ISTANBUL TECHNICAL UNIVERSITY « GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

DEVELOPING A NAVIGATIONAL MODEL FOR THE TURKISH STRAITS

Ph.D. THESIS

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İSTANBUL TEKNİK ÜNİVERSİTESİ « FEN BİLİMLERİ ENSTİTÜSÜ

TÜRK BOĞAZLARI İÇİN BİR SEYİR MODELİ GELİŞTİRİLMESİ

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Ali Cömert, a Ph.D. student of ITU **Graduate School of Science Engineering and Technology** student ID 5120220002, successfully defended the **thesis** entitled **"DEVELOPING A NAVIGATIONAL MODEL FOR THE TURKISH STRAITS"**, which he prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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FOREWORD

The Turkish Straits is very important, strategic and also very dangerous waterway. This thesis is prepared in order to develop a safe navigational model for this difficult and busy passage. I would like to express my deepest gratitude to my advisor Prof. Dr. Osman Kâmil SAĞ for his support and guidance. I would also like to extent my appreciation to my committee members Prof. Dr. Ömer GÖREN and Dr. Özkan POYRAZ for their advices during my preparation of this thesis. My sincere appreciation is extended to Prof. Dr. Nil GÜLER, Prof. Dr. Mahmut Celal BARLA, Prof. Dr. Sezer ILGIN, and Prof. Dr. Fevzi ERDOĞMUŞ for their support and guidance. This work is fully supported by ITU Graduate School of Science, Engineering and Technology, ITU Maritime Faculty, Directorate General of Coastal Safety and Turkish Maritime Pilots' Association. I would also like to express my special thanks to the Director Prof. Dr. İsmail KOYUNCU and all academic and other working staff of the ITU Graduate School of Science, Engineering and Technology, to the Dean Prof. Dr. Nil GÜLER and all academic and other working staff of the ITU Maritime Faculty, to the General Director Capt. Salih ORAKCI and all other working staff of the Directorate General of Coastal Safety, and also to Capt. Hüseyin Şükrü ARIK, Chief Pilot (retired), to Capt. Saim OĞUZÜLGEN, Chief Pilot (retired), to Capt. Ömür ÖZTAŞKIN, Chief Pilot (retired), to Capt. Nihat TURAN, Chief Pilot, to Capt. Hüseyin ENER, Chief Pilot, to Capt. İsmail AKPINAR, Chief Pilot, President of the Turkish Maritime Pilots' Association and Vice-President of European Maritime Pilots' Association, and to the directors and members of Turkish Maritime Pilots' Association and to all my maritime pilot colleagues. I would also like to extent my deep appreciation and thanks to my family for their support and encouragement. All figures (images, photographs, and graphics), tables, and texts in this thesis belong to the author, unless otherwise mentioned.

July 2013

Ali CÖMERT
Senior Maritime Pilot,
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ABBREVIATIONS

3D : Three dimension
A. : Assembly
AAKKM : Ana Arama Kurtarma Koordinasyon Merkezi **(**Turkish Main Search and Rescue Co-ordination Centre)
AIS : Automatic identification system
ARPA : Automatic radar plotting aid
ASD : Azimuth stern drive
BIMCO : The Baltic and International Maritime Council
CCTV : Closed circuit television
Circ. : Circular
C-o-C : Certificate of competency
COLREG's : International Regulations for Preventing Collisions at Sea 1972
DF : Direction finder
DGCS : Directorate General of Coastal Safety (of Turkey) (KEGM)
Doc. : Document
doi : digital object identifier
DSC : Digital Selective Calling
EC : European Council
ECDIS : Electronic chart display and information system
EEA : European Economic Area
EMPA : European Maritime Pilots' Association
ENC : Electronic navigational charts
FED : Formel Emniyet Değerlendirmesi (Formal Safety Assessment, FSA)
Fl : Flashing light
FSA : Formal Safety Assessment
G : Green (light)
GNA : Grand National Assembly of Turkey (TBMM, Türkiye Büyük Millet Meclisi)
GRT : Gross registered tonnage
H.D. : The Hidrographic Department of the Admiralty
IAIN : International Association of Institutes of Navigation
IALA : International Association of Marine aids to Navigation and Lighthouse Authorities
IBS : Integrated bridge system
ICS : International Chamber of Shipping
IMLA : International Maritime Lecturers Association
IMO : International Maritime Organization
IMPA : International Maritime Pilots' Association
ISBN : The International Standard Book Number
ISO : International Organization for Standardization
Iso : Isophase light which has dark and light periods of equal length
ISO : The International Organization for Standardization

ISSN : An International Standard Serial Number
ITU : Istanbul Technical University (İstanbul Teknik Üniversitesi, İTÜ)
ITUMF : Istanbul Technical University Maritime Faculty **(**İstanbul Teknik Üniversitesi Denizcilik Fakültesi, İTÜDF)
İTÜ : İstanbul Teknik Üniversitesi (Istanbul Technical University, ITU)
İTÜDF : İstanbul Teknik Üniversitesi Denizcilik Fakültesi (Istanbul Technical University Maritime Faculty, ITUMF)
KEGM : Kıyı Emniyeti Genel Müdürlüğü (Directorate General of Coastal Safety (DGCS) of Turkey)
LNG : Liquefied natural gas
LOA : Length over all
m : Metre
M : Mile
M.E.B. : T.C. Milli Eğitim Bakanlığı (Republic Of Turkey Ministry Of National Education, M.N.E.)
MARPOL : International Convention for the Prevention of Pollution from Ships
MARSIM : International Conference on Marine Simulation and Ship Manoeuvrability
MCTcm : Moment to change trim for one centimetre
MEPC : Marine Environment Protection Committee
METU : Middle East Technical University (Ortadoğu Teknik Üniversitesi, ODTÜ)
MMSI : Maritime mobile service identity
MPI : Maritime Pilot Institute, Covington, LA, USA
MSC : Maritime Safety Committee
MT : Metric ton
OCIMF : Oil Companies International Marine Forum
ODTÜ : Ortadoğu Teknik Üniversitesi (Middle East Technical University, METU)
ONHO : Turkish Navy, Office of Navigation, Hydrography and Oceanography (T.C. Deniz Kuvvetleri Komutanlığı Seyir, Hidrografi ve Oşinografi Dairesi Başkanlığı, SHOD)
P&I : Protection and indemnity
p. : page
Para. : Paragraph
PPU : Pilot portable unit
Q-Max : Qatar maximum size of liquefied natural gas carrier
R : Red (light)
R/T : Radio Telephony
RCTCWSMP: Regulations of Competencies, Trainings, Certifications and Working Standards of Maritime Pilots, 2006 (Kılavuz Kaptanların Yeterlikleri, Eğitimleri, Belgelendirilmeleri ve Çalışma Usulleri Hakkında Yönetmelik, 2006)
Res. : Resolution
s : second
SEC : Seafarers’ Examination Centre (of Turkey) (GASM)
SHOD : T.C. Deniz Kuvvetleri Komutanlığı Seyir, Hidrografi ve Oşinografi Dairesi Başkanlığı (Turkish Navy, Office of Navigation, Hydrography and Oceanography, ONHO)
SHS : Ship handling simulator

SMCP : Standard Marine Communication Phrases
SOLAS : Safety of Life at Sea
SP : Sailing plan
SP1 : Sailing Plan (1) of TUBRAP
SP2 : Sailing Plan (2) of TUBRAP
T.C. : Türkiye Cumhuriyeti (Republic of Turkey)
TBMM : Türkiye Büyük Millet Meclisi
TEU : Twenty-foot equivalent unit
TMMOB : Türk Mühendis ve Mimar Odaları Birliği (Union of Chambers of Turkish Engineers and Architects, UCTEA)
TSS : Traffic Separation Scheme
TSVTS : Turkish Straits Vessel Traffic Services
TUBRAB : Turkish Straits reporting system
TUMPA : Turkish Maritime Pilots' Association
UK : United Kingdom
UKHO : United Kingdom Hydrographic Office
UN : United Nation
USA : United States of America
UTC : Coordinated universal time
VHF : Very high frequency
vol. : Volume
VTS : Vessel traffic services
W : White (light)
WGS : World geodetic system
YÖK : Yüksek Öğretim Kurumu (Turkish Higher Education Council)

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DEVELOPING A NAVIGATIONAL MODEL FOR THE TURKISH STRAITS

SUMMARY

Turkish Straits are the unique passage between the Black Sea and the Aegean Sea. Beside its strategic location, this passage is a very important world heritage with its historical and environmental specifications. Despite this delicate situation, the maritime traffic increased by numbers, by sizes and by tonnages of passing vessels. They have almost reached to such physical satisfaction level with average 55000 vessels per year trough the İstanbul Strait and 50000 vessels per year trough the Çanakkale Strait. Total number of passages has reached to over 100000 passages per year. If you like to compare the total number of passages with 1936; it was 4500 passages of vessels per year. The tonnages of those vessels were smaller than today's average ship sizes.

Turkish Straits are the Turkish territorial waters which are also open for international sea traffic, for the innocent passages. Due to several natural conditions the Turkish Straits are very hazardous waterway. More than 15,000,000 peoples living around the Turkish Straits. Every days more than 150 vessels trough the İstanbul Strait, 140 vessels trough the Çanakkale Strait passing with several types of cargoes. Many of them are dangerous cargoes. They are passing within the very heavy populated area and very heavy local maritime traffic. And due to heavy traffic, they are waiting in vicinity of this big population and very delicate natural environment.

There are many studies and several proposals for the Turkish Straits. The Turkish State made considerable investment for this passage. Therefore to utilise all these safety precautions by obeying rules and regulations and utilising the vessel traffic services are very important. But the most important safety precaution for this dangerous waterway is utilising the very high standards services of the Turkish Maritime Pilots. Despite the strong recommendations by the International Maritime Organisation the percentage of the vessels utilising these services is not yet in satisfactory level.

In this thesis southbound and northbound passages for a vessel through the Turkish Straits have been briefly explained with courses, turns and reference points. Dangers and difficulties of the passages through the Turkish Straits have been analysed. Services such as pilotage service have been explained. Standards and certifications of the Turkish maritime pilots have been interpreted and analysed. A proposed syllabus has been developed using references developed by the International Maritime Organisation. The proposed syllabus has been explained with necessary details and examples.

Simulation systems in relation with the Turkish Straits have been explained and analysed. Computer simulation, bridge / ship handling numeric simulation, manned model ship handling simulation systems have been explained and analysed. Importance of using simulation systems for training, research and development has been explained.

In order to develop a navigational model for the Turkish Straits, Specialised Formal Safety Assessment Method has been used. Updated statistics of the number of passages, number of accidents and places of accidents have been analysed. Graphics have been prepared related the passages and accidents, using the statistics. Risks and existing precautions have been analysed.

As the result of the assessment, technical, legal, operational aspects of the existing navigational system through the Turkish straits have been evaluated and a proposed new model has been developed. The precautions to reduce the risks, the solutions to solve existing problems, the recommendations to improve the safety of navigation have been proposed. The main recommendation is the utilising the pilotage service for the passages through the Turkish Straits. Beside this recommendation, it is also recommended to maintain the existing high standard of the pilotage services by updating and upgrading all aspects of the services including the standards, training, procedures, facilities, operations and organisation. Many other recommendations related public relations, rules and recommendation, facilities and equipments have also been proposed. This thesis strongly proposes to utilise the pilotage services for every vessel movement in Turkish Straits. It also recommends technical, legal and operational precautions in order to encourage utilising the pilotage services.

TÜRK BOĞAZLARI İÇİN BİR SEYİR MODELİ GELİŞTİRİLMESİ

ÖZET

Türk Boğazları Karadeniz ile Ege Denizini birbirine doğrudan birbirine bağlayan yegane suyoludur. Karadeniz ile diğer denizleri birbirine bağlamanın yanında Asya ve Avrupa arasında kara ulaşımının önemli bir bölümü bu bölgeden geçer. Bu özelliği ile ilk çağlardan bu yana sahip olduğu stratejik konumunun yanında Türk Boğazları çevresel ve tarihsel özellikleriyle önemli bir dünya mirasını oluşturmaktadır. Bu duyarlı ortama rağmen geçen gemiler gerek sayı gerek boyut gerekse tonajları bakımından artış göstermiştir. Hatta senelik İstanbul Boğazından 55000, Çanakkale Boğazından 50000 geçiş yapan gemi sayısı ile bir çeşit fiziksel doygunluk noktasına gelmiştir. Toplam gemi geçişi yılda 100,000 gemi seviyesinin üzerine çıkmıştır. 1936 yılıyla kıyaslamak isteseniz, o sene toplam geçiş sayısı yalnızca 4500 gemiydi. Bu gemilerin tonajı bu günkü ortalama gemi ölçülerine göre daha küçüktüler.

Türk Boğazları uluslararası deniz trafiğinin zararsız geçiş yapan gemilerine açık olan Türk kara sularıdır. Doğal yapısı ve diğer çeşitli doğal koşullar nedeniyle Türk Boğazları çok tehlikeli bir suyoludur. Türk Boğazlarının çevresinde 15000 üzerinde nüfus yaşamaktadır. Her gün İstanbul Boğazından 150, Çanakkale Boğazından 140 gemi çeşitli yüklerle geçmektedir. Bu yüklerin bir çoğu tehlikeli yüklerdir. Bu gemiler yüksek yoğunlukta nüfusun ve yoğun bir yerel deniz trafiğinin içinden geçmekte ve yoğun trafik yüzünden bu yüksek nüfusun ve hassas doğal çevrenin yakınında beklemektedirler.

Türk Boğazlarına ilişkin bir çok çalışma ve çeşitli önerileriler vardır. Türk Devleti boğazlarımız ve buralardan gemilerin emniyetle geçişi için kayda değer yatırımlar yapmıştır. Geçiş yapan gemilerin ve boğazlarımızın emniyetine ve korunmasına yönelik tüm önlemler kazaların, can ve mal kayıplarının, çevre felaketlerinin önlenmesi, boğazlarımızdan deniz ulaşımına devam edilebilmesi, Türk boğazları bölgesinde yaşayanların huzur, sağlık ve emniyet içinde hayatlarına devam edebilmelerini amaçlamaktadır. Bu nedenle gemilerin uyması gereken genel kurallara ile Türk Boğazlarına ilişkin özel kurallara uymak ve Türk Boğazlarında en üst düzeyde verilen gemi trafik hizmetlerini kullanmak yoluyla bütün bu emniyet tedbirlerinden yararlanmak büyük önem taşır. Fakat bu tehlikeli suyolu için en önemli emniyet tedbiri, Türk Boğazlarında hizmet veren, hizmet bölgelerinin ve bu bölgedeki yerel koşulların, kuralların, yasak ve kısıtlamaların, çeşitli hizmetlerin ve diğer olanakların uzmanı olan kılavuz kaptanların verdiği çok yüksek standarttaki hizmetlerinden yararlanmaktır. Kılavuzluk hizmetlerinden yararlanan gemiler dolayısıyla diğer tüm hizmetlerden de, daha etkin ve verimli bir şekilde yararlanabilirler. Uluslararası Denizcilik Örgütünün şiddetle tavsiyede bulunmasına rağmen kılavuzluk hizmetinden faydalanan gemi sayısı henüz tatmin edici bir seviyeye ulaşmamıştır.

Bu tez çalışması içinde, bir geminin Türk Boğazlarından kuzeyden güneye ve güneyden kuzeye geçişi rotalar, dönüşler ve referans noktaları olmak üzere, genel yapısı ve önemli unsurlarıyla özet olarak açıklanmıştır. Türk Boğazlarından geçiş yapan en büyük boyutlarda gemiler ve geçişi çeşitli nedenlerle zorluk ve veya kısıtlamalara bağlı olarak yapılabilen veya kurallar gereği özel geçiş koşullarına bağlı olan farklı tonaj ve boyutlarda gemiler de dahil olmak üzere, gece, gündüz, yaz, kış, farklı hava, deniz ve görüş koşullarında, farklı akıntı koşullarında farklı gemilerle yapılan çok sayıda geçişte gemilerin köprüüstünden yapılan gözlemler sonucunda oluşturulan açıklamalar manevralar süresince çekilen fotoğraflarla desteklenmiştir. Öncelikle Karadeniz'den İstanbul Boğazı'na yaklaşan bir geminin geçiş koşullarına ilişkin bilgiler verilmiştir. Bir geminin İstanbul Boğazı'nı kuzeyden güneye geçişi her bir rota ve her bir dönüş için açıklanmıştır. Marmara Denizi geçişi, bu bölgedeki trafik ayrım düzeni, gemi trafik hizmetlerine ilişkin sektörler, seyir rotaları, trafik durumu ve diğer koşullarla birlikte açıklanmıştır. Çanakkale Boğazı kuzeyden güneye geçişi aynı yöntemle açıklanmıştır. Daha sonra Türk Boğazları güneyden kuzeye hakkında geçişi farklılıklarıyla birlikte bilgi verilmiştir. Güney kuzey geçişinde faklı rotalar ve dönüşler ilgili diğer bilgiler ve açıklamalarla birlikte verilmiştir.

Bu çalışma kapsamında Türk Boğazlarından geçişe ilişkin tehlikeler ve zorluklar analiz edilmiştir. Doğal koşullardan, özellikle akıntıdan, sığlıklardan, dar bölgelerden ve keskin dönüşlerden kaynaklanan zorluklar örneklerle irdelenmiştir. Türk Boğazlarında hakim yüzey akıntısının, koyların içinde ve burunların ardında oluşan anaforların, farklı derinliklerdeki ters dip akıntılarının, bu akıntılarda farklı rüzgar koşullarında ortaya çıkan değişimin gemi seyri üzerinde oldukça önemli, seyri ve boğalardan emniyetle geçişi zorlaştıran hatta bazen engelleyen etkileri vardır. Normal ve yaygın hava koşullarında mevcut olan, kuzeyli rüzgarlarla artan güney yönlü hakim yüzey akıntıları, güneyli rüzgarların boğazların güney girişi önüne suları yığarak içerde tümüyle farklı, kuzey yönlü bir akıntı oluşturması, faklı iki akıntının boğazın içinde karşılaştıkları yerde suların karışması ve akıntıdaki ani değişimler, boğazın koyları ve burunlarıyla oluşturdu şekilden kaynaklanan akıntıdaki farklılaşmalar, ters akıntıların gemilerin seyri ve manevrası üzerinde önemli etkileri vardır.

Türk Boğazlarında günümüzde birçok hizmet verilmektedir. Kılavuzluk, gemi trafik hizmetleri, fenerler, şamandıralar ve diğer seyir yardımcıları, tahlisiye hizmetleri, sağlık / karantina denetim ve hizmetleri gibi hizmetler tez çalışması kapsamında incelenip açıklanmıştır. Bu hizmetler içinden yararlanılması zorunlu olanlar özet olarak, her ne kadar tavsiye kararı olsa da yararlanılması ihtiyari olan kılavuzluk hizmeti ise, nasıl yaygın hale getirilebileceği üzerinde durmak amacıyla geniş olarak ele alınmıştır. Türk kılavuz kaptanlarının standartları ve belgelendirilmeleri konusu analiz edilmiş ve yorumlanmıştır. Bu kapsamda kılavuz kaptanların ilgili mevzuatlarına atıfla eğitim, sınav ve belgelendirme standartları özetlenmiş bu çerçevede mevcut eğitim ve sınav usul ve içerikleri ayrıntılı olarak ele alınmıştır. Mevcut yapının üzerine, Uluslararası Denizcilik Örgütünün kılavuz kaptanlar için genel amaçlı referanslarına dayalı olarak, Türk Boğazlarında hizmet veren kılavuz kaptanlara özel, genel hatlarıyla, çerçeve bir eğitim müfredatı oluşturulmuştur. Eğitim konuları bir tabloda ana hatlarıyla oluşturulmuş daha sonra ilgili maddelerin detaylandırarak üzerinde çalışılmış ve içerikleri geliştirilip, örneklerle zenginleştirilerek belirginleştirilmiştir.

Tez çalışması kapsamında Türk Boğazlarına ilişkin olarak simülasyon sistemleri incelenmiştir. Simülasyonun ne olduğu, çeşitleri açıklanmış ve analiz edilmiştir. Bilgisayar simülasyonu, köprüüstü / gemi kullanma amaçlı sayısal simülasyon sistemleri, insanlı model gemi kullanma simülasyon sistemleri incelenmiştir. Simülasyon sistemleri hakkında genel bilgi verilerek gemi manevrasıyla ilişkili olarak değerlendirmelerde bulunulmuştur.

Köprüüstü benzetimli ve gemi kullanma amaçlı simülasyon konusunda ülkemizde ve dünyada bulunan simülasyon merkezleri hakkında bilgiler verilmiştir. Tezin hazırlanma sürecinde İTÜ Denizcilik Fakültesi Simülatörler Merkezinde, Tam Donanımlı Köprüüstü / Gemi Kullanma Simülatöründe Türk Boğazlarına ilişkin çeşitli çalışmalar yapılmıştır. Söz konusu simülatör merkezinde, öğrenci, gemiadamı, kılavuz kaptan ve gemi trafik operatörlerinin eğitimlerinin planlama ve icra faaliyetlerine, ayrıca araştırma ve geliştirme ve değerlendirme faaliyetlerine iştirak edilmiştir. Ayrıca yurtiçi ve yurtdışı diğer bazı simülasyon merkezlerinde incelemelerde bulunulmuştur. İlgili çalışmaların sonucunda ulaşılan bilgiler derlenmiş, gözlemlerde ve değerlendirmelerde bulunulmuştur.

Diğer bir simülasyon türü olan insanlı model gemi simülasyonu konusunda dünyadaki gelişmeler araştırılarak değerlendirilmiştir. İnsanlı model gemi simülasyonu konusunda en tecrübeli merkezlerden biri olan Fransa'nın Port Revel İnsanlı Model gemi Simülasyon Merkezinde bir haftalık altı kişilik küçük bir gruptan oluşan kılavuz kaptanlara yönelik bir eğitimde bulunulduğu süre içinde gözlem ve araştırmalar yapılmıştır.

Simülasyon merkezlerinde yapılan çalışmalar sonucunda simülasyonun Türk Boğazlarına ilişkin eğitim, araştırma, geliştirme ve değerlendirme faaliyetlerinde etkin ve verimli olarak kullanılabileceği sonucuna varılmıştır.

Bu tez çalışması kapsamında, Türk Boğazları için bir seyir modeli geliştirmek amacıyla özelleştirilmiş Formel Emniyet Değerlendirilmesi (FED) metodu kullanıldı. Türk Boğazlarından geçiş yapan gemi sayılarının, kazaların ve kaza yerlerinin belirtildiği güncellenmiş istatistikler analiz edildi. Gemilerin geçiş sayılarının, kazaların sayıları ve yerlerinin bulunduğu istatistikler kullanılarak grafikler oluşturuldu. Riskler ve mevcut önlemler analiz edildi. Mevcut ve sürdürülen yapı ve önlemlerin mevcut ve öngörülen risklere karşı yeterli olup olmadığı çeşitli yönleriyle irdelendi. Uygulanan yönteme uygun olarak öneriler geliştirildi.

Seyir emniyetinin arttırılması, denize ve doğal çevreye ve Türk Boğazları çevresinde yaşayan insanlara yönelik risklerin azaltılması amacıyla, bu amacın gerçekleştirilmesi ve sürdürülmesi durumunda elde edilecek olumlu sonuçlar arasında Türk Boğazlarının ulaşım ve taşımacılık için olduğu kadar kültür, turizm, eğlence, hobi, balıkçılık ve spor gibi farklı alanlarda kullanım ve üretim olanaklarının da korunacağı gerçeğinin de göz önünde bulundurulması gerekir. Türk Boğazları'nda deniz kazalarının ve bu kazalar sonucu ortaya çıkabilecek felaketlerin, ölüm ve yaralanmaların, yangın ve patlamaların, kirlilik ve kayıpların önlenmesi, Türk Boğazları'ndan günümüzde ve gelecekte her açıdan verimli olarak yararlanılması, Türk Boğazlarının tarihi ve doğal güzelliklerinin gelecek nesillere bırakılabilmesi amacıyla uygulanabilir her türlü önlemin alınması gerekir.

Değerlendirmenin sonunda, Türk Boğazlarında mevcut seyir sisteminin teknik, hukuki, işletimsel yönleri değerlendirildi. Söz konusu değerlendirme sonucunda önerilmek üzere yeni bir model oluşturuldu. Mevcut riskleri azaltmak için önlemler, mevcut sorunların giderilmesine yönelik çözümler, seyir emniyetini artırmaya yönelik öneriler geliştirildi. Tüm önerilerin içinde en temel öneri Türk Boğazlarından geçişlerde kılavuzluk hizmetlerinden faydalanmak olarak belirlendi. Bu önerinin yanında kılavuzluk hizmetlerinin yüksek standardını korumak için hizmetin standartlar, eğitimler, yöntemler, tesisler, işlemler ve organizasyon dahil olmak üzere tüm yönlerini güncellemek ve geliştirmek önerilmektedir. Halkla ilişkiler, kurallar ve tavsiyeler, araçlar ve tesislere ilişkin diğer bir çok öneri de oluşturulmuştur. Bu tez çalışması Türk Boğazlarındaki her bir gemi hareketi için kılavuzluk hizmetlerinden faydalanmayı şiddetle önerir. Bununla birlikte kılavuzluk hizmetlerinden yararlanılmasını desteklemek amacıyla teknik, hukuki ve işletimsel her türlü önlemin alınması önerilir.

1. INTRODUCTION

The Turkish Straits includes the Strait of Istanbul, the Strait of Çanakkale, and the Marmara Sea, connecting the Black Sea and the Mediterranean Sea. It is a 278 km-long and 75 km-wide inland sea between the Mediterranean and Black Sea, with a surface area of approximately 11,350 sq km and a volume of 3,380 cu km.

Vessels of growing sizes and numbers are passing through the Turkish Straits; and it seems that there is a tendency to increase every year to reach an overweight. Half of the former and two thirds of the latter respectively were the vessels of non-calling any Turkish port in Marmara Region and twenty percent of the passages were larger than 150 meters in length.

1.1 Purpose of Thesis

The Turkish Straits are situated with its sharp bends and the currents which is changing its direction at these points with whirlpools. There are the necessities to alter the course at least twelve times in a southbound (or northbound) passage. There are also many narrows such as Kandilli passage in the Strait of İstanbul and Nara Passage in the Strait of Çanakkale.

The Turkish Straits are well known with its natural difficulties such as the currents. The velocity of the surface current which may increase up to 7- 8 miles/hour in some areas due to the prevailing wind direction and speed at the most important point of the Straits from the point of view of navigation. The underwater current the direction of which is contrary to the surface current and the interface with the latter is variable, and as an exceptional situation in case of having south-westerly winds in the region the effect of the contrary surface currents which sets for in northerly direction, called "*orkoz*". There are also many difficulties such as local traffic, embodied by the passenger ferries and other local traffic making total 2500 trips daily; condition, size and draft of the transiting vessels. The Turkish Straits play a significant role in the protection of the biodiversity of both the Mediterranean and Black Sea basins as a biological corridor for the various migratory fish, cetaceans and invertebrates. The health of this system is vital for the protection of the marine biodiversity of the Black Sea and the Mediterranean Sea, particularly for the Black Sea, as the straits arc the only means of water exchange with other water. One of the most serious problems is oil pollution, related to ship traffic, because the Istanbul Strait is one of the world's busiest waterways.

Considering all these facts, all efforts to analyse the current situation and to develop better and safer methods for the planning and executing the passages of vessels and all other related services are very important. The aim of this study is, therefore, to analyse the existing one and to develop an improved and updated navigational model for the Turkish Straits.

1.2 Background, Short History and Literature Review

The Turkish Straits were always very important and interesting subject for the politics, the history, the geography, the science and the art since the ancient ages. When the literature on the Turkish Straits is mantioned, very long history since the mythological legends must be considered.

1.2.1 Turkish Straits during the antiquity

İstanbul Strait is also known as Bosporus (or Bosphorus) which means “ox ford” (cow passage). According to ancient mythological legends, it was named for Io, when as a heifer she crossed that strait as explained by (Bulfinch, 1855, p. 49). Bosporus derived its name, from the cow, a mythological figure, having swum across it. This cow was Io, daughter of Inachus, the King of Argos. Io was the lover of Zeus and had been changed into a cow because Zeus wanted to hide her from his wife Hera. Io had escaped and wandered all over the world and had crossed from Europe to Asia at the strait gained its name from her. According to Brewer (1922) also the origin of the name is the same mythological figure as stated as “Zeus (Jupiter) greatly loved Io, and changed her into a white cow or heifer from fear of Hera or Juno; to flee from whom she swam across the strait, which was thence called bos poros, the passage of the cow.” (p. 165).

Turkish Straits are also the passage for the legendary voyage of the vessel “Argo”. The Argo is the name of the vessel of the legend of “Golden Fleece”. According to the legend the King Athamas and his first wife the Cloud Goddess Nephele had two children, the boy Phrixus and the girl Helle. But later Athamas has fallen in low with Ino, divorced Nephele and married her. Nephele left them in anger and drought came upon the land. Ino has convinced Athamas that they have to sacrifice the children in order to end the drought. Nephele appeared to the children with a winged ram whose fleece was of gold. Nepheles' children escaped on the winged ram over the sea. But Helle fell off and drowned in the Strait, named after her Hellespont, later called the Dardenelles, today's Çanakkale Strait. The ram took the boy safely to Colchis (today's Georgia). In Colchis Phrixus sacrificed the winged ram to Poseidon and ram became the constellation Aries. According to Bernal (2006), "… Abraham's offering his son…. This substitution is also found in the legend of the Golden Fleece; Zeus send the ram to replace Phrixos the son that King Athamas was about to sacrifice" (p. 559). Phrixus hung the Golden Fleece reserved from the sacrifice of the ram on an oak tree in a grove sacred to Ares, the god of the war. The Golden Fleece was guarded by a dragon and remained there until Jason came and took it.

Jason (ancient Greek: Iason or Ieson) is a Thessalian hero, the elder son of Aeolus' grandson Aeson, who should rightfully have been king of Iolcus in Magnesia, and of Alcimede or Polymede. But Pelias, his uncle, became regent for Jason after Aeson's death. According to Scull (1880), "Jason determined to reclaim the throne to which he was heir" (p.344). Jason demanded his father's throne from his uncle, but offered to allow Pelias to keep his private wealth. Pelias therefore pretended that he was sending Jason to Colchis in the capacity of his own deputy and heir. Jason's task was to retrieve the golden fleece of the ram that Jason's ancestor Phirixus had flown to Colchis on its back. Jason eagerly undertook the perilous expedition proposed to him by his uncle, who, well aware of the dangers attending such an enterprise, hoped by this means to rid himself for ever of the unwelcome intruder.

Jason accordingly began to arrange his plans without delay, and invited the young heroes whose friendship he had formed whilst under the care of Chiron, to join him in the perilous expedition. None refused the invitation, all feeling honoured at being allowed the privilege of taking part in so noble and heroic an undertaking.

Jason firstly applied to Argus, one of the cleverest ship-builders of his time, built for him a splendid fifty-oared galley, which was called the Argo, after the builder. In the upper deck of the vessel the goddess had imbedded a board from the speaking oak of the oracle of Zeus at Dodona, which ever retained its powers of prophecy. The exterior of the ship was ornamented with magnificent carvings, and the whole vessel was so strongly built that it defied the power of the winds and waves, and was, nevertheless, so light that the heroes, when necessary, were able to carry it on their shoulders. When the vessel was completed, the Argonauts (so called after their ship) assembled, and their places were distributed by lot.

Briefly, after many adventures, the Argo arrived to İstanbul and passed the İstanbul Strait. This narrow passage between the Sea of Marmara and the Black Sea, was the edge of the known world to the ancient world. Since the times of legends the Turkish Straits are known and accepted extremely dangerous due to the currents created by the flow of water from the Black Sea. The ancient Greeks believed that clashing rocks guarded the straits and that the rocks would close together and smash any ship sailing through. Jason had been told by a blind prophet, Phineus, how to fool the rocks. He was to send a bird ahead of him. The rocks would crash in on it and then reopen, at which point he could successfully sail through. The myth of Jason’s life was told by ancient Greek writers Pindar, Euripides and Apollonius Rhodius as they have been also translated into English and other languages and published in modern age. There are severel ancient classics about the passage of Jason and his crew “Argonauts” with their vessel “Argo” translated to English and also books in English about these classics such like (Morice, 1879; Done, 1876; Apollonius of Rhodes, 1993). These ancient classics have also been translated to severel other languages. The passage of vessel “Argo” through the İstanbul Strait is explained in the different English interpretations of the legend and other texts where mentioned about the legend, with some differences. There are many texts in English, where it is stated that Tiphys was the pilot while passing the İstanbul Strait such as (Lempière, 1788; Dupuis, 1795; Banier, 1740). According to Apollonius (3rd Century BC), in the English translation of the Argonautica by R.C. Seaton in 1912, exiting from the İstanbul Strait to the Black Sea was given as follow “But Tiphys was quick to ease the ship … and in all its mass the wave rolled away beneath the keel, and at the stern it raised Argo herself and drew her far away from the rocks; …” (Book ll. 568-592). According to Colum (2009), the same text about the Istanbul Strait, Nauplius has acted instead of Tiphys, as per following passage “… But Nauplius was quick to ease the ship, and the wave rolled away beneath the keel, and at the stern it raised the Argo and dashed her away from the rocks.” (p. 49). But there is also some differences as per Berens (1894) stating “Tiphys acted as steersman and Lynceus as pilot” (p. 216). According to Kingsley (1856), the white pigeon was the pilot, as mentioned in the following text from his book the Hereos, “But Tiphys the cunning helmsman stood silent, clenching his teeth, till he saw a heron come flying mast-high toward the rocks, ... Then he cried, 'Hera has sent us a pilot; let us follow the cunning bird” (p. 99). According to Mitropoulos (2004), “… it might be argued that the Turkish Straits are the spiritual home of pilotage, because legend has it that when Jason, …, wanted to make the difficult passage through the Straits …, he sought the assistance of a local pilot.” as he has stated in his keynote address, XVIIth IMPA Congress, as the Secretary-General of the IMO. According to İstikbal (2006), “… Tiphys, who may also have been the first known pilot …“ (p. 69). Turkish Straits are used to be always a very difficult waterway since the legendary time of the ancient ages like as stated in the Argonautica “ … they steered through the eddying Bosporus. Hereupon a wave like a steep mountain rose aloft in front as though rushing upon them, ever upheaved above the clouds; nor would you say that they could escape grim death, …” (Apollonius, 3rd Century BC, Book II.164-177).

The commertial and strategic position of the Turkish Straits, connecting the Black Sea trade to the rest of the world, improved the trade and number of passages of ships through the Turkish Straits. During the passages of ships through the Turkish Straits, strong winds and currents, eddying waters, sharp bends and narrow passages might be the necessities, reasons and demand for the inovations of many maritime services and proffesions. Most of the maritime activities, such as pilotage, salvage, assistance, fresh water supply, ship chandler services such as victualing and other thechnical supplies, agency services and many other maritime jobs and services have probably been invented and begun in the Turkish Straits. The prevailing Northeasterly winds and southwesterly surface currents were forcing ships bounded for the Black Sea in the South enterence of the Çanakkale Strait. Sailing technology, used in ships until the first century BC, hasn’t made possible yet sailing against the wind. The city of “Troy” beside the South enterence of the Çanakkale Strait, was supposedly founded about five thousand years ago and it was immortalised by “The Iliad” the Homer’s epic story. Ships were waiting in Beşik Bay for rare favorable southerly winds and probaly buying fresh water, provisions and other necessities and developing the trade, as Homer said, “the wind brought wealth to Troy.”

Despite strong winds and currents, eddying waters, sharp bends and narrow passages, the Turkish Straits have been a strategic waterway and an object of conquest throughout history as observed in the Trojan war and also similarly in the Çanakkale Battles during the First World War.

The ancient city of Troy, where the Trojan War took place, as told in the legend of The Iliad by Homer, is about 25 km to the south of Çanakkale. It is situated over the Hisarlık Hill on the north-western tip of Troad Peninsula (today's Biga Yarımadası). Troy was also known as or Ilios or Illium, source of the name Iliad. Archaeologists say, in all, nine cities were built on the site of Troy. The oldest and first city on the site of Troy was Wilusa (or Truwisa), founded by the Hittites in the Bronze Age, the 3rd millennium BC. Geographical position of the City of Troy is a very suitable place for the control of the unique passage to the Black Sea, today's Turkish Straits.

According to legends the abduction of Helen, the daughter of the king of Sparta, by the Trojan Prince Paris, sparked enmity and then long lasting war between the Trojans and Achaeans from across the Aegean Sea. The Achaeans had failed to capture this wealthy city at the end of a war and a siege lasting for ten years. Finally, Achaeans decided to set up a trick. They made a clever plan. The Achaeans constructed an enormous, large wooden horse in which they hid their own bravest warriors and left it in front of the gate of the city. Then they pretended to have given up and raised the siege, leaving the Trojan horse standing outside the city wall and retreating in their ships to behind the Tenedos Island (today's Bozcaada) out of sight of Troy. During the night the Achaeans ships returned and Achaeans warriors hidden in the horse opened the gates of Troy. Thousands of Achaean warriors poured in. They set Troy on fire, plundered and destroyed it, and made a big slaughter as described in detail in (Virgil, 19 BC).

This event affected the people so much that, over hundreds of years, it became a legend and subject of various works of arts and literature. The Trojan horse became an idiom and symbol. There are two replicas of Horse of Troy in Çanakkale. One of these two replicas is a model horse used in the film "Troy", a "Warner Bros." production, released in 2004. In this movie Brad Pitt acted the leading role of Achaean warrior Achilles. The model Horse of Troy of this film, (A twelve tonne fibreglass replica of a Trojan horse, the Hollywood star, held together with bolts, ropes and nails) has been in exhibited on the seafront of Çanakkale as from 15th of

September 2004. Other replica Horse of Troy which was made by a Turkish carpenter from Çanakkale, Ahmet Karadeniz using pine trees from the Ida Mountain (Kaz Dağı) is at the entrance of the site of ancient city of Troy as from 1974. Both replicas of wooden horse of Troy and the amphitheatre of ancient Troy are shown in the Figure 1.1.

Figure 1.1 : Horses of Troy in Çanakkale, the amphitheartre of Troy .

Informations about the Turkish Straits during the antiquity may be obtained from the resources such as (Apollonius, 3rd Century BC; Apollonius of Rhodes, 1993; Bernal, 2006; Graves, 1993; Banier, 1740; Bell, 1790; Berens, 1894; Brewer, 1922; Bulfinch, 1855; Colavito, 2010; Colavito, 2011; Colum, 1921; Done, 1876; Dupuis, 1795; Flaccus, 1916; Given, 1905; Kingsley, 1856; Lempière, 1788; Morice, 1879; Scull, 1880; Virgil, 19 BC).

1.2.2 Settlement and sovereignty of Turks in and around the Turkish Straits

During the history, proto-Turks or ancestors of Turks have always been in the area around the Turkish Straits, in Anatolia and Thrace, as well as in Balkan Peninsula. Despite the traditional Eurocentric approach to the history, limiting the Turkish History with only the time after Seljuk Turks and later Ottoman Turks in this area; the region around the Turkish Straits, the Marmara Region, Anatolia and Balkan Peninsula have been stated as one of the most ancient Turkish settlement area, at least, since 4^{th} and 3^{rd} millennium BC, by many historians such as (Ayda, 1974, 1992; Bayram, 2011; Kafesoğlu, 1992; Karaşarlı, 2006, 2011; Westropp, 2003; Zekiyev, 2013).

Apart from the proto-Turks, Seljuk Turks (known also Seljuks, Seldjuks, Seljuqs, Seldjuqs, and in Turkish: Selçuklular), Anatolian Beyliks Turks and Ottoman Turks have been and settled around the Turkish Straits. Turks from Anatolian Seljuks passed first time to Thrace in 1261 with Kaykaus II (İzzeddin Keykavus II), the

Sultan of Anatolian Seljuks and settled in Dobruja (also spelled Dobrudza, Dobrudja and Turkish: Dobruca). Dobruja is a historical region between the lower Danube River and the Black Sea, and includes the Danube Delta, Romanian coast, and the northernmost part of the Bulgarian coast.

