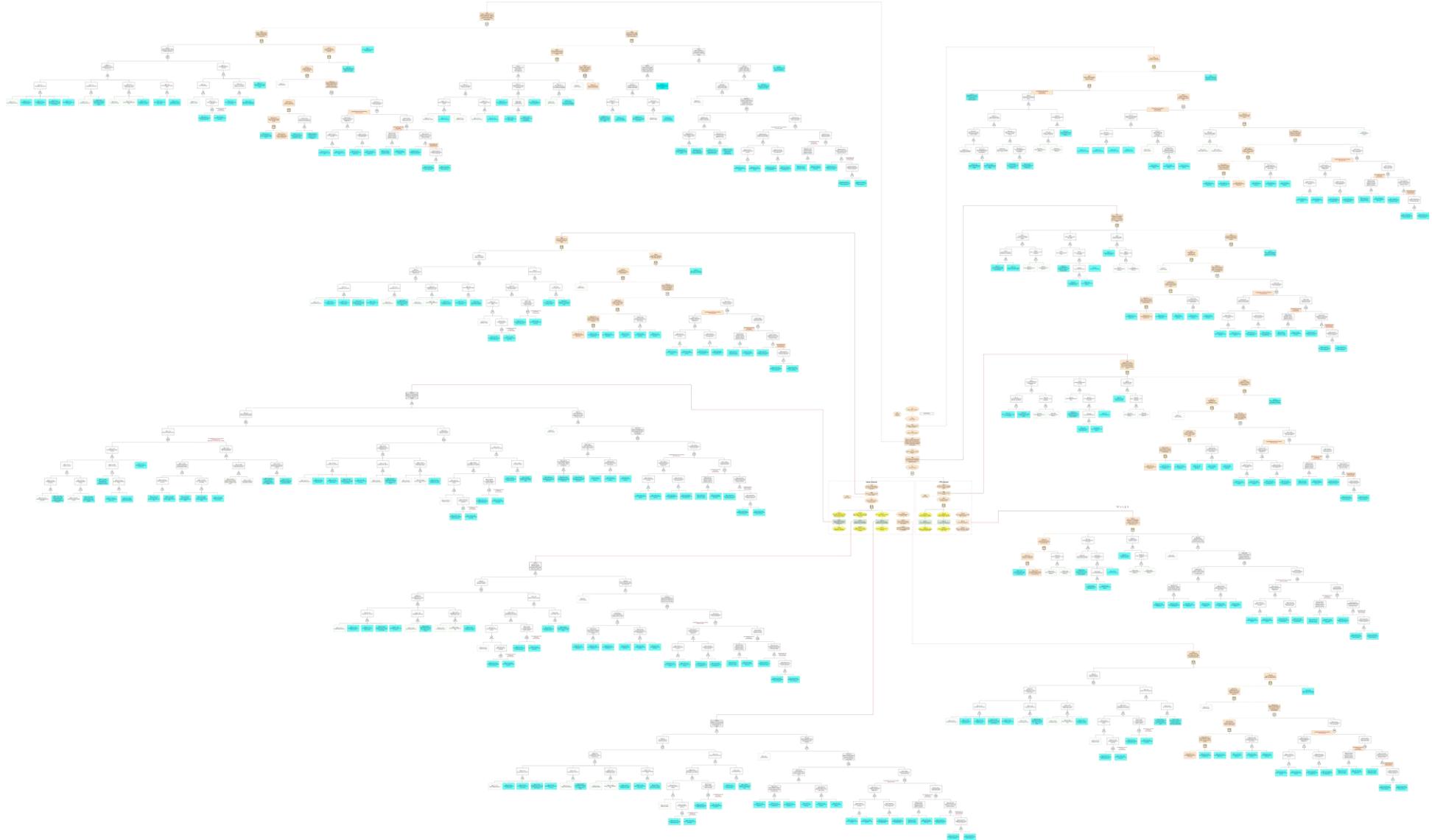
Results

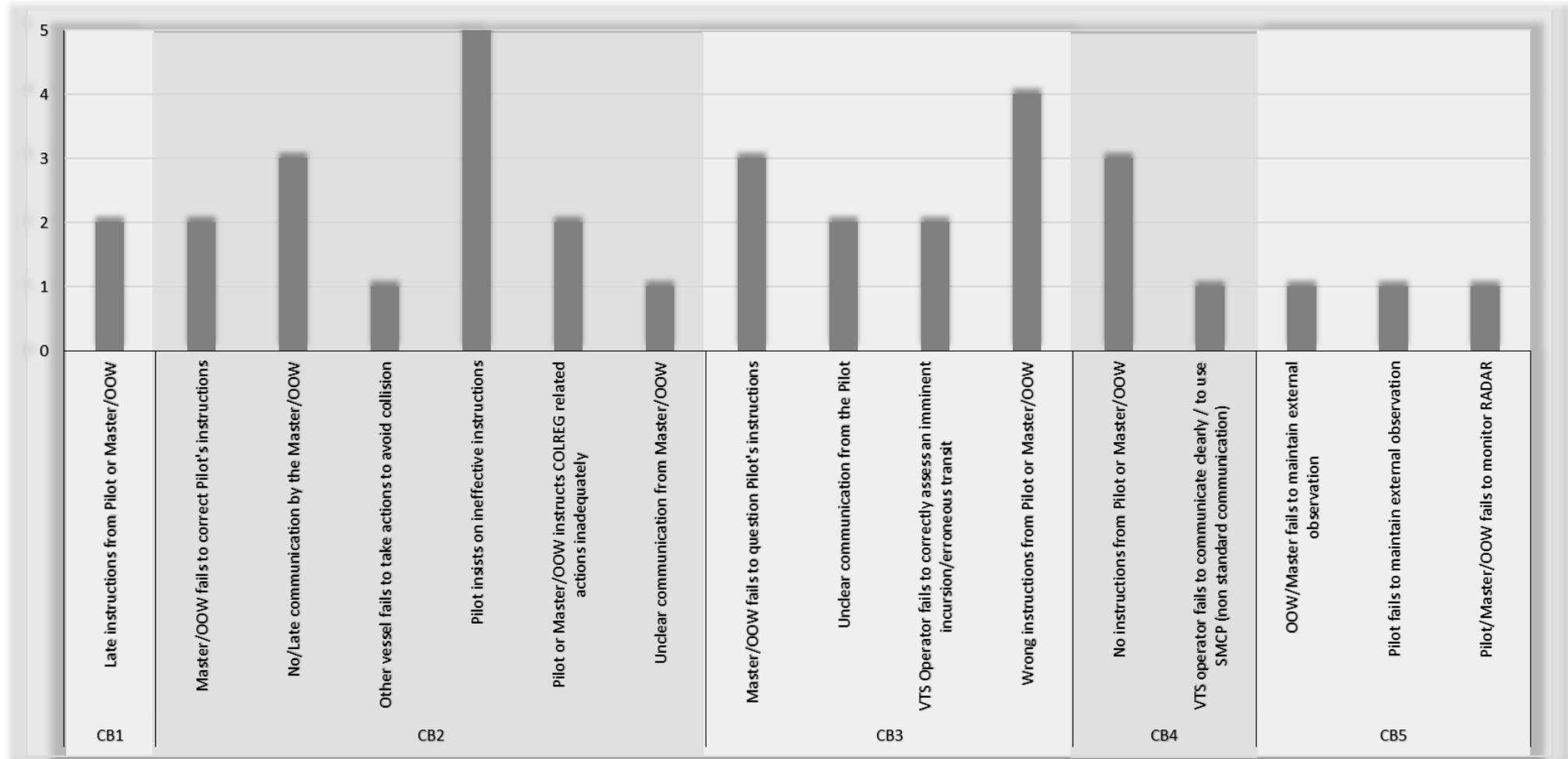
City of Rotterdam



Results

Primula Seaways





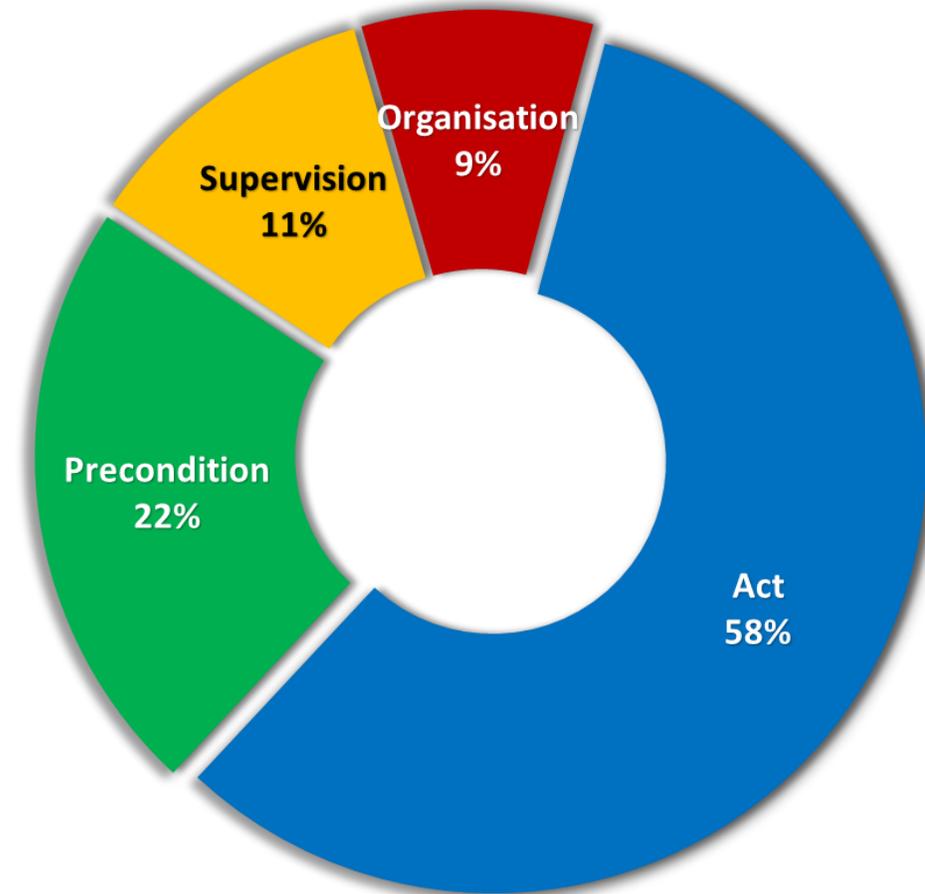
Performance Shaping Factors

City of Rotterdam

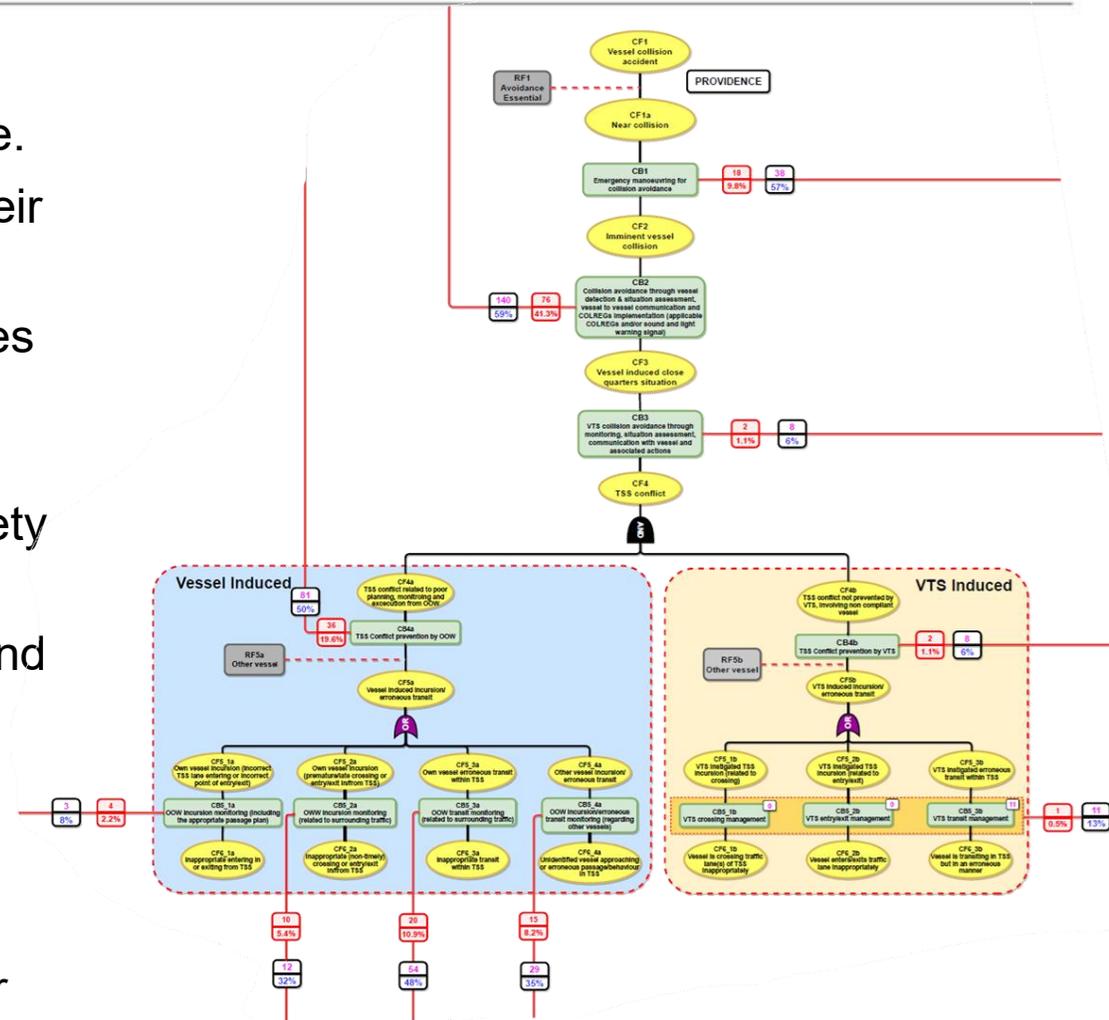
Primula Seaways

Party	Actor	BEs	SFs
Ship-1	Pilot (Actor1)	14	36
	Master (Actor2)	11	31
Ship-2	Master (Actor3)	6	9
VTS	Controller (Actor4)	3	7
Total		34	83

Shaping Factors by layers



- It helps to **understand** the context of a certain accident type.
- It can be used to **identify** HF's contribution and **evaluate** their influence on **failure** as well as **success**.
- It is generic and can be **implemented** in other accident types (e.g., Fire, cargo handling, pollution, etc.).
- It can **support** risk management by **informing** safety managers with valuable information about their existing safety measures.
- It can be used for **prioritising** different safety alternatives and **estimate** their impact on the system reliability.
- It can be used to identify the key HF's impacted by the implementation of new solution/concept (e.g., new bridge design).
- It is a powerful tool to **quantifiably assess** the Human error probabilities and the overall System's Reliability.



Finally, can you spot the difference between the two?



Thank you for your attention

Yaser B. A. Farag | yaser.farag@strath.ac.uk



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N°814961.

The 1st International
Maritime Human Factors
Symposium