Turkish sovereignty in the Turkish Straits starts with the conquest of Gelibolu in 1354 by Suleyman Pasha (Süleyman Paşa), the elder son of Sultan Orhan Gazi and completed with the conquest of İstanbul in 1453 by Fatih Sultan Mehmet.

1.2.3 Ancient rule of the Empire

According to Agoston and Masters (2009), "The Ottomans were the first power since antiquity to gain effective control of the Black Sea and the only power ever to hold the region for three centuries. Thus arose the term "Ottoman lake" to refer to the Black Sea." The three centuries were from the conquest of the İstanbul until the Treaty of Kala-i Sultaniye (Çanakkale). According to İnan (2001), "From 1453 until 1809, the Ottomans were the sole power to determine the regime of the Straits. The accepted regime was to close the Straits to foreign civil and military traffic even in time of peace..." This regime was called as "the ancient rule of the Empire" and the phrase, " ancient rule of the Empire" apparently is found for the first time in the Treaty of the Kala-i Sultaniye (Çanakkale) between Great Britain and Otoman Empire in I809.

1.2.4 International agreements during the nineteenth century

By 1809, passage through the Straits had become an international issue and subject to international agreements. Under the 1809 Treaty of Çanakkale and following 1829 Treaty of Edirne, 1833 Treaty of Hünkar İskelesi, 1841 Treaty of London, 1856 Treaty of Paris and the Paris Straits Conventions, the 1871 Treaty of London and 1878 Treaty of Berlin, the Otoman Empire was committed to the signatory states to open the Straits to commercial vessels of all states and to close them, in principle, to all naval vessels of third states, in time of peace. The Turkish Straits regime founded under the nineteenth century agreements lasted until the outbreak of the First World War, and Wilson's principles played an important role in determining the ensuing legal regime for the Turkish Straits.

1.2.5 The First World War and Çanakkale Battles

During the First World War, Çanakkale and the Strait of Çanakkale were the places of a heroic defence of Turks their country, against to the very powerfull combined fleet of British and French warships crewed with their own soldiers and soldiers from dominion countries. At the end of final Allied naval attack which Vice-Admiral John Michael de Robeck has launched on the 18th March 1915, three British warships, Inflexible, Irresistible, Ocean and two French warships Bouvet and Gaulois, total five Allied warships were sunk or disabled during the Allied naval attack. Allied fleet failed to force the Strait of Çanakkale. For the memory of the great national naval victory at the Çanakkale Strait, the date of "18 Mart 1915 (18th March 1915)" made a large red memorial on the hillside above Çanakkale. The memorial of "18 Mart 1915" is visible from the vessels passing trought the Strait of Çanakkale as shown in the Figure 1.2.

Figure 1.2 : "18 Mart 1915" (date of Çanakkale maritime victory) memorial .

It is the day the Allied warships were sunk or turned back by the bravery and steadfastness of the Turkish hero gunners of the forts of the Straits of Çanakkale like

Corporal Seyit Ali (Çabuk), known also as “Koca Seyit from Havran – the Çanakkale Hero” as stated by Erdin (1969) and the naval heroes like Lieutenant-Commender Hakkı Bey (Güverte Kıdemli Yüzbaşı Tophaneli İbrahim oğlu Hakkı), the captain / commender of the Ottoman Navy Ship Minelayer Nusrat (known also as Nusret or Nousret). According to Nusrat Mayın Gemisi (2013), number of crew was sixty one people. Together with Captain Hakkı Bey, also Commander of Mine Group Lieutenant-Commander Hafız Nazmi (Akpınar) (He was also maritime pilot for the Turkish Straits), Deck Lieutenant-Commander Hüseyin, Chief Engineer Lieutenant-Commander Ali (Denizalp), Second Engineer Ahmet, Third Engineer Lieutenant-Commander Hasan, Electric Officer Lieutenant Hasan, Gunner Lieutenant Kadri and other fifty four sailors were in duty onboard Nusrat. On the night of 7-8 March 1915 (early morning of 8th of March), the Turkish minelayer Nusrat has laid a line of 26 mines into the Çanakkale Strait, along the shoreline in the Erenköy Bay (Akyarlar) in 100 metres intervals (not across the strait, but parallel to the shore). This operation changed the destiny of the 1915 naval battle. After 10 days, on the 18th of March 1915, as a result of the mining of the Çanakkale Strait, three ships from the Allied Fleet are sunk and three badly damaged.

Original of hero minelayer Nusrat is placed and exhibited in Tarsus, in Çanakkale Park that is made for Nusrat. There is also a replica of Nusrat in the Çanakkale Strait as shown in the Figure 1.3.

Figure 1.3 : The replica of the minelayer Nusrat in Çanakkale.

Allied warships couldn’t pass the Strait of Çanakkale. They decided to land and occupy the Gelibolu Peninsula from Gulf of Saros.

The land battles continued untill the evacuation of Allied forces from the Gelibolu Peninsula on 8th of January 1916. Colonel Mustafa Kemal was the commender of the 19th Division which served as main reserve force of Turkish Fifth Army. Gazi Mustafa Kemal became one of the war heroes in Çanakkale Battles with the title of “the Hero of Anafartalar”. According to Australian War Memorial (2013) “His superb grasp of strategy and ability to inspire his troops by his reckless bravery in action boosted Turkish morale and proved decisive in thwarting allied plans. Given command of all Turkish forces fighting in the Anafarta sector … ”.

Gazi Mustafa Kemal was awarded the title of Pasha after the August battles in Çanakkale. The Mustafa Kemal Atatürk Memorial at Conkbayırı, Gelibolu and the concrete stone balls on the ground in front of the memorial mark the place where Mustafa Kemal was hit by shrapnel are shown in the Figure 1.4.

Figure 1.4 : Atatürk Memorial and the place where he was hit by shrapnel.

When looking from the vessels passing trought the Çanakkale Strait; there is also other conspicious memorial above the fort of Kilitbahir, on a hilltop to the right, a huge figure of Turkish soldier carved in white upon the hillside beside a Turkish inscription saying “Dur yolcu! Bilmeden gelip bastığın / Bu toprak, bir devrin battığı yerdir”. These words are the first two lines of the whole poem named “Bir Yolcuya” of Necmettin Halil Onan, the Turkish Poet and researcher that the information about him and his bibliography is given is (Cunbur, 1972; Türkçeciler, 2007; Ministry of Culture and Tourism, 2005). The poem has been very succesufly translated into English by Prof. Dr. Syed Tanvir Wasti. The English name of the poem is “ To A Traveller”. The first two lines from the translation of Wasti (2012) are as follow:

”Stop wayfarer! Unbeknownst to you this ground / You come and tread on, is where an epoch lies;”. “Dur Yolcu” memorial is shown in the Figure 1.5.

Figure 1.5 : “Dur Yolcu” Memorial above the fort of Kilitbahir.

The poem of Onan (1927a, 1927b) says that the heart of the homeland beats here where Turkish soldier “Mehmet” laid down his life for the freedom and the independence of his country and paid indeed for them with his own blood. Stop wayfarer, remember the price that Turkey paid for the victory in Çanakkale. The price was as per Erickson (2001), “56,643 dead, excluding the illness 107,007 wounded, 11,178 missing and prisoners”. According the Australian Government (2013) casualities of Turks in Çanakkale were “87,000 dead and over 164,000 wounded” According to the studies citing the Turkish official resources, casualities of Turks were “55,127 matyrs in battle, 21,498 matyrs in hospital, 76,625 matyrs in total, 100,177 wounded, 10,067 missing, 64,440 returned from battles due to the illness and 251,309 total casualities” (Moorehead, 1956; Bodur, 2008).

1.2.6 Occupation, Commission of the Straits, dark years for Turkish Straits

Despite the Victory in Çanakkale, as the results of the Armistice of Moudros, Turkish Straits have been occupied. Alleged Treaty of Sèvres almost ignored and excluded Turkey from the control of the Turkish Straits. Armistrice of Mudanya after the Turkish War of Independence allowed the Allied Troops to remain in the region of the Turkish Straits until the conclusion of a peace treaty. Even the Treaty of Lausanne limited the Turkish sovereignty with the establishment of the Straits Commission and demilitarisation of the Turkish Straits. Turkey couldn’t obtain full control and sovereignty over the Turkish Straits until the Montreux Convention Regarding the Regime of the Straits which has been signed on the 20th of July 1936.

The Armistice of Moudros (also known as Mudros, in Turkish “Mondros Ateşkes Antlaşması”) which was concluded on 30 October 1918 and was signed by the Ottoman Minister of Marine Affairs Hüseyin Rauf Bey (Orbay) and the British Admiral of the Fleet Sir Somerset Arthur Gough-Calthorpe, onboard the British battleship HMS Agamemnon in Moudros harbour on the Lemnos Island (in Turkish “Limni Adası”). Beside several conditions to the Armistice, the Ottomans surrendered their remaining garrisons outside Anatolia (in Hedjaz, Assir, Yemen, Syria, and Mesopotamia) to the nearest Allied Commander, demobilized the army, surrendered all war vessels, as well as granted the Allies the right to occupy forts controlling the Çanakkale Strait and the İstanbul Strait; and the right to occupy "in case of disorder" any Ottoman territory in case of a threat to security. The Ottoman army including Ottoman air force was demobilized, and all ports, railways, and other strategic points were made available for use by the Allies. The armistice was followed with occupation of İstanbul and subsequent partitioning of the Ottoman Empire. The alleged Treaty of Sèvres (10th August 1920) followed the armistice, but this treaty was not enacted due to the outbreak of the Turkish War of Independence.

The alleged Treaty of Sèvres was the alleged peace treaty between the occupied Ottoman Empire and Allies, for the partitioning of the Otoman Empire, at the end of First World War. The Treaty of Sèvres was signed on the 10th of August, 1920; but it was never adopted. The alleged Treaty of Sèvres has included the articles about a Commission of the Straits which has own flag, own budget and separate organisation. This Commission was composed of representatives appointed respectively by the United States of America (if and when that Government is willing to participate), the British Empire, France, Italy, Japan, Russia (if and when Russia becomes a member of the League of Nations), Greece, Romania, Bulgaria and Turkey (if and when the two latter States become members of the League of Nations). Each Power permitted to appoint one representative. The representatives of the United States of America, the British Empire, France, Italy, Japan and Russia should each have two votes. The representatives of Greece, Romania, and Bulgaria and Turkey should each have one vote. Each Commissioner should be removable only by the Government which appointed him. The Commissioners should enjoy diplomatic privileges and immunities. The Commission would exercise the powers conferred on it by the present Treaty in complete independence of the local authority.

The Commission would be charged with the execution of any works considered necessary for the improvement of the channels or the approaches to harbours; the lighting and buoying of the channels; the control of pilotage and towage; the control of anchorages; the control necessary to assure the application in the ports of İstanbul and Haydarpaşa; the control of all matters relating to wrecks and salvage; the control of lighterage. The Turks have never accepted this alleged treaty and alleged results of the First World War. The Turkish National Movement "Kuvâ-i Milliye" with the Leadership of Gazi Mustafa Kemal (Atatürk), continued to fight.

The resistance against the imperialist intervention became the independence war of the Turkish Nation. The Turkish War of Independence has been fought from 19th of May, 1919, to 24th of July, 1923. The Turkish National Movement "Kuvâ-i Milliye" in Anatolia culminated in the formation of a new Grand National Assembly (GNA), (in Turkish Türkiye Büyük Millet Meclisi, TBMM) by Mustafa Kemal Atatürk and his colleagues. The Turkish War of Independence was a war waged by the Turkish nation against the Allies, after the country was occupied and partitioned following the Ottoman Empire's defeat in World War I. The Turkish National Movement (Kuvva-i Milliye) and later regular Army of Grand National Assembly defended the Turkish homeland against the Allied powers which were consisted of the powers of Greece, Armenia, France, French West Africa, French Armenian Legion, United Kingdom, British India, Italy, Georgia, United States of America as Naval Support, Forces of Order "the Kuvâ-i İnzibâtiyye" (known also as Caliphate Army), the army which was established on the 18th of April 1920 by the imperial government of the Ottoman Empire in order to fight against the Turkish National Movement "the Kuvâ-i Milliye" in the aftermath of World War I and others local colaborators of the Allied powers.

The Turkish War of Independence was ended with the Armistice of Mudanya. It was an agreement which was signed on the 11th of October, 1922, in the Turkish town of Mudanya, in the province of Bursa, between representatives of the Grand National Assembly of Turkey and representatives of Great Britain, France, and Italy. The Kingdom of Greece acceded to the Armistice on the 14th of October, 1922. The Armistice of Mudanya provided for the immediate evacuation of Greek troops from eastern Thrace to the Meriç River (known also in Bulgarian Maritsa, in Greek Evros). Allied troops were to remain temporarily in Istanbul and in the region of the

Straits until the conclusion of a peace treaty. The Mudanya Armistice remained in effect until the conclusion of the Lausanne Peace Treaty of 1923.

The alleged Treaty of Sèvres was annulled in the course of the Turkish War of Independence and the parties signed and ratified the superseding Treaty of Lausanne. The Treaty of Lausanne was a peace treaty signed in Lausanne, Switzerland on 24 July 1923 and after the ratifications of the parties, came into force on 6 August 1924. It officially ended the state of war that had existed between Turkey and the Allies since the onset of First World War. It was signed between Turkey and Allied British Empire, Frence, Italy, Japan, Greece, Romania, and Serb-Croat-Slovene State. According to Atatürk (1927), as he has mantioned in his Great Speach (Nutuk) “This treaty, is a document declaring that all efforts, prepared over centuries, and thought to have been accomplished through the Sèvres Treaty to crush the Turkish nation have been in vain.” In the same speach of Atatürk (1927), also stated that the Lausanne Treaty was an important diplomatic success as he said “It is a diplomatic victory unheard of in the Ottoman history!”. The Lausanne Treaty has included Convention Relating to the Régime of the Straits. According this Convention the Contracting Parties agreed to recognise and declare the principle of freedom of passage and of navigation by sea and by air in the Straits. The Lausanne Straits Convention was limited the Turkish sovereignty with the establishment of the Straits Commission and demilitarisation of the both shores of the Straits and the islands in the Marmara Sea except the İmralı (Emir Ali) Island.

1.2.7 The Montreux Convention

The Republic was proclaimed on the 29th of October, 1923, in the new capital of Ankara. Mustafa Kemal was elected as the first President. The young Turkish Republic obtained the full control and sovereignity over the Turkish Straits only thirteen years after the proclamation of the Republic. The Montreux Convention Regarding the Regime of the Straits has been signed on the 20th of July 1936 and it is still in force today. The Montreux Convention (1936) gives Turkey full control and sovereignty over the Straits and guarantees the free passage of civilian vessels in peacetime. It restricts the passage of naval ships not belonging to Black Sea states. The Convention also has permitted Turkey to remilitarise the Straits and ensure their security, just like an other part of the country.

1.2.8 Other legal instruments

Turkey has also other strong legal instruments relating to the Turkish Straits, after and in adition of the Montreaux Convention such as the related documents of the International Maritime Organisation. For example, there is a recommendation of the International Maritime Organisation (IMO), encouraging utilisation of pilots on board ships in the Turkish Straits. Presently there are seven resolutions with such recommendations for different geographical areas and the latest one of them is for the Turkish Straits. IMO Resolution A.827 (19) (adopted 1995) on “Ships' Routeing” includes the Annex 2 “Rules and Recommendations on Navigation through the Strait of Istanbul, the Strait of Çanakkale and the Marmara Sea”. This document states that "Masters of vessels passing through the Straits are strongly recommended to avail themselves of the services of a qualified pilot in order to comply with the requirements of safe navigation." There are also paralelles recommendations related to the Turkish Straits by the International Maritime Pilots’ Association (IMPA), European Maritime Pilots’ Association (EMPA), the Turkish Authorities and non-governomental organisations.

1.2.9 Other studies and resources related to the Turkish Straits or this study

There are many studies regarding the Turkish Straits. While reviewing the related literature and available resources on the Turkish Straits, we may categorise them as per their subjects and methods. Many of them are related to the political or strategic characteristics of the Turkish Straits. Some of the studies are related the technical aspects. There are also studies about the environmental issues about the Turkish Straits. To understand clearly any specialised issue related to the Turkish Straits, it might be necessary to learn and study many other aspects. History, legislation, geography, environment, climate, politics, economy, sociology and most of brunches of the science and culture include some aspects of the Turkish Straits or vice versa. Many of the studies use different approaches and they have different subjects related to the Turkish Straits. Some of these studies are related to the difficulties, risks, techniques, regulations, safety, and security of the passage of the Turkish Straits by vessels. In some studies, some simulation methods have been used like real time simulation, ship handling simulation, etc. Some studies provide some general or specialised information related the Turkish Straits. Some studies propose some solutions for defined questions, methods, guidance of procedures in order to obtain any improvement of safety, security and in order to reduce risks.

Turkish Straits provide vital link between the Black Sea and the Aegean Sea. Transportation, logistics, economy and general information about the Turkish Straits are also subjects of some studies such as (Akten, 1968; Akten, 1996; Akten, 2003; Akten and Gönençgil, 2002; Brito, 2000; Öztürk and Özkan, 2002).

Oil transport through the Turkish Straits is also one of the important facts and subjects of many studies such as (Bilbo, 2001; Bilgin, 2007; Güven, 2002; Plant, 2000).

There are several studies about the Turkish Straits, related to pollution and environmental issues such as (Akten, 2002a; Akten et al, 1995; Ateş, 2007; BIMCO, 1993; Birpınar et al, 2009; Cömert, 2007; Deniz and Durmuşoğlu, 2007; Doğan and Burak, 2007; Kazezyılmaz et al, 1998; Kemerli, 2002; Kesgin and Vardar, 2001; Kılıç and Belivermiş, 2013; Kılıç and Çotuk, 2011; Lagaria et al, 2013; Otay and Yenigün, 2003; Öztürk et al, 2001; Türkoğlu, 2008).

Turkish Straits are also very important fishing area with its very good position for the passage of several kinds of seasonal fishes between Black Sea, Sea of Marmara, and Mediterranean Sea and also contain a lot of types of local fishes, several types of migrating fishes and many other marine species. One of the important academic papers about the fishes and fishery in the Turkish Straits is (Öztürk et al, 2002).

There are also several studies about the Turkish Straits, related to accidents and risk analyses including but not limiting with the followings: (Akten, 1982; Akten, 2002a; Akten, 2002b; Akten, 2004; Akten and Gönençgil, 1998; Akten et al, 1995; Baş, 1999; Bolat and Yongxing 2013; Cahill, 1983; Chapman and Akten, 1998; Cömert, 2001; Darbra and Casal, 2004; Ece, 2005; Gören, 2002; Gören and Or, 2002; IMO Res. A.849(20), 1997; IMO Res. A.884(21), 1999; İstikbal, 2001; Koldemir, 2004; Koldemir, 2005; Koldemir, 2006; Kornhauser and Clark, 1995; Or and Kahraman, 2002; Otay, 2003a; Otay, 2003b; Otay and Özkan, 2003; Otay and Özkan, 2005; Poyraz, 1998; Sevilir, 1996; Sungur, 2005; Tan and Otay, 1999; Tumbat, 1999; Ulusçu et al, 2009).

Maritime safety and maritime security are very important for any maritime activity in all waters and as well as in the Turkish Straits. There are also some studies about the

Turkish Straits, related to safety and security management such as (Caşin, 2002; Cerit, 2000).

Hydrology and oceanography in and about the Turkish Straits are also two of the important subjects of many studies such as (Chiggiato et al, 2012; Makaroff, 1919; Myers et al, 2003; Özsoy et al, 2001; Özsoy et al, 2002; Şen, 2012; Ullyott and Ilgaz, 1943).

Currents must be considered as very important subject for any study related to the Turkish Straits; especially the studies of Hydrology, oceanography, navigation, transportation, logistics, economy, pollution, maritime environment and many other subjects. Currents in and through the Turkish Straits are also important facts and subjects of many studies such as (Aydoğan et al, 2010; Chiggiato et al, 2012; Cömert, 2006a; H. D., 1941; İneceli, 1968; Makaroff, 1919; Özsoy et al, 2001; Özsoy et al, 2001; Özsoy et al, 2002; Şen, 2012; Ullyott and Ilgaz, 1943).

There are several studies about the Turkish Straits, related to navigation such as (Baş, 1999; Cömert, 2006a; Denizcilik Müsteşarlığı, 2000; Dyoulgerov, 1999; Ece, 2001; Ece et al, 2007; IMO Res. A.827(19), 1995; IMO Res. A.893(21), 1999; İneceli, 1968; İstikbal, 2002; Kondratenko and Sydorenko, 2003; Liu et al, 2006; Mavrakis and Kontinakis, 2008; OCIMF, 1997; Otay and Tan, 1998; Özkan, 2003; Sarıöz and Narlı, 2003; Şimşir and Ertuğrul, 2009; Yazıcı, 2004; Yazıcı and Otay, 2009).

Charts and nautical publications are very important for any nautical study. The main publisher for nautical publication for the Turkish Straits is “T.C. Deniz Kuvvetleri Komutanlığı Seyir, Hidrografi ve Oşinografi Dairesi Başkanlığı, SHOD (Turkish Navy, Office of Navigation, Hydrography and Oceanography, ONHO)”. The charts and publications of SHOD are sufficient and efficiently cover the necessary information for most of nautical studies and many other nautical activities. There are also other resources such like charts and pilot books published by British Admiralty. The following charts and nautical publication have been used for this study and they may be necessary for other nautical studies: (H. D., 1941; SHOD, 1983; SHOD, 1984a; SHOD, 1984b; SHOD, 1991; SHOD, 2001; SHOD, 2007; SHOD, 2008; SHOD, 2009; SHOD, 2012; SHOD, 2013a; SHOD, 2013b; UKHO, 2013).

Local maritime traffic is heavy in the Turkish Straits due to heavy population living around. There are also some studies about the Turkish Straits, related to local traffic management such as (Aydoğdu et al, 2012).

Vessel Traffic Services (VTS) in the Turkish Straits are very important in order to improve maritime safety and reduce risks of collisions in the Turkish Straits. There are also some resources about the Turkish Straits, related to vessel traffic services (VTS) traffic management such (IALA, 2005; IMO Res. A.857(20), 1997; KEGM, 2012; Ustaoğlu and Poyraz, 2002).

Statistics about the Turkish Straits can be obtained from official resources of "Ana Arama Kurtarma Koordinasyon Merkezi, AAKKM" (Turkish Main Search and Rescue Co-ordination Centre) and "Kıyı Emniyeti Genel Müdürlüğü, KEGM" (Directorate General of Coastal Safety (DGCS) of Turkey). These official resources provide continuous records of the updated statistics about the Turkish Straits related to the accidents, incidents, number of passages of different types of vessels through the Turkish Straits such as (AAKKM, 2013; KEGM, 2013a).

Law and policy about the Turkish Straits are also subjects of the many studies. Some studies are mainly about the laws and policy and directly related to the Turkish Straits; some others may be partly related to the Turkish Straits. There are several papers about the Turkish Straits, related to the law and policy such as (Akten and Gönençgil, 2002; Aybay and Oral, 1998; Bundock, 1995; Fornari, 2005; Güçlü, 2000; İnan, 2001; Joyner and Mitchell, 2002; Morgan, 1989; Oral, 2001; Plant, 1996; Plant, 2000; Scharfenberg, 1996; Soysal, 1995; Ünlü, 2002).

Resources about the international conventions and other international legislation related to and/or which can be applied to the Turkish Straits are (COLREGs, 1972; IMO Res. A.827(19), Annex 2, Para. 3, 1995; LOAD LINES, 1966/1988; MARPOL, 1973; Montreux Convention, 1936; SHOD, 2000; SOLAS, 1974; STCW, 1978; Sturt, 1991; IMO Doc. MSC 63/7/2 and Annex, 1994).

Resources about the national legislation related to and/or which can be applied to the Turkish Straits are (Act of Ports, 618, 1941; Act of Protection of Life and Property at Sea, 4922, 1946; Çanakkale ve Gelibolu Liman Başkanlıkları Yerel Deniz Trafiği Rehberi, 2011; İstanbul Liman Başkanlığı Yerel Deniz Trafiği Rehberi, 2011; KEGM, 2012; SHOD, 2003; Turkish Straits Maritime Traffic Regulation, 1998).

There are many studies and resources about the simulation systems. Some of them are directly related to the Turkish Straits. Some of them are general studies about the simulation systems but for many aspects, they can be applied to the Turkish Straits. Studies and resources about the simulation systems related to and/or which can be applied to the Turkish Straits are (Banks et al, 2001; Committee on Ship-Bridge Simulation Training, 1996; İnce and Topuz, 2004; Kaplan and Jacobsen, 1993; Köse et al, 2003; Mavrakis and Kontinakis, 2008; Perez and Blanke, 2000; Port Revel, 2013; Sarıöz et al, 1999).

Ship handling and Manoeuvring are very important knowledge for any nautical study. Some of the studies, IMO resolutions and other resources, about the ship handling and manoeuvring, which can be applied to the Turkish Straits and/or which have been used in this study, are (IMO Res. A.160(ES.IV), 1968; IMO Res. A.431(XI), 1979; IMO Res. A.601(15), 1987; IMO Res. MEPC.232(65), 2013; IMO Res. MSC.137(76), 2002; Miller et al, 1987; Port Revel, 2013).

Ships reporting systems and requirements are important maritime issues. They can be also applied to the Turkish Straits. IMO resolutions about the ship reporting systems and requirements are (IMO Res. A.851(20), 1997; IMO Res. MSC.111(73), 2000; IMO Res. MSC.189(79), 2004; IMO Res. MSC.43(64), 1994).

Formal Safety Assessment (FSA) has been used as a methodology in this thesis, to develop a navigational model in order to improve the safety of navigation and to reduce the risks of accidents and other incidents. International Maritime Organization (IMO) resources and resolutions about the “FSA” are (IMO FSA, 2013; IMO MSC/Circ.1023 - MEPC/Circ.392, 2002; IMO MSC/Circ.1180 - MEPC/Circ.474, 2005; IMO MSC-MEPC.2/Circ.5, 2006).

As the results of the study, pilotage has been found as the most important safety precaution to improve safety of navigation in the Turkish Straits. Utilising the services of a qualified pilot, by the masters of vessels passing through the Turkish Straits, as also strongly recommended by IMO, in order to comply with the requirements of safe navigation, is also most important mean to utilise any other possible and available measure or precaution of maritime safety in the Turkish Straits such as proper communication with local trafic and local authorities, updated navigational information, specialised local knowledge and expertise, experience of ship-handling and manoeuvring in the pilotage area. Some of the studies, IMO resolutions and other resources about the pilotage, general resources about the pilotage and the resources which can be also applied to or related to the Turkish Straits, are (EU Directive 2009/16/EC, Article 23, 2009; IALA, 2007; IMO Res. A.159(ES.IV), 1968; IMO Res. A.480(XII), 1981; IMO Res. A.486(XII), 1981; IMO Res. A.668(16), 1989; IMO Res. A.710(17), 1991; IMO Res. A.960(23), 2003; IMO Res. MSC.138(76) Annex 1, 2002; IMO Res. MSC.138(76) Annex 2, 2002; İstikbal, 2006; Oğuzülgen, 1995; RCTCWSMP, 2006; Sağ, 2006; Yüceer, 2001).

The pilotage organization under the “Kıyı Emniyeti Genel Müdürlüğü, KEGM” (Directorate General of Coastal Safety (DGCS) of Turkey) is one of the oldest and biggest pilotage organizations of the world. KEGM provides very high quality pilotage services in the Turkish Straits (in the Strait of Çanakkale, Strait of İstanbul, Sea of Marmara, at Çanakkale Port, Gelibolu Port and İstanbul Port) with about 150 qualified pilots, 30 pilot boats, 6 pilot stations, and adequately qualified management, administrative and support staff. Pilotage service is given onboard the vessel utilising the service. Therefore pilot transfer to and from the vessels is very important and critical. Only in the Turkish Straits, two maritime pilots lost their lives within the last seven years due to the pilot transfer accidents. Senior Maritime Pilot Capt. Lütfü Berk died in 2006 and Senior Maritime Pilot Capt. Fahrettin Aksu died in 2009. Both of pilots’ names are given to the pilot stations. “Capt. Lütfü Berk” is the name of the pilot station at the north entrance of the İstanbul Strait and “Capt. Fahretin Aksu” is the name of the pilot station at the south entrance of the İstanbul Strait. Pilot transfer is a subject of an international regulation. The Regulation 23 of the Chapter V (Safety of Navigation) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 is related to the pilot transfer arrangement. Resources about the pilot transfer arrangements’ international rules and regulations including IMO resolutions and standards including the ISO standards which can be also applied to the pilot transfer in the Turkish Straits are (IMO Res. A.1045(27), 2011; IMO Res. A.130(V), 1967; ISO799:2004, 2004; SOLAS, 1974).

Beside many academic papers, reports of scientific researches, studies, theses, articles, rules, regulations, resolutions, conventions, texts or books of information, textbooks for education, encyclopaedias, guides, charts, atlases, sailing directions, brochures, journals, newspapers, bibliography, catalogues, indexes, and many other printed materials, there are also films and documentary audio-visual records about the Turkish Straits. There are not only academic studies and scientific researches, but also tales, legends, novels, poets, songs, movies, paintings and many other different forms of literatures and arts have been produced about the Turkish Straits or being inspired by the Turkish Straits.

2. PASSAGES TROUGH THE TURKISH STRAITS

2.1 Southbound Passage

This section of the study is describing the navigational outline of the southbound passage trough the Turkish Straits from the Black Sea to the Aegean Sea. The southbound passage includes passages trough the İstanbul Strait, the Marmara Sea and the Çanakkale Strait.

2.1.1 Approaching to İstanbul Strait from north

Vessels, approaching to the Istanbul Strait, come from the Black Sea ports, from the anchorage or from the drifting area. The anchorage area is providing safe stay for vessels in calm weather condition. But, it is completely exposed to the northerly, north-easterly and easterly winds. Therefore in bad weather condition, staying at drift is safer than waiting at anchorage. Entering to the Istanbul Strait, because of the bad weather in the Black Sea, outside of the İstanbul Strait, is also possible for the vessels in difficulties. They may get the assistance from the VTS and pilots in order to proceed to the emergency anchorage in Büyükdere or may continue to their passages.

Vessels, passing trough the Turkish Straits are obliged to observe and apply all rules and regulations related to the Turkish Straits, and all instructions given by the Turkish Authorities. The Turkish Rules and Regulations are mainly based to the Montreux International Convention. As the basic principle, The Convention asks to Turkish Government, to provide the freedom of the passage for ships and gives rights to regulate this passage considering to the safety, security and environmental protection. The freedom of passage means the innocent passage regulated by the Turkish Authorities. The area, which is called the Turkish Straits, is very special area with its high population, admirable natural environment, very old, rich and still alive culture and history. All this specialities make the area a natural and cultural heritage for Turkish and also all the world nations. Increasing number, size and the tonnage of the vessel passing the Turkish Straits create a considerable risk for the area.

Vessels passing trough the Turkish Straits are subject to Health Inspection. Vessels must observe Sanitary Yellow Flag Rules. Vessels have to raise the yellow flag before entering the Turkish Straits and can lower it after their sanitary clearance. Vessels without stopover at the Turkish Straits must follow the yellow flag rules at each passage from the Turkish Straits, northbound and southbound. High fines are applied for vessels failing to fully comply with this rule. Vessels must keep necessary Quarantine Flag flying (Yellow) during daytime and Quarantine Lights on (Red & White) during night time until Free Pratique is granted. Vessels passing the Turkish Straits, must obtain free pratique from the Heath Authority. Health inspections in the Strait of Istanbul may be carried out just before pilot embarking position and at locations that will not affect safety of navigation. Sanitary (or Quarantine) Boat comes alongside to southbound vessels before or at the north entrance of the Istanbul Strait, close to Türkeli Lighthouse. The over ground speed of vessels is required less than nine knots to provide safe alongside for quarantine boat. The ship must produce and keep ready the necessary documents for sanitary boat. Health Declaration Form, copies and originals of certificates of Deratting/Deratization, Tonnage and Ship Registry, two copies of crew list and ship's stamp are required. Sanitary (or Quarantine) Boat alongside a southbound vessels at the north entrance of the İstanbul Strait and İstanbul Sanitary (Quarantine) Office are shown in the Figure 2.1.

Figure 2.1 : Quarantine boat and Quarantine Office in İstanbul.

Southbound vessels entering to the Istanbul Strait must approach with the safe speed. The regulation speed is 10 knots over ground, but the speed can be increased if it is required for the safety of manoeuvring. The vessels must keep the minimum 8 cables distance from other vessels and they are advised not to overtake during the passage. If they have to overtake for the safety of navigation, in this case they have not to overtake from Kanlıca to Vaniköy. Also overtaking other vessel around the waypoints is not advised. Overtaking may be assumed safe, only if there is an agreements between the vessels and the permission of the VTS, when the vessels are proceeding with the strait courses and also if the opposite and local traffic conditions are suitable.

For the vessels approaching to the İstanbul Strait North entrance, there are two major lights as principal marks. One of them is the Türkeli Light. It is in the European side of the entrance. The Türkeli Light has the characteristic of white flashing light, with a period of 12 seconds and a range of 18 nautical miles, having a horn as fog signal. The Türkeli Light has been built as a white round stone tower, 30 metres in height, in position of 41º14′N, 29º07′E, as shown in Figure 2.2.

Figure 2.2 : Türkeli Lighthouse.

The other principal mark is the Anadolu Light. It is in the Asian side of the north entrance of İstanbul Strait. The Anadolu Light has a characteristic of white long flashing light with a period of 20 seconds and a range of 20 nautical miles. It has been built as a white concrete tower and dwelling, 20 metres in height, in position of 41º13′N, 29º09′E as shown in Figure 2.3.

Figure 2.3 : Anadolu Lighthouse.

Pilots are always ready for service for southbounded vessels in the north enterence. They wait in the “Kaptan Lütfü Berk Pilot Station. The pilot station name is from a former maritime pilot, Captain Lütfü Berk, who lost his life as the tesult of a trasfer accident from the vessel in on the 20th of December 2006 in the İstanbul Strait. The pilot station contains a jetty for pilot boats and other facilities for pilots. The “Kaptan Lütfü Berk Pilot Station” is in Büyük Liman, Karataş Burnu, south of Garipçe village as shown in Figure 2.4.

Figure 2.4 : Kaptan Lütfü Berk Pilot Station.

Pilot boat asks boarding speed around 6 to 10 knots depending to the weather and current conditions. Pilot ladder must be prepared and rigged strictly according to SOLAS, Regulation 23 of Chapter V. Many pilot transfer accidents occurs ay the straits. Two pilots lost their life and many of them seriously injured. Pilot boarding area is quite far from the entrance and very exposed to the bad weather condition. Therefore the boarding is usually done at the entrance or more south depending to the weather condition according to the agreement between the master of the vessel and the pilot.

2.1.2 Türkeli to Çalı Burnu

Southbound vessels’ approaching course is should be within the southbound traffic lane of the TSS (Traffic Separation Scheme). The arrows marked within the lane, shown in the navigational charts, give the suggested true course in normal condition. The initial course is aiming to Yoros Kalesi. If the vessel is almost in the middle of the traffic lane the true course around 215 degrees. Vessels proceed with this course until the abeam of the Çalı Burnu buoy light. This light marks the shallow water behind the buoy. Depending to the size of the ship, current, the position of the vessel and the traffic condition, vessel must start the course alteration after passing the Garipçe village. A photograph taken from a vessel, passing in front of and seeing her starboard beam of Garipçe village is given in Figure 2.5.

Figure 2.5 : Garipçe Village.

Garipçe is a very charm fisherman village situated in a fortress. The course alteration will bring the ahead of the vessel from Yoros Kalesi to Close to Telli Tabya Burnu after passing the Çalı Burnu Light Buoy. Dikilikaya Light and Telli Tabya Burnu must be kept starboard side and northbound vessels to be kept on port side. If the vessels delay to starboard turn, it may confuse the northbound vessels and may endanger port to port safe passage.

2.1.3 Çalı Burnu to Büyükdere

Keeping the vessel within the southbound traffic lane also will keep the vessel clear from the northbound traffic on port side and obstructions on starboard side. The vessel heading is to be aimed to Kireçburnu light when the vessel approaches to Büyükdere. The Line between the Kavak Burnu and Dikilikaya Light is the border between the two TSVTS Sectors. Southbound vessels report to Sector Türkeli south exit from the sector, and then change VHF Radio Channel from 11 to 12 and report to Sector Kandilli, north entrance to the sector. A photograph of Dikilikaya light and Rumelikavağı village are given in Figure 2.6.

Figure 2.6 : Dikilikaya light and Rumelikavağı.

A vessel approaching to Büyükdere with the heading to Kireçburnu light will also observe Tellitabya Burnu on her starboard bow and Acar Burnu on her port side. Over head power cables are suspending between Tellitabya and Anadolukavağı. The false radar echo shown on the radar view confuse the seafarers, especially in dence fog. A photograph and a radar view of a vessel abeam Kavak Point, and Dikilikaya light are given in Figure 2.7.

Figure 2.7 : Heading to Kireçburnu, abeam Kavak Point and Dikilikaya light.

2.1.4 Büyükdere turn

Büyükdere turn occurs within the Büyükdere Bay and Umur Banks. Southbound vessels should approach the turn with the heading, aiming the Kireçburnu Light. Considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be started early enough. For large vessels, seeing the fist two cardinal buoys in transit (the north cardinal buoy and the west cardinal buoy) may give a good position to give a helm order. The ECDIS photograph of a southbound vessel approaching to the Büyükdere Turn is given in Figure 2.8.

Figure 2.8 : ECDIS view of a vessel approaching to Büyükdere turn.

Vessels approach to the turn with the heading to Kireçburnu Light. Light is not so conspicuous day and night time. Some time it can be behind a fishing vessel alongside in front. There are streets lights during the nights, behind the Kireçburnu Light which make very difficult to distinguish it. After the completion of most of the turn, when it is to close it can be seen as shown in Figure 2.9.

Figure 2.9 : Kireçburnu light.

The current is usually sets the vessels to starboard during the turning. Current is stronger at the starboard side of the navigable waters, comparing to the port side, close to the cardinal buoys. This difference usually increases the rate of turn during the turn. Many times to give small helm order for a while will give enough initial power for turning. To bring the helm to amidships is usually necessary. It is also necessary to meet the rudder earlier to control the rate of turn and to hold the vessel swinging when reaching to the intended heading. Radar view of the southbound vessel approaching to the Büyükdere turn and the photograph of the vessel with the heading between Kireçburnu Light and Tarabya Hotel are shown in the photograph given in Figure 2.10.

Figure 2.10 : Southbound Büyükdere Turn.

The surface current reaching to Kireçburnu Coast is parting to two different directions and creates one eddy in Büyükdere Bay. Other part of the current continues southbound beside the European Coast of the Strait.

After the completion of the first part of the turn, the vessel’s heading should turn from Kireç Burnu to Tarabya Hotel. Aiming to Tarabya Hotel will provide approximately a southerly course (180 degrees) between the north cardinal buoy and the first west cardinal buoy (middle buoy). The view from the bridge of a vessel with the heading to Tarabya Hotel is given in the Figure 2.11.

Figure 2.11 : Heading to Tarabya Hotel.

The next course alteration is to bring the ship's heading from the Tarabya Hotel to Paşabahçe Light. It occurs between the middle buoy and Tarabya hotel. These two preceding course alterations can be unified to the unique turn for the large vessels.

2.1.5 Büyükdere to Yeniköy

Southbound vessels should complete the Büyükdere turn and set the heading 145 degrees, aiming to Paşabahçe Light as shown in the Figure 2.12.

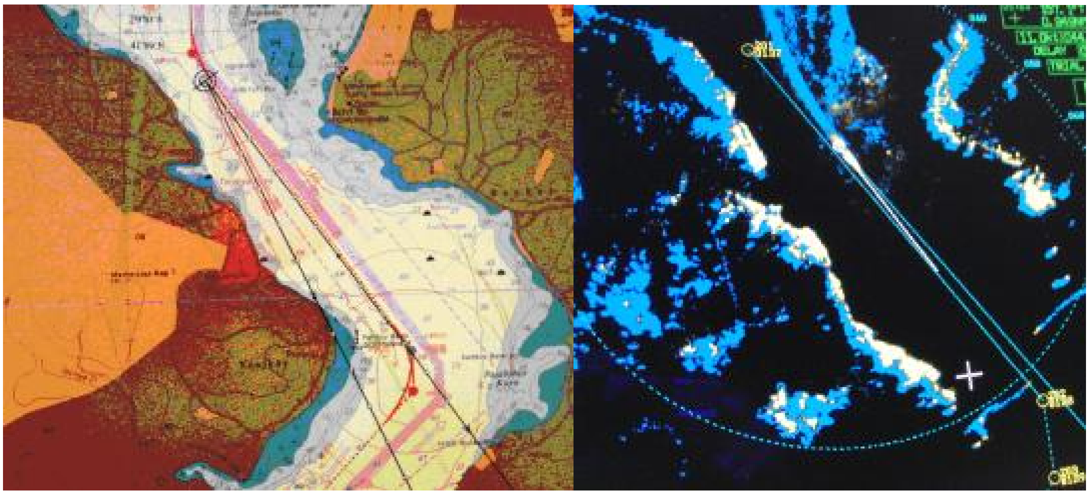

Figure 2.12 : ECDIS and radar view of a vessel approaching to Yeniköy.

The surface current is generally southbound and follows the path alongside the European costs. After passing the Tarabya Hotel another conspicuous building, Tarabya Presidential Campus (Huber Villa) will be seen abeam starboard side as shown in Figure 2.13.

Figure 2.13 : Presidential Campus (Huber Villa).

A photograph of a vessel with the heading 145 degrees, aiming to Paşabahçe Light is given in the Figure 2.14.

Figure 2.14 : Heading to Paşabahçe Light.

Vessels approaching to Yeniköy must consider northbound traffic behind the Yeniköy Point and also local traffic between Beykoz, Paşabahçe and Yeniköy.

2.1.6 Yeniköy turn

Yeniköy turn is the sharpest turn of the Istanbul Strait. It is almost right angle. The turn occurs as a combination of two course alterations around the Yeniköy Light which is marking the Yeniköy (or Koybaşı) Shoal. Southbound vessels should approach the turn with the heading, aiming the Paşabahçe light.

Considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be started early enough. For large vessels, it is necessary to give a starboard helm order before seeing the Austria Consulate starboard abeam. The current is usually increases the vessels' rate of turn. Vessels are exposed to strong current with their starboard quarter. Therefore using initially small degrees helm may create very big rate of turn. To be able to control the rate of turn it may be necessary to meet the helm early enough. Yeniköy turn of a southbound vessel radar and ECDIS photographs are given in Figure 2.15.

Figure 2.15 : Yeniköy turn. Radar & ECDIS views.

To turn gradually is also suitable precaution for controlled turn. Otherwise reaching to the intended final course without ending the turn due to the excessive rate of turn may cause grounding at the Yeniköy shoal. While turning gradually the first suggested course is therefore initially 180 degrees. Holding the ship’s heading when it reaches to Hidiv Kasrı provides southerly course. For large vessels due to the big turning circle these two course alteration can be combined. Many times to give small helm order for a while will give enough initial power for turning. To bring the helm to amidships is usually necessary. It is also necessary to meet the rudder earlier to control the rate of turn and to hold the vessel swinging when reaching to the intended heading. The vessel’s heading should turn from Paşabahçe Light to Hidiv Kasrı. Aiming to Hidiv Kasrı will provide the southerly course (180 degrees) as the first step of turning gradually. The next course alteration is to bring the ship’s heading from the Hidiv Kasrı to Baltalimanı light. These two preceding course alterations can be unified within the unique turn for the large vessels. Photographs of Yeniköy Light and Yeniköy ferry landing are given in the Figure 2.16.

Figure 2.16 : Yeniköy light and ferry landing.

2.1.7 Yeniköy to İstinye

After completion of the Yeniköy turn the vessel’s heading is normally aims to Baltalimanı Light, with the course approximately 222 degrees. After the completion of the turn of Yeniköy, a photograph and electronic chart display view of a vessel with the heading to Baltalimanı Light are given in Figure 2.17.

Figure 2.17 : Approaching to İstinye. Photograph& ECDIS view.

Initially the current coming alongside the European coasts is aiming to Paşabahçe Coasts at Yeniköy and behind the Yeniköy Point there is usually an eddy. Current reaching the Paşabahçe coasts reflects from the coasts to two different directions. One part goes to Beykoz alongside to the coast, which creates the Beykoz Counter Current. The other one part follows the coast line from Paşabahçe, Çubuklu to Kanlıca then leading to Baltalimanı, drifting the southbound vessels to starboard from İstinye to Baltalimanı.

Large vessels usually with the bigger turning circle, after the Yeniköy Turn sets their course to Baltalimanı, 222 – 225 degrees, other small vessels which may turn closer to Yeniköy Light sets smaller degrees courses such as 215 degrees as parallel to outside border of southbound traffic lane, depending their positions.

Depending to the weather condition and the nature of currents, it is usually good practice to keep the vessel away from eddies and confusing waters. Considering starboard setting current vessels must start turning earlier and must turn with sufficient angle of helm before the Tokmak Burnu. Radar and ECDIS views of a vessel altering her course abeam Tokmak Burnu is given in Figure 2.18.

Figure 2.18 : Abeam Tokmak Burnu. Radar & ECDIS views.

Tokmak Burnu is the point where the İstanbul VTS Centre is situated in its vicinity. The vessel's heading should turn from Baltalimanı Light, to the European coasts towers of the Fatih Sultan Mehmet Bridge, which is approximately 200 degrees.

2.1.8 İstinye to Emirgan

After completion of the course alteration abeam Tokmak Burnu, the vessel's heading is normally aims to the towers of the Fatih Sultan Mehmet Bridge on the European coasts, with the course approximately 200 degrees. The current flowing by the coast line from Paşabahçe to Kanlıca then leading to Baltalimanı sets the southbound vessels to starboard in this area. Therefore the course alteration to port should be done early and sufficiently enough considering this setting. Emirgan mosque and Emirgan Ferry Landing given are given in Figure 2.19.

Figure 2.19 : Emirgan Mosque and Emirgan Ferry Landing.

Emirgan is another waypoint Before Fatih Sultan Mehmet Bridge. For large vessels course alteration abeam Tokmak Burnu and Emirgan may be combined which will bring the vessels heading from Baltalimanı Light to the electric power mast on the top of the Kandilli Hill or for large vessels to the middle of the bridge. A photograph of the vessel approaching to the Fatih Sultan Mehmet Bridge with the heading of the electric power mast on the top of Kandilli Hill, is given in the Figure 2.20.

Figure 2.20 : Southbound approach to Fatih Sultan Mehmet Bridge.

2.1.9 Emirgan to Aşiyan

Vessels Approaching to Fatih Sultan Mehmet Bridge must have enough speed through the water to keep the vessel manoeuvrability. Between the Kandilli point to Aşiyan is the narrowest place in the İstanbul Strait. Therefore it causes different hydrodynamic affects to the vessels. Vessels approach to The Fatih Sultan Mehmet Bridge with southerly course, around 180 degrees.

Large vessel must start to turn to starboard early enough to avoid the sideway movement to port due to strong southerly surface current before and while turning to starboard. Otherwise vessel may drift very close to Küçüksu River mouth and the Kandilli Point. In vicinity of the Aşiyan Point there are usually some local traffic with small fishing boats and leisure crafts. In hot summer days there are also swimmers here. They may come easily away from the shore due to the strong current. Views of people on the Aşiyan Seaside and Aşiyan Light, from a vessel, are given in the Figure 2.21.

Figure 2.21 : Aşiyan seaside and Aşiyan light.

2.1.10 Aşiyan-Bebek-Akıntı Burnu turn

Aşiyan – Bebek – Akıntı Burnu turn is also known southbound Kandilli turn. This turn is one of the most critical turns of the İstanbul Strait. The turn occurs as a combination of two course alterations around the Aşiyan Point and Kandilli Point. Southbound vessels should approach the turn considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be planed and executed as necessary. ECDIS and radar views of a southbound vessel in a most narrow place of the İstanbul Strait, between the Aşiyan and Kandilli given in Figure 2.22.

Figure 2.22 : Southbound Kandilli turn. ECDIS & Radar views.

In normal weather and current condition, the main axis of the surface current is leading generally to the Bebek Bay. The current after reaching to the shore is parting to two brunches. One following the Bebek Bay shore line and create a counter current. Other brunch is leading the opposite direction. Surface current flows trough the Akıntı Point to Vaniköy and unify with other brunches of general surface current. Vessels must firstly to turn to Bebek Bay around Aşiyan Point, then to alter the course to port around Kandilli point, to bring the vessel’s heading to Beylerbeyi Light. Southbound vessels turning around Kandilli point, must avoid from Akıntı Burnu, northbound vessels and the local traffic while keeping the vessel position in the southbound traffic lane. Photographs of Bebek Light in Bebek Bay and Akıntı Burnu Light are given in the Figure 2.23.

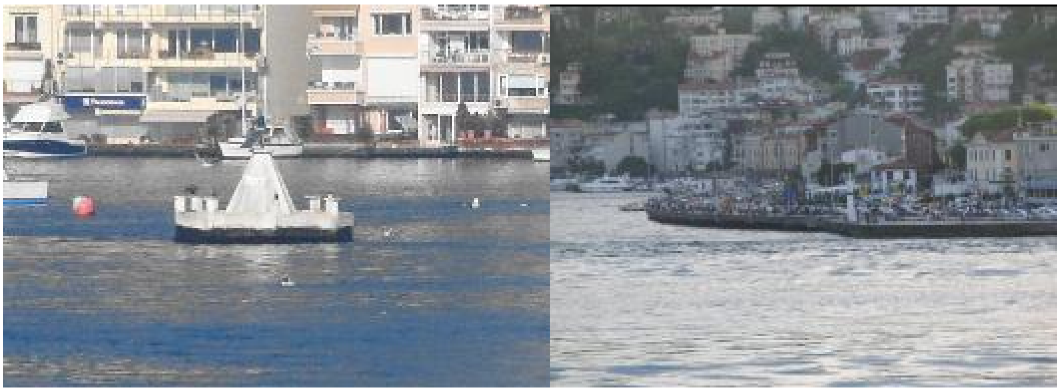

Figure 2.23 : Bebek Light and Akıntı Burnu Light.

2.1.11 Akıntı Burnu to Kuruçeşme

Southbound vessels, after completing Kandilli Turn set the vessel’s heading, aiming to the Beylerbeyi Light, approximately 195 degrees. The view of large tanker with the heading to Beylerbeyi Light and a photograph of Beylerbeyi Light are given in the Figure 2.24.

Figure 2.24 : Heading to Beylerbeyi Light.

The course which is approximately 195 degrees, with the heading to the Beylerbeyi Light, can be kept until clearing Akıntı Point; then in order to keep the vessel in traffic lane and to show the northbound vessels clear intention, vessel’s heading can be set to the middle of the Boğaziçi Bridge, which is approximately 205 degrees. After Kandilli, the narrowest place of the İstanbul Strait, the current is becoming stronger and the main axis comes closer to the Anatolian Coasts. Behind the Akıntı

Point, close to the European Coasts, Arnavutköy, Kuruçeşme, there are counter current and eddies. Vessels approaching to the Kuruçeşme turn observe the Galatasaray Island and Kuruçeşme Light on her starboard side. Photographs of the Galatasaray Island and Kuruçeşme Light are given in the Figure 2.25.

Figure 2.25 : Galatasaray Island, Kuruçeşme Light.

2.1.12 Kuruçeşme turn

Southbound vessels approaching to Boğaziçi Bridge alter their course to Beyazit Tower, in the old İstanbul Peninsula, in order to obtain the course which is approximately 235 degrees. Normal current condition usually increases the rate of turn during turning. Therefore small rudder angle is usually enough to turn the vessel and considerable angle is required to meet and hold the ship’s heading when it reaches to the intended course.

2.1.13 Kuruçeşme to Kabataş

Boğaziçi Bridge is the border between the two TSVTS Sectors. Southbound vessels report to Sector Kandilli south exit from the sector, and then change VHF Radio Channel from 12 to 13 and report to Sector Kadıköy, north entrance to the sector. Southbound vessels approaching to the south exit of the İstanbul Strait proceed within the southbound traffic lane. While keeping the position, to continue sharp lookout for local traffic is very important in this area. Because the local traffic density is the heaviest in this area. Crossing scheduled passenger ferries, pleasure crafts, fishing boats and other items of local traffic are to be always considered with sharp lookout while trying to keep the vessel within the traffic lane and passing clear away from northbound traffic. A photograph and radar view of a vessel with the heading to Beyazit Tower abeam Ortaköy and a photograph of Ortaköy are given in Figure 2.26.

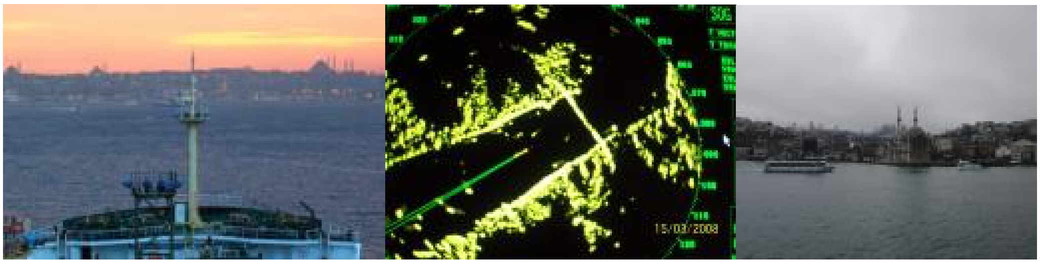

Figure 2.26 : Heading to Beyazit Tower - Abeam Ortaköy.

2.1.14 Kabataş - Sarayburnu turn

Kabataş - Sarayburnu turn is also known southbound Kızkulesi turn. This turn is one of the most critical turn of the İstanbul Strait. The turn occurs around the Kızkulesi on the port side. Southbound vessels should approach the turn considering the southerly surface current and depending to the size, speed and turning characteristics of the vessel, the turn is to be planed and executed as necessary.

In normal weather and current condition, the main axis of the surface current is leading generally to the old İstanbul peninsula. The current after reaching to the shore is parting to two brunches. One following the Eminönü shore line and create a counter current. Other brunch is leading to the opposite direction. It flows through the Sarayburnu to Haydarpaşa Port breakwater and unify with other brunches of general surface current.

Vessel must firstly approach to the old peninsula keeping the Bayezid fire control tower ahead; than turn around Kızkulesi in order to bring the vessel’s heading to the south, approximately to Sivriada. Southbound vessels turning around Kızkulesi, must avoid from heavy local traffic and amateur fishing boats while keeping the vessel position in the southbound traffic lane.

2.1.15 Sarayburnu to Ahırkapı sığlığı

Vessels proceed to south with the true course approximately 180 degrees, after the Kızkulesi turn. The surface current is usually sets the southbound vessels to starboard, towards the shallow waters around the Ahırkapı Shoal buoy. Therefore it might be necessary to apply some counter setting to the course, avoiding northbound traffic and considering the vessel’s position within the traffic lane limits. There is usually considerable local traffic in the area from Sarayburnu Point to Ahırkapı Shoal. Vessels must navigate with caution. On the south exit of the İstanbul Strait and north entrance of the Sea of Marmara, Ahırkapı Light is seen abeam starboard side as shown in Figure 2.27.

Figure 2.27 : Ahırkapı Lighthouse.

2.1.16 Ahırkapı sığlık şamandırası turn

The turn around Ahırkapı Shoal buoy occurs between the opposite traffic lane and the shallow waters around Ahırkapı buoy. Deep draft vessels must avoid from shallow waters around the Ahırkapı Buoy. Vessels must also keep sharp lookout for the leaving or approaching vessels from or to the Ahırkapı anchorage, area “A”. High speed crafts which may leave from or approach to Yenikapı Landing must be considered as an important part of the local traffic.

2.1.17 Ahırkapı sığlığı to separation buoy

Southbound vessels proceed beside and parallel to the Ahırkapı Anchorage area “A”, “B”, “C” after the Ahırkapı Shoal Buoy. Ahırkapı anchorage area “A” is the anchorage area for vessels waiting for İstanbul Port. Anchorage area “B” is the anchorage area for vessels carrying other then dangerous cargo. Anchorage area “C” is the anchorage area for tankers and vessels with dangerous cargo. It is also necessary to keep in mind that the local traffic, fishing boats and other maritime traffic are always alive and usually very heavy in the vicinity of the TSS system. It has to be noted that the approaching courses of vessels may give some confusion also around the Separation buoy, considering the traffic turns anticlockwise around the buoy.

2.1.18 Separation buoy to Ambarlı

Vessels leaving İstanbul Strait and proceeding to the Sea of Marmara, must navigate on the Traffic Separation Scheme. Vessels must obey the regulations of the TSS and reporting system. Abeam Ambarlı vessels must leave from Sector Kadıköy, and enter the Sector Marmara. Southbound vessels report to Sector Kadıköy south exit from the sector, and then change VHF Radio Channel from 13 to 14 and report to Sector Marmara, north entrance to the sector.

2.1.19 Ambarlı to Şarköy

After passing Ambarlı, southbound vessels must keep radio watch on Sector Marmara, VHF Channel 14, until the border of Sector Gelibolu which is at south of Silivri, 028º 10´ East Longitude. South of Silivri vessels must leave from Sector Marmara, and enter the Sector Gelibolu. Southbound vessels report to Sector Marmara south exit from the sector, and then change VHF Radio Channel from 14 to 11 and report to Sector Gelibolu, north entrance to the sector.

Marmara Sea is an important part of the Turkish Strait Area. Despite the large and deep waters, heavy traffic makes the passage difficult and dangerous. Vessels, coming from and/or going to many ports around the Marmara Sea, are joining, leaving and crossing the traffic separation scheme.

2.1.20 Şarköy to Gelibolu pilot boarding area

Tankers and vessels carrying dangerous cargo have the anchorage area south of Şarköy. Other vessels may proceed with caution around this anchorage area considering the leaving and approaching tankers to the anchorage. Vessels must enter to the Çanakkale Strait according to the scheduled time, with the instructed speed. They have to keep also eight cables distances with the previous vessel.

2.1.21 Gelibolu pilot boarding area to Gelibolu pilot station

Gelibolu Pilot boarding area is located after the beam of the Zincirbozan Bank Light (Fl, 10s, 10m, 7M) Boarding speed varies depending to weather condition but usually around 6-8 knots. Inbound vessels to Çanakkale Strait from the Marmara Sea must keep always clear from the outbound vessels. Vessels approach with the course 235 degrees, aiming to Gelibolu Limanı and keeping the Gelibolu Lighthouse starboard side. Gelibolu town, ferry landings, old port and fortress, Gelibolu lighthouse, Gelibolu pilot station are shown as Figure 2.28.

Figure 2.28 : Gelibolu.

2.1.22 Gelibolu pilot station to Karakova Burnu

Abeam Gelibolu Pilot Station vessels alter course to 218 degrees, than proceed to this course until abeam Karakova Burnu. Vessels must keep as much as possible within the traffic lane. There are very busy ferry lines between Gelibolu and Çardak, and also between Gelibolu and Lapseki. Vessels must navigate with caution considering this heavy local traffic. Abeam Kanarya Light (Sütlüce Burnu), vessels must report to leave from Sector Gelibolu and enter to Sector Nara. Karakova Burnu is shown, as a view from the bridge of a southbound vessel and also a photograph of radar image of a southbound vessel, in Figure 2.29.

Figure 2.29 : Southbound approach to Karakova.

Karakova light is located at Karakova Burnu. It is a red flashing light with a period of 6 seconds and a range of 10 miles (Fl R 6S 10 M). There is the Gelibolu Shipyard in Cumalı Bay, southwest of Karakova Burnu. The Karakova Burnu and the Karakova Light are shown in the photograph given in Figure 2.30.

Figure 2.30 : Karakova Light.

2.1.23 Karakova Burnu to Akbaş Burnu

Abeam Karakova Burnu vessels alter course to 231 degrees, aiming the Nara Burnu Light, green flashing light with a period of 10 seconds and a range of 7 miles (Fl (2) G 10s 8m 12M), than proceed to this course until abeam Akbaş Burnu Light, red flashing light with a period of 15 seconds and a range 12 miles (Fl (3) R 15s 6m 12M). A photograph of Akbaş Burnu, taken from the bridge of southbound vessel abeam Akbaş Burnu and a photograph of a radar image are given in Figure 2.31.

Figure 2.31 : Abeam Akbaş Burnu, views from southbound vessel.

2.1.24 Akbaş Burnu to Nara Geçidi

Vessels alter course to 254 degrees, abeam Akbaş Burnu, aiming the Poyraz (Kilye) Light, red flashing light with a period of 5 seconds and a range of 10 miles, (Fl(2) R 5s 7m 10M), than proceed until the Nara Geçidi turn. Photographs of the radar and ECDIS views, taken from the bridge of a southbound approaching vessel to Nara Geçidi are given in Figure 2.32.

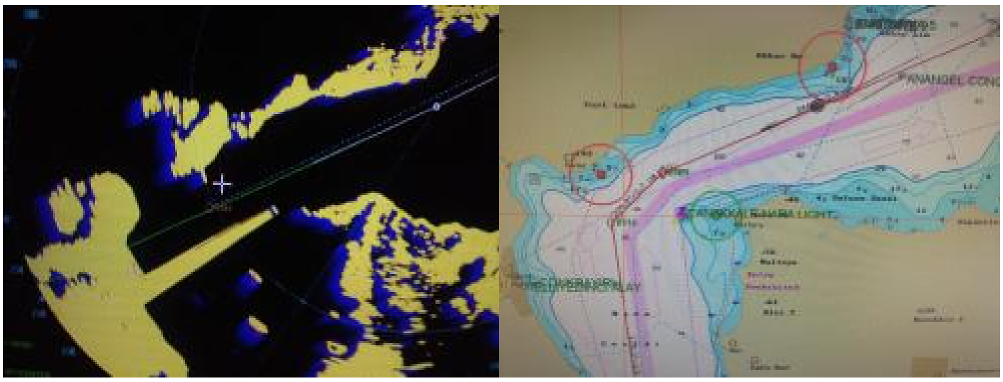

Figure 2.32 : Radar and ECDIS views of a southbound approach to Nara.

Overtaking is not permitted from Nara to Kilitbahir. Therefore vessels must adjust their speed before the Nara turn, in order to fallow the vessel ahead of them with a safe distance. From Akbaş Burnu to Nara Geçidi, vessels must proceed with caution for the northbound vessels turning Nara. Southbound vessels are advised to consider that some vessels may have problem, delay with turning and may approach on the separation zone or on the southbound traffic lane. Vessels may keep as much as starboard side of the southbound traffic lane, as a good precaution of safe navigation, in order to give more safe distance to northbound vessels.

2.1.25 Nara Geçidi turn (southbound)

Nara Geçidi turn is the sharpest turn of the Çanakkale Strait. The turn occurs as a combination of two course alterations around the Nara Burnu.

Southbound vessels should approach the turn with the heading aiming from the Kakma Dağı (130 metres) to the Poyraz (Kilye) Light as shown in a photograph taken from the bridge of a southbound approaching vessel to Nara Geçidi is given in Figure 2.33.

Figure 2.33 : Southbound approach to Nara.

Southbound vessels must keep proper lookout and consider the difficulties of the sharp turn for northbound vessel against stong current. In order to keep the position within the southbound traffic lane, southbound vessels are to avoid early turn to port. For many cases, to start to turn abeam west cardinal buoy of Nara Geçidi is early enough for make smooth and large turning path. It is also necessary to navigate with caution considering local traffic and fishing boats.

Considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be started early enough. The first course alteration is abeam Nara west cardinal buoy. For large vessels, it may be necessary to give a little early port helm order. Vessels turn to port, to bring the heading 225 degrees, aiming the Eceabat breakwater, than proceed until abeam Kösetabya on portside, Poyraz Cove on starboard side. Vessels alter course abeam Poyraz Cove further to port in order to obtain the heading 172 degrees; aiming the Kepez Mosque minaret. For large vessels, generally, these two course alterations are included in a conbined turn. A photograph taken from the bridge of a southbound vessel turning the Nara Geçidi and heading to Eceabat, during the turn, is given in Figure 2.34.

Figure 2.34 : Nara turn, heading to Eceabat.

Vessel must also consider the soutwestbound surface current reaching to the coasts of Gelibolu Peninsula, from Eceabat to Kilitbahir and following the coastline. The axis of current change according to the shape of the coastline of the Çanakkale Strait. After Nara Geçidi, the current reaching to Eceabat also deviating and creating eddies in Poyraz Cove and Çanakkale İç Liman. The current makes usually turns of southbound vessels very easy. But at the completion of the turn, stopping the turn and holding the heading may be difficult. Therefore small rudder angle which is just sufficient to turn the vessel sould be used. Meeting the vessel early enough with sufficient rudder angle is always necessary.

A photograph taken from the bridge of a southbound vessel turning the Nara Geçidi and heading to Çamburnu, during the turn, is given in Figure 2.35.

Figure 2.35 : Southbound Nara turn, heading Çam Br.

A ECDİS photograph taken from the bridge of a southbound vessel turning the Nara Geçidi, after the turn, is given in Figure 2.36.

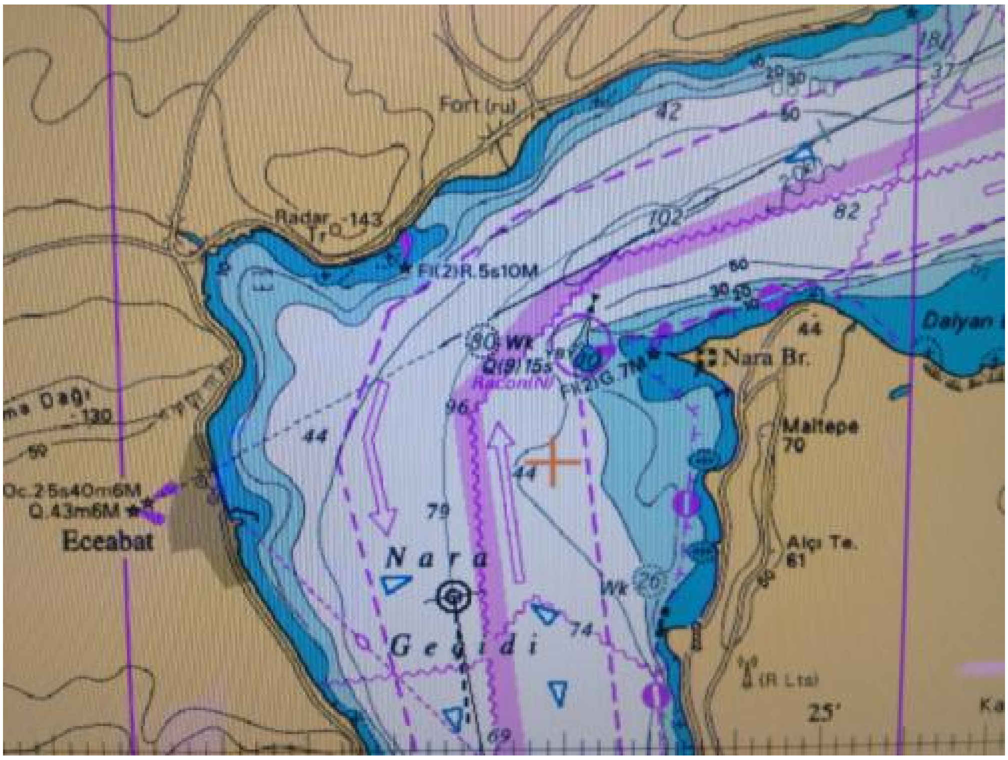

Figure 2.36 : ECDIS view of a southbound Nara turn.

2.1.26 Nara Geçidi to Kilitbahir

After altering course abeam Poyraz Cove further to port in order to obtain the heading 172 degrees, aiming the Kepez Mosque minaret, vessels proceed until abeam Kilitbahir Light on starboard side. Vessels must navigate with caution considering the car ferries navigate across the Çanakkale Strait, connecting Çanakkale with

Kilitbahir, Çanakkale with Eceabat and Eceabat with Kepez. A photograph taken from the bridge of a southbound vessels approaching to the Kilitbahir is given in Figure 2.37.

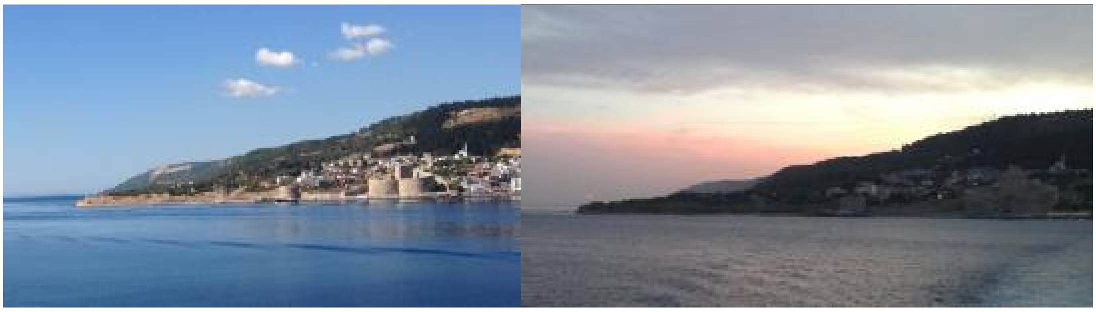

Figure 2.37 : Kilitbahir.

The narrowest point of the Çanakkale Strait is between Kilitbahir Burnu and the mouth of the river Sarıçay at Çanakkale. Therefore southbound vessels must not to overtake other vessels until the completion of the turn, keep clear from local traffic and maintain their position within the southbound traffic lane.

2.1.27 Kilitbahir turn

Kilitbahir turn is a combination of two course alterations. Initially, vessels alter course to starboard in order to obtain the course 199 degrees, aiming the Kanlıdere (Kepez) Burnu Light, than proceed until abeam Sarısığlar west cardinal buoy where the second course alteration shall occurs. At the end of the turn, vessel's heading is to be 222 degrees.

The Kilitbahir turn is a critical and dangerous turn especially for southbound vessels. The passage between the Kilitbahir and Çanakkale is the narrowest passage of the Çanakkale Strait. Strong southerly current makes the turn difficult to control. Usually, it is common practice to use very small rudder to starboard to start to turn early enough. It may be necessary to meet the rudder during the turn, in order to control the rate of turn or to turn gradually. A big rudder angle to port may be necessary to hold the vessel against the strong surface current pushing the vessel on the starboard quarter and helping to turn to starboard.

A ECDİS photograph taken from the bridge of a southbound vessel turning Kilitbahir, after the turn, is given in Figure 2.38.

Figure 2.38 : ECDIS view of southbound Kilitbahir turn.

2.1.28 Kilitbahir to Karanfil Burnu

After the completion of the Kilitbahir Turn, vessels proceed to 222 degrees, until abeam Karanfil Burnu on starboard side. There is usually strong southerly current along the Gelibolu coastline. Current increase the vessels' speed and cause some drift to starboard side in this area. Abeam Kepez Light on port side, southbound vessels report to TSVTS, for leaving from the Sector Nara, in the VHF channel 12, than for entering to the Sector Kumkale, in the VHF channel 13. The photograph taken from the bridge of a southbound vessel, with a position (40° 07.3 N 26° 21.8 E), approaching to the Karanfil Burnu is given in Figure 2.39.

Figure 2.39 : Southbound approach to Karanfil Burnu.

The photograph taken from the bridge of a southbound vessel abeam Karanfil Burnu is given in Figure 2.40.

Figure 2.40 : Abeam Karanfil Burnu.

2.1.29 Karanfil Burnu to Anıt Limanı

Vessels alter course abeam Karanfil Burnu further to starboard in order to obtain the heading 236 degrees; aiming the middle of the channel at the south exit, between Seddülbahir and Kumkale; than proceed to this course until abeam Anıt Limanı light buoy, on starboard side.

Karanfil light is also call point for Mehmetcik Pilot to give the first notice for disembarkation, in order to make necessary arrangement and preparation with pilot boats. Contacts with the agents' and ship chandlers' boats are normally not permitted except the anchorages. In case of urgent necessity it can be permitted by the TSVTS, not exceeding one hour and at the positions south of the line between the Karanfil Light and Kanlıdere (Kepez) light, as much as starboard side of the traffic lane. Therefore, after the Karanfil Light, it is always necessary to navigate with caution for vessels having agent/ship chandler contacts. Vessels are usually required to reduce their speed around seven knots in order to make suitable speed for the agents' and ship chandlers' boats to come alongside for contact. Strong current may drift southbound vessels considerably to starboard around Karanfil Burnu.

The photograph of radar wiew taken from the bridge of a southbound vessel, between Karanfil Burnu and Kepez, is given in Figure 2.41.

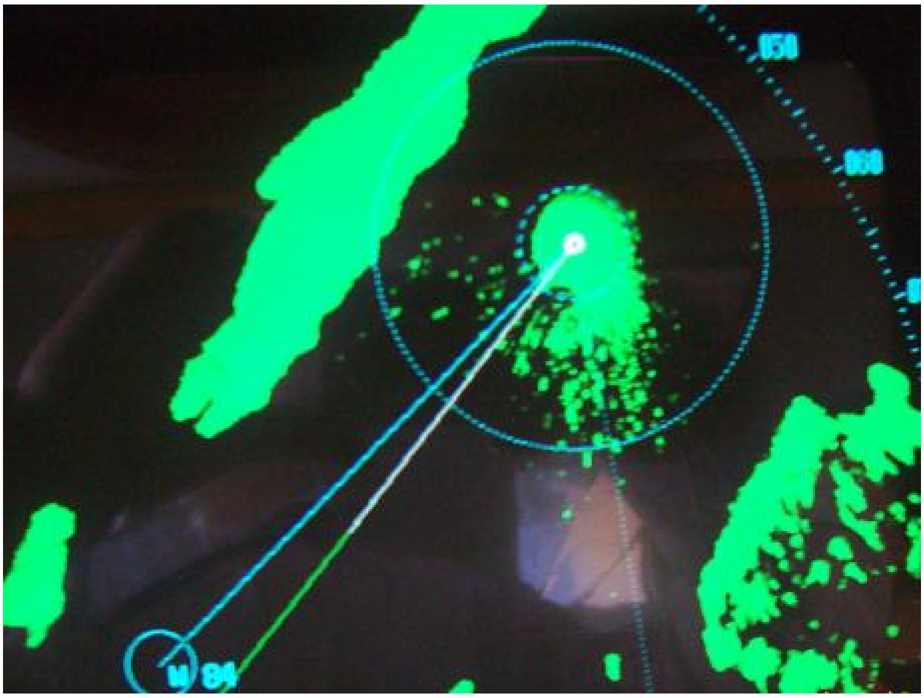

Figure 2.41 : Radar view of Karanfil Burnu – Kepez Burnu.

2.1.30 Anıt Limanı to Mehmetçik Burnu

Vessels alter course abeam Anıt Limanı light buoy further to starboard in order to obtain the heading 248 degrees; than proceed until abeam Mehmetçik Burnu Light, a red flashing light with a period of 5 seconds and a range of 12 miles (Fl W R 5s 50m 19-12M), on starboard side.

Mehmetçik Pilot station is between Anıt Limanı and Mehmetçik Burnu, beside the Kale Burnu. Pilots embark and disembark west of the longitude passing through the Kumkale Lighthouse depending to the weather condition. In bad weather, especially during strong southwesterly winds, soutbound vessels approach to the middle of the strait with a slow speed and considerably turn to starboard in order to make a lee, while disambarking pilots from their starboard sides.

The photographs which are given in Figure 2.42 has been taken from the bridge of southbound vessels, includes the south end of the Gelibolu Peninsula from the Mehmetçik Burnu, to Abide Burnu (the Çanakkale Martyrs' Memorial), It also includes Kale Burnu, Mehmetçik Pilot Station, Morto Bay, Anıt Limanı.

Figure 2.42 : Seddülbahir to Abide (War Memorial).

2.1.31 Mehmetçik Burnu to Mehmetçik pilot disembarking area

Vessels alter course abeam Mehmetçik Burnu Light to 268 degrees; than proceed until the pilot disembarkation area following the outbound traffic lane. It is also necessary to keep sharp lookout for inbound traffic. Vessels after disembarking pilot must continue to keep the radio watch for Sector Kumkale, in VHF channel 13 until the end of the traffic separation scheme.

2.2 Northbound Passage

This section of the study is describing the navigational outline of the northbound passage trough the Turkish Straits from the Aegean Sea to the Black Sea.

2.2.1 Approaching to Çanakkale Strait from south

Vessels, approaching to the Çanakkale Strait, come either from the vicinity such as Aegean Sea ports, Mediterranean Sea ports or from far away, such as Far East ports, American ports, Australian ports. They may come from the anchorage or from the drifting area.

Vessels, passing trough the Turkish Straits are obliged to observe and apply all rules and regulations related to the Turkish Straits, and all instructions given by the Turkish Authorities. The Turkish Rules and Regulations are mainly based to the Montreux International Convention. As the basic principle, The Convention asks to Turkish Government, to provide the freedom of the passage for ships and gives rights to regulate this passage considering to the safety, security and environmental protection. The freedom of passage means the innocent passage regulated by the Turkish Authorities. The area, which is called the Turkish Straits, is very special area with its high population, admirable natural environment, very old, rich and still alive culture and history. All this specialities make the area a natural and cultural heritage for Turkish and also all the world nations. Increasing number, size and the tonnage of the vessel passing the Turkish Straits create a considerable risk for the area.

Vessels passing trough the Turkish Straits are subject to Health Inspection. Vessels must observe Sanitary Yellow Flag Rules. Vessels have to raise the yellow flag before entering the Turkish Straits and can lower it after their sanitary clearance. Vessels without stopover at the Turkish Straits must follow the yellow flag rules at each passage from the Turkish Straits, northbound and southbound. High fines are applied for vessels failing to fully comply with this rule. Vessels must keep necessary Quarantine Flag flying (Yellow) during daytime and Quarantine Lights on (Red & White) during night time until Free Pratique is granted. Vessels passing the Turkish Straits, must obtain free pratique from the Heath Authority. Health inspections in the Strait of Çanakkale may be carried out at the entrance from the Aegean just before pilot embarking position or after the Strait's exit pilot disembarking positions, at locations which will not affect navigational safety. The Sanitary Inspection of ships arriving from the Aegean Sea is carried out at the Strait of Çanakkale. However, tankers with a deadweight over 100.000 tons proceeding to the Gulf of Kocaeli to discharge or load petroleum products may obtain free pratique there, without stopping at Çanakkale, provided agents are notified 96 hours in advance. In the event of bad weather at Çanakkale, vessels may be allowed to continue their voyage to Istanbul and undergo Sanitary Inspection there. Permission to do so is notified to them by the Çanakkale Sanitary Office with the signal letters H.M. in day time and three vertical lights (green, white, green) at night. The ship must produce and keep ready the necessary documents for sanitary boat. Health Declaration Form, copies and originals of certificates of Deratting/Deratization, Tonnage and Ship Registry, two copies of crew list and ship's stamp are required. Vessels passing the Turkish Straits, must obtain free pratique from the Heath Authority, Sanitary (or Quarantine) Boat comes alongside to northbound vessels at the south entrance of the Çanakkale Strait, close to Kumkale Lighthouse. The over ground speed of vessels is required less than nine knots to provide safe alongside for quarantine boat. The quarantine boat alongside a vessel for health inspection and the Çanakkale Sanitary Office are shown in the photographs given in Figure 2.43.

Figure 2.43 : Quarantine boat and Quarantine Office in Çanakkale.

Pilot boat asks boarding speed around 6 knots depending to the weather and current conditions. Pilot ladder must be prepared and rigged strictly according to SOLAS, Regulation 23 of Chapter V. Many pilot transfer accidents occurs at the Turkish Straits. Two pilots lost their life and many of them seriously injured. Pilot boarding area is quite far from the entrance and very exposed to the bad weather condition. Therefore the boarding is usually done at the entrance, close to or abeam Kumkale light depending to the weather condition according to the agreement between the master of the vessel and the pilot. The Mehmetçik Pilot Station is shown in the photograph given in Figure 2.44.

Figure 2.44 : Mehmetçik Pilot Station.

Northbound vessels entering to the Çanakkale Strait must approach with the safe speed. The regulation speed is 10 knots over ground, but it can be increase if it is required for the safety of manoeuvring. The vessels must keep the minimum 8 cables distance from other vessels and they are advised not to overtake during the passage. If they have to overtake for the safety of navigation, in this case they have not to overtake from Kepez to Akbaş. Also overtaking other vessel around the waypoints is not advised.

2.2.2 Mehmetçik pilot embarkation area to Kumkale Burnu

Northbound vessels' approaching course is should be within the northbound traffic lane of the TSS (Traffic Separation Scheme). The arrows marked within the lane, shown in the navigational charts, give the suggested true course in normal condition. The initial course is aiming to Karakulak Burnu. If the vessel is almost in the middle of the traffic lane, the true course is around 070 degrees. Vessels proceed with this course until abeam of the Kumkale Burnu light. Mehmetçik Pilot station is on the Gelibolu Peninsula, on port side, between Mehmetçik Burnu and Anıt Limanı, beside the Kale Burnu. Pilots embark and disembark west of the longitude passing through the Kumkale Lighthouse, depending to the weather condition.

2.2.3 Kumkale Burnu to Karanlık Liman

Northbound vessels alter course abeam Kumkale Burnu to starboard in order to obtain the heading 078 degrees; aiming the Çınarlı Mosque minaret; than proceed to this course until abeam Halileli Mosque minaret on starboard side.

The photographs of ECDIS and radar views which have been taken in the bridge of a northbound vessel in Karanlık Liman is given in Figure 2.45. The ECDIS phograph shows AIS marks of heavy traffic and radar photograph shows tracks of horthbound vessels in Karanlık Liman.

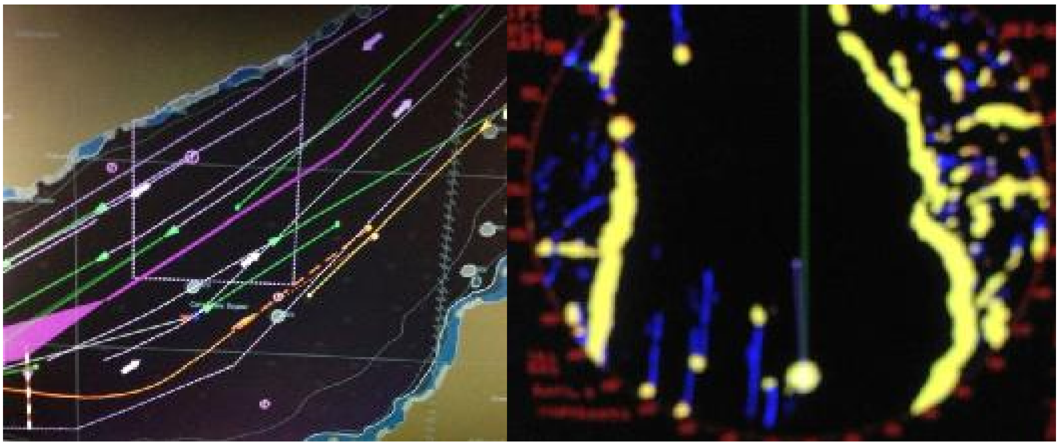

Figure 2.45 : ECDIS & Radar views of Karanlık Liman.

2.2.4 Karanlık Liman to Kanlıdere (Kepez) Burnu

Northbound vessels alter course abeam Halileli Mosque Minaret on starboard side; to starboard in order to obtain the heading 045 degrees; aiming the Hamidiye Tabya west cardinal light buoy; than proceed to this course until abeam Kanlıdere (Kepez) Burnu on starboard side. Until Kepez Burnu northbound vessels must keep radio watch on VHF channel 13, Sector Kumkale. Abeam Kepez Light on starboard side, northbound vessels report to TSVTS, for leaving from the Sector Kumkale, on the VHF channel 13, than for entering to the Sector Nara, on the VHF channel 13.

2.2.5 Kanlıdere (Kepez) Burnu to Çanakkale

There is the Kanlıdere (Kepez) Light in Kanlıdere (Kepez) Burnu, white flashing light with a period of 5 seconds and range of 10 miles (Fl 5S 10M). Vessels alter course abeam Kanlıdere (Kepez) Burnu Light to 037 degrees; than proceed to this course until abeam Kilitbahir Burnu Light on portside and the Hamidiye Tabya west cardinal light buoy on starboard side. Kanlıdere (Kepez) Burnu is shown in the photograph given in Figure 2.46.

Figure 2.46 : Kanlıdere (Kepez) Burnu Light.

2.2.6 Çanakkale turn

Northbound vessels approaching to Çanakkale must turn between Çanakkale and Kilitbahir, the narrowest part of the Çanakkale Strait, keeping the vessel within the traffic lane and away from the southbound vessels turning Kilitbahir. It is also necessary to keep sharp lookout for local traffic to and from Çanakkale.

The photograph taken from the bridge of a northbound vessel, with a position (40° 08.1 N 26° 23.4 E), approaching to Çanakkale is given in Figure 2.47.

Figure 2.47 : Northbound Approach to Çanakkale turn.

Northbound vessels alter course to port in order to obtain the heading 007 degrees, abeam Kilitbahir on their port side, aiming the Nara Burnu light, green group of 2 flashing light, with a period of 10 seconds and a range of 12 miles, (Fl (2) G 10s 8m 12M), than proceed until abeam the light at the edge of breakwater of İç Liman (Fl G 3M) on starboard side.

There are ferry lines between Çanakkale, Kilitbahir and Eceabat. Ferries, fishing boats and leisure crafts create considerable local traffic around Çanakkale. The photograph of Çanakkale, taken from the bridge of a northbound vessel passing abeam Çanakkale which includes city center and ferry landings and other two photographs showing the troian horse are given in Figure 2.48.

Figure 2.48 : Çanakkale.

2.2.7 Çanakkale to Nara Geçidi

Northbound vessels alter course to port abeam the light at the edge of breakwater of İç Liman, a green flashing light with a period of 3 seconds and a range of 3 miles (Fl G 3M) on starboard side; in order to obtain the heading 350 degrees; aiming the middle of the Nara Geçidi; than proceed to this course until abeam the jetty with red flashing light at south of Nara Burnu on starboard side. Generally southbound current reaching to and reflecting from the coast of Gelibolu Peninsula creates a counter current. Northbound vessels drift to starboard side and their speed increases as the result of this counter current while approaching to Nara Geçidi. The photograph of Nara Geçidi, taken from the bridge of a northbound vessel approaching to the Nara Geçidi, is given in Figure 2.49. It shows the west cardinal buoy and a southbound vessel approaching to the Nara Geçidi behind the west cardinal buoy.

Figure 2.49 : Northbound approach to Nara Geçidi.

2.2.8 Nara Geçidi turn (northbound)

Nara Geçidi turn is the sharpest turn of the Çanakkale Strait. The turn occurs as a combination of two course alterations around the Nara Burnu. Northbound vessels should approach the turn with the heading aiming the middle of the Nara Geçidi. Considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be planed as necessary. The first course alteration is abeam the jetty with red flashing light at south of Nara Burnu on starboard side. Vessels turn to starboard, to bring the heading 032 degrees, aiming the Uluflu Hill, than proceed until abeam Nara Burnu light, green flashing light with a period of 10 seconds and a range of 12 miles (Fl (2) G 10s 8m 12M) on starboard side. Vessels make second course alteration abeam Nara Burnu light. Vessels turn to starboard, to bring the heading 070 degrees, aiming the Kümren Burnu. For large vessels these two course alteration are to be combined as necessary. Deep draft vessel must consider the shallow water area around the west cardinal buoy with the depth less than 20 metres.

2.2.9 Nara Geçidi to Kabageven Burnu

After completion the Nara Geçidi turn, vessels proceed to the course 070 degrees, aiming the Kümren Burnu until abeam Kabageven Burnu on starboard side. Vessels must navigate with caution considering shallow water along the coastline on their starboard side such like Musa Bankı, maintaining their position always inside the northbound traffic lane. Opposite surface current (southerly) gets weak after Nara.

2.2.10 Kabageven Burnu to Suluca

Northbound vessels alter course to port, abeam Kabageven Burnu on starboard side; in order to obtain the heading 051 degrees; than proceed to this course until abeam the Karakova Burnu light on portside and Suluca Mosque minaret on starboard side. The photographs of Umurbey, Gocuk (or Bergaz) Burnu Light and TSVTS radar tower, taken from the bridge of a northbound vessels approaching to Karakova / Suluca, is given in Figure 2.50.

Figure 2.50 : Gocuk Burnu Light and VTS radar tower.

2.2.11 Suluca to Çardak

Vessels alter course to 040 degrees, abeam Karakova Burnu light on port side and Suluca on starboard side; than proceed until abeam Gelibolu Burnu Light on port side and Çardak bank west cardinal light buoy on starboard side. It is also necessary to keep sharp lookout for local traffic, ferries between Gelibolu – Lapseki, Gelibolu - Çardak and inbound vessels to Çanakkale Strait from Marmara Sea. From Kepez, until Kanarya Burnu northbound vessels must keep radio watch on VHF channel 12, Sector Nara. Abeam Kepez Light on starboard side, northbound vessels report to TSVTS, for leaving from the Sector Nara, on the VHF channel 12, than for entering to the Sector Gelibolu, on the VHF channel 11. The ECDIS photographs of Kanarya Burnu Light taken from the bridge of a northbound vessels approaching to Kanarya Burnu and a photograph of Kanarya Burnu are given in Figure 2.51.

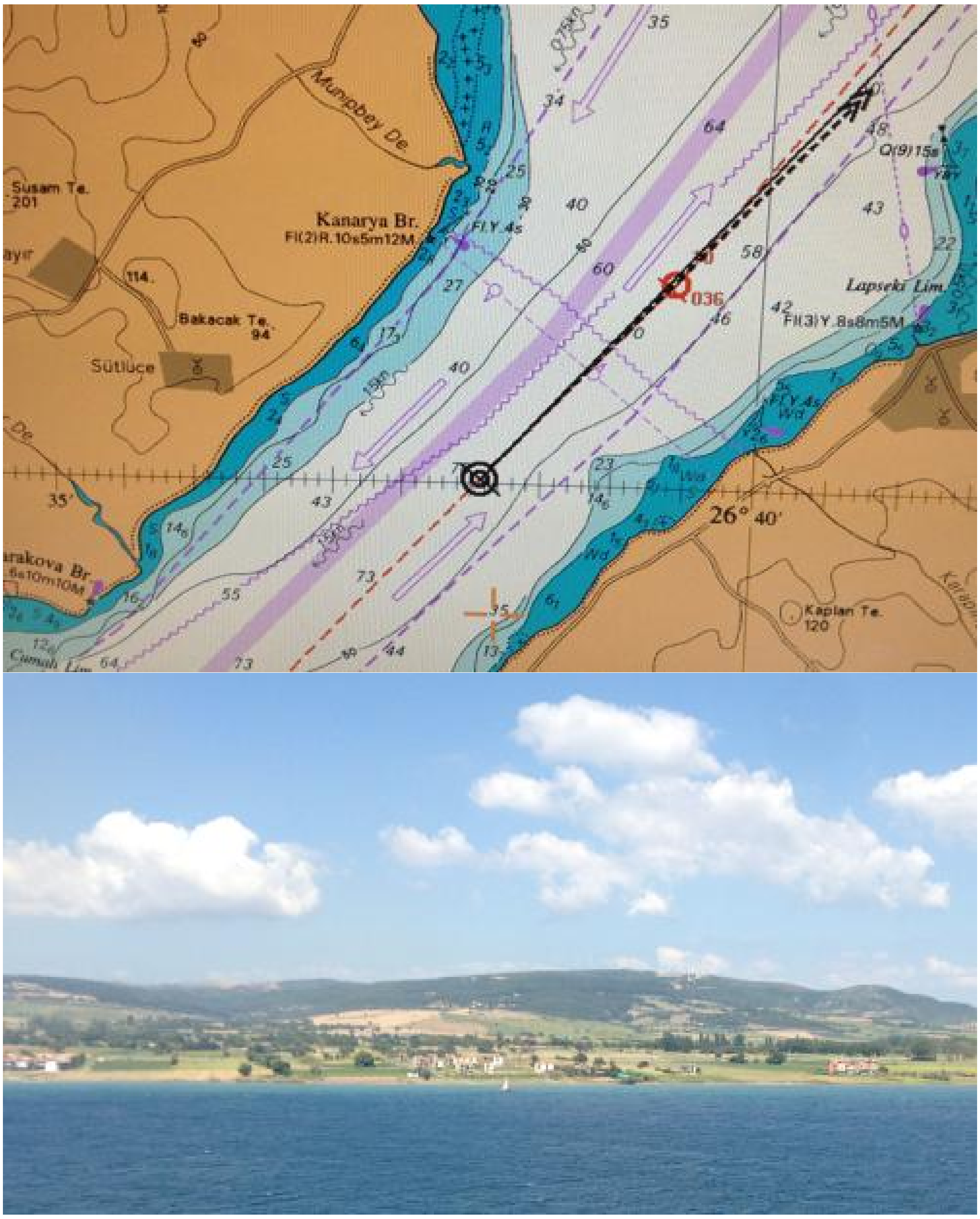

Figure 2.51 : ECDIS view and photograph of Kanarya Burnu.

2.2.12 Çardak to pilot disembarkation area

Vessels alter course to 050 degrees abeam Çardak bank west cardinal light buoy; than proceed until the pilot disembarkation area following the outbound (starboard) traffic lane. It is also necessary to keep sharp lookout for inbound traffic.

2.2.13 Zincirbozan to Kadıköy

Marmara Sea is an important part of the Turkish Strait Area. Despite the large and deep waters, heavy traffic makes the passage difficult and dangerous. Vessels, coming from and/or going to many ports around the Marmara Sea, are joining, leaving and crossing the traffic separation scheme.

2.2.14 Pilot embarkation area to İnci Burnu

İstanbul Strait south entrance pilot boarding area is located abeam the separation buoy. Inbound vessels to İstanbul Strait from the Marmara Sea must keep always clear from the outbound vessels and other approaching vessels from the anchorages and drifting areas. The photograph of pilot boats and the jetty of Kaptan Fahrettin Aksu Pilot Station at İnciburnu, Kadıköy, in early morning, is given in Figure 2.52.

Figure 2.52 : Kaptan Fahrettin Aksu Pilot Station.

Pilot boat asks boarding speed around 6 knots depending to the weather and current conditions. Pilot ladder must be prepared and rigged strictly according to SOLAS, Regulation 23 of Chapter V. Many pilot transfer accidents occurs ay the straits. Two pilots lost their life and many of them seriously injured. Pilot boarding area is quite far from the entrance and very exposed to the bad weather condition. Therefore the boarding is usually done at the entrance or more south depending to the weather condition according to the agreement between the master of the vessel and the pilot.

Northbound vessels entering to the Istanbul Strait must proceed with the safe speed. The regulation speed is 10 knots over ground, but it can be increase if it is required for the safety of manoeuvring. The vessels must keep the minimum 8 cables distance from other vessels and they are advised not to overtake during the passage. If they have to overtake for the safety of navigation, in this case they have not to overtake from Vaniköy to Kanlıca. Also overtaking other vessel around the waypoints is not advised. The photograph of İnciburnu Light is given in Figure 2.53. It also shows south enterence of the İstanbul Strait and an oil platform entering to the Strait in front of Ahırkapı Lighthouse.

Figure 2.53 : İnci Burnu Light and an oil platform entering to the İstanbul Strait.

2.2.15 İnci Burnu to Kızkulesi

Vessels approach to İnci Burnu with a course 008 degrees. Vessels alter course to port to 000 degrees abeam İnci Burnu Light, white isophase light with a period of 4 seconds and a range of 13 miles (Iso 4s 11m 13M), aiming the south cardinal buoy in vicinity of the Dolmabahçe Palace until abeam Sarayburnu. The south entrance of the

İstanbul Strait is always very crowded with local traffic. Ferries, high speed crafts, leisure crafts, fishing boats may cross the traffic lanes. The photographs of Haydarpaşa breakwater and Kızkulesi are given in Figure 2.54. They are taken from the bridge of a northbound vessel.

Figure 2.54 : Northbound approach to Kızkulesi.

2.2.16 Kızkulesi turn

After passing Sarayburnu, vessels alter course around Kızkulesi, in order to alter the course to initially to 014 degrees until abeam Şemsipaşa, than to 053 degrees, aiming Çengelköy light, red flashing light with a period of 15 seconds and a range of 9 miles (Fl (3) R 15s 13m 9M). Northbound Kızkulesi turn is one of the most critical turns of the İstanbul Strait. The turn occurs around the Kızkulesi on the starboard side around the west cardinal buoy in vicinity of Kızkulesi. Large vessels should combined the two course alterations, considering the southerly surface current and depending to the size, speed and turning characteristics of the vessel, the turn is to be planed and executed as necessary. Vessels turning around Kızkulesi must also keep sharp lookout and avoid from very heavy local traffic, fishing boats, leisure crafts, crossing ferries etc.

2.2.17 Kızkulesi to Çengelköy

Northbound vessels heading to Çengelköy keep their northbound traffic lane approach the Boğaziçi Bridge. The Boğaziçi Bridge is the border between the two TSVTS Sectors. Northbound vessels report to Sector Kadıköy north exit from the sector, and then change VHF Radio Channel from 13 to 12 and report to Sector Kandilli, south entrance to the sector.

2.2.18 Beylerbeyi - Çengelköy turn

Northbound vessels alter course abeam Kuruçeşme light (Fl (3) G 15s 7m 10M) on port side; to port in order to obtain the heading 014 degrees; aiming the Aşiyan Burnu Light (Fl (3) G 15s 7m 8M); than proceed until abeam Kandilli Burnu on starboard side. Large vessel must start to turn much earlier considering their turning ability. Controlled turn may start under the Boğaziçi Bridge or abeam Beylerbeyi Light. The photographs of Çengelköy Light and Beylerbeyi Palace are given in Figure 2.55.

Figure 2.55 : Çengelköy Light & Beylerbeyi Palace.

2.2.19 Çengelköy - Kandilli

Northbound vessel approaching to Kandilli heading normally to Aşiyan Light, must keep their position within the northbound traffic lane, considering strong against current and heavy local traffic. The views of radar, ECDIS and eyesight photographs are given in Figure 2.56.

Figure 2.56 : Radar-ECDIS-eyesight photographs of Kandilli.

İstanbul Strait gets most narrow part between Kandilli and Aşiyan points. Therefore it makes such kind of nozzle effect, increasing the speed of the southerly surface current in this area, especially around Vaniköy, Mehmetcik Point.

The photographs of northbound approach to Kandilli are given in Figure 2.57. The photograph of a radar view of a northbound vessel approaching to Kandilli (in the middle) shows an echo in the middle of the Strait between Kandilli Burnu and Akıntı Burnu. It looks like an echo of the southbound vessel, but it is not. This is the echo of the 154 kV Vaniköy-Etiler overhead power cables which have 69 metres minimum clearance from the water level. As it is seen in this radar photograph it may be understood as an approaching vessel, especially in restricted visibility. Such misunderstanding may be very dangerous. Vessels may do unnecessary manoeuvring to avoid from this imaginary vessel in this narrow area with strong and confusing currents.

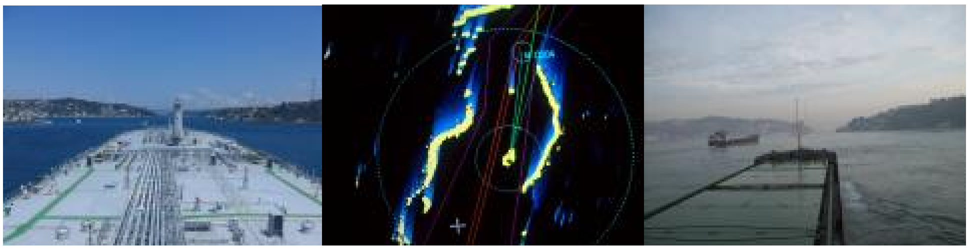

Figure 2.57 : Northbound approach to Kandilli.

2.2.20 Kandilli turn

Northbound Kandilli turn is one of the most critical turn of the İstanbul Strait. The turn occurs around the Kandilli Point. The photographs of Kandilli turn of a northbound vessel are given in Figure 2.58.

Figure 2.58 : Kandilli Turn.

Northbound vessels should approach the turn considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be planed and executed as necessary. When there is no wind or there is north-easterly wind, surface current coming from Küçüksu Bay passing around Kandilli point and which makes eddies at the south of the point, pushes the vessels away from Kandilli point. When there is *“orkoz”* as the result of strong south-westerly wind, northerly surface current pushes vessels toward the Kandilli point.

2.2.21 Kandilli to Anadoluhisarı

Northbound vessels alter course abeam Kandilli Burnu light (Fl R 3s 7m 10M) on starboard side; to starboard in order to obtain the heading 041 degrees; aiming the Anadolu Hisarı; than proceed until abeam Göksu west cardinal light buoy on starboard side. It is also necessary to keep sharp lookout in this area. The photographs of Anadolu Hisarı and west cardinal light buoy in front of the river mouth of Göksu are given in Figure 2.59.

Figure 2.59 : Anadolu Hisarı and Göksu River.

Considering Kandilli - Aşiyan passage as a most narrow place of the İstanbul Strait, vessels avoid and keep clear from the opposite traffic and very busy local traffic.

2.2.22 Anadoluhisarı turn

Northbound vessels must turn to port, almost after they complete their Kandilli turn to starboard. Large vessel must combine these two turns. They have to stop to turn to starboard by port helm and then start to turn port early enough before the cardinal buoy on the starboard side and Aşiyan light on port side.

2.2.23 Anadoluhisarı to Kanlıca

Vessels alter course to port to bring the vessel’s heading to İstinye Light, approximately to north (000 degrees), abeam west cardinal light buoy in front of the river mouth of Göksu, on starboard side; than proceed until abeam Kanlıca radar tower on starboard side.

During calm weather and with north-easterly winds, there is generally strong southbound current in the middle and port side (Rumelihisarı) and a counter current in starboard side (Anadoluhisarı) of the Strait.

Between Anadoluhisarı and Kanlıca, there is also an air draft restriction. Fatih Sultan Mehmet Bridge has 67.6 metres maximum clearance from the water level and 64 maters clearance for safe passage. A photograph of radar view of northbound vessel after passing Fatih Sultan Mehmet Bridge, approaching to Kanlıca turn and a photograph of Kanlıca are given in Figure 2.60.

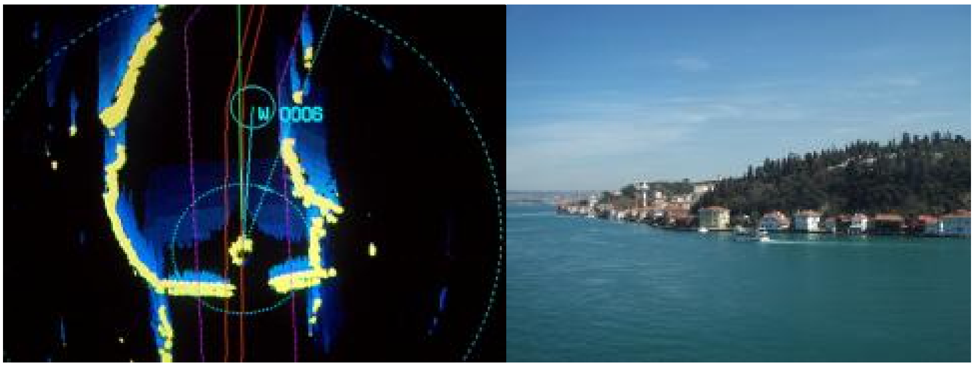

Figure 2.60 : Approaching to Kanlıca turn.

2.2.24 Kanlıca turn

Kanlıca turn is the combination of two course alteration around the Kanlıca radar tower and Kanlıca Burnu Light. Vessels must start to turn to starboard before reaching abeam Kanlıca radar tower. Considering the current is initially sets the vessels away from the shore, but just after the Kanlıca Burnu, the current sets the vessels toward the shore. Therefore turning within the traffic lane and keeping the necessary distance to the shore is a critical part of the Kanlıca Turn. Abeam Kanlıca radar tower vessels alter course to 016 degrees, aiming the Yeniköy Burnu, than abeam Kanlıca Burnu light, to 047 degrees, aiming the İncirköy light.

2.2.25 Kanlıca to Paşabahçe

After the Kanlıca turn vessels proceed, with the heading to İncirköy Light, approximately to the course 047 degrees until abeam Paşabahçe light on starboard side. Northbound vessels must avoid from opposite traffic coming behind Yeniköy. Therefore they must keep the position within the northbound traffic lane and as much as starboard side of the traffic line. Photographs of İncirköy light - Beykoz, are given in Figure 2.61.

Figure 2.61 : İncirköy Light - Beykoz.

2.2.26 Paşabahçe turn (northbound Yeniköy turn)

Yeniköy turn is the sharpest turn of the Istanbul Strait. It is almost right angle. The turn occurs as a combination of two course alterations around the Yeniköy Light which is marking the Yeniköy (or Koybaşı) Shoal. Northbound vessels should approach the turn with the heading, aiming the İncirköy Light. Considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be started early enough. For large vessels, it is necessary to give a port helm order early enough. The current is usually changes the vessels' rate of turn. Vessels are exposed to strong current during the turn. Generally large vessels and most of types of the vessels must consider the set and drift of the existing current. During the "orkoz" caused by strong south-westerly wind vessels must turn as much as closer to the Yeniköy light, if the southbound traffic permits. Otherwise they may drift very close Beykoz, where the shallowest water, with 14.6 metres, within the traffic lane, in vicinity of Beykoz old shoe factory. Radar photographs of northbound Yeniköy turn are given in Figure 2.62.

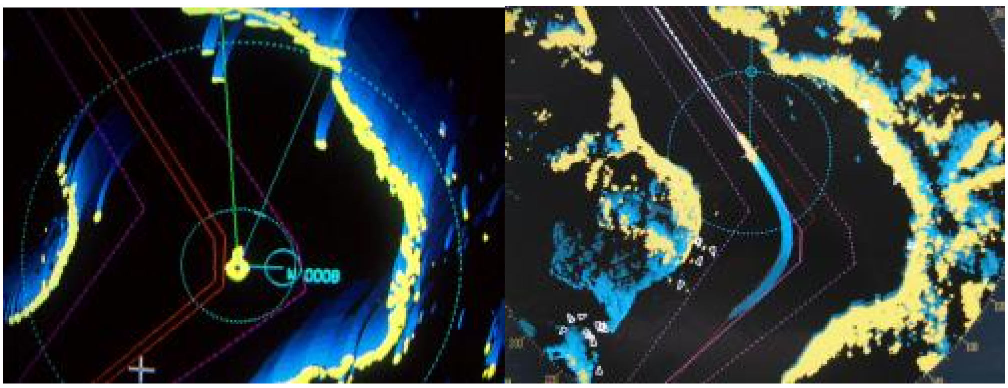

Figure 2.62 : Radar photographs of northbound Yeniköy turn.

While turning gradually the first suggested course is initially 000 degrees. Holding the ship's heading when it reaches to Hünkar Köşkü provides northerly course. For large vessels due to the big turning circle these two course alteration can be combined. The vessel's heading should turn from İncirköy Light to Hünkar Köşkü. Aiming to Hünkar Köşkü will provide the northerly course (000 degrees) as the first step of turning gradually. The next course alteration is to bring the ship's heading from the Hünkar Köşkü to Büyükdere light (323 degrees). These two preceding course alterations can be unified within the unique turn for the large vessels.

2.2.27 Paşabahçe to Umuryeri

Northbound vessels complete the Kanlıca turn with the course 232 degrees; aiming the Büyükdere light; than proceed until abeam Umuryeri cardinal light buoys on starboard side. It is also necessary to keep sharp lookout in this area for the vessels approaching and leaving Selviburnu tanker terminal, Büyükdere emergency anchorage. Vessels must to avoid and keep clear from the opposite and local traffic. Photographs of Selviburnu, Umuryeri are given in Figure 2.63.

Figure 2.63 : Selvi Burnu, Umuryeri.

2.2.28 Umur Banks turn

Umur Banks turn is the last turn for the northbound vessels before aiming the Black Sea. South, west and north cardinal buoys must be kept clear on starboard side. The turn occurs within the Büyükdere Bay and Umur Banks. Northbound vessels should approach the turn with the heading, aiming the Büyükdere Light. Considering the southerly surface current and depending to the size, speed and turning characteristic of the vessel, the turn is to be started early enough.

In the traffic lane passing out of the Umuryeri banks marked with cardinal buoys, current is stronger at the port side of the navigable waters away from the cardinal buoys, comparing to the starboard side, close to the cardinal buoys. The vessels heading should turn from Büyükdere light to Sarıyer Ferry Landing, abeam the second west cardinal buoy (middle buoy). Aiming to Sarıyer Ferry Landing will provide the northerly course (000 degrees) between the second west cardinal buoy (middle buoy) and the north cardinal buoy. The next course alteration is to bring the ship's heading from the Sarıyer Ferry Landing to the Black Sea. It occurs around the north cardinal buoy. These two preceding course alterations can be unified within the unique turn for the large vessels. A photograph of a radar view northbound Umuryeri turn and a photograph of north cardinal buoy are given in Figure 2.64.

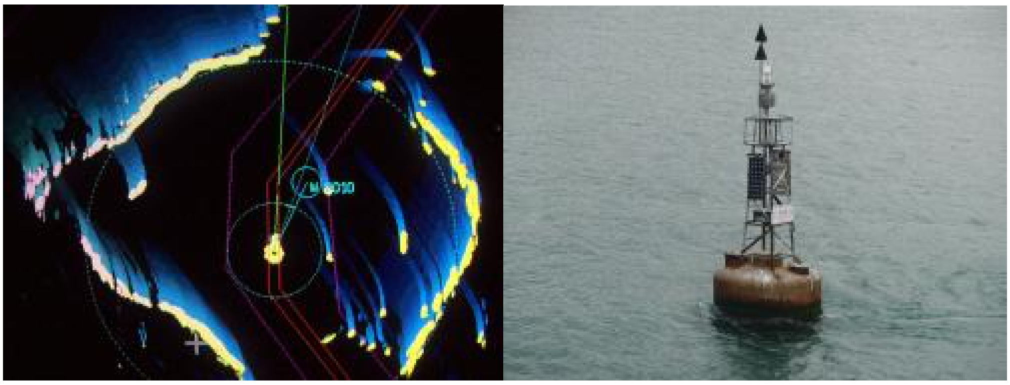

Figure 2.64 : Umur banks turn and the north cardinal buoy.

2.2.29 Umuryeri to Kavak

After the Umuryeri turn the course is 038 degrees until abeam Kavak Burnu. Between the Anadolu Kavağı and Rumeli Kavağı aerial high power line has led to misunderstanding on radars by reflecting echoes. Vessel should be careful under the bad visibility conditions. The line between Kavak Point and Dikilikaya Light is the border between the two TSVTS Sectors. Northbound vessels report to Sector Kandilli north exit from the sector, and then change VHF Radio Channel from 12 to 11 and report to Sector Türkeli, south entrance to the sector.

A photograph from the bridge of northbound vessel after completion of Umuryeri turn, heading to Çalı Burnu and a photograph of a northbound vessel approching to Kavak point are given in Figure 2.65.

Figure 2.65 : Northbound approach to Kavak.

2.2.30 Kavak to Fil Burnu

Vessels alter course to 049 degrees, abeam Kavak Burnu on starboard side; than proceed to this course until abeam Çalı Burnu west cardinal light buoy on port side. Keeping the vessel within the northbound traffic lane also will keep the vessel clear from the southbound traffic on port side and obstructions on starboard side. The vessel heading is to be aimed close to Fil Burnu with the course 049 degrees, when the vessel approaches to Fil Burnu. A photograph of Fil Burnu and Keçilik Bay is given in Figure 2.66.

Figure 2.66 : Fil Burnu and Keçilik Bay.

2.2.31 Fil Burnu to pilot disembarkation area

Vessels alter course to 032 degrees abeam Çalı Burnu west cardinal light buoy, on port side; the next course alteration is abeam Paşa Burnu light, on port side, to 043 degrees, than proceed until the pilot disembarkation area following the outbound (starboard) traffic lane. Pilots embark and disembark north of the line joining Hamsi Limanı (Port Hamsi) and the Fil Burnu (Cape Fil) Light depending to weather and traffic condition. After Fil Burnu, a village sheltered with a breakwater, Poyraz Köy is seen on starboard side as shown in Figure 2.67.

Figure 2.67 : Poyrazköy.

It is also necessary to keep sharp lookout for inbound traffic and fishing boats. Pilot boats usually requires 5-6 knots speed and making a lee side generally starboard side by turning for a while to starboard if traffic condition and vessel position are suitable, during Northeasterly strong wind. Anadolu Feneri (Anadolu Light) is a historical lighthouse which is situated on Yom Burnu, in Anadolufeneri, a fisherman’s village in Beykoz district, located on the Asian side of the İstanbul Strait north entrance / exit as shown in the Figure 2.68.

Figure 2.68 : Anadolu Feneri.

Anadolu Light, with white long flashing light with a period of 20 seconds and a range of 20 miles, and the entirely white painted tower which has a height of 19 metres, is 75 metres high above the sea level. It is across from the lighthouse Turkeli Feneri (Türkeli Light), which is on the European side of the İstanbul Strait. Northern Limit of the Strait of İstanbul is the line drawn between Anadolu Light and Türkeli Light.

3. ANALYSIS AND DISCUSSIONS

3.1 Analysing the Manoeuvring Difficulties in the Turkish Straits of the Ships of Various Sizes in Relation with the Shoals, the Banks and the Currents

Considering the existing traffic separation scheme in the Turkish Straits, for smaller and the suitable size of ships; navigating safely in its own traffic lane should be, for sure, much easier and less hazardous, if the same TSS (Traffic Separation Scheme) is established in the different area, other then Turkish Straits, which doesn't contain any of the shoals, banks and strong currents. But both of the Straits, Istanbul and Çanakkale, relatively to the sizes of the passing ships, are formed with the shallow and narrow waters. On the other hand, there are also considerably strong currents, with the different set and drift at the middle and sides of the waterway, and also at the surface, bottom and between, which also vary behind the capes, in the bays, near the bends and banks.

The variable regime of the currents in the Turkish Straits isn't resulted from only its oceanographic form. Weather conditions, winds, barometric changes and also many seasonal changes in the Black Sea, Sea of Marmara and Aegean Sea are effective for the currents in this area directly or indirectly. For these reasons, the hazards and the difficulties of the Turkish Straits for the passing ships are always presented since old ages mythological legends, until today's scientific updated data. Despite all the positive improvements related to the navigational safety, which are obtained as the result of the application of developing maritime technologies since old ages, Ships which are getting bigger and bigger in size and in tonnage, and also increasing number of passage by ships and complicated maritime traffic are forcing the limits of all other restricted waterways and especially Turkish Straits.

Before analysing the shallow water effects especially in the Turkish Straits we will review the general scientific laws regarding the shallow water effects in ship handling. The hydrodynamic effects between the vessel navigating in shallow water and the seabed (seaways bottom) increase the water resistances around the ships hull. Due to the smaller under keel clearance water move faster under the ships hull. The frictional resistance increase and the pressure decrease in this area. As it is well known, the relationship between the flow velocity and the pressure of the fluids is formulated in the “Bernoulli Law”. The relation between a vessel and the surroundings waters where the vessel is immersed may be better explained with this law. To understand how and why Bernoulli's Principle works, we need to look at Bernoulli's Equation. This equation can be summarized as follows: Bernoulli's Equation tells us how much the pressure within a moving fluid increases or decreases as the speed of the fluid changes. A simplified Bernoulli’s Equation is given in (3.1)

$$\frac{1}{2}\, r\, v_1^{\,2} + p_1 = \frac{1}{2}\, r\, v_2^{\,2} + p_2 \tag{3.1}$$

This equation which is constituted by the fluid velocity, pressure and the density; where:

(r) is the density in $\frac{kg}{m^3}$ (kilograms per cubic metres).

(p) is the pressure in $\frac{N}{m^2}$ (newtons per square metres).

(v) is the velocity in $\frac{m}{s}$ (metres per seconds).

There are two ways to derive Bernoulli's Equation. They are simply, using Newton's Second Law or using the conservation of energy. The first approach implies that a change in pressure creates a change in velocity. The second approach implies that a change in velocity creates a change in pressure. So what is the cause, and what is the effect? The answer depends on the situation, and not the derivation. At least theoretically, any quantity can be changed in the physical sciences, making that quantity's change the "cause", and resulting changes in other quantities the "effect". Bernoulli Law can be considered as the application of “law of conservation of energy” to fluids. Increasing velocity of the fluids molecules, as the result of moves and pushes of each one another after accumulating in the front of narrow crosscut of the flow causes to decrease the pressure of the fluid in same flow. This law is the background of the ship handling theory of narrow water, shallow water and interaction between ships.

In shallow water, due to the decrease of the pressure around the hull, vessel squats into the water. The decrease of pressure is resulted from two reasons, the first one is the vessel or the fluid velocity around the vessel (vessel’s speed through the water, log speed), and the second one is additional pressure effect between the bow and the sea bottom which cause the flow with increased velocity under the vessel’s keel. Therefore, the total amount of the squat in the shallow water is approximately two times more then the amount which could be in deep water with the same vessel’s speed through the water. In shallow water resistances also increase and it causes more vibration. The effect of rudder gets less. Steering becomes more difficult. It becomes difficult to keep the vessel in her course using the helm and the engines as necessary due to sudden deviations at times.

In most of the ship-handling resources, a description of the shallow water is given for the practical purposes, mostly it is mentioned that, a vessel can be considered in a shallow water, if the under keel clearance of that vessel is equal or less than the vessel’s draft; in other words, if the depth of the water, where the vessel floats, is equal or less than one and half times of the vessel’s draft. Despite this very popular description, shallow water effects don’t start suddenly from the sharply precise point. It start from minimum and it increase gradually.

Considerable shallow water effects occur in the water which is equal or less deep then approximately two and half times of vessel’s draft. For example a vessel with a draft of ten metres, start to be exposed to shallow water effects when she is in water of twenty five meters depth; and the shallow water effects increase contrariwise to the depth of water. For a vessel with same draft given in this example, shallow water effects can be observed in the waters less then 25 metres within the Traffic Separation Scheme in the Istanbul and Çanakkale Straits. When we give examples for Istanbul Strait, from north to south, there are shoals with a depth less than twenty five metres in various positions within the traffic separation scheme, such as off Poyraz Burnu, Fil Burnu, Garipçe Burnu, Çalı Burnu, Selvi Burnu, Aşiyan Burnu, Galatasaray Islands, and Haydarpaşa Breakwater. Beside these shoals, it is well known that a vessel may encounter with much more dangerous shoals when she is partly or completely out of traffic separation scheme due to various reason such as current, wind, traffic conditions, size of the vessel etc…

Beside all its negative effects, shallow water increases the ship squat. The increased squat reduces the under-keel clearance and it may causes danger of stranding especially with the high navigating speed. When we consider the under-keel clearance of a vessel, there are different values in the static and dynamic conditions. Because a vessel has different drafts when she stay alongside a berth in calm water and when she makes way troughs the water. When a vessel increases her speed through the water she squats and generally gains a trim by head. The squat occurs in shallow water. In confined water, squat is almost two times bigger than its value in open water. A simplified Barrass formula for the squat in open water is given in (3.2)

$$S_o = \frac{C_b \, v^2}{100} \tag{3.2}$$

(S_o) is the squat of the vessel in open water in metres.

(C_B) is the block coefficient the vessel. (the ratio of the immersed volume of a vessel to the product of its immersed draft, length, and beam. Also called coefficient of fineness.

(v) is the velocity (vessel's speed trough the water) in $\frac{NM}{h}$ (nautical miles per hours), (for the same meaning "knots" is mostly used as a nautical term).

The squat of the vessel in confined water is predicted two times biger than what she has in open water. A simplified Barrass formula for the squat in confined water is given in (3.3)

$$S_c = \frac{2(C_b v^2)}{100} = 2\,S_o \tag{3.3}$$

(S_c) is the squat of the vessel in confined water in meters.

Let's calculate squat of a vessel with a block coefficient (0.86) in confined water with 10 knots log speed as an example of squat in confined water. This calculation is given in (3.4)

$$S_s = \frac{2(C_b v^2)}{100} = 2\,\frac{0.86\,x10^2}{100} = 1.72\ m \qquad \textbf{(3.4)}$$

The squat for the above calculation has been found 1.72 metres in confined water and 0.86 metres in open water as a parallel sinkage. If the vessel is even-keel with her static drafts, we may estimate increase of draft due to trim by head approximately 20 centimetres for an average size of cargo ship. It occurs when the vessels is underway with the speed that causes the squat. Then, squat changes hydrostatic values of MCTcm (moment to change trim per centimetres) that changes the vessel trim by head. The change of trim by 20 centimetres for an even-keel vessel shall cause 10 centimetres increase of the maximum draft of that vessel. Therefore, total squat may estimated to reach to 1.82 metres for confined waters and 0.96 metres for open waters in this example. It means that the dynamic maximum draft of the vessel will be 1.82 metres or 0.96 metres more than static maximum draft depending the vessel's position

Considering the Istanbul Strait, we may calculate a realistic example. Let's continue to calculate under-keel clearance in a certain position in Istanbul Strait for above mentioned vessel. The calculation is given in Table 3.1.

Table 3.1 Calculation of dynamic under keel clearance.

Minimum depth at chart datum	14.60 m
a) Height of tide	-00.25 m
b) Allowance for accuracy of hydrographical data and tidal prediction	00.00 m
c) Allowance for nature and stability of the bottom	-00.05 m
d) Allowance for reduction of depth over pipelines	00.00 m
e) Allowance for sea state and weather	-00.30 m
……..	
Minimum anticipated controlled depth (A)	14.00 m
Maximum Static draft	12.80 m
a)Allowance due to anticipated change of density and associated change of trim	00.00 m
b)Increase due to squat and change of trim	+00.96 m
c)Increase due to list/heel	+00.20 m
d)Allowance of hogging / sagging and accuracy of ship's draft	+00.04 m
………….	
Deepest (dynamic) navigational draft (B)	14.00 m
UNDER-KEEL CLEARANCE (A-B)	00.00 m

In this example we calculate the dynamic under-keel clearance, supposing above mentioned vessel with 12.80 metres static draft, and speed of 10 knots, navigates in Istanbul Strait, in northbound traffic lane, off Selvi Burnu, in position with depth of water 14.60 metres.

In this calculation we make and use a table format which can be used in any port of the world. First of all we put the minimum depth at chart datum 14.60 metres, and we apply various corrections. Some elements which are not effective for Istanbul Strait, due to its geographical position, such as height of tide accepted as 25 centimetres, allowance for accuracy of hydrographical data and tidal prediction, allowance for reduction of depth over pipelines etc. have been accepted as null.

Considering the allowance for nature and stability of the bottom, we take into account that the area covered with sea mussels and we may estimate 5 centimetres accumulation of organic growths and other material above the chart datum, from last survey till today. Using the last 50 years records of meteorological data, an approximate average value of 30 centimetres has been accepted as the allowance for sea state and weather. As the first result we have obtained the minimum anticipated controlled depth as 14.00 metres. Second part of the table is for the vessel's maximum static draft and its corrections, and deepest (dynamic) navigational draft obtained as the result of various corrections. We have accepted that the water density is same as the departure port. Therefore we have accepted the allowance due to anticipated change of density and associated change of trim as null.

The correction for the increase due to squat and change of trim has been transferred from the previous calculation. Only we have to decide if we are in open or confined water. For deciding we have to look for blockage factor. Blockage factor is the division of intersection of the vessel to the intersection of canal. If the blockage factor is between 0.10 to 0.25 vessel is in confined water. In our example our position will be accepted as open water.

We have accepted that the length-over-all of our vessel is 200 metres and the correction for increase due to list and heel has been done accordingly. Istanbul strait has relatively sheltered waters. But even in these sheltered waters, we have to consider considering the waves created by others water crafts, wind effects, current effects, eddies, encountering waters due to main current and counter-current, the vessel’s own movements, course alterations etc. Increase of draft of approximately 20 centimetres (due to slight ship’s motions such as rolling, piching and heaving and other reasons mentioned before) has been estimated by the calculations.

Allowance of hogging / sagging and accuracy of ship’s draft has been estimated as the result of calculations considering the vessel’s length-over-all, as an increase of draft of 3 centimetres. Finally the difference of the deepest (dynamic) navigational draft and the minimum anticipated controlled depth gives the anticipated under-keel clearance. In the given example by the Table 3.1 (Calculation of dynamic under-keel clearance), if the above vessel navigates in this position off Selvi Burnu, anticipated under-keel clearance will be zero. It means that the vessel will strand. In this situation vessel is expected to navigate avoiding the mentioned shoal, with safe speed, using preferably mid of the traffic separation scheme, even southbound traffic lane if there is no opposite traffic.

Like many other restricted waterways, another very important hydrodynamic circumstance which we may encounter in Turkish Straits is narrow water effect, in other words bank effect. It occurs as cushion effect near the bow, and suction effect near the stern, when the vessel navigates close to a bank. Bank effect pushes the fore part of the vessel away from the bank and pulls the aft part close to the bank. As the result of both, cushion and suction effects, vessel moves crosswise to the waterway, unless her heading is maintained by steering and using sufficient helm towards the bank. Bank effect occurs much stronger due to the high speed of vessel through the water, her dipper draft and also shallow water in the waterway. Both in shallow and narrow waters the hydrodynamic effects occur depending to the ship’s speed trough the water.

3.2 Maritime Pilots as a Major Safety Precaution Against the Hazardous Passage of the Turkish Straits

3.2.1 General

Maritime pilots are selected for their experience, their knowledge of the local waters, local conditions and all relevant procedures. At all times, the captain remains in control and relies on the pilot as an important advisor.

The service given by a pilot reduces errors and most importantly creates the optimal and most secure path to the destination. Maritime pilots with large and continuously updated local knowledge have been employed on board ships for centuries to guide vessels safely into or out of port or wherever navigation may be considered hazardous, particularly when a shipmaster is unfamiliar with the area. Beside a local knowledge and expertise, pilots are able to provide effective communication with the shore and with tugs, often in the local language. Therefore the pilot training should be planned and executed mainly to improve the local knowledge of the maritime pilots.

3.2.2 Requirements emphasising local knowledge of maritime pilots

"Recommendations on training and certification and operational procedures for maritime pilots other than deep-sea pilots" IMO Res. A.960(23) (2003) paragraph 5.4.3 states that "Initial and continuing training in the master-pilot information exchange should also cover best practices in the specific pilotage area.", and paragraph 6.1.1. regarding the "Continued proficiency" states that "In order to ensure the continued proficiency of pilots and updating of their knowledge, the competent pilotage authority should satisfy itself, at regular intervals not exceeding five years, that all pilots under its jurisdiction continue to possess recent navigational knowledge of the local area to which the certificate of licence applies."

The Turkish national legislation "Regulations of Competencies, Trainings, Certifications and Working Standards of Maritime Pilots (2006)" states that during the minimum four months apprenticeship for the Strait of İstanbul, the candidate pilots must attend at least total 160 pilotages under the supervision of an authorised pilot, for the passages of the vessels of 5000 or more gross tons. Half of these 160 passages (80 passages) must be by day; other half must be by night. Number of passages in both directions of the İstanbul Straits should be equal as far as practicable. At least half of these 160 passages (80 passages) must be onboard vessels of 150 metres length over all (LOA) or more. Apprenticeship in the Strait of Istanbul should include the whole passage.

There are also similar requirements for the Çanakkale Strait in the "Regulations of Competencies, Trainings, Certifications and Working Standards of Maritime Pilots (2006)". During the minimum four months apprenticeship for the Strait of

Çanakkale, the candidate pilots must attend at least total 100 pilotages under the supervision of an authorised pilot, for the passages of the vessels of 5000 or more gross tons. Half of these 100 passages (50 passages) must be by day; other half must be by night. Number of passages in both directions of the Çanakkale Strait should be equal as far as practicable. At least half of these 100 passages (50 passages) must be onboard vessels of 150 metres length over all (LOA) or more. Apprenticeship in the Strait of Çanakkale should include the whole passage.

3.2.3 IMO recommendation on navigation through the Turkish Straits

There are International Maritime Organisation (IMO) recommendations encouraging utilisation of pilots on board ships in certain areas. Presently there are six resolutions with such recommendations for different geographical areas. IMO Resolution containing the recommendation for utilising the pilotage service in the Turkish Straits is the one of these six IMO Resolutions (IMO Res. A.827(19),1995; IMO Res. A.480(XII), 1981; IMO Res. MSC.138(76), 2002; IMO Res. A.486(XII),1981; IMO Res. A.668(16), 1989; IMO Res. A.710(17), 1991)

IMO Res. A.827(19) Annex 2 (1995) Rules and Recommendations on Navigation through the Strait of Istanbul, the Strait of Çanakkale and the Marmara Sea in “Ships' Routeing” clearly stated that "Masters of vessels passing through the Straits are strongly recommended to avail themselves of the services of a qualified pilot in order to comply with the requirements of safe navigation."

In addition to the Turkish Straits there are other geographical areas where the pilotage is recommended by IMO with the following Resolutions: IMO Res. A.480(XII) (1981) recommends the use of qualified deep-sea pilots in the Baltic Sea and IMO Res. MSC.138(76) Annex 1 (2002) recommends that Ships, on Navigation through the Route-T, with a draught of 11 m or more should, furthermore use for the passage the pilotage services locally established by the coastal States. Ships irrespective of size or draught, carrying a shipment of irradiated nuclear fuel, plutonium and high-level radioactive wastes on board ships (INF-cargoes) should use for the passage the pilotage services locally established by the coastal States. IMO Res. A.486(XII) (1981) recommends the use of deep-sea pilots in the North Sea, English Channel and Skagerrak. IMO Res. MSC.138(76) Annex 2 (2002) recommends that Loaded oil tankers, on Navigation through the Sound, with a draught of 7 m or more, loaded chemical tankers and gas carriers, irrespective of size, and ships carrying a shipment of irradiated nuclear fuel, plutonium and high-level radioactive wastes (INF-cargoes), when navigating the Sound between a line connecting Svinbaadan Lighthouse and Hornbaek Harbour and a line connecting Skanör Harbour and Aflandshage (the southernmost point of Amager Island) should use the pilotage services established by the Governments of Denmark and Sweden.

IMO Res. A.668(16) (1989) recommends the use of pilotage services in the Euro-Channel and IJ-Channel (in the Netherlands). IMO Res. A.710(17) (1991) recommends ships of over 70 metres in length and all loaded oil tankers, chemical tankers or liquefied gas carriers, irrespective of size, in the area of the Torres Strait and Great North East Channel, off Australia, to use pilotage services.

3.3 Standards of Training and Certification of Turkish Maritime Pilots

3.3.1 General

Maritime pilot is the person who pilots the vessel and guides the master of the vessel, for the subjects related to the vessel's navigation and manoeuvring, as per international practices, within the area where he/she is authorized by holding the necessary pilot licence, providing the services limited with navigation and manoeuvring only, while the master of the vessel remains essentially responsible. The above definition was established by the Turkish Maritime Legislation, "Regulations of Competencies, Trainings, Certifications and Working Standards of Maritime Pilots", as promulgated in the Turkish Official Gazette with number 26360 of 28 November 2006.

There are international and national requirements for the qualifications, training and certifications of the maritime pilots. The International Maritime Organisation (IMO) Assembly in 2003 adopted resolution A.960 (23) "Recommendations on training and certification and operational procedures for maritime pilots other than deep-sea pilots", which includes two main sections with the titles "Recommendation on Training and Certification of Maritime Pilots other than Deep sea Pilots" and "Recommendation on Operational Procedures for Maritime Pilots other than Deep sea Pilots". Considering international requirement and recent development the Turkish national legislation for maritime pilot training and certification has been amended in 2006. “Regulations of Competencies, Trainings, Certifications and Working Standards of Maritime Pilots”, has been promulgated in the Turkish Official Gazette number 26360 of 28 November 2006. We will refer these Regulations as RCTCWSMP (2006) in this paper.

3.3.2 Turkish maritime pilots’ licences:

Every particular pilotage area has separate pilotage licence, and separate training, evaluation and certification procedures in Turkish pilotage waters. RCTCWSMP (2006) states also the levels of the pilot licences. Turkish Maritime Pilots have two different classes of licences.

a) Maritime Pilot (up to 20000 GRT)

b) Senior Maritime Pilot (unrestricted)

Maritime Pilots holding the licence (up to 20000 GRT) are permitted to serve as pilot onboard the vessels of 20000 gross tons or less. Senior Maritime Pilots are permitted to serve as pilot onboard vessels of any gross tons.

3.3.3 Background of Turkish maritime pilots:

Turkish maritime pilots are senior seafarers with considerable sea-going experience and as the result of high standard training witch they have to attend initially and throughout their professional life they develop very detailed local knowledge and expertise. The General Conditions to Obtain Maritime Pilot Licences of Competency are providing considerable high standards. RCTCWSMP (2006) Article 6 states that in order to obtain any kind of licence, it is required;

a) to be a citizen of the Turkish Republic,

b) to have contractual capacity

c) not to carry prior encumbrances for the crimes listed in article 6-c

d) to have undergraduate degree,

e) to have an ocean-going master licence (unlimited), and minimum one year command experience as master,

f) to be medically fit as per the related provisions of this regulation,

g) to prove, with a report to be obtained from a competent hospital, that he can speak fluently without stuttering,

h) to complete successfully “Maritime Pilot Basic Training”

i) to be under the age of 50 on the day the on-the-job training started,

j) to complete on the job training and to obtain a testimonial as per Article 7,

k) to prove English language proficiency as per related provisions of this regulation,

l) to pass the Maritime Pilot oral and practical (onboard) exams on related exam topics.

3.3.4 Application and maritime pilot basic training

The topics of the “maritime pilots’ basic training” are given in Table 3.2. These topics are required by the pilotage legislation RCTCWSMP (2006).

Table 3.2: Outline of the maritime pilots’ basic training.

No	Outline of the maritime pilots’ basic training	Hours
A. Ship handling Theory		
1	Vessels types and manoeuvring characteristics	49 hours
2	Propulsion systems and manoeuvring	
3	Propeller	
4	Inertias, moments and resistances	
5	Rudder	
6	Turning circle	
7	Pivoting point	
8	Bow and stern thrusters	
9	Tugs, types and characteristics	
10	Manoeuvring with tugs	
11	Interaction with tugs	
12	Wind	
13	Current	
14	Shallow water	
15	Narrow water (bank effects)	
16	Anchorage	
17	Navigation and manoeuvring planning	
18	Use of electronic navigational aids (AIS, portable pilot units, and other devices)	
19	Vessel traffic Services (VTS)	
20	Bridge Resource Management	
21	Human factor, leadership,	
22	Manoeuvring in emergencies	
23	Case studies regarding the ship handling	
24	Related legislation	
25	Maritime English	
B. Practical (hands on) training using the full mission bridge simulator or manned model ships		21 Hours
	Total	70 hours (15 days)

Turkish Maritime Pilot Candidates have to successfully complete this standardised training before starting their apprenticeship (on-the-job training) in any pilotage area. Maritime pilot candidates who fulfil the general conditions may apply for being a maritime pilot to the Harbour Master of the pilotage area in order to have the "Maritime Pilot Basic Training". Harbour Master shall give the candidate application form for the basic training supported with the manned models or simulators in the authorised training centres. If the candidate successfully completes the basic training, may obtain a certificate. This certificate is valid for two years.

3.3.5 Maritime pilot on-the-job training and testimonial

RCTCWSMP (2006) Article 8 states that in order to take the maritime pilot licence exam, the candidates shall fulfil the following on-the-job training conditions and they have also to obtain a testimonial from the pilotage organisation, according the written opinions of authorised pilots with whom the candidate attend as apprentice pilots. If they fail to obtain a testimonial, they shall repeat the same training again. The applications for being an apprentice maritime pilot shall be submitted to the pilotage organisation that authorized in the related port. The pilotage organisation shall submit to the harbour master the document evidencing that the Candidate to be trained as a pilot is appointed as a "apprentice maritime pilot" and the document stating compliance of attributes of the Candidate with the conditions specified under the paragraphs RCTCWSMP (2006) Article 6, accompanied with a petition bearing the date when the candidate will start the on-the-job training. Before starting the training, the Candidate to take the pilotage training shall submit training book, a copy of which is given in RCTCWSMP (2006), to the approval of the pilotage organisation and of the port authority.

Standards for on-the-job training for harbour pilots are described separately within the legislation. The apprentice maritime pilot shall attend in the pilotage of at least 90 vessels of 500 or more gross tones for at least 6 months in the related port. However, the Administration may reduce number of the ships to 50 for smaller ports with less traffic in the event that it is unlikely to dock 90 vessels within six months. For the apprentice pilots for Istanbul Port, the apprentice shall attend pilotage of minimum 35 vessels each in Haydarpaşa and Karaköy, and at least 20 vessels in other parts of the port. Apprentice pilot must attend to manoeuvrings in all parts of the port, for every one of the piers, facilities, mooring buoys and anchorages at least one manoeuvring during the on-the-job training period. For the existing pilots when they apply for on-the job in any port 60 vessels in within four month are accepted sufficient to complete their on-the-job training.

Standards for on-the-job training of pilots of Turkish Straits are also explained within the legislation. RCTCWSMP (2006) states that during the minimum four months apprenticeship for the Strait of İstanbul, the candidate pilots must attend at least total 160 pilotages under the supervision of an authorised pilot, for the passages of the vessels of 5000 or more gross tons. Half of these 160 passages (80 passages) must be by day; other half must be by night. Number of passages in both directions of the İstanbul Straits should be equal as far as practicable. At least half of these 160 passages (80 passages) must be onboard vessels of 150 metres length over all (LOA) or more. Apprenticeship in the İstanbul Strait should include the whole passage.

There is similar also similar requirement for Çanakkale Strait in the RCTCWSMP (2006). During the minimum four months apprenticeship for the Strait of Çanakkale, the candidate pilots must attend at least total 100 pilotages under the supervision of an authorised pilot, for the passages of the vessels of 5000 or more gross tons. Half of these 100 passages (50 passages) must be by day; other half must be by night. Number of passages in both directions of the Çanakkale Straits should be equal as far as practicable. At least half of these 100 passages (50 passages) must be onboard vessels of 150 metres length over all (LOA) or more. Apprenticeship in the Çanakkale Strait should include the whole passage.

3.3.6 Maritime pilot exams and exam topics

The apprentice pilot who has completed successfully the on-the-job training and fulfils the general conditions may apply to Harbour Master for pilot’s exam. Maritime Pilots’ Exams are carried out by the Seafarers’ Examination Centre (SEC). SEC representative must be an ocean-going master holding unlimited master certificate of competency (C-o-C). Under the chairmanship of a representative of SEC, five members (including the chairman) constitute the Examination Board. A regional directorate representative with the unlimited master licence, Harbour Master of the pilotage area and two senior pilots from the pilotage organisation are other four members. These topics are required by the RCTCWSMP (2006). The candidates have to be successful in both, oral and practical exams. Oral and practical exams shall be evaluated separately with the full grade 100. Anyone succeeding less than 70 for one of these exams shall be deemed to have failed. The topics of the “maritime pilots’ exams” are given in Table 3.3.

Table 3.3: Oral and practical exams topics of Turkish maritime pilots.

a) Maritime Pilot Oral Exam Topics:	
1)	Information on the navigational, port and straits charts limited with the pilotage area, limits of the port area, berths and anchorages, mooring buoys, shoals, forbidden area, warnings, lights, buoys, marks, symbols, abbreviations, in the ports and in the straits, pilot embarkation and disembarkation points, local currents, eddies, winds and their effects, courses to navigate, traffic separation schemes (TSS) (if any), transits and bearings, Vessel Traffic Services (VTS) structures and functions, emergency procedures, general information on the sea area within the pilotage area and neighbouring vicinity,
2)	Ship handling, characteristics of the propulsion system, propellers, rudders and its functions, effects of the variables such as draught, trim, speed trough the water, ground speed, under keel clearance, turning circle, stopping distance on the ship handling. Effects of winds and currents on ship manoeuvring and ship navigation, anchoring and leaving the anchorage, berthing, unberthing, mooring to the buoys, making a stern-fast with and without the tug
3)	Legislation: the Act of Ports (no. 618, dated 14.04.1941), the Act on Protection of Life and Property at Sea (no: 4922, dated 10.06.1946), related port legislations, local rules and regulations, general usages and customs, the International Regulations for Preventing Collisions at Sea (COLREGs), 1972, other maritime related national legislation and international conventions, Montreux Convention for the maritime pilots of İstanbul and Çanakkale Straits
4)	Maritime English: The proper and fluently use of the Part (A) of the Standard Maritime Communication Phrases (SMCP) as per the requirements of IMO Recommendation A.918.
b) Maritime Pilot Practical Exam Topics:	
1)	For the Harbour Pilot: Candidate pilot must practice an entire manoeuvring of berthing, under the supervision of an authorised pilot, without hesitation, calmly and safely. Additional manoeuvrings such as anchoring, mooring the buoys, making a stern-fast, unberthing may also be requested by the Examination Board. If it is available, manoeuvrings with tugs are preferable for the exams.
2)	For the Turkish Straits Pilot: Candidate pilot must practice an entire passage of a vessel of 150 metres or more trough the strait, safely and according the requirements of a proper pilotage, under the supervision of an authorised pilot.

3.3.7 Maritime pilots training seminars and revalidation of the certificates

Turkish Maritime Pilots licenses are valid for two years. Every pilot mast also participates to refreshment seminar at least once within the two years in order to get revalidation of the licence.

The topics of the “maritime pilots’ refreshment seminars” are given in Table 3.4. These topics are required by the pilotage legislation RCTCWSMP (2006). Turkish maritime pilots shall participate to these seminars in order to refresh their knowledge and to revalidate their licences. The seminars are also meetings of pilots where they can update their knowledge with the new rules, applications and technology and exchange their knowledge with their colleagues.

Table 3.4: Outline of the maritime pilots' refreshment seminars.

No	Topics
1	Latest developments in the pilotage and ship manoeuvring
2	Case studies, examples of events and incidents about manoeuvring and safety of navigation in different pilotage areas
3	Latest developments in national and international maritime legislation
4	Latest developments in the navigational equipments and technologies
5	The use new navigational equipments
6	Risk management at sea
7	Fatigue management
8	Other similar subjects considering the latest developments with the pilotage.
9	Practical training related the above topics using simulators supports. The program includes all above topics but is not limited with them

3.3.8 Upgrading to the senior pilot licence

To upgrade to the unrestricted pilot licence, it is required to work at least four years as pilot (up to 20000 GRT) and to complete "the Upgrading Training" in the authorised training centres, and also to obtain a reference letter from the pilotage organisation. The topics of the "maritime pilots' upgrading trainings" are given in them.

Table 3.5: Outline of the maritime pilot upgrading trainings.

No	Topics
1	Latest developments in the pilotage and ship manoeuvring
2	Case studies, examples of events and incidents about manoeuvring and safety of navigation in different pilotage areas
3	Latest developments in national and international maritime legislation
4	Latest developments in the navigational equipments and Technologies
5	The use new navigational equipments
6	Risk management at sea
7	Fatigue management
8	Other similar subjects considering the latest developments with the pilotage.
9	Practical training related the above topics using simulators supports. The program includes all above topics but is not limited with them
10	Other additional topics decided by the Maritime Administration

Candidates have to successfully complete this standardised training required by the RCTCWSMP (2006) in order to upgrade their licence to the unrestricted level.

3.4 Use of simulation systems

According to Banks et al. (2001) "Simulation is the imitation of the operation of a real-world process or system over time" (p.3). There are many purposes for using simulation systems, such as technology for performance optimization, safety engineering, testing, training, education and games (entertainment simulation).

Simulators are widely in use for training and also for research and development in many different areas. Ship Handling Simulators also are very useful for all these functions. Simulation system are not necessarily very sophisticated electronic device with projectors and very well designed cubicles (ship's bridges or aeroplane cockpits) in order to provide highly realistic environment. There are also simulation systems and programs which can be run only with computers.

3.4.1 Simulation system as a training tool

In Turkey, simulators are largely in use for the training purpose in many maritime education and training centres. Several experiments have been done as a part of this study in the Simulators' Centre of ITU Maritime Faculty. A photograph of the Simulator Centre is given in Figure 3.1.

Figure 3.1 : ITU Maritime Faculty Simulators' Centre.

The Simulators' Centre of ITU Maritime Faculty has a full mission ship handling simulator. The ship handling simulator has a realistic navigation bridge with a realistic audial system and visual environment obtained by a projection system around the bridge as shown in Figure 3.2.

Figure 3.2 : ITUMF SHS Navigation Bridge.

Usually Training Simulators are designed with very realistic environment providing suitable simulated model of the real one to the trainees. In this model the trainee can learn with role playing which is the most productive learning method. Despite its productivity, any simulation system for training, should be used considering within its own limits. Otherwise a simulator can not provide sufficient learning – training outcomes which are normally expected from. Therefore, practicing the simulations systems (with necessary preperations, briefing, execution of the scenario and debriefing) will increase the productivity and the effectiveness ot these systems, which are important and expensive training tool.

The ship handling simulator's (SHS) navigation bridge in work which is given in Figure 3.3 shows the northbound approach to the Boğaziçi Bridge.

Figure 3.3 : ITUMF SHS Navigation Bridge, (NAMURA, 2003).

A Ship Handling Simulator (SHS) can be used very efficiently in the training purpose for maritime students, seaferers, ship masters and officers, candidate, new and existing pilots.

3.4.2 Simulation system as a assesment, research and development utility

Simulators can be used also for trying what you can not try in real life without any risk. Before manoeuvring new types of vessel coming fist time to the existing port, or before going to be anongside to the new jetties to accept first time our existing size of vessels, it should be a kind of safety precaution and smooth preperation to try it, at first, on the simulated model. The trial can be useful if it is used considering the limits of the simulation sistems.

Simulation sistems are increasingly used for research and development. For this purpose mostly a computer simulation systems are used. There is a definition of the computer simulation given by Banks et al. (2001) "A computer simulation is an attempt to model a real-life or hypothetical situation on a computer so that it can be studied to see how the system works. By changing variables in the simulation, predictions may be made about the behaviour of the system. It is a tool to virtually investigate the behaviour of the system under study" (p.3).

There are many ready to use software packages which can be used for computer-based simulation modelling, such as Dymola, Tortuga Scilab, Sage, Emler, Ascent, Monte Carlo simulation, stochastic modeling and multimethod modeling and many others that makes all the modelling very easy. We may also understand "computer simulation" from its modern usage, any computer based representation.

Considering the limitation of the simulation systems and utilising the necessary and correct inputes may provide correct and useful solutions for particular technical questions and may also do some risk analyses in particular areas with limited variables and limited scenerios.

Many developed types of ship handling simulators can also be used in the assessment and research subjects with its advanced functions as area, traffic flow and scenario creating / editing functions. Users can create / edit the areas wherever they want to execute a training, assessment and research such as the İstanbul Strait, Çanakkale Strait, Haydarpaşa Port, Karaköy - Salıpazarı Port. For example ITU Maritime Faculty Ship Handling Simulator contains the functions to define many of environmental conditions such as 3D views, navigational aids, fender and bollards, depths, currents, winds, wave, etc. In the Simulatotors' Centre of the ITU Maritme Faculty, the ship handling simulator (SHS) has a powerfull main server, an operator consol as shown in Figure 3.4.

Figure 3.4 : Main server and operator consol.

Users can create / edit any density of traffic flows with variety kinds / sizes of vessels such as container ships, tankers, bulk carriers, car carriers, also local traffic items such ad fishing boats, etc. To combine the data of areas and traffic flows, users can create the training / assessment / research scenarios easily. Users can edit those created scenarios easily to satisfy their requirements. An editing station and a briefing room as shown in the Figure 3.5.

Figure 3.5 : Editing station and briefing room.

Studies of optimum maneuvers with reference to the configuration of ports and harbors, ship berthing and un-berthing operations in consideration of the orientation of berth face, maneuvers within turning basin or channel with specific configuration, navigators' visibility affected by reclaimed land and other obstacles, marine-scape in relation to bridge and other constructions, Determination of limited criteria for ship entry and departure of ports, Researches into the effects of maritime traffic environment by construction of offshore structures, the effects on maneuvers by lights and obstructions, the effects of offshore construction works on navigating vessels are examples of assessment subjects which can be done using a ship handling simulator. Studies of evaluation methods for optimum ship maneuvering in case port entry or departure, the operation system of super-high speed vessels, developments of supporting systems on ship operation, safety assessment systems of navigation in heavy traffic waters, IBS (Integrated Bridge System), research of marine casualties are examples of research subjects which can be done using a ship handling simulator. Flowchart of the utilisation of the ship handling simulator is given in the Figure 3.6.

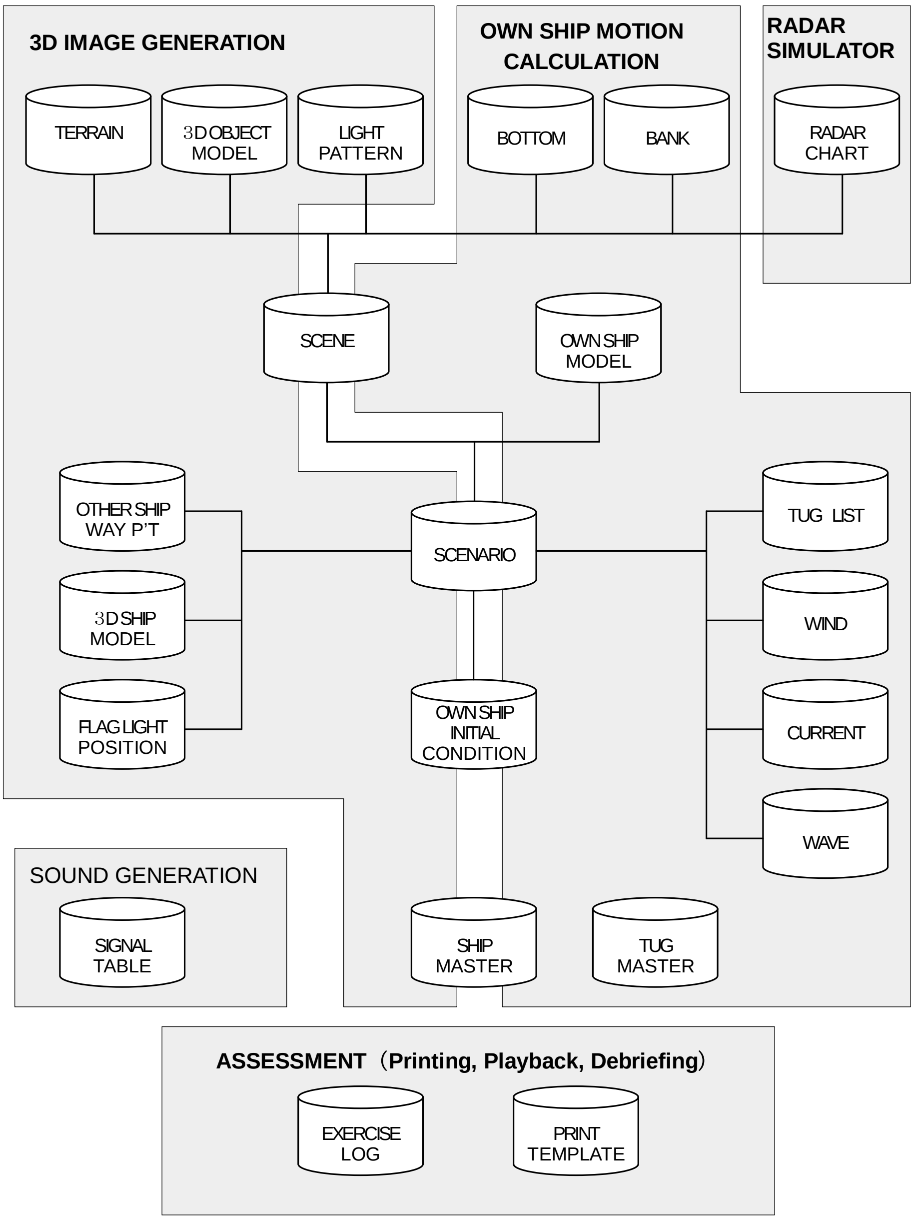

Figure 3.6 : Ship handling simulator (SHS), (NAMURA, 2003).

In the Simulatotors' Centre of the ITU Maritme Faculty, the ship handling simulator (SHS) is also able to give a printout of the simulation after the completion of the simulation session. A printout of the simulation of the passage of İstanbul Strait is given in Figure 3.7.

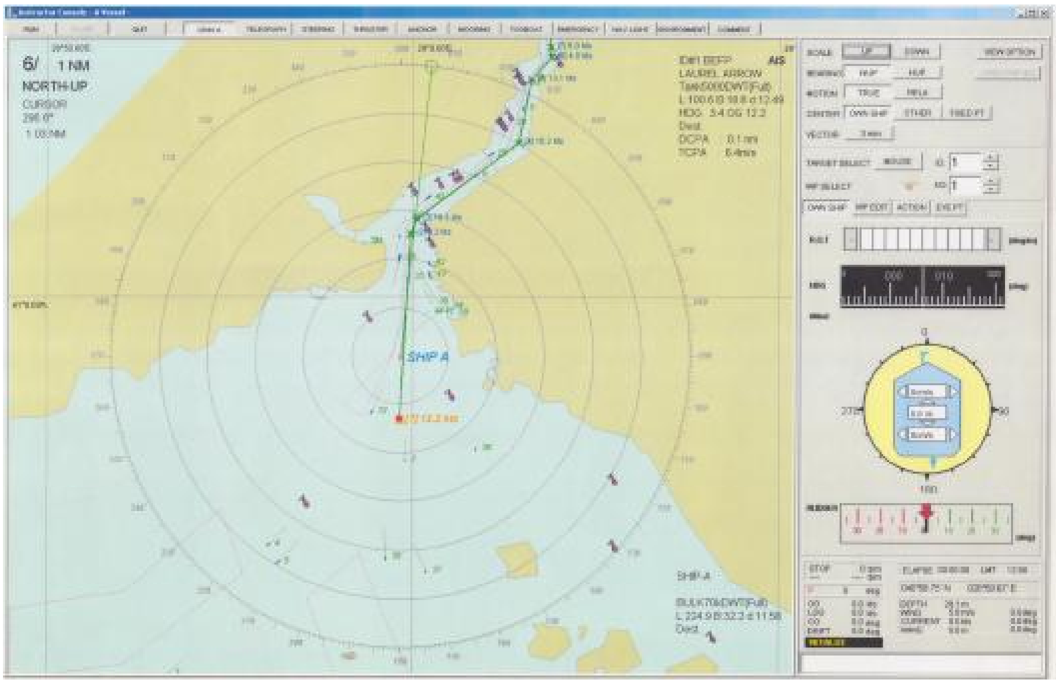

Figure 3.7 : Printout of a simulation of İstanbul Strait's passage in ITUMF SHS.

3.4.3 Simulation with manned model

Another simulation system for ship handling is the "manned model simulation. There isn't yet any manned model simulation facility in Turkey. There are manned model simulation centres known by the maritime sector internationally such as the Port Revel Manned Model Simulation Centre in France, the Port Ash Centre in Australia, the Tisbury Lake Ship Handling Centre in UK, the Maritime Pilot Institute (MPI) in Covington, La, USA, Massachusetts Maritime Academy Center for Maritime Training, Manned Model Courses, USA, Ship Handling Research and Training Centre, Ilawa, Poland.

Directorate Generale of Coastal Safety of Turkey, that includes also pilotage organisation in the Turkish Straits, beside many other developped training facilities, utilise the Port Revel Centre for manned model training for their maritime pilots who serve in the Turkish Straits, Port of Çanakkale, Port of Gelibolu, Port of İstanbul and Port of İzmir.

As a part of this study, training, research, observations and simulation practices have been done in the Port Revel, France. The Port Revel Manned Models' Simulation Centre has one of the world's best known facilities for manned model simulation.

The Port Revel Manned Model Simulation Centre is near Grenoble, France. The centre is located in a quiet natural park. The simulation area is on a thirteen acre lake which is highly versatile with very little interference from wind. The lake is shown in the Figure 3.8.

Figure 3.8 : Port Revel Simulation Centre (Port Revel, 2013).

The lake is a man-made and was remodelled in order to reproduce real sailing conditions. At scale, the water area represents a navigable zone of about 5 by 2 nautical miles, allowing several models to sail at the same time at normal manoeuvring speeds. The technology is designed to reproduce wind, currents, waves, and hydrodynamic effects such as interactions between ships, under-keel clearance, and ship/berth interaction to the same scale as the model ships in order to obtain a realistic environment for trainees and researchers. In the lake, there is a wave generator. The wave generator is designed to produce waves of varying period and height (usually 3 m at full scale, or 12 cm for the models). The model ship with righthand fixed pich proppeller, with the engine stoped and without any headway or sternway drifts with waves, than she turns to port (the stern moves toward the waves) when engine runs astern, despite the opposite transverse truste and the rudder in midships position in the experiment using the wave generator shown in Figure 3.9.

Figure 3.9 : Experiment with generated waves.

There are also current generators and wind generators and complex port approach configurations. The wind generators are shown in the Figure 3.10.

Figure 3.10 : Wind generators in Port Revel, photograph from (Ofdağ, 2013).

The lake has the different types of moorings and facilities which exist in ports or near the coast such as open wharves, solid quays, offshore platform structure, Panama locks and a single buoy mooring. In the lake, there are also the different types of buoyed channels with different widths and depths and also a length of narrow and bended ship canal. A boat house is situated in the lake for shelter and maintenance of the models. There are also a number of leading marks on land, and an observation tower and a "track recording system". The DGPS system allows accurate debriefing of the exercises performed on the lake. It allows three models to be followed at the same time. The average accuracy of this system is better than ± 1 cm on the lake, corresponding to ± 0.25 m at full scale. Model ships are precisely reproduced to a 1:25 scale. The fleet of 10 models at scale 1:25 reproducing over 20 different vessels and the 4 escort tugs are operated by a real tug master at the pilot's orders. Typically very heavy with weak motors, they are designed to mimic the feel of the large ships the pilots handle. To ensure that the models behave like real ships, they are equipped with indicators giving rudder angle, engine speed, ship speed, wind speed, etc. as well as bow and stern thrusters and operational anchors. In addition, scale model tug boats are controlled at the pilot’s orders by a tug master via a remote-control system. The Port Revel fleet contains different types of ships. Six of the manned models represent at scale real oil tankers or bulk carriers ranging from 38,000 to 400,000 dwt. The seventh is a replica of the liquid natural gas (LNG) carrier "Ben Franklin" (125,000 m3). Capt. Ali Cömert turns to port using the port anchor against to strong current generated at the exit of the narrow canal with “Ben Fraklin” in Figure 3.11.

Figure 3.11 : Manned model ship “Ben Fraklin” (Port Revel, 2013).

The eighth is a replica of a 4,400 TEU post panamax container ship, the "CGM Normandie". This ship can be used with a bridge at the ninth ship, introduced in a large 8,500 TEU container ship. The latest ship, Q-Max is a large 266,000 cubic metres capacity twin-screw LNG carrier. Q-Max is a type of ship, specifically a membrane type liquefied natural gas carrier. In the name Q-Max, "Q" stands for Qatar and "Max" for the maximum size of ship able to dock at the LNG terminals in Qatar. Ships of this type are the largest LNG carriers in the world. A ship of Q-Max size is 345 metres long and measures 53.8 metres wide and 34.7 metres high, with a draft of approximately 12 metres. It has an LNG capacity of 266,000 cubic metres, equal to 161,994,000 cubic metres of natural gas. It is propelled by two slow speed diesel engines, which are claimed to be more efficient and environmentally friendly than traditional steam turbines. The first Q-Max LNG carrier was floated out of dry-dock in November 2007. Total fourteen Q-Max LNG carriers have been built from 2007 to 2010. Capt. Ali Cömert navigates with the manned model “Q-Max“ LNG Carrier in Figure 3.12.

Figure 3.12 : Manned model ship “Q-Max” (Port Revel, 2013).

All models but the Normandie and Otello are fitted with a diesel motor and steam turbine, and the Normandie can be controlled from the front deck like a car carrier and a cruise ship, so that the fleet in fact reproduces over 20 different vessels. The models are fitted out with all the conventional features found on board a real ship with a "bridge", comprising the helm and rudder angle indicator, the "chadburn" (transmission of orders to engine room) and indicator of propeller rpm, the compass, the electronic log (speed indicator), an anemometer, bow and stern thrusters controls (these thrusters can simulate the action of tugs), remote control of anchors; an "engine", replaced on the model by an electric motor supplied by a series of batteries on board, which serve as part of the ship's ballast, a rudder, a bow thruster (some of the models also have a stern thruster), mooring lines, including anchors and chain, windlasses. Obviously, the rudder and engine response times are respected. These are adjustable, as is the "power" of the engine, so as to reproduce the characteristics of turbine or diesel engine propulsion.

Port Revel has acquired four "Tractor-Tugs", two of the Voith-Schneider type (one of them with the famous Turbo Fin), the others being a Z-Peller drive tug and a Carrousel Tug. All tugs are at 1:25 scale. Tugs models are too small to be manned. They are radio-controlled by a tug captain and/or by an instructor. They are able to provide a bollard pull of about 70 newtons a force close to 100 tons at full scale, which at the present time is well in excess of the bollard pull of the actual tug. Azimuth stern drive (ASD) model tug with z-peller propulsion system “Rastar 2” assists manned model vessels in Figure 3.13.

Figure 3.13 : Model ships with model tugs’ assistance (Port Revel, 2013).

The crew of each model is made up of two participants: one is "embarked" on the bridge, and acts as captain. He has the same angular vision, hence the same perspective, as on the real ship (the seat being vertically adjustable). The other participant fulfils the functions of "helmsman" and "chief engineer". His eyes are at deck level so that he can follow and observe the manoeuvres performed by the captain and learn from them. It goes without saying that the helmsman must scrupulously and rapidly obey the orders given by the captain so as not to upset the normal progress of the manoeuvre. Views of captains and helmsman / chief engineer are given in Figure 3.14.

Figure 3.14 : Views of captain and helmsman (Port Revel, 2013).

The participant at the helm of Port Revel's ship models often has only a partial view of the manoeuvres he performs. Indeed, he must pay constant attention to the "real" difficulty of manoeuvring the models, as well as to the fact that time is "shortened". On the lake, everything happens five times faster than in reality, and a manoeuvre which takes one hour at full scale is completed in 12 minutes on the lake, although requiring exactly the same number of orders from the captain of the model. At the same time, certain parameters, in particular the variation of turning circle diameter with depth, are difficult to evaluate and quantify on the basis of visual impressions only. It is therefore highly advantageous for the participant to have a trace of the course followed and the manoeuvres undertaken, instead of having to depend on his memory or that of the instructor dispensing the training. This is why the centre was equipped with a track recording system enabling reproduction, in digital or graphic form, of the course followed by the model, with simultaneous recording of the orders given to helm and engine, speed and heading of the model, wind speed and apparent direction, use made of bow or stern thrusters.

Manned model simulation is very realistic. It is also good method to acquire certain reflexes which are necessary for ship handling. Training on the scale models provides experience that could never be gained on real ships due to the risks to be taken. Scale models allow the ship-handler to make mistakes. Scale models allow experimentation on ship behaviour to explore unknown fields beyond the limits of safety.

The environment is very naturel on scale models, with random effects that are similar to those of real-life situations. The unforeseeable nature of winds, shallows, currents and waves calls for an immediate, appropriate reaction, without any repeat or automatic response and without any “reset” switch. For the same reason hydrodynamic effects are correctly reproduced on scale models and it is therefore unnecessary to transpose them in the form of complex equations. This gives a better simulation of hydrodynamic effects such as interactions between ships (for example in a canal), interactions between the ship and berth, small under-keel clearance (such as 10% of the ship's draught) and the use of anchor dredging in various operating situations. Port Revel Manned Model Simulation Centre model ships “Gilda”, “Berlin”, “Grenoble” are given in Figure 3.15.

Figure 3.15 : Model ships Gilda, Berlin, Grenoble (Port Revel, 2013).

The scale effect of wind on a manned model is well known, but it is also well known that this is in no way detrimental to the use of manned models for serious and effective shiphandling training. Wind is a factor in the everyday life of pilots throughout the world. The design of our manned model lake is such that the wind element will vary in different parts of the lake. This allows a course to be structured in such a manner as to introduce wind as and when required. Extreme wind conditions are encountered in the real world. If they occur at a manned model centre, with care they can be used in various scenarios to demonstrate how well control can be maintained. The ship models behave exactly like real ships, only much faster. In carrying out a given operation with the model, such as mooring alongside a wharf for instance, exactly the same instructions are given to the engine room and helm as on a real ship, but there is only one fifth of the time available in which to give them. Reality will be much slower than the model, thus leaving quite a lot more time to react. Manned models sharpen the shiphandlers’ natural senses of perception and anticipation and enable an appreciation of the ships’ behaviour as a whole. The time scale also means that it is possible to perform five times as many manoeuvres. In other words, it is possible to perform as many manoeuvres in 35 hours on the models as in 175 hours on the real ship.

In Port Revel, over 6,500 experienced pilots and captains have been trained since 1967. The courses are tailored to reproduce local navigation conditions. The instructors are highly experienced maritime pilots holding a foreign-going master's licence. In the Port Revel Manned Model Simulation Centre, Turkish Straits are not specially simulated yet. But the simulations area with narrow passages, bends, currents are very useful also for training of Turkish Pilots from the Turkish Straits and other Turkish ports.

There isn’t any manned model simulation facility yet in Turkey. Such centre may be very good training tool for turkish captains and pilots and also for many seafarers from neighbouring countries and other countries. Planing a manned model simulation centre in long term and utilising existing facilities such as Port Revel Centre can be a good training policy for Turkey.

3.5 Develloping a Navigational Model Using Formal Safety Assesment

Formal Safety Assessment (FSA) has been described as "a rational and systematic process for assessing the risks associated with shipping activity and for evaluating the costs and benefits of IMO's options for reducing these risks" (IMO FSA, 2013).

It is well known that it makes only sense if the action is taken before a disaster occurs. This is the only way of ensuring. It is the use a process known as formal safety assessment. It can be used as a tool to help evaluate rules and regulations, or to compare proposed changes with existing standards, or to evaluate any maritime related system and related changes. It enables a balance to be drawn between the various technical and operational issues, including the human element and between safety and costs. In 1988 an offshore platform, named “Pier Alpha” exploded in the North Sea and 167 people lost their lives. Formal safety assessment was originally partly developed as a response of that sad accident. It is now being applied to the IMO rule making process. The Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule-making process were approved in 2002 within the content of (IMO MSC/Circ.1023-MEPC/Circ.392, 2002). The Guidelines have since been amended by (IMO MSC/Circ.1180-MEPC/Circ.474, 2005; IMO MSC-MEPC.2/Circ.5, 2006)

3.5.1 The Turkish Straits safe navigation model methodology

Turkish Straits are one of the most dangerous and busy waterways of the world. Despite this obvious high risk there is very high population and natural and cultural heritage around this unique natural passage. For the Turkish Straits, the model's objectives are enhancing maritime safety, including protection of life, health, the marine environment and property, by using risk analysis and cost benefit assessment utilising the formal safety assessment which is a structured and systematic methodology. This methodology will be used as a tool to help in the evaluation of existing risks and potential improvement in the Turkish Straits, for maritime safety and protection of the marine environment. The Turkish Straits specialised formal safety assessment consists of five steps:

3.5.1.1 Idendification of hazards

The Turkish Straits specialised formal safety assessment's first step is to identify the hazards. To identify the hazards we may prepare a list of all relevant accident scenarios with potential causes and outcomes. We may ask the question "What might go wrong?" To answer this question we may need some statistics about the Turkish Straits. We have Statistics from (KEGM, 2013a; AAKKM, 2013). Numbers of passages of vessels through the Turkish Straits, per year from 2003 to 2012 as per statistics from KEGM (2013a) are are given in Table 3.6.

Table 3.6: Number of passages of vessels per year (KEGM, 2013a).

Years	Strait of Çanakkale	Strait of İstanbul
2003	46939	42648
2004	54564	48421
2005	54794	49077
2006	54880	48915
2007	56606	49913
2008	54396	48978
2009	51422	49453
2010	50871	46686
2011	49798	45379
2012	48329	44613

Number of passages of vessels through the Turkish Straits increased up to the almost limit of its capacity. It is increasing the risks of maritime accidents, risks to the lifes in these area and risks to the maritime environments. Numbers of passages of vessels through the Turkish Straits, per year from 2003 to 2012 as per statistics from KEGM (2013a) are shown in the graffic given in Figure 3.16.

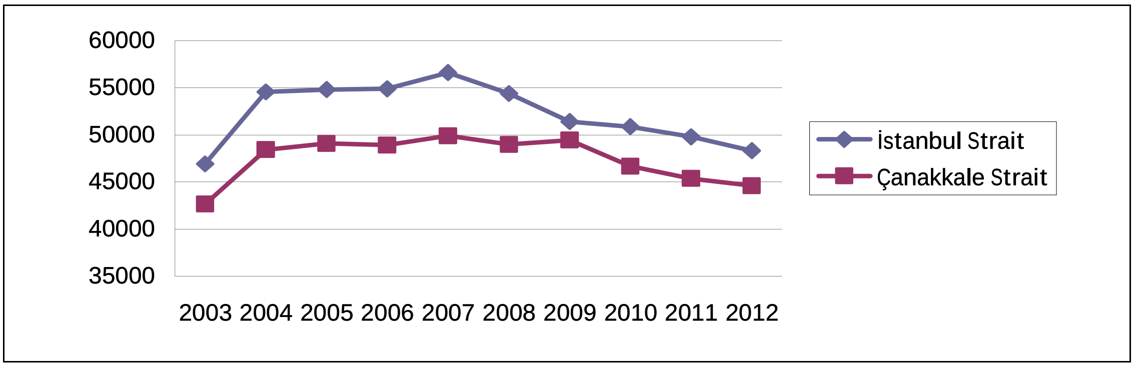

Figure 3.16 : Vessels' passages per year (KEGM, 2013a).

Dangerous cargoes carried by vessels through the Turkish Straits also increased. It is increasing additionally the risks of maritime accidents, risks to the lifes in these area and risks to the maritime environments. Dengerous cargoes in metric ton carried by tankers through the Turkish Straits, per year from 2003 to 2012 as per statistics from KEGM (2013a) are given in Table 3.7.

Table 3.7: Dangerous cargoes carried by tankers (KEGM, 2013a).

Years	Strait of Çanakkale (MT)	Strait of İstanbul (MT)
2003	134603741	145154920
2004	143898164	155561833
2005	143567196	148951326
2006	143452401	152725702
2007	143939432	149320062
2008	140357231	149052174
2009	144660044	152105494
2010	146750218	156928857
2011	138496245	154605680
2012	131122919	151030884

Dangerous cargoes carried by tankers in MT through the Turkish Straits, from 2003 to 2012, as per statistics from KEGM (2013a) are given as a graphic in Figure 3.17.

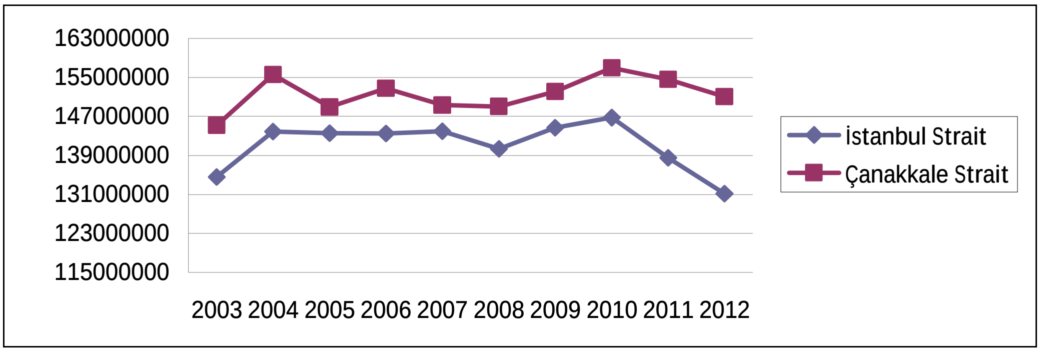

Figure 3.17 : Dangerous cargo in MT carried by tankers (KEGM, 2013a).

Numbers of tankers' passages with dangerous cargo through the Turkish Straits per year from 2003 to 2012 as per statistics from KEGM (2013a) are given in Table 3.8.

Table 3.8: Numbers of tankers with dangerous cargo (KEGM, 2013a).

Years	Strait of Çanakkale	Strait of İstanbul
2003	8097	8114
2004	9399	9016
2005	10027	8813
2006	10153	9567
2007	10054	9271
2008	9303	8758
2009	9299	9567
2010	9274	9252
2011	9103	8818
2012	9027	8998

Numbers of tankers' passages with dangerous cargo through the Turkish Straits per year from 2003 to 2012 as per statistics from KEGM (2013a) are given as graffic in Figure 3.18.

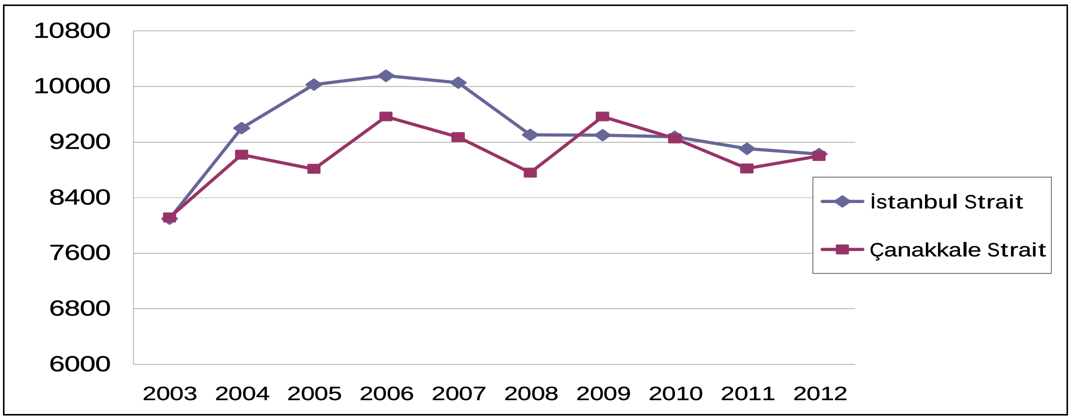

Figure 3.18 : Numbers of tankers with dangerous cargo (KEGM, 2013a).

Despite the increased risks due to the increased number of passage and increased amount of dangerous cargoes carried by vessels through the Turkish Straits, utilising the pilotage services in this area is still not satisfactory.

Considering the strong recommendation by IMO and many other international and national entities for using the pilotage services in the Turkish Straits, a greater number of vessels could be expected to use the pilotage services. The ship masters, owners and managers must consider this recommendation, risks of this passage and benefits of using the pilotage services in this area for all related parties. Pilotage must be considered as a key element in order to improve maritime safety and to reduce risks.

Numbers of vessels used pilotage services through the Turkish Straits per year from 2003 to 2012 as per statistics from KEGM (2013a) are given in Table 3.9.

Table 3.9: Vessels used pilotage services (KEGM, 2013a).

Years	Strait of Çanakkale	Strait of İstanbul
2003	21175	13020
2004	22318	14404
2005	24494	15661
2006	26589	16871
2007	26685	16886
2008	27001	18334
2009	25073	18588
2010	26035	18678
2011	26011	18920
2012	24792	18775

International Maritime Organisation clearly stated that "Masters of vessels passing through the Straits are strongly recommended to avail themselves of the services of a qualified pilot in order to comply with the requirements of safe navigation." in IMO Res. A.827(19) Annex 2 (1995) Rules and Recommendations on Navigation through the Strait of Istanbul, the Strait of Çanakkale and the Marmara Sea in “Ships' Routeing”. Numbers of vessels used pilotage services through the Turkish Straits per year from 2003 to 2012 as per statistics from KEGM (2013a) are given as graphic in Figure 3.19.

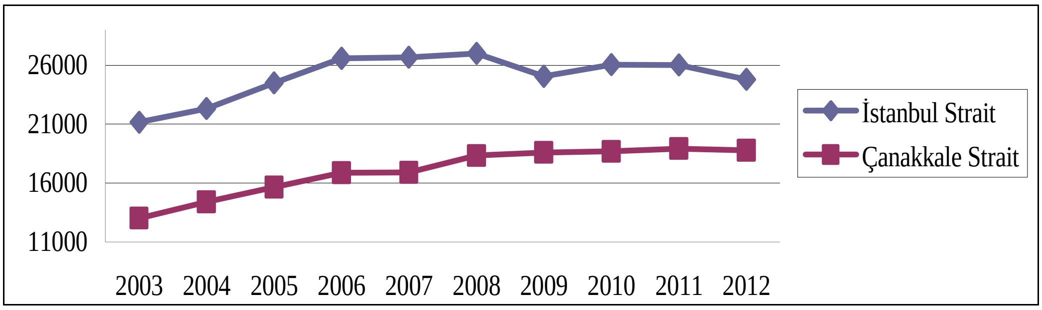

Figure 3.19 : Vessels used pilotage services (KEGM, 2013a).

Turkish Main Search And Rescue Co-ordination Centre (AAKKM) provide a continuously updated open resources about the accidents and incidents in Turkish waters. The statistics of accidents and incicents are taken from the AAKKM database. In this statistics, types of maritime accidents and incidents are devided as collision/contact, grounding/stranding, fire, capsizing, drifting, engine breakdown, person over board, missing/assumed lost, listing, damage, water ingress, exploitation, hazardous incident, and others. The types and numbers of maritime accidents and incidents in İstanbul and Çanakkale between 2001 and 2013 as per the statistics from AAKKM (2013) are given in Table 3.10.

Table 3.10: Types of accidents, 2001-2013, adapted from (AAKKM, 2013).

Maritime Accidents / Incidents	İstanbul	Çanakkale	Total
Collision / Contact	309	43	352
Grounding / Stranding	124	103	227
Hazardous Incident	80	32	112
Fire	86	25	111
Capsizing	70	21	91
Drifting	57	14	71
Others	41	26	67
Engine Breakdown	18	31	49
Person over board	12	3	15
Missing / Assumed lost	4	4	8
Listing	6	-	6
Damage	5	-	5
Water Ingress	3	1	4
Exploitation	1	1	2
Total	816	304	1120

The graphic of the types and numbers of maritime accidents and incidents in İstanbul and Çanakkale between 2001 and 2013 are given in Figure 3.20 as per the statistics (AAKKM, 2013).

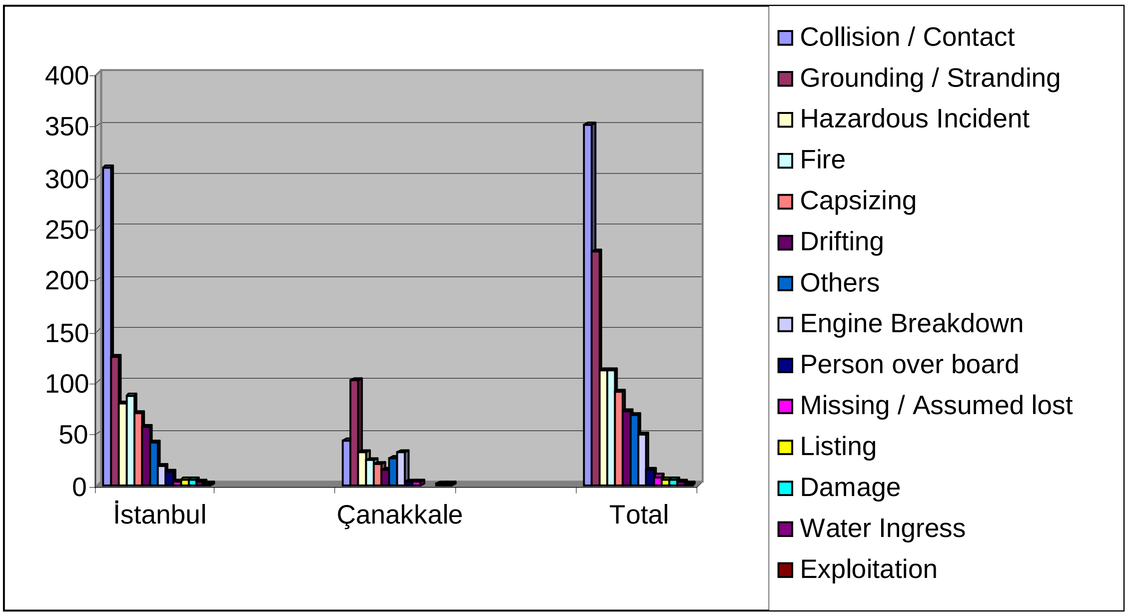

Figure 3.20 : Types of accidents, 2001-2013, adapted from (AAKKM, 2013).

3.5.1.2 Assessment of risks

After the identification of hazard, second step is the assesment of risk. It can be done also by the evaluation of risk factors. We may ask the questions “How bad and how likely?” To answer this question we may need some further statistics about the Turkish Straits and we may also need to evaluate these statistics. Table and figures are perepared using the statistics and adapted from (AAKKM, 2013). Numbers and places of maritime accidents and incidents in the Turkish Straits between 2001-2013 are given in Table 3.11

Table 3.11: Places of accidents, 2001-2013, adapted from (AAKKM, 2013).

Area in Istanbul Strait	**Accidents**	**Area in Çanakale Strait**	**Accidents**
Ahırkapı Anchorage	102	Çanakkale Strait South Aproach/Bozcaada	39
İstanbul Strait North Aproach/Türkeli	34	Çanakkale Strait North Aproach	36
Yeniköy	19	Kumkale	24
Ahırkapı	18	Nara Burnu	16
Türkeli Anchorage	18	Kepez	10
Haydarpaşa	16	Çanakkale Jetty	8
Harem – Kızkulesi	15	Gocuk – Umurbey	7
Sarayburnu	15	Kilitbahir	6
Umuryeri	12	Çardak	5
Bebek	10	Eceabat	5
Kuruçeşme-Galatasaray Island	10	Çamburnu	4
Kandilli	9	Karanlık Liman	3
Kadıköy	9	Lapseki	3
İstanbul Strait South Aproach	8	Akbaş	3
Haliç	6	Sarıçay	2
Anadolu Kavağı	5	Sarısığlar	2
Kanlıca	5	Kanarya	2
Fenerbahçe Shoal	4	Güzelyalı	2
Üsküdar	4	Karanfil	2
Salıpazarı	3	Seddülbahir	1
Beşiktaş	3	Havuzlar	1
Karaköy	2	Uzunburun	1
Fatih Sultan Mehmet Köprüsü	2		
Tellitabya	2		
Aşiyan	2		
Ortaköy	2		
Moda	2		
Trabya	2		
Emirgan	2		
Beylerbeyi	2		
Kabataş	1		
Çengelköy	1		
Kireç Burnu	1		
Keçilik	1		
Arnavutköy	1		
Baltalimanı	1		
Paşabahçe	1		
Beykoz	1		
Büyükdere	1		
Dolmabahçe	1		
Rumeli Hisarı	1		
Boğaziçi Bridge	1		
Anadolu Hisarı	1		
Kabataş	1		
İnciburnu	1		
Dikilikaya	1		
Total	359		182

In order to make an assessment of risks in the Strait of İstanbul, a risk chart of the İstanbul Strait is prepared, using the numbers and places of maritime accidents and incidents in the Turkish Straits, between the years from 2001 to 2013, which are given in Table 3.11. It is also adapted from the statistics of (AAKKM, 2013).

The risk chart of İstanbul Strait, showing the numbers and places of the maritime accidents and incidents occurred in the İstanbul Strait, between the years from 2001 to 2013, using nine references areas are given in Figure 3.21.

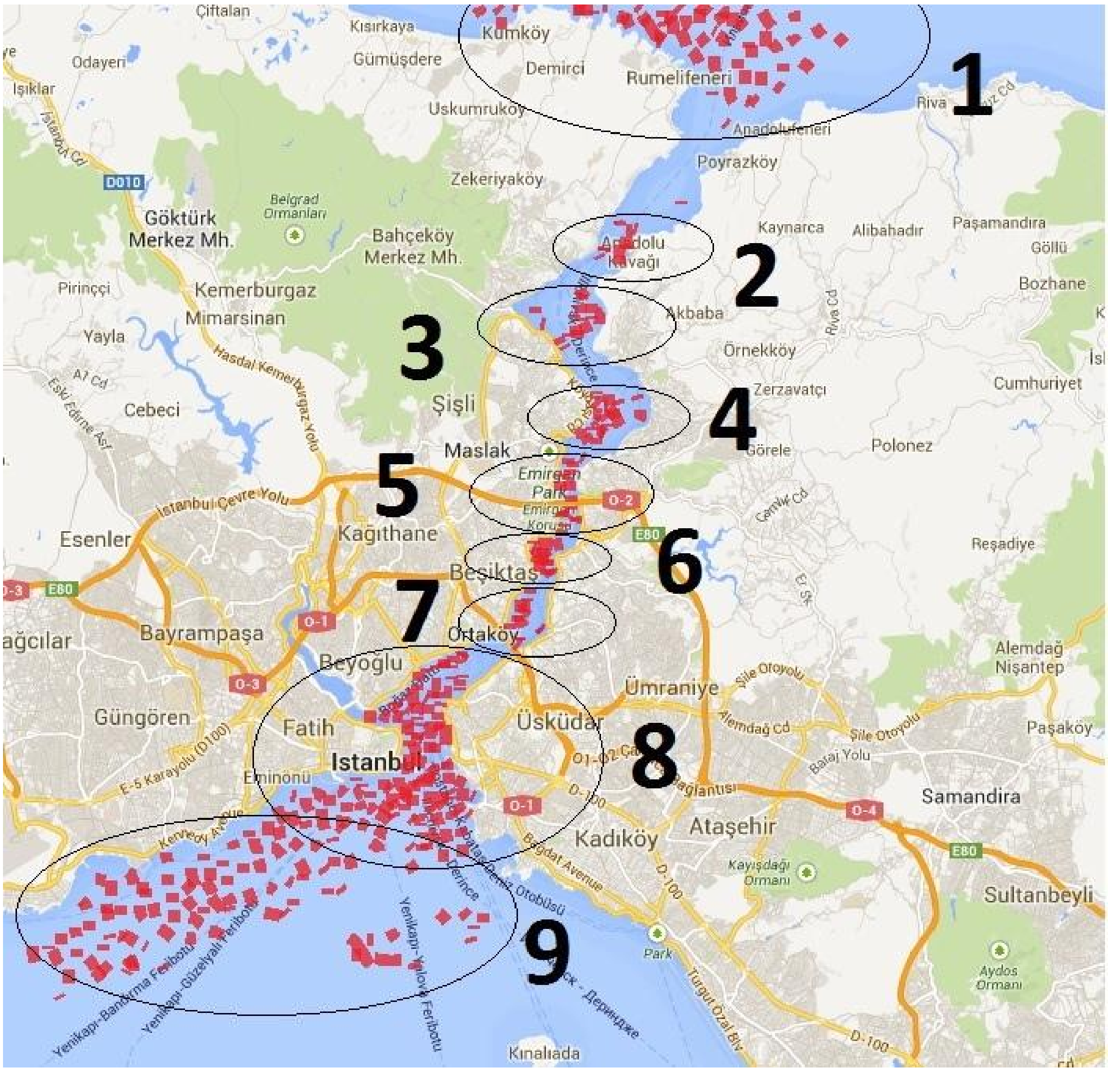

Figure 3.21 : Accidents in İstanbul Strait 2001-2013 (AAKKM, 2013).

In order to make an assessment of risks in the Strait of Çanakkale, a risk chart of the Çanakkale Strait is prepared, using the numbers and places of maritime accidents and incidents in the Turkish Straits, between the years from 2001 to 2013, which are given in Table 3.11. It is also adapted from the statistics of (AAKKM, 2013).

The risk chart of the Çanakkale Strait, showing the numbers and places of the maritime accidents and incidents occurred in the Çanakkale Strait, between the years from 2001 to 2013, using five references areas are given in Figure 3.22.

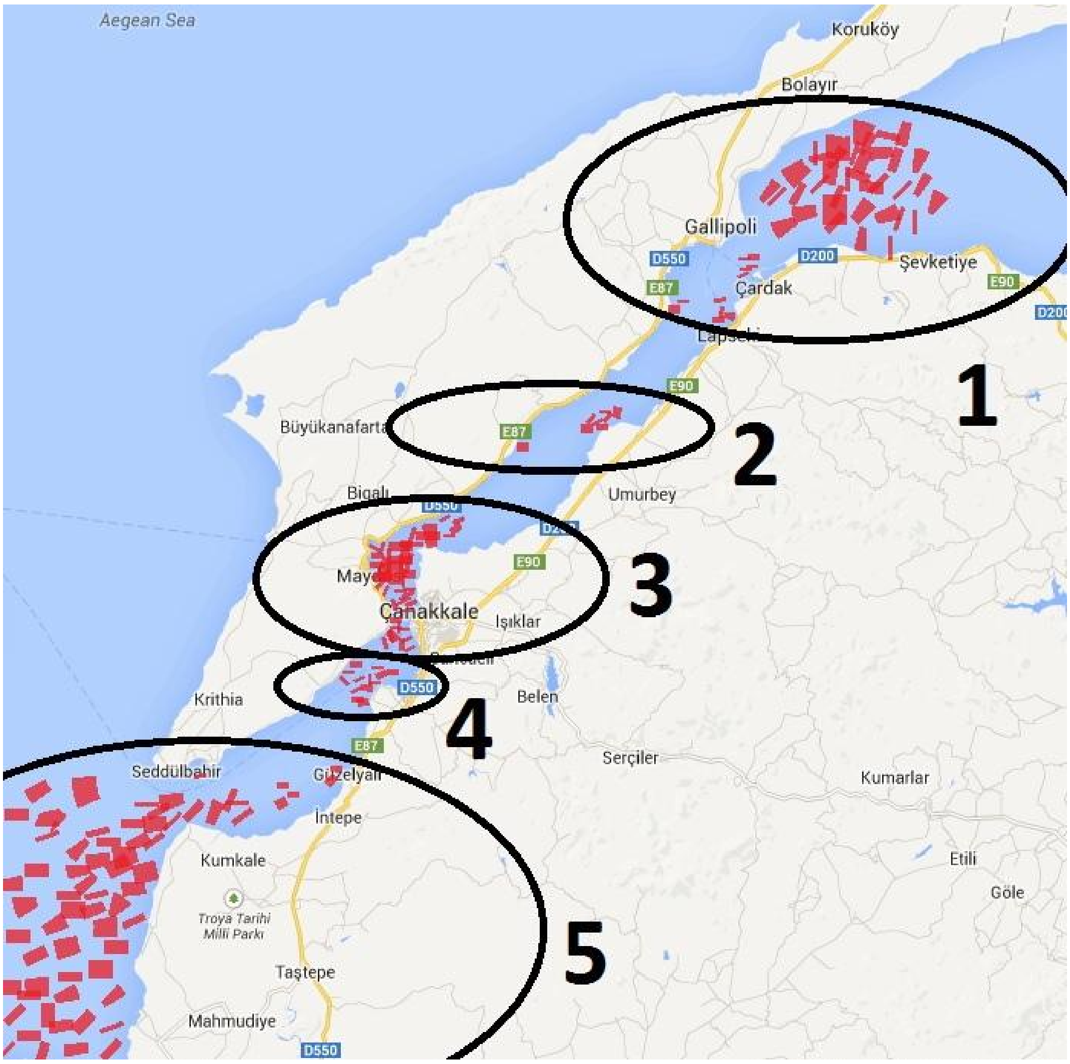

Figure 3.22 : Accidents in Çanakkale Strait, 2001-2013 (AAKKM, 2013).

A risk evaluation matrix is prepared, using the numbers and places of maritime accidents and incidents in the Turkish Straits, between the years from 2001 to 2013, which are given in Table 3.11, Figure 3.21 and Figure 3.22, in order to make an assessment of risks in the Turkish Straits. It is also adapted from the statistics of (AAKKM, 2013).

The risk evaluation matrix which is made using the same datas and refering to the areas on the risk charts. The referances areas 1 to 9 for İstanbul Strait and 1 to 5 for Çanakkale Strait are evaluated for the probability and impact. Very high, high, medium, low, very low, no data, level of probability and impact ranking are marked by colours as red, pink, yellow, green, blue and no colour. Level of risk ranking are marked high severity with red, medium severity with green, low severity with blue. The risk evaluation matrix for the Turkish Straits is given in Table 3.12.

Table 3.12: Risk matrix for the Turkish Straits, adapted from (AAKKM, 2013).

		Probability										
		10	9	8	7	6	5	4	3	2	1	0
Impact	10		8ist		6ist	5ist		7ist				
	9	9ist					4ist		3ist			
	8					3çnk				2ist		
	7			1ist				4çnk				
	6			1çnk						2çnk		
	5		5çnk									
	4											
	3											
	2											
	1											
	0											

Very high: #, high: #, medium: #, low: #, very low: #, no data: #

High severity, medium severity, low severity

3.5.1.3 Risk control options

The Turkish Straits specialised formal safety assessment's third step is "Risk control options". It includes devising regulatory measures to control and reduce the identified risks. We may ask the question: "Can matters be improved?"

The answer will be for sure yes. There are always regulatory and technical measures to control and reduce the identified risks. For the Turkish Straits, regulatory measures can be in three main subjects:

1. Regulations and other measures in order to improve technical and safety standards of the vessels.
    a. Inspections of the vessels.
    b. Services and repairing facilities.
2. Regulations and other measures in order to improve standards of local navigational aids and facilities.
    a. Lights, buoys and other navigational aids.
    b. Tugboats and other facilities for asistance, search and rescue.
    c. Vessel traffic services (VTS).
3. Regulations and other measures in order to encourage vessels to utilise the pilotage services.

a. Regulations and other measures in order to improve the technical standards of the pilotage services.

   i. Pilot boats, helicopters.

   ii. Pilot’s personal equipment, such as portable VHF Radio, pilot portable units (PPU) with pilot plug, personal protective devices, etc.

b. Regulations and other measures in order to improve training standards of the pilotage services.

3.5.1.4 Cost benefit assesment

The Turkish Straits specialised formal safety assessment’s fourth step is the “cost benefit assessment”. It includes the determining cost effectiveness of each risk control option. We may ask the questions “What would it cost?” and “How much better would it be?”. Cost benefit assesment is not very easy for the Turkish Straits. Considering high population, cultural, historical and natural values we have to understand and define tangible results of any improvement of the maritime safety. There are always some practical measures with very small cost or no cost at all. Utilising some existing services or reorganising some process or rearranging some procedures are to be always considered as priority. For example, efficient training usully creates considerable benefit for reasonable cost.

As the result of a cost benefit assesment biggest benefit can be obtained for all related parties utilising the pilotage services and supporting to improve these services in the Turkish Straits.

3.5.1.5 Recommendations for decision making

The Turkish Straits specialised formal safety assessment’s fifth step is “recommendations for decision-making”. It includes information about the hazards, their associated risks and the cost effectiveness of alternative risk control options is provided. We may ask the question “What actions should be taken? Answer contains the recommendations. They are briefly listed in this section and will be detailed in the section of “ Conclusion and Recommendations” and used as a part of the recommended model:

1. Existing routings and the Traffic Seperation Scheme (TSS) are found as an optimum routing of the safe passage as the result of many studies, evaluations and researches. Therefore it should be maintained.

2. High standards for the navigational aids and facilities for services must be maintained and futher developped as per the new necessities and demands, considering the changes and development of maritime traffic through the Turkish Straits, local maritime traffic, number, size and types of the vessels and other related subjects.

3. In order to reduce risk of maritime accidents, inspection and monitoring of all vessels using the Turkish Straits must be achieved as much as applicable. Considering the majority of vessels utilising pilotage services have better technical and management standards, inspections and monitoring of especially vessels without pilots should be in priority.

4. For the Turkish Straits most low cost and high benefit measure is utilising the existing high standard pilotage services as also strongly recommended by the International Maritime Organisation. Other measures also should be considered to maintain and improve the standard of the pilotage services.

4. CONCLUSION AND RECOMMENDATIONS

4.1 Aspects of the Proposed Model for the Turkish Straits

There are different aspects of a navigational model for a waterway as technical, legal, organisational aspects. The proposed model in this study has been developped as a result of evaluation of all these aspects within the FSA method.

Existing high standards of the all related aspects of the safe navigation through the Turkish Straits must be maintained such as the rules and regulations, services and organisations, navigational aids, facilities for services. Futher development must be achieved as per the new necessities and demands, considering the changes and development of maritime traffic through the Turkish Straits, local maritime traffic, number, size and types of the vessels, any other change and development with other related subjects.

Inspection and monitoring of all vessels using the Turkish Straits must be achieved as much as applicable, to improve the maritime safety. Vessels without pilots must be considered with the difficulties of monitoring and inspection to ensure an innocent passage through the Turkish Straits. Solutions must be provided to improve the abilities of control the safety of passages through the Turkish Straits.

Utilising the pilotage services must be encouraged with the all means of public relation methods. All necessary measures must be considered to maintain and futher improve the standard of the pilotage services.

4.2 Pilotage as a Key of the Safe Navigation in the Turkish Straits

Considering the legal necessities and nautical characteristics of the Turkish Straits, the outlines of a training module may be developed. The Candidate pilots undertaking the Turkish Straits Maritime Pilots Training Program will be of mature age and will have successfully completed the education, training and practical seagoing experience necessary to be awarded a certificate of competency as an Ocean-going Master for unlimited tonnage and unlimited area. The achievement of that competency implies that candidates have the ability and self-discipline to undertake what is largely a self-directed program of training and the attitude and skills to participate productively in the ‘master/apprentice/authorised pilot’ relationship during their apprenticeship in the Turkish Straits. Therefore within the existing apprenticeship program a guiding syllabus may be proposed to facilitate to follow the necessary topics to ensure to develop of specialist local knowledge of the Turkish Straits.

Being a maritime pilot itself is a matter of constantly learning, updating and reviewing when the term training is generally concerned. This continuous training and upgrading with several practices throughout the professional life develop the higher level, cognitive skills which set the Maritime Pilot apart from the other seafarers on a vessel. A role of the maritime pilots to improve the maritime safety is given within the risk model is shown in the Figure 4.1.

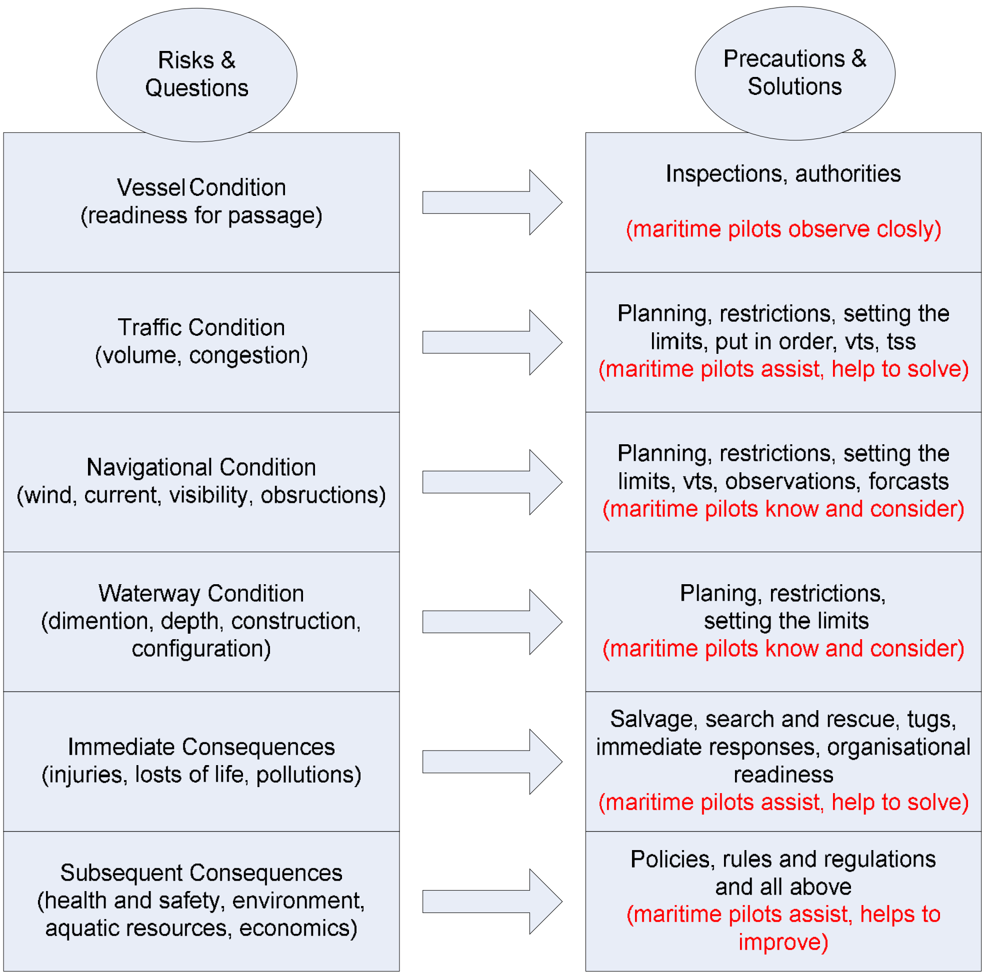

Figure 4.1 : A waterway risk model. Role of the pilots.

Turkish maritime pilots are senior mariners with long tradition and high reputation nationally and internationally. The latest legislation regarding to the competencies of the maritime pilots "Regulations of Competencies, Trainings, Certifications and Working Standards of Maritime Pilots", as promulgated in the Official Gazette no. 26360 of 28 November 2006, upgrades the standards of Maritime Pilots, in many aspects, such as background qualification, training, refreshing the knowledge, evaluation, certifications and upgrading the licences.

The revised Turkish Legislation fulfils all international requirement and recommendations. Turkish legislation and Turkish Maritime Pilots keep higher standards in order to protect human life and environment in many pilotage areas in Turkey, in the Ports in the Black Sea, the Marmara Sea, the Aegean Sea, and the Mediterranean Sea and in the Turkish Straits.

Developing a navigational model for the Turkish Straits should be understood as developing a model for vessels' safe navigation within the Turkish Straits, considering legal, technical, safety, environmental aspects of this passage. A vessel may improve the understanding and positive relationship with all related factors of the safe navigation with a qualified pilotage service easily and effectively as shown in Figure 4.2.

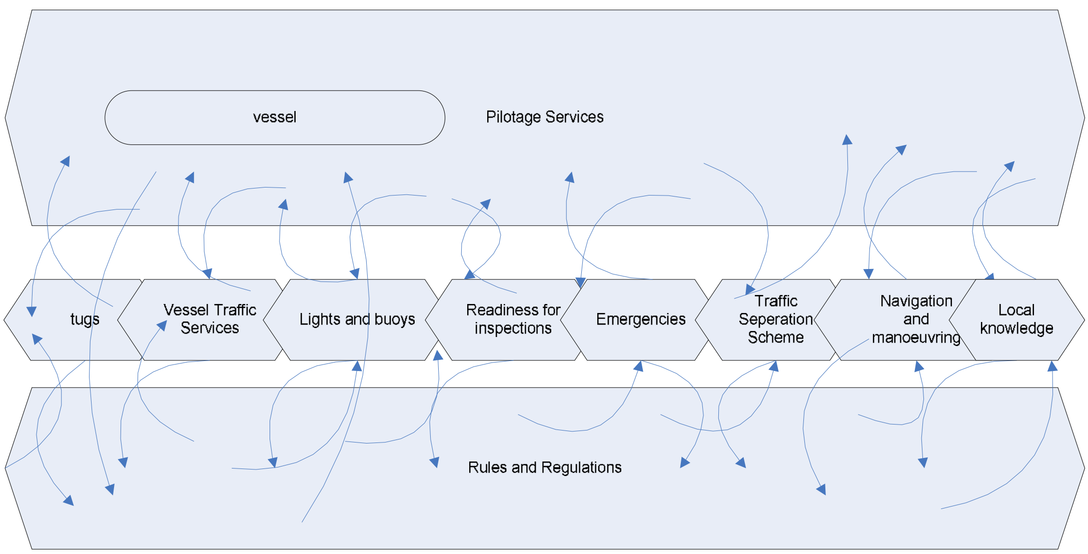

Figure 4.2 : A vessel's relations with many factors through the pilotage.

Turkish Straits are very important and very hazardous waterway. There are many dynamic variables regarding the oceanographic and meteorological factors. Therefore utilising very qualified and professional pilotage service is the best practice and will provide the best navigational model for any vessel passing trough the Turkish Straits.

4.3 Proposed Syllabus for Maritime Pilot's Training for Turkish Straits

Considering the importance of the contribution of the pilotage services to the safety of navigation, to develop the headlines and the main structure of a program of training for the candidate maritime pilots in the Turkish Straits should be useful. The program is based on the related international and national legislation. After determining the legislative foundations by analysing and comparing the current regulations, the legislative requirements have been used as a base to create a syllabus considering the local nautical characteristics of the Turkish Straits.

This syllabus has been developped considering a useful tool during the apprenticeship period. It may be used as a guide to follow or as a aprenticeship record book to fulfill all necessary subjects using the blank spaces which might be kept after each section. It is based on "the syllabus for pilotage certification or licensing" in section 7 of Annex 1 (Recommendation on Training and Certification of Maritime Pilots other than Deep-Sea Pilots) of Resolution A.960(23) (Recommendations on Training and Certification and on Operational Procedures for Maritime Pilots other than Deep-Sea Pilots) which has been adopted on the 5th of December 2003 as agenda item 17 of 23rd session of International Maritime Organisation (IMO) Assembly. In the IMO syllabus, area means the waters for which the applicant is to be certified or licensed. In the "Proposed syllabus for the maritime pilot's training for the Turkish Straits", the area is the Turkish Straits. Each applicant for a pilot certificate or license should demonstrate that he or she has necessary knowledge of the subjects of the IMO syllabus. In this study, a speciliased local version of the IMO syllabus has been developped for the Turkish Straits. This syllabus contains following sections and also its brief outline and its references has been shown in Table 4.1.

Table 4.1: Proposed syllabus for the Turkish Straits maritime pilot's training.

No	Knowledge, understanding and proficiency	Reference
1	Limits of Turkish Straits, (Strait of Istanbul, Sea of Marmara, Strait of Çanakkale, Port of İstanbul, Port of Çanakkale, Limits of Traffic Separation Schemes (TSS))	Res.A.960(23)-Annex/1-7.1.1
2	International Regulations for Preventing Collisions at Sea, 1972 as amended, and also such other national and local navigational safety and pollution prevention rules as may apply in the Turkish Straits, Rule 10, Rule 9 and other related rules.	Res.A.960(23)-Annex/1-7.1.2
3	System of buoyage in the Turkish Straits,	Res.A.960(23)-Annex/1-7.1.3
4	Characteristics of the lights and their angles of visibility and the fog signals, racons and radio beacons and other electronic aids in use in the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.4
5	Names, positions and characteristics of buoys, beacons, structures and other marks in the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.5
6	Names and characteristics of the channels, shoals, headlands and points in the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.6
7	Bridge and similar obstruction limitations including air draughts. (Bridges of Boğaziçi and Fatih Sultan Mehmet, Overhead Electric Power Cables and other natural and artificial obstructions.)	Res.A.960(23)-Annex/1-7.1.7
8	Depths of water throughout the Turkish Straits, including tidal effects and similar factors	Res.A.960(23)-Annex/1-7.1.8
9	General set, rate, rise and duration of the currents and use of the information resources of currents for the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.9
10	Proper courses and distances in the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.10
11	Anchorages in the Turkish Straits. (Emergency anchorage, waiting area, dangerous cargo anchorage)	Res.A.960(23)-Annex/1-7.1.11
12	Ship handling for piloting, anchoring, berthing and unberthing, manoeuvring with and without tugs, and emergency situations. General review of ship handling theory and specific manoeuvrings in the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.12
13	Communications and availability of navigational information. Information resources in the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.13
14	Systems of radio navigational warning broadcasts in the Turkish Straits and the type of information likely to be included;	Res.A.960(23)-Annex/1-7.1.14
15	Traffic separation schemes (TSS), vessel traffic services (VTS) and similar vessel management systems in the Turkish Straits;	Res.A.960(23)-Annex/1-7.1.15
16	Bridge equipment and navigational aids. (Regulations and recent technological developments...)	Res.A.960(23)-Annex/1-7.1.16
17	Use of radar and other electronic devices; their limitations and capabilities as navigation and collision avoidance aids. (Characteristics of radar waves reflection in the Turkish Straits)	Res.A.960(23)-Annex/1-7.1.17
18	Manoeuvring behaviour of the types of ships expected to be piloted and the limitations imposed by particular propulsion and steering systems.	Res.A.960(23)-Annex/1-7.1.18
19	Factors affecting ship performance such as wind, current, tide, channel configuration, water depth, bottom, bank and ship interaction including squat	Res.A.960(23)-Annex/1-7.1.19
20	Use and limitation of various types of tugs	Res.A.960(23)-Annex/1-7.1.20
21	The English language to a standard adequate to enable the pilot to express communications clearly	Res.A.960(23)-Annex/1-7.1.21
22	IMO Standard Marine Communication Phrases	Res.A.960(23)-Annex/1-7.1.22
23	IMO Code for the investigation of marine casualties and incidents	Res.A.960(23)-Annex/1-7.1.23
24	Master-Pilot Relationship, Pilot Card, operational procedures	Res.A.960(23)-Annex/1-7.1.24
25	Pollution prevention; Facilities in the Turkish Straits.	Res.A.960(23)-Annex/1-7.1.25
26	Emergency and contingency plans for the Turkish Straits	Res.A.960(23)-Annex/1-7.1.26
27	Safe embarking and disembarking procedures;	Res.A.960(23)-Annex/1-7.1.27
28	Analysing of local traffic in the Turkish Straits	Res.A.960(23)-Annex/1-7.1.28
29	International and National legislation related to the Turkish Straits, maritime pilots and pilotage	Res.A.960(23)-Annex/1-7.1.28

4.3.1 Limits of Turkish Straits

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the limits of the Turkish Straits, (Strait of Istanbul, Sea of Marmara, Strait of Çanakkale, Port of İstanbul, Port of Çanakkale, Limits of Traffic Separation Schemes (TSS)).

Reference: IMO Resolution A.960(23), Annex 1, 7.1.1: (limits of local pilotage areas;)

Content: Limits of Turkish Straits as defined in reladed National Law, limits of Strait of Istanbul, Sea of Marmara, Strait of Çanakkale, Port of İstanbul, Port of Çanakkale, limits of Traffic Separation Schemes (TSS) and limits of Turkish Straits Vessel Traffic Services (TSVTS) sectores as shown in the Figure 4.3 sould be learned by the candidate/apprentice pilots. All related visual references, nautical chart informations, ECDIS and radar views should be memorised by them, in order to develop a personal skill enable to have continuouse awarness of actual geografical position.

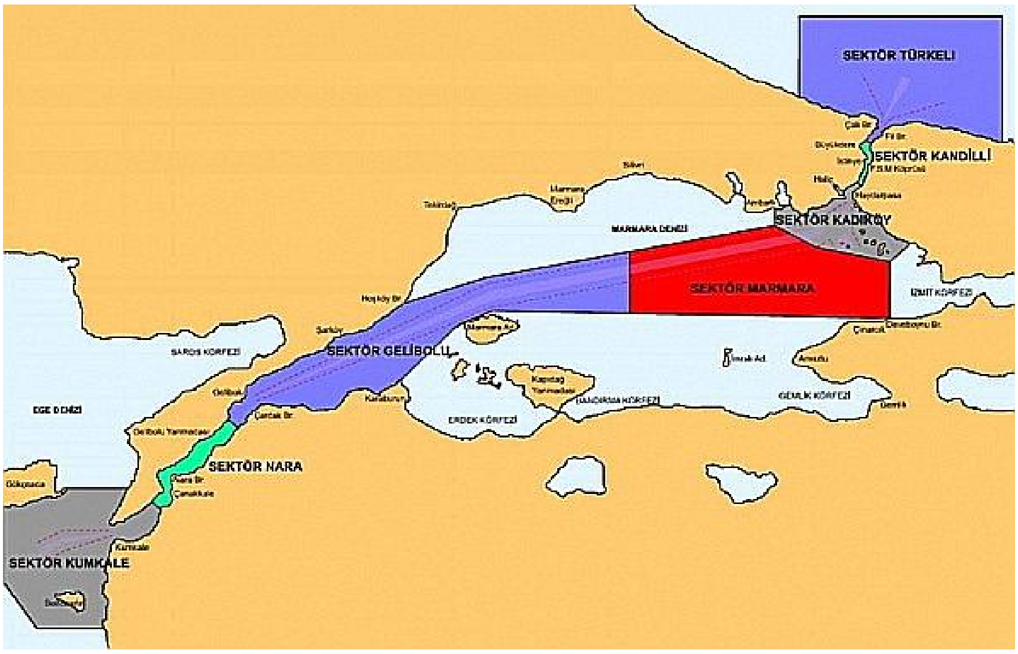

Figure 4.3 : Turkish Straits VTS Sectors (KEGM, 2012).

According to the “Maritime Traffic Regulations for the Turkish Straits” which has been promulgated in the Turkish Official Gazette number 23515 of 6th of November 1998 the “Turkish Straits” means the navigable waters of Marmara Sea, Istanbul and Çanakkale Straits and the coastline surrounding these areas. Northern Limit of the Strait of Istanbul is the line drawn between Anadolu Light and Türkeli Light.

Southern Limit of the Strait of İstanbul is the line drawn between Ahirkapi Light and Kadıköy, İnciburnu Breakwater Light. Northern Limit of the Çanakkale Strait is the meridian passing through Zincirbozan Light. Southern Limit of the Çanakkale Strait is the line drawn between Mehmetçik Light and Kumkale Light.

4.3.2 Collision regulations (COLREGs)

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the “International Regulations for Preventing Collisions at Sea, 1972 (as amended)”, and also such other national and local navigational safety and pollution prevention rules as may apply in the Turkish Straits, Rule 10, Rule 9 and other related rules.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.2: (International Regulations for Preventing Collisions at Sea, 1972 as amended, and also such other national and local navigational safety and pollution prevention rules as may apply in the area;)

Content: The International Regulations for Preventing Collisions at Sea 1972 (COLREGs) are published by the International Maritime Organization (IMO), and set out, among other things, the "rules of the road" or navigation rules to be followed by ships and other vessels at sea in order to prevent collisions between two or more vessels. The COLREGs are derived from a multilateral treaty called the Convention on the International Regulations for Preventing Collisions at Sea which has been adapted on 20 October 1972 (Entry into force: 15 July 1977). The 1972 Convention was designed to update and replace the Collision Regulations of 1960 which were adopted at the same time as the 1960 SOLAS Convention. One of the most important innovations in the 1972 COLREGs was the recognition given to traffic separation schemes. Rule 10 gives guidance in determining safe speed, the risk of collision and the conduct of vessels operating in or near traffic separation schemes. The first such traffic separation scheme was established in the Dover Strait in 1967. It was operated on a voluntary basis at first but in 1971 the IMO Assembly adopted a resolution stating that that observance of all traffic separation schemes be made mandatory and the COLREGs make this obligation clear.

The COLREGs contain rules directly related to the narrow channels, fairways and traffic seperation schemes. Maritime Pilots must have necessary knowledge of these rules and also the entire regulations. Regarding the rules directly related to the narrow channels, fairways and traffic seperation schemes, International Maritime Organisations gives following explanations: “In Rule 9 a vessel proceeding along the course of a narrow channel or fairway is obliged to keep "as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable." The same Rule obliges a vessel of less than 20 metres in length or a sailing vessel not to impede the passage of a vessel "which can safely navigate only within a narrow channel or fairway."

The Rule also forbids ships to cross a narrow channel or fairway "if such crossing impedes the passage of a vessel which can safely navigate only within such channel or fairway." The meaning "not to impede" was classified by an amendment to Rule 8 in 1987. A new paragraph (f) was added, stressing that a vessel which was required not to impede the passage of another vessel should take early action to allow sufficient sea room for the safe passage of the other vessel. Such vessel was obliged to fulfil this obligation also when taking avoiding action in accordance with the steering and sailing rules when risk of collision exists.

Rule 10 of the Collision Regulations deals with the behaviour of vessels in or near traffic separation schemes adopted by the Organization. By regulation 8 of Chapter V (Safety of Navigation) of SOLAS, IMO is recognized as being the only organization competent to deal with international measures concerning the routeing of ships.

The effectiveness of traffic separation schemes can be judged from a study made by the International Association of Institutes of Navigation (IAIN) in 1981. This showed that between 1956 and 1960 there were 60 collisions in the Strait of Dover; twenty years later, following the introduction of traffic separation schemes, this total was cut to only 16.

In other areas where such schemes did not exist the number of collisions rose sharply. New traffic separation schemes are introduced regularly and existing ones are amended when necessary to respond to changed traffic conditions. To enable this to be done as quickly as possible the MSC has been authorized to adopt and amend traffic separation schemes on behalf of the Organization.

Rule 10 states that ships crossing traffic lanes are required to do so "as nearly as practicable at right angles to the general direction of traffic flow." This reduces confusion to other ships as to the crossing vessel's intentions and course and at the same time enables that vessel to cross the lane as quickly as possible.

Fishing vessels "shall not impede the passage of any vessel following a traffic lane" but are not banned from fishing. This is in line with Rule 9 which states that "a vessel engaged in fishing shall not impede the passage of any other vessel navigating within a narrow channel or fairway. "In 1981 the regulations were amended. Two new paragraphs were added to Rule 10 to exempt vessels which are restricted in their ability to manoeuvre “when engaged in an operation for the safety of navigation in a traffic separation scheme” or when engaged in cable laying.

In 1987 the regulations were again amended. It was stressed that Rule 10 applies to traffic separation schemes adopted by the Organization (IMO) and does not relieve any vessel of her obligation under any other rule. It was also to clarify that if a vessel is obliged to cross traffic lanes it should do so as nearly as practicable at right angles to the general direction of the traffic flow. In 1989 Regulation 10 was further amended to clarify the vessels which may use the inshore traffic zone.”

Turkish Straits contain the traffic separation scheme adopted by the International Maritime Organisation (IMO), covering the passage between the Black Sea and the Aegean Sea, which also includes the Marmara Sea. COLREGs Rule 10 applies to the Turkish Straits traffic separation scheme.

4.3.3 System of buoyage

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the system of buoyage in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.3: (system of buoyage in the area;)

Content: As a result of a series of disastrous collisions in the Dover Strait in 1971, the International Association of Lighthouse Authorities (IALA) began implementing two new systems, A and B. Two international systems of buoys were in use globally for navigation. The rules of these were later combined into what is now known as the “IALA maritime buoyage system” which operates in two regions, notably the IALA region A and the IALA region B. Region B covers the whole of the Americas, Japan, South Korea and the Philippines, while the rest of the world belongs to the region A. Region A uses red to mark the port-hand side of a channel when entering with the flood tide, and green for the starboard side. Region B uses green to mark the port-hand side and red for the starboard. The system uses five types of marks: lateral, cardinal, isolated danger, safe water, and special.

Implementation of IALA Maritime Buoyage System Region A (red to port) is substantially complete in the İstanbul Strait, the Çanakkale Strait and the Sea of Marmara. Turkish territorial waters, including the Turkish Straits, are covered by the IALA Region A. In Turkish Straits, both the cardinal system and the lateral system are in use in combination.

Cardinal marks are in use around north of Sütlüce Burnu, around Umuryeri Banks, west of Yeniköy Burnu, off mounth of Göksu river, north of Kızkulesi in the İstanbul Strait, and west of Çardak Bank, west of Dalyan Burnu, west of Nara Burnu, west of Hamidiye Shoal, off Kanlıdere (Kepez) Burnu in the Çanakkale Strait.

Cardinal marks are located to the north, east, south or west of a danger, in the cardinal points of the compass. They each have a distinctive top mark, colour scheme and light sequence. The top marks are logical. North cardinal mark has two black cones pointing up. East cardinal mark has two black cones pointing up and down. South cardinal mark has two black cones pointing down. West cardinal mark has two black cones point to point. If the top marks are missing, the black and yellow stripes are distinctive. The top mark cones point to the black stripe(s). The lights are based on the clock face. The lights can be quick flash or very quick flash, at 15 sec or 10 sec intervals to avoid confusion with marks close together. East cardinal is at 3 o'clock - 3 flashes. South cardinal is at 6 o'clock - 6 flashes - plus a long flash to avoid confusion with a West cardinal. At night it can be difficult to count a large number of flashes, with the waves hiding some. West cardinal is at 9 o'clock - 9 flashes. So if a large number of flashes are seen with no long flash; this is a west cardinal. North cardinal at 12 o'clock, instead of 12 flashes, in order to make it more distinguishable, it is continuous flashing. Therefore a light with a large number of flashes with no dark interval is a north cardinal. As examples, some photographs of cardinal marks in the Turkish Straits, north cardinal buoy in Umuryeri, west cardinal buoy in the north of Kızkulesi, east cardinal mark in the west of Yeniköy Burnu, south cardinal mark in the south of Umuryeri Banks are shown in Figure 4.4.

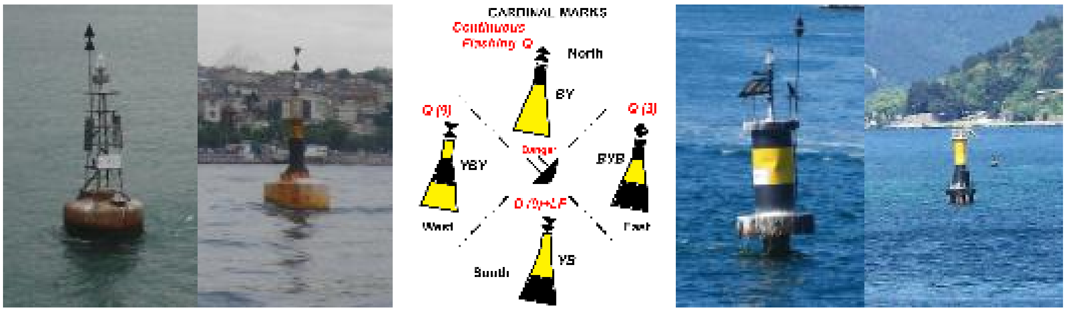

Figure 4.4 : Cardinal marks in the Turkish Straits.

In İstanbul Strait, red is in use to mark the port-hand side of the strait, when entering from Black Sea into the territorial waters (southbound passage). In Çanakkale Strait, red is in use to mark the port-hand side of the strait, when entering from Aegean Sea into the territorial waters (northbound passage). IALA "A" lateral buoyage systems are shown in Figure 4.5.

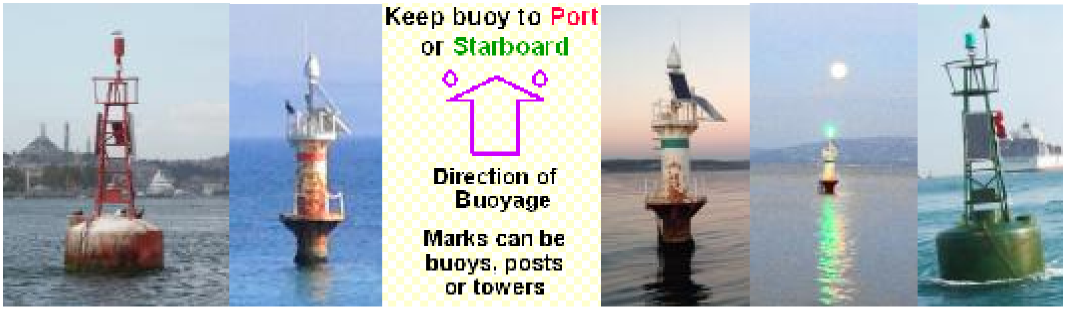

Figure 4.5 : IALA Lateral "A" buoyage system in the Turkish Straits.

4.3.4 Lights, fog signals and electronic aids

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the characteristics of the lights and their angles of visibility and the fog signals, racons and radio beacons and other electronic aids in use in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.4: (characteristics of the lights and their angles of visibility and the fog signals, racons and radio beacons and other electronic aids in use in the area;)

Content: Maritime pilots must be able to utilise all visual, audial and electronic references including the lights, fog signals and electronic navigational aids such as radio beacons. Memorising all of them in their working area and updating the necessary knowledge using the related publications is required for safe navigation. As examples Ahırkapı, Aşiyan and Çengelköy lights are shown in the Figure 4.6.

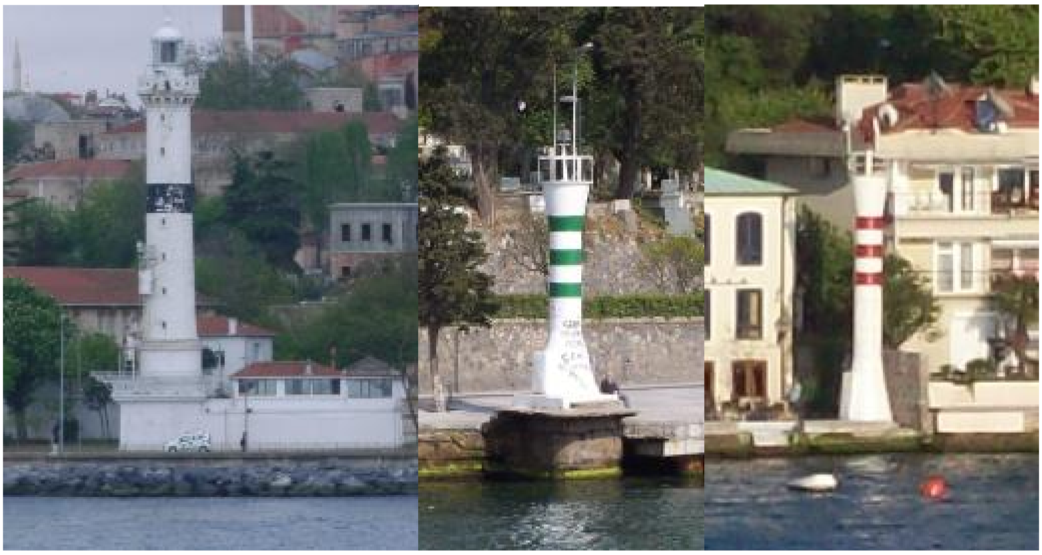

Figure 4.6 : Ahırkapı, Aşiyan, Çengelköy lights.

4.3.5 Buoys, beacons, structures and other marks

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the names, positions and characteristics of buoys, beacons, structures and other marks in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.5: (names, positions and characteristics of the light vessels, buoys, beacons, structures and other marks in the area;)

Content: Maritime pilots must be able to utilise all visual, audial and electronic references including the buoys, beacons, structures and other marks. Memorising all of them in their working area and updating the necessary knowledge using the related publications is required for safe navigation. In the Turkish Straits there are many conspicuous objects. Some of them are also visible at night using its own electric light illumination or with the reflection of the city lights in vicinities. In the Istanbul Strait, Yoros Kalesi (Yoros Fortress), Hidiv Kasrı Kulesi (Hidiv Garden Tower), Fatih Sultan Mehmet Bridge, Anadolu Hisarı (Anadolu Fortress), Rumeli Hisarı (Rumeli Fortress), Çengelköy Kuleli Askeri Lisesi (Kuleli Military High School), Galatasaray Island, Boğaziçi Bridge, Kızkulesi (Maiden Tower), Beyazit Kulesi (Beyazit Fire Control Tower), Topkapı Palace, Many mosques, minarets, ferry landings, seaside houses and many other building are very conspicuous day and night. Also in Çanakkale Strait, Fortresses of Çimenlik and Kilitbahir, ferry landings of Kilitbahir, Çanakkale, Eceabat, Çardak, Lapseki and Gelibolu, several war monuments, Gelibolu Shipyard, Kepez Port, Çanakkale Radio-TV Aerial, many mosques, minarets and other buildings in Çanakkale, Kilitbahir, Eceabat, Çardak, Lapseki, Gelibolu are also very conspicuous.

4.3.6 Channels, shoals, headlands and points

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the names and characteristics of the channels, shoals, headlands and points in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.6: (names and characteristics of the channels, shoals, headlands and points in the area;)

Content: Maritime pilots should know about the names and characteristics of the channels, shoals, headlands and points in their area. Istanbul Strait is also connected to another natural waterway which divides the old city peninsula from northwest part of Istanbul. It is called Haliç. It is also known as Golden Horn. Haliç is a navigable waterway from Eminönü/Karaköy entrance to Eyüp/Kağıthane connecting to Kağıthane Deresi. There are also rivers connected to the Istanbul Strait. Göksu and Küçüksu rivers are between Anadolu Hisarı and Kandilli. Small fishing boats and leisure crafts use Göksu River for berthing. In Çanakkale Strait, Sarıçay is a small river beside the Çimenlik Kalesi. It is navigable by small fishing boats and leisure crafts.

There are islands, banks and shoals in the Turkish Straits. There are five island surrounded with shoals and banks. They are all in İstanbul Strait. From south to north, they are Kızkulesi (Maiden Tower Island), Kuruçeşme Light, Galatasaray Adası, Bebek Light, Dikilikaya Light. Kızkulesi and Galatasaray Island are well known as island, but others are accepted as islands, despite that they are small rocks above the water level. Banks and shoals from south to north along European coast of Istanbul Strait are Ahırkapı Shoals before the south enterence, Sarayburnu Banks, Ortaköy Banks, Kuruçeşme Banks, Galatasaray shoals, Bebek Banks, Baltalimanı, İstinye – Yeniköy (Koybaşı) Banks, Büyükdere Banks, Sarıyer Banks, Dikilikaya Banks, Büyükliman Banks.

Banks from sourh to north along Asian coast of Istanbul Strait are Kızkulesi banks, Anadoluhisarı or Göksu Bank, Paşabahçe Banks, İncirköy Bank, Umur Banks, Acar Bank, Poyraz Banks

Banks and shoals in Çanakkale Strait are mostly along the Asian of the Strait. From south to north Kumkale Banks, Sarısığlar shoals, Nara shoals, Abidos Bank, Musa Bank, Çardak Bank, Zincirbozan Bank are imortant shallow waters areas. Along the European coast before the north entrerance Doğan Aslan sand banks may be dangerous for leasure crafts using the inshore traffic.

Important headlands and points in the İstanbul Strait, from north to south in the European coasts are Türkeli, Garipçe, Çalı Burnu, Karataş Burnu, Telli Tabya, Sarıyer, Büyükdere, Kireçburnu, Tarabya, Yeniköy, İstinye, Emirgan, Baltalimanı, Rumelihisarı, Aşiyan, Bebek, Akıntı Burnu, Arnavutköy, Kuruçeşme, Defterdar Burnu, Ortaköy, Beşiktaş, Kabataş, Küçük Liman, Salı Pazarı, Karaköy, Sarayburnu, Ahırkapı. From south to north in the Asian coast, İnciburnu, Haydarpaşa, Harem, Kızkulesi, Üsküdar, Paşalimanı, Kuzguncuk, Beylerbeyi, Çengelköy, Mehmetçik Burnu, Vaniköy, Kandilli, Küçüksu, Göksu, Anadoluhisarı, Kanlıca, Çubuklu, Paşabahçe, Beykoz, Hünkariskelesi, Selvi Burnu, Umuryeri, Sütlüce, Acar Burnu, Anadolukavağı, Kavak Burnu, Keçilik Koyu, Fil Burnu, Poyrazköy, Çakal Limanı, Anadolufeneri are importants headlands and points.

4.3.7 Bridges and similar obstructions

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the Bridge and similar obstruction limitations including air draughts. (Bridges of Boğaziçi and Fatih Sultan Mehmet, Overhead Electric Power Cables and other natural and artificial obstructions.)

Reference: IMO Resolution A.960(23), Annex 1, 7.1.7: (bridge and similar obstruction limitations including air draughts;)

Content: There are two bridges in the İstanbul Strait and the third one is under construction. There are also overhead electric power cables passing in two different locations. Boğaziçi Bridge has 64 metres heights (clearance from water level) at its vertex point (maximum) and 58 metres safe passage clearance. Fatih Sultan Mehmet Bridge has 67.6 metres maximum clearance from the water level and 64 maters clearance for safe passage. 154 kV Vaniköy-Etiler power cable has 69 metres minimum clearance from the water level. 380 kV Anadolu Kavağı – Rumeli Kavağı overhead power cable has 70 metres minimum clearance from the water level. Vessels with air draft between 54 – 58 metres are subjects of the special passage conditions including two escort tugs to insure safe passage trough the middle of the bridges. There isn't any air draft limitation in the Çanakkale Strait. Bridges in the İstanbul Strait are given in Figure 4.7.

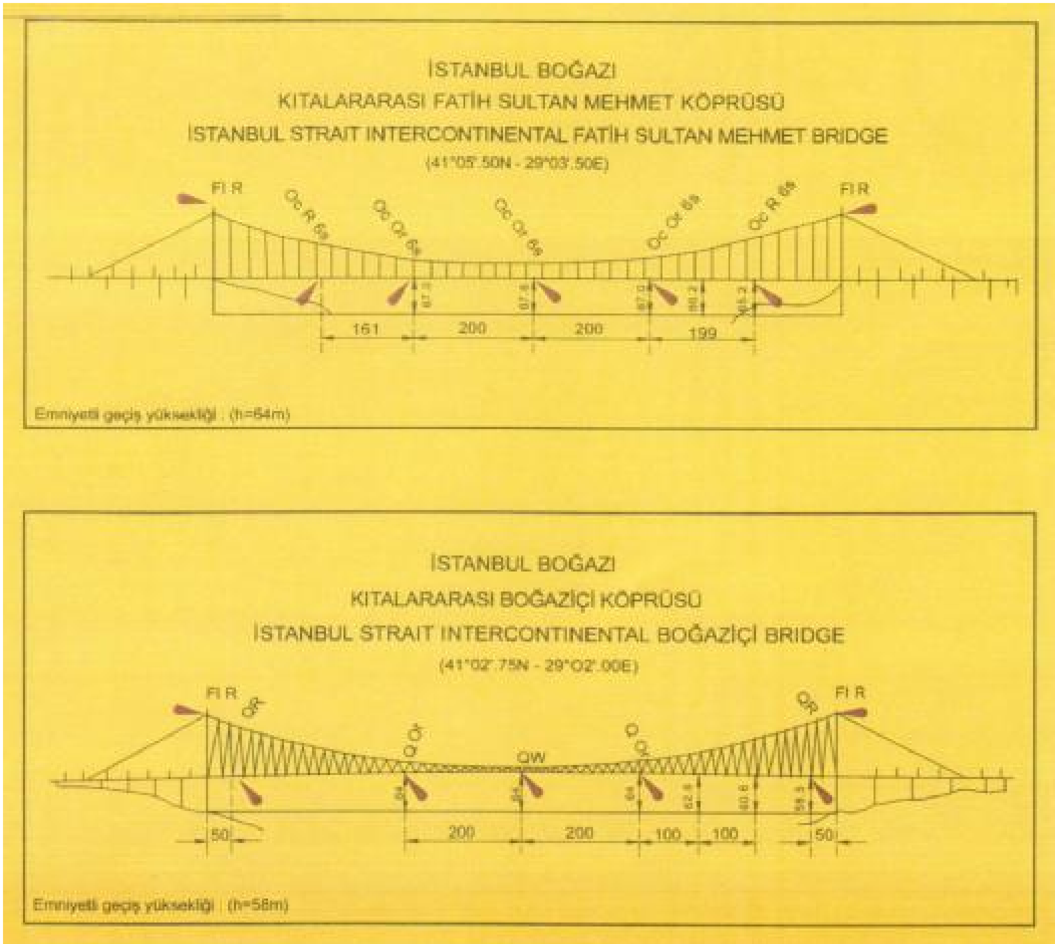

Figure 4.7 : Bridges in İstanbul Straits (SHOD, 2013a).

4.3.8 Depths of water

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the depths of water throughout the Turkish Straits, including tidal effects and similar factors .

Reference: IMO Resolution A.960(23), Annex 1, 7.1.8: (depths of water throughout the area, including tidal effects and similar factors;)

Content: There are sufficient depths of water for most of the types of the vessel in the Turkish Straits. Despite the depth of average 30-60 metres navigable waterway, there are also shoals in the Turkish Straits.

Shallow water and its effects are also very important topics for ship's manoeuvring. Depths in the Turkish Straits in and out of traffic separation schemes (TSS) may be dangerous for navigation depending to the vessel's draughts. In most of the ship-handling resources, a description of the shallow water is given for the practical purposes, mostly mentioned that, a vessel can be considered in a shallow water, if the under keel clearance of that vessel is equal or less than the vessel's draught; in other words, if the depth of the water, where the vessel floats, is equal or less than one and half times of the vessel's draught. Despite this very popular description, shallow water effects don't start suddenly from the sharply precise point. It starts from minimum and it increases gradually. Considerable shallow water effects occur in the water which is equal or less deep then approximately two and half times of vessel's draught. For example a vessel with a draught of ten metres, starts to be exposed to shallow water effects when she is in water of twenty five meters depth; and the shallow water effects increase inversely proportional to the depth of water. For a vessel with same draught given in this example, shallow water effects can be observed in the waters less than 25 metres within the Traffic Separation Scheme in the Istanbul and Çanakkale Straits. When examples are given for Istanbul Strait, from north to south, there are shoals with a depth less than twenty five metres in various positions within the traffic separation scheme, such as off Poyraz Burnu, Fil Burnu, Garipçe Burnu, Çalı Burnu, Selvi Burnu, Aşiyan Burnu, Galatasaray Island, and Haydarpaşa Breakwater. Beside these shoals, it is well known that a vessel may encounter with much more dangerous shoals when she is partly or completely out of traffic separation scheme due to various reasons such as current, wind, traffic conditions, size of the vessel and her manoeuvring characteristics.

Beside all its negative effects, shallow water increases the ship squat. The increased squat reduces the under-keel clearance and it may cause danger of stranding especially with the high navigating speed. When the under-keel clearance of a vessel is considered, there are different values in the static and dynamic conditions. Because a vessel has different draughts when she stays alongside a berth in calm water and when she makes way troughs the water. When a vessel increases her speed through the water she squats and generally gains a trim by head. The squat occurs in deep water. In shallow water, squat is almost two times bigger than its value in deep water.

Depths and shoals in the Turkish Straits are always very well known by the Turkish Straits Maritime Pilots, and they must always be considered as important part of the initial training.

4.3.9 Currents

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the General set, drift and duration of the currents and use of the information resources of currents for the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.9: (general set, rate, rise and duration of the tides and use of the tide tables and real-time and current data systems, if available, for the area;)

Content: In the Turkish Straits, the main cause of the current is the difference in density between the Aegean Sea and the Black Sea. The surface current is the consequence of the difference in level between these two seas, and can reach up to 8 knots. There are counter currents, eddies and counter deep currents below the surface currents.

When the surface current in the Strait of Istanbul exceeds 4 knots, or northerly currents are caused by Southerly winds, vessels with a manoeuvring speed of 8 knots or less are in critical situation. If these vessels can not proceed with at least 4 knots ground speed, they are not permitted to enter the Strait of Istanbul unless having an escort tug as per rules. Otherwise they have to wait until current speed is decreased. Between the south entrance of the Strait of Istanbul and Kandilli Burnu the current runs mainly on the South East side of the Strait. The North West side of the Strait from Haliç to Akıntı Burnu is occupied by eddies. Between Kandilli Burnu and Selvi Burnu the current normally occupies the whole navigable width of the Strait, except eddies between İstinye and Yeniköy. The current through the remainder of the Strait generally occupies the middle of the Strait and reaches rates of 1 to 1.5 knots.

In the Strait of Çanakkale also, vessels with speed of less than 4 knots, are not to enter the Strait, but wait for the current speed to diminish. Vessels with speed of less than 4 knots must use an escort tug for the passage through the both Straits. At the entrance to the Strait of Çanakkale, the West South West current occupies the full width of the Strait. The average rate is 1.5 knots, but can reach 3 knots on the South East side. From Kumkale Burnu to Nara Geçidi the current lies nearer to the North West side, following at a rate of 2.5 to 3 knots (apart from the vicinity of Kepez Burnu where the current fills the width of the Strait). The higher rate is usually found in the approaches to Nara Geçidi. Throughout Nara Geçidi the currents generally fill the width of the Strait. The current is generally weaker in the middle than at the sides. Off Nara Burnu the current sets West South West across the bank and occupies the width of the Strait. From Nara Geçidi to Gelibolu Geçidi the current is strongest along the North West coast where it reaches a rate of approximately 1.5 knots. At Gelibolu Geçidi the current normally runs at a rate of 1 to 1.5 knots and is strongest in the middle of the channel. Currents through the Sea of Marmara generally run South Westerly along the line of the traffic separation scheme.

Currents, counter-currents, eddies and Orkoz (strong northbound current reaching the halfway of the strait, resulted by strong and continuous south-westerly wind. It makes eddies and confusing waters where it meets with southbound current) are important factors to be always considered for the safety of navigation. Therefore maritime pilot training must include all necessary detailed information related the currents in Turkish Straits.

4.3.10 Courses and distances

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the proper courses and distances in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.10: (proper courses and distances in the area;)

Content: Maritime pilots must have necessary knowledge about the proper courses and distances in the area. They have to know by heart including with all necessary visual references. As a result of several practices all pilots knows accurately and continuously his/her ship's position easily using several visual references, from that position can easily find the proper and accurate course or courses within the safety margins. As they know the proper distances and considering the speed, they can always estimate very accurately time to go to any position within the working area.

4.3.11 Anchorages

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the anchorages in the Turkish Straits. (Emergency anchorage, waiting area, dangerous cargo anchorage)

Reference: IMO Resolution A.960(23), Annex 1, 7.1.11: (anchorages in the area;)

Content: Anchorages for the Turkish Straits are defined as follows:

İstanbul Strait north entrance anchorages (off Kumköy):

A – Dangerous cargo anchorage: 1. 41°15'.40N/028°57'.45E,

2. 41°17'.50N/028°57'.45E, 3. 41°17'.50N/029°00'.00E, 4. 41°14'.90N/029°00'.00E.

B – Passenger and dry cargo anchorage:1. 41°14'.90N/029°00'.00E,

2. 41°17'.50N/029°00'.00E, 3. 41°17'.50N/029°02'.37E, 4. 41°15'.90N/029°05'.00E,

5. 41°15'.00N/029°05'.00E.

İstanbul Strait south entrance anchorages (off Ahırkapı – Yeşilköy):

A – Anchorage for ships waiting for port (Pilot is compulsory for the vessels anchoring and leaving from this anchorage):1. 41°00'.40N/028°59'.15E,

2. 40°59'.39N/028°58'.60E, 3. 40°58'.15N/028°56'.50E, 4. 41°00'.15N/028°56'.50E.

B – Passenger and dry cargo anchorage: 1. 41°00'.15N/028°56'.50E,

2. 40°58'.15N/028°56'.50E, 3. 40°56'.82N/028°53'.50E, 4. 40°58'.92N/028°53'.50E.

C – Dangerous cargo anchorage: 1. 40°58'.92N/028°53'.50E,

2. 40°56'.82N/028°53'.50E, 3. 40°56'.12N/028°51'.95E, 4. 40°55'.88N/028°50'.00E, 5. 40°57'.48N/028°50'.00E.

D – Quarantine anchorage: 1. 40°57'.54N/028°48'.70E, 2. 40°56'.10N/028°48'.70E, 3. 40°56'.40N/028°47'.40E, 4. 40°58'.23N/028°47'.40E.

Photographs of a radar view and part of the nautical chart of the İstanbul Strait south entrance anchorages (off Ahırkapı – Yeşilköy) are shown in the Figure 4.8.

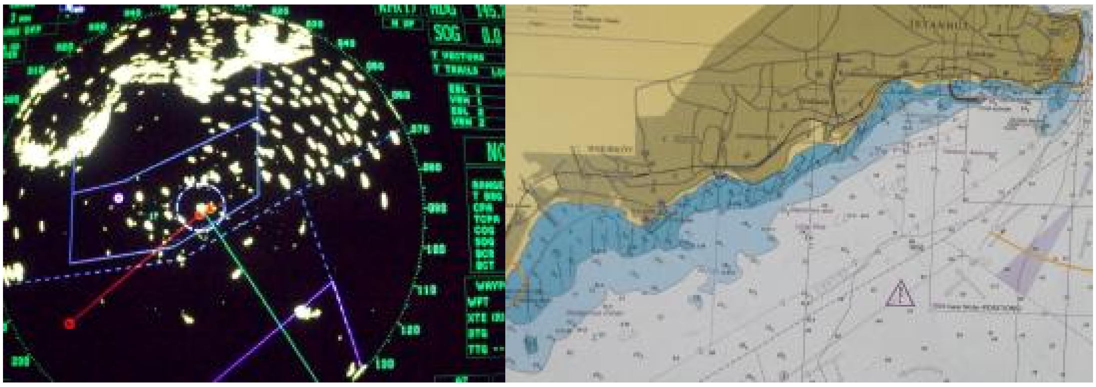

Figure 4.8 : İstanbul Strait south anchorages, chart from (SHOD, 2013a).

Çanakkale Strait north entrance anchorages (off Şarköy – Koruköy)

A – Dangerous cargo anchorage

1. 40°37'.55N/027°10'.00E, 2. 40°36'.45N/027°10'.00E, 3. 40°32'.65N/027°00'.00E

4. 40°33'.42N/026°59'.80E.

Photographs of a tanker at anchor and part of the nautical chart from SHOD (2013a) of the Çanakkale Strait north entrance dangerous cargo anchorage are shown in the Figure 4.9.

Figure 4.9 : Çanakkale Strait, north anchorage, chart from (SHOD, 2013a).

B – Passenger and Dry Cargo Anchorage: 1. 40°33'.42N/026°59'.80E,

2. 40°32'.65N/027°00'.00E, 3. 40°30'.00N/026°53'.00E, 4. 40°31'.30N/026°52'.40E.

Çanakkale Strait Inner Anchorage (Karanlık Liman) (Pilot is compulsory for the vessels anchoring and leaving from this anchorage): 1. 40°00'.90N/026°15'.10E,

2. 40°01'.70N/026°17'.40E, 3. 40°03'.07N/026°18'.95E, 4. 40°02'.55N/026°19'.80E, 5. 40°01'.40N/026°18'.75E, 6. 40°00'.30N/026°15'.20E.

Çanakkale Strait South Entrance Anchorages (Southwest and south of Bozcaada):

A – Dangerous Cargo Anchorage: 1. 39°49'.17N/026°00'.00E,

2. 39°46'.00N/025°57'.40E, 3. 39°46'.90N/025°55'.30E, 4. 39°50'.45N/025°53'.40E, 5. 39°54'.15N/025°57'.80E, 6. 39°52'.75N/026°00'.00E, 7. 39°50'.40N/025°57'.90E.

B – Passenger and Dry Cargo Anchorage: 1. 39°48'.10N/026°04'.97E,

2. 39°44'.00N/026°01'.90E, 3. 39°46'.00N/025°57'.40E, 4. 39°49'.17N/026°00'.00E

4.3.12 Shiphandling

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the shiphandling for piloting, anchoring, berthing and unberthing, manoeuvring with and without tugs, and emergency situations. General review of shiphandling theory and specific manoeuvrings in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.12: (shiphandling for piloting, anchoring, berthing and unberthing, manoeuvring with and without tugs, and emergency situations;)

Content: Every candidate pilot should have necessary knowledge of the effects of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances, the effects of wind and current on ship handling, manoeuvres and procedures for emergencies situations, squat, shallow-water and similar effects, proper procedures for anchoring and mooring, handling ship in restricted waters, having regard to the effects of current, wind and restricted water on helm response, application of constant rate-of-turn techniques, manoeuvring in shallow water, including the reduction in under-keel clearance caused by squat, rolling and pitching, interaction between passing ships and between own ship and nearby banks (canal effect), berthing and unberthing under various conditions of wind, tide and current with and without tugs, ship and tug interaction, use of propulsion and manoeuvring systems, choice of anchorage; anchoring with one or two anchors in limited anchorages and factors involved in determining the length of anchor cable to be used, dragging anchor; clearing fouled anchors, towing operations, ability to determine the manoeuvring and propulsion characteristics of common types of ships, with special reference to stopping distances and turning circles at various draughts and speeds and any additional manoeuvring skill which is especialy required for the pilotage area.

Ship handling is accepted as an art. There is no known method to predict exactly the manner in which a ship will react in a given situation. These predictions can only be made in general terms because the forces which act on the ship vary at any given moment. The best method of describing the procedure of ship handling procedure is to analyse the forces which can affect the ship and understand the types of forces to be encountered, where they will be encountered, and how to counteract, negate or employ them.

The forces which act on a ship can be classified into three basic categories. They are controllable forces, semi-controllable forces and uncontrollable forces. Controllable forces are those that can be regulated by the ship handler's own action. They are engine, propeller, rudder, bow thrusters, anchors, moorings, tugs. Semi-controllable forces are those that result from the ship's speed and location, with respect to bottom and sides of a given body of water. The ship handler can regulate them by proper and timely use of the controllable forces at his disposal. They are effects of shallow waters, narrow waters, interaction between vessels. Uncontrollable forces are those defined as the forces of nature. These cannot be regulated, but must either be compensated for, or employed to advantage by the ship handler. They are wind, current and waves. To have proper controllable forces is very important, in narrow channels with strong current and wind effect, and with many sharp turns like Turkish Straits. Therefore we will emphasise about the ship’s equipment and manoeuvrability of the different types of vessels.

The most fundamental ship maneuver is the turning maneuver. The response of the ship to rudder deflection, and the resulting forces and moments produced by the rudder, can be divided into two parts. The firt one is an initial transient in which significant surge, sway, and yaw accelerations occur. The second one is a steady turning phase in which rate of turn and forward speed are constant and the path of the ship is circular.

Generally, the turning path of a ship is characterized by four measures: advance, transfer, tactical diameter, and steady turning radius. The figure also shows the position of the so called pivot point in a steady turn. This point is of interest because to an observer aboard a turning ship it appears as if the ship were pivoting about a point usually somewhat aft of the bow and foreward of amidships. In Turkish Straits due to hevy local traffic and strong current use of rudder is based on the continouse observation of the vessel’s beheviour. It means the navigator must observe the situation and to increase, or to ease, or to meet the rudder.

4.3.13 Navigational information

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the communications and availability of navigational information. Information resources in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.13: (communications and availability of navigational information;)

Content: every candidate pilot should learn all necessary VHF working channels with port authorities, local traffic elements, Vessel Traffic Services (VTS) VHF channels, communication ability with chief pilot and other colleagues, necessary contact details with pilotage organisation, necessary contact details with public health, security, safety and other emergencies, contact details of other information resources.

4.3.14 Radio navigational warning broadcasts

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the systems of radio navigational warning broadcasts in the Turkish Straits and the type of information likely to be included;

Reference: IMO Resolution A.960(23), Annex 1, 7.1.14: (systems of radio navigational warning broadcasts in the area and the type of information likely to be included;)

Content: Candidate pilots should be aware about the radio navigational warning broadcasts and type of information about the Turkish Straits.

4.3.15 Traffic separation schemes (TSS) and vessel traffic services (VTS)

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the traffic separation schemes (TSS), vessel traffic services (VTS) and similar vessel management systems in the Turkish Straits; A 23/Res.960- 7.1.15.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.15: (traffic separation schemes, vessel traffic services and similar vessel management systems in the area;)

Content: There is a traffic separation system (TSS) in the entire Turkish Straits, including İstanbul Strait, Marmara Sea and Çanakkale Strait. COLREGs Rule 10 is in force. The maritime pilots, who are authorised for the Turkish Straits utilise all existing navigational aids and technological means in order to improve safety of navigation. They work also utilising of full support of one of the latest and most developed Vessel Traffic Services of the world. The Turkish Straits VTS has been established in accordance with related national and international legislation in order to improve the safety of navigation, protection of life, environment, and property in the Turkish Straits by using the latest technology. Marine Traffic in the TSVTS is monitored by using Radar, ENC, AIS, CCTV and VHF equipment such as VHF R/T, DSC and DF. İstanbul and Çanakkale VTS Centres are shown in the Figure 4.10.

Figure 4.10 : İstanbul and Çanakkale VTS Centres.

Turkish Straits maritime pilots provide high quality pilotage services to the vessels passing trough the Turkish Straits or calling the ports of İstanbul, Çanakkale and Gelibolu in the Turkish Straits area. The Turkish Straits Pilots work with full support and cooperation of the TSVTS operators. They also fully cooperate with the TSVTS operators. Therefore candidate pilots should learn all related legislation, procedures, reporting system etc. for the TSVTS. The candidate pilot training programme also includes TSVTS training at the TSVTS Centres. Apprentice Pilots during their apprenticeship are assigned ten working days, to observe the structure and functions of the VTS in the related VTS centre. Practical training programme includes the reporting system, the sectors and corresponding VHF/RT working channels in the İstanbul and Çanakkale Straits, the sector limits, all services provided by the TSVTS such as information service, navigational assistance service, traffic organization service, and all procedures for ships. Training place is the İstanbul TSVTS Centre for the apprentice pilots for Strait of İstanbul and Port of İstanbul and the Çanakkale TSVTS Centre for the apprentice pilots for Strait of Çanakkale and Port of Çanakkale.

The Turkish Straits VTS has been established in accordance with applicable national laws and international rules and regulations in order to improve the safety of navigation, protection of life, environment, and property in the Turkish Straits by using the latest technology. This User's Guide has been prepared to provide information related to the services provided, needed by the participant vessels that are navigating in the Turkish Straits. This User's Guide aims to be used together with the Turkish Straits Maritime Traffic Regulations, as promulgated in the Official Gazette no.23515 of 6 November 1998.

The TSVTS, prepared taking into account related IALA resolutions and recommendations and in compliance with IMO Resolutions A.857(20) and A.827(19) provides the Information Service, Navigational Assistance Service and Traffic Organization Service.

The TSVTS covers, from north to south, the Türkeli, Kandilli, Kadıköy, Marmara, Gelibolu, Nara and Kumkale Sectors. The İstanbul Strait, The Çanakkale Strait and the Marmara Sea area are covered so that the entire area of the Turkish Straits is included in the TSVTS service area. Vessels carrying dangerous cargo and vessels 20 meters in length or over, whether in stopover or non-stopover passage through the Turkish Straits, for whatever purpose, shall be designated as "Active Participant" vessels within the TSVTS area and it is strongly recommended that Active Participant vessels comply with all the requirements of TUBRAP. Vessels less than 20 meters in length and local traffic vessels within the TSVTS area, for whatever purpose, shall be designated as "Passive Participant" vessels. Passive participants are not required to participate in TUBRAP. However, VHF frequency of the sector should be monitored at all times and all messages given by the TSVTS should be followed within the TSVTS Area. Within the TSVTS system, an ENC, prepared based upon WGS 84 datum, is in service. Participants using charts of a different datum should make the necessary datum corrections for the positions given by the TSVTS in latitudes and longitudes.

All vessels which will pass through the Turkish Straits should advise their arrival details (SP1 report) at least 48 hours prior to arrival to the first Turkish Strait at each way (Çanakkale or İstanbul). According to Turkish Straits Reporting System (TUBRAP), arrival details should be reported in below format and all reports should be sent to agents.

A- Vessel's Name / Flag / Call Sign / IMO No / MMSI No
B- Date / Time (UTC) (Reporting Date / Time)
C- Reporting Position
F- Continuous Maneuvering And Sea Speed
G- Port Of Departure
H- Date / Time And Point Of Entry Into Traffic Separation Scheme
I- Port Of Destination
J- Pilot Requirements
O- Fwd / Aft Drafts And Air Draft
P- Cargo (Type And Quantity Of Cargo)
Q- Defect / Damage / Deficiencies / Other Limitations
R- Description Of Dangerous, Nuclear and Pollutant Goods (UN No / Name / Class / Quantity)
T- Ship's agent
U- Ship's type
W- Total crew on board
X- P and I Information (P&I Club Name / Policy Number / Validity)
and Copies of Vessel' s P&I Certificates (All Pages)
bunkers on arrival at entrance fueloil.....mt / gasoil.....mt / luboil.....mt

Vessels sailing through the Strait of Istanbul in compliance with the traffic separation scheme shall pay attention to warning lights of the bridges regarding sailing safety. Vessels with an air draught of 58 metres or more may not pass through the Strait of Istanbul. Vessels with an air draught of 54-58 metres shall be accompanied by tug boat(s), the number and force of which will be determined by the Administration; to ensure they keep their course.

There is no definite L.O.A. and/or draught restriction determined by the administration, however; vessels 150-200 metres in length and/or whose draught is between 10-15 metres shall submit SP1 reports to the VTS Centre, at least 24 hours before entering the Turkish Straits. Vessels 200-300 metres in length and/or with a draught of in excess of 15 metres shall submit SP1 reports at least 48 hrs before entering the Turkish Straits. For vessels in excess of 300 metres in length, the owner/operator must provide the administration with the information on the vessel and its cargo at the planning phase of the journey. Based on such information, the VTS Centre, and - if necessary - the Administration, shall inform the vessel's owner/operator/captain of any requirements and recommendations to ensure the vessel’s safe passage through the Turkish Straits. In doing so, all vessel specifications, including dimensions and manoeuvring capabilities, as well as the morphological and physical structure of the Turkish Straits and the season shall be taken into account. Safety of life, property, the environment and maritime will also be considerations. Vessels fulfilling the conditions of passage must submit their SP1 report at least 72 hrs in advance.

Measures shall be taken by the VTS Centre to ensure safe passage for the vessels mentioned above. For vessels carrying dangerous cargo, the rule to navigate within the traffic separation lanes in a certain area may be suspended, if and when deemed necessary. When a vessel carrying dangerous cargo, with the characteristics described in Regulations, enters the Strait of Istanbul, no other vessel with the same characteristics is permitted to enter the Straits, until the first vessel has passed the Boğaziçi Bridge (when entering from the north) or Hamsi Burnu - Fil Burnu line (when entering from the south). In the Strait of Çanakkale, this ruling applies until the first vessel has left the Nara Burnu region. It is recommended that the passage of vessels in excess of 200 metres in length, or with a draught of 15 metres of more, take place during day-time. When the surface current speeds in the Straits of Istanbul or Çanakkale exceed 4 knots, or when northerly surface currents are caused by southerly winds, vessels carrying dangerous cargo, large vessels and deep draught vessels with a speed of 10 knots or less, may not enter the straits. They will be required to wait until current speeds have dropped to 4 knots or less, or northerly currents have ceased. Other vessels, however, may transit by obtaining the tugboat(s) necessary as determined by the VTS Centre, in accordance with their tonnage.

When the surface current speeds in the Straits of İstanbul and Çanakkale exceed 6 knots, or when strong northerly currents are caused by southerly winds, vessels carrying dangerous cargo, large vessels and deep draught vessels (regardless of their speed) will not be permitted to enter the Strait. They will be required to wait until current speeds are less than 6 knots or the strong northerly currents have ceased. The administration shall notify vessels and the relevant authorities of the conditions of the currents. When the current speed or pattern reverts to normal, the VTS Centre shall inform vessels and the relevant authorities of the order of vessels' passage through the Straits. This shall be established according to the Turkish Straits reporting system and according to the types of vessels in order to speed up the flow of traffic.

When visibility is 2 nautical miles or less, anywhere in the Straits, transiting vessels passing will keep their radars turned on constantly to provide radar reading. On vessels with two radars, one will be assigned for the pilot's use. When visibility is 1 nautical mile or less anywhere in the Straits, maritime traffic will be open in the appropriate direction and closed in the opposite direction. In the meantime, vessels carrying dangerous cargo, large vessels and deep draught vessels shall not enter the Straits. When visibility anywhere in the Strait is less than 0.5 nautical mile, traffic will be suspended in both directions. When visibility in the straits is suitable for navigation, the VTS Centre shall inform vessels and the relevant authorities of the order of vessels' passage through the Straits. This shall be established according to the Turkish Straits reporting system and according to the types of vessels in order to speed up the flow of traffic.

4.3.16 Bridge equipment and navigational aids

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the bridge equipment and navigational aids. (Regulations and recent technological developments...)

Reference: IMO Resolution A.960(23), Annex 1, 7.1.16: (bridge equipment and navigational aids;)

Content: Vessel must be equipped with all necessary bridge Equipment and navigational aids as per related rules and regulation. Maritime pilots also must be familiar and have updated information and knowledge about the bridge equipment and navigational aids. Pilotage organisation should provide necessary training about the new regulations and recent technological developments.

In Turkish Straits during the passage Bridge Team must be ready for hand steering. A sreering wheel (helm) and rudder indicator and a rate of turn indicator are shown in the Figure 4.11.

Figure 4.11 : Helm, rudder and rate of turn indicators.

Engines must be ready all the time to increase or reduce the engine speed or stop if necessary. Engine telegraph, RPM indicator, RPM nameplate and bow thruster control are shown in the Figure 4.12.

Figure 4.12 : Engines’ controls and indicators.

Vessels must be ready for emergency anchorage. Both anchors must be kept standby during the passage. emergency steering must be kept ready to use. Forcastle deck (beside anchor windlass) and Steering room must be manned with proper communication between bridge. Magnetic and gyro compasses must be in good working condition. A gyro compass reapeter and magnetic compasses are shown in the Figure 4.13.

Figure 4.13 : Gyro and magnetic compasses.

Ship's whistle and aldis lamp must be in good working condition and they must be kept ready during the passage. A ship's whistle button, an aldis lamp and a mors signal key are shown in the Figure 4.14.

Figure 4.14 : Whistle, aldis lamp and mors key.

Automatic Identefication System (AIS) receiver and AIS pilot plug are very important to identify and understand their manoeuvring of the vessels in vicinitiy. GPS receivers are very essential for navigation and most of other navigational devices and equipments are depending to them. An AIS receiver, an AIS pilot plug and a GPS receiver are shown in Figure 4.15.

Figure 4.15 : AIS receiver, socket for pilot plug, GPS receiver.

Bridge team must be ready to use all navigational equipment, communication equipment, logs and indicators, lights and day shapes and all normally required equipment during navigation an also specially in congested waters. All related equipment must be kept ready. During the navigation in the vicinity of shoals and shallow waters such as the Turkish Straits, echo sounder is very important navigational equipment. Speed log is also very information resource for navigation and manoeuvring. Echo sounders and speed logs are shown in the Figure 4.16.

Figure 4.16 : Echo sounders and speed logs.

VHF redios are very important for the navigation in the Turkish Straits. Vessels must listen sector channels and pilot channels as necessary. Navtex is also important to receive navigational warnings. VHF radios and navtex receivers in the navigational bridge are shown in the Figure 4.17.

Figure 4.17 : VHF radios and navtex receivers.

Anemometre is an important equipment to monitor winds speed and direction. Clinometre shows vessels's list and monitors her rolling. An anemometre, a clinometre and a barograph are shown in the Figure 4.18.

Figure 4.18 : Anemometre, clinometre, barograph.

4.3.17 Use of radar and other electronic devices

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the use of radar and other electronic devices; their limitations and capabilities as navigation and collision avoidance aids. (Characteristics of radar waves reflection in the Turkish Straits)

Reference: IMO Resolution A.960(23), Annex 1, 7.1.17: (use of radar and other electronic devices; their limitations and capabilities as navigation and collision avoidance aids;)

Content: Radar is very important collision avoidance device in all visibility condition; but it is vital in restricted visibility. In the Turkish Straits depending meteorological factors, especially in February, March, April and May, restricted visibility, including very dense fog, may occur. An ARPA Radar in use in the navigational bridge of a nortbound vessel in the İstanbul Strait, approaching to the Boğaziçi Bridge, after the Kızkulesi turn, shown in the Figure 4.19.

Figure 4.19 : An ARPA radar.

As per local regulations, vessels must provide one of the ship's radars, in good working condition, for the pilot's use. Therefore maritime pilots in the Turkish Straits must be familiar to use and operate radars. Pilots must be familiar also to complete the entire passages using only radar view, in zero visibility condition.

4.3.18 Manoeuvring behaviour of the types of ships

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the manoeuvring behaviour of the types of ships expected to be piloted and the limitations imposed by particular propulsion and steering systems.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.18: (manoeuvring behaviour of the types of ships expected to be piloted and the limitations imposed by particular propulsion and steering systems;)

Content: Almost all types of vessels including cruisers, coasters, tankers, bulkers, fishing boats, general cargo ships, container vessels, reefers, LNG carriers, LPG carriers, navy ships, live stock carrier and some other types of ships of different sizes and tonnages, from small yachts to very large tankers or bulk carriers, also towing systems such as oil platforms are expected to be piloted in the Turkish Straits. Pilots must be able to estimate manoeuvring behaviour of these vessels. Pilots must be aware also the limitations imposed by particular propulsion and steering systems. Beside the theorical knowledge about propulsion and steering systems and other effects such as inertia of large vessels, practicing the ship handling and manoeuvring as much as different types of vessels will improve the awerness during the apprenticeship period and along the proffession.

4.3.19 Factors affecting ship performance

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the factors affecting ship performance such as wind, current, tide, channel configuration, water depth, bottom, bank and ship interaction including squat

Reference: IMO Resolution A.960(23), Annex 1, 7.1.19: (factors affecting ship performance such as wind, current, tide, channel configuration, water depth, bottom, bank and ship interaction including squat;)

Content: Winds from the North and North East are the most frequent in the Strait of Istanbul and also in the Strait of Çanakkale. These winds are most persistent from June to September. From October to March winds are generally between the South East and West. These winds are often strong and squally and can occasionally reach gale force. When winds are light they are frequently accompanied by fog. The winds in the Sea of Marmara are generally from the North East. Winds are very important factors to be considered for the safety of navigation. Winds are also effecting the direction and speed of the currents in the Turkish Straits. Maritime Pilots must always develop their expertise and to keep themselves with the updated information about the weather condition of their pilotage area.

The Turkish Straits consisting of Istanbul Strait, Çanakkale Strait and the Marmara Sea; is the unique waterway between the Black Sea and the Mediterranean Sea. Beside this strategic aspect, the Turkish Straits are known as a difficult and hazardous waterway. Considering the existing traffic separation scheme in the Turkish Straits, for smaller and the suitable size of ships; navigating safely in its own traffic lane should be, for sure, much easier and less hazardous, if the same "Traffic Separation Scheme" (TSS) is established in the different area, which doesn't contain any of the shoals, banks and strong currents, other then Turkish Straits. But both of the Straits, Istanbul and Çanakkale are formed with the shallow and narrow waters, in relation to the sizes of the passing ships. On the other hand, there are also considerably strong currents, with the different set and drift at the middle and sides of the waterway, and also at the surface, bottom and between, which also vary behind the capes, in the bays, near the bends and banks. In the Turkish Straits, the variable regime of the currents isn't resulted from only its oceanographic form. Weather conditions, winds, barometric changes and also many seasonal changes in the Black Sea, Sea of Marmara and Aegean Sea are effective for the currents in this area directly or indirectly. For these reasons, the hazards and the difficulties of the Turkish Straits for the passing ships are always presented since old ages until today, from the mythological legends, to most recently updated scientific data. Despite all the positive improvements related to the navigational safety, which are obtained as the result of the application of developing maritime technologies during the history, Ships which are getting bigger and bigger in size and in tonnage, and also increasing number of passage by ships and complicated maritime traffic are forcing the limits of all other restricted waterways and especially Turkish Straits.

Like many other restricted waterways, another very important hydrodynamic circumstance may be encountered in the Turkish Straits is narrow water effect, in other words bank effect. It occurs as cushion effect near the bow, and suction effect near the stern, when the vessel navigates close to a bank. Bank effect pushes the fore part of the vessel away from the bank and pulls the aft part close to the bank. As the result of both, cushion and suction effects, vessel moves crosswise to the waterway, unless her heading is maintained by steering and using sufficient helm towards the bank. Bank effect occurs much stronger due to the high speed of vessel through the water, her dipper draught and also shallow water in the waterway. Bank effect may be observed when passing closely to Kandilli Burnu, Akıntı Burnu, Aşiyan Burnu and many other points where the depths are permitting to vessels to pass very near. Eliminating the bank effect requires very special techniques using the rudders in order to keep the vessel on the planned route. Local knowledge is the key factor to estimate bank effects in several positions of the Turkish Straits.

Navigating in the Turkish Straits require many course alterations and most of them are sharp turns with the considerable angles. Planning a turn in the Turkish Straits, considering strong currents and all above mentioned factors, is very important part of the safe navigation. Planning and executing course alterations within the sharp bends of the Turkish Straits is also very important part of the local knowledge of maritime pilots working in this pilotage area. Therefore it should be included in the maritime pilot training for candidate pilots and also as a review topic for refreshment trainings.

There are also other natural and artificial obstructions limiting the vessels in the Turkish Straits. The maximum permitted air draught in the Istanbul Strait is 58 metres to ensure the safe passage under the Boğaziçi Bridge. Over head power cables gives false echoes on the radar screens. More than 15 million peoples living around the Turkish Straits create local marine traffic, with very high density, which is surrounding and crossing traffic separation scheme. All these difficulties must be considered as important part of the apprentice pilot training.

4.3.20 Use of tugs

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the use and limitation of various types of tugs.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.20: (use and limitation of various types of tugs;)

Content: Pilots must be able to utilise tugs properly, considering their use and limitations. Therefore propulsion system and bollard pull capacities of tugs are important references. In the Table 4.2, tugs in use in the Turkish Straits are listed.

Table 4.2: Tugs in use in the Turkish Straits (KEGM, 2013b).

Tug's Name	Propulsion System	Bollard Pull
Kurtarma 9 – Kurtarma 10	2 x VOITH Cyclodial	89 tons
Kurtarma 1 – Kurtarma 2	2 x VOITH Cyclodial	53 tons
Kurtarma 3 – Kurtarma 4	2 x VOITH Cyclodial	14 tons
Kurtarma 5	2 x VOITH Cyclodial	65 tons
Kurtarma 6	2 x VOITH Cyclodial	66 tons
Kurtarma 7 – Kurtarma 8	2 x VOITH Cyclodial	67 tons
Zübeyde Ana	2 x ASD (Azimuth Stern Drive)	65 tons
Kızkulesi	2 x ASD (Azimuth Stern Drive)	50 tons
Söndüren 2	1 x Controllable Pitch Proppeller	35 tons
Söndüren 3	1 x Controllable Pitch Proppeller	30.5 tons
Söndüren 4	1 x Controllable Pitch Proppeller	29 tons
Söndüren 5	1 x Controllable Pitch Proppeller	30.15 tons
Söndüren 6	1 x Controllable Pitch Proppeller	25.5 tons
Söndüren 7	1 x Controllable Pitch Proppeller	31.4 tons
Söndüren 8 - Söndüren 9 - Söndüren 12	1 x Controllable Pitch Proppeller	35 tons
Söndüren 10	1 x Controllable Pitch Proppeller	32 tons

KEGM tugs are in use for escort services, towage services, assisting to vessels for any manoeuvring such as berthing, unberthing, anchoring and mooring, and also for emergency services, salvage, and fire fighting, emergency towage, escorting and assisting in special passage condition. A photograph of tugs alongside Çanakkale jetty is given in Figure 4.20.

Figure 4.20 : KEGM Tugs Kurtama 2 and Söndüren 7.

4.3.21 English language

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the English language to a standard adequate to enable the pilot to express communications clearly.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.21: (the English language to a standard adequate to enable the pilot to express communications clearly;)

Content: Considering the international aspect of the pilotage, maritime pilots must be able to communicate clearly in English. To ensure an adequate standard, necessary training should be provided. Turkish maritime pilots have entering standard.

4.3.22 Standard marine communication phrases (SMCP)

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the IMO Standard Marine Communication Phrases.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.22: (IMO Standard Marine Communication Phrases;)

Content: Candidates should have necessary knowledge of the IMO Standard Marine Communication Phrases and should use them fluently, clear and understandable.

4.3.23 IMO code for the investigation of marine casualties and incidents

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the IMO Code for the investigation of marine casualties and incidents.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.23: (IMO Code for the investigation of marine casualties and incidents;)

Content: Candidates should have necessary knowledge of the IMO Code for the investigation of marine casualties and incidents (Resolution A.849(20) adopted on 27 November 1997) in order to promote a commun approach for marine casualties and incidents.

4.3.24 Master-pilot relationship

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the Master-Pilot Relationship, Pilot Card, operational procedures.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.24: (Master-Pilot Relationship, Pilot Card, operational procedures;)

Content: candidates of pilots should have necessary knowledge of the master – pilot relationship, pilot card, operational procedures and pilot role as a member of the bridge team.

4.3.25 Pollution prevention

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the pollution prevention and the facilities in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.25: (pollution prevention;)

Content: Emergency contact details, reporting procedures, pollution prevention, international, national and local rules, facilities in the Turkish Straits should be known by the candidate pilots.

4.3.26 Emergency and contingency plans

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the emergency and contingency plans for the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.26: (emergency and contingency plans for the area;)

Content: Candidate pilots should have necessary knowledge of the emergency and contingency plans for the Turkish Straits made by the Maritime Adminastiration, and pilotage organisation.

4.3.27 Safe embarking and disembarking procedures

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the safe embarking and disembarking procedures;

Reference: IMO Resolution A.960(23), Annex 1, 7.1.27: (safe embarking and disembarking procedures;)

Content: For maritime pilots embarking and disembarking are very dangerous but unavoidable part of the profession. Pilotage service is given on the bridge by taking over the con as a part of the bridge team. Therefore pilots must be transferred to the vessel while approaching to the pilotage area. Many accidents have been occurred during the pilot transfer. As the results of these accidents every two years one pilot loses life and many of them are seriously injured. To improve the safety of the pilot's transfer there are many safety campaigns and recent legislative development. The poster of the required boarding arrangement for pilot in accordance with SOLAS Regulation V/23 & IMO Resolution A.1045(27) which was published by International Maritime Pilots' Association is given in Figure 4.21.

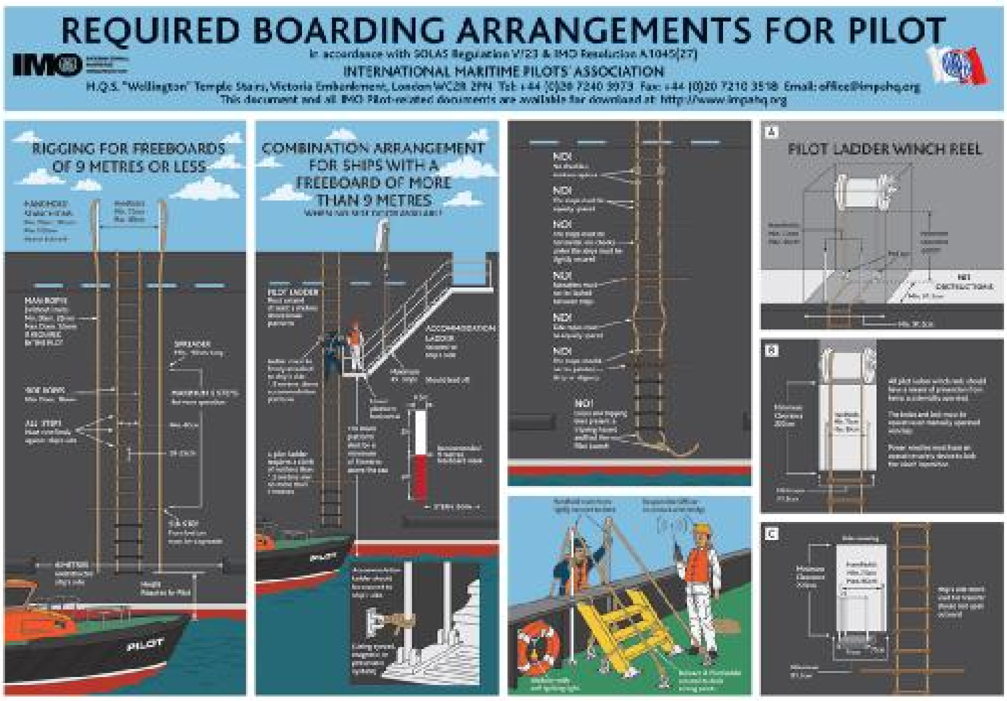

Figure 4.21 : Required boarding arrangement for pilots, (IMPA, 2013).

Pilot ladder safety is a subject of the recently updated resolution. New rules are valid since 1st of July 2012. Convention for Safety of Life at Sea (SOLAS), 1974, (as amended) Chapter-V (Safety of Navigation), Resolution A.1045 (27) and/or ISO 799:2004.

4.3.28 Local traffic

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the analysing of local traffic in the Turkish Straits.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.28: (any other relevant knowledge considered necessary.)

Content: Local traffic is the one of the facts and reasons of difficulties for the navigation in the Turkish Straits. Around the Turkish Straits there is a considerable population and the sea is also used for local transportation, fishing, tourism, sport and pleasure, even for swimming. There is naturally very heavy local traffic. A passenger ferry and car ferries are shown in Figure 2.22.

Figure 4.22 : Passenger and car ferries in the İstanbul Strait.

In the İstanbul Strait, the most crowded local traffic is usually in the south entrance. Ferry lines between Kadıköy – Karaköy, Üsküdar – Eminönü, Harem – Eminönü, Üsküdar – Beşiktaş, create heavy local traffic. But there is also considerable local traffic in other part of the İstanbul Strait.

In the Çanakkale Strait ferry lines are between Çanakkale – Kilitbahir, Çanakkale – Eceabat, Kepez – Eceabat, Gelibolu – Lapseki, Gelibolu – Çardak. A ferry from

Çanakkale to Kilitbahir passing astern of a northbound vessel and a ferry from Çardak to Gelibolu are shown in the Figure 2.23.

Figure 4.23 : Car ferries in the Çanakkale Strait.

In good weather, especially in weekends and holidays, there are more amateur fishing boats and leisure crafts in the Turkish Straits. There are many kinds of local and seasonal fishes in the Turkish Straits. Bonito, blue fish, mackerel and sardines are some of the seasonal fishes. Small fishing boats descend on the Turkish Straits every fall as fish migrate from the Black Sea to the warmth of the Marmara and Aegean seas. Regardless of her length, any vessel engaged in fishing shall not fish within the TSS and shall not impede the passage of other vessels while navigating outer limit of TSS (Turkish Straits Maritime Traffic Regulations, 1998).

A fishing boat and a leisure craft in the İstanbul Strait are shown in the Figure 2.24.

Figure 4.24 : A fishing boat and a leisure craft in the İstanbul Strait.

There are also sailing boats and other sport crafts in the Turkish Straits. Navigating by sail or under oars, swimming and fishing within the Turkish Straits TSS is prohibited. However, sailing, rowing and swimming competitions conducted for sporting purposes and demonstrations and ceremonies are subject to the permission of Administration and arrangement to be made (Turkish Straits Maritime Traffic

Regulations, 1998). A sailing boat off Karakova Burnu, in the Çanakkale Strait, is shown in the Figure 4.25.

Figure 4.25 : A sailing boat off Karakova Burnu.

Gelibolu has a ferry landing and fishing shelter. Fishing boats off Gelibolu are shown in the Figure 4.26.

Figure 4.26 : Fishing boats off Gelibolu.

As a part of the local traffic there are also official boats such as quarantine boats, coast guard patrol boats, harbour master's boats, pilot boats. A quarantine boat and a pilot boat are shown in the Figure 4.27.

Figure 4.27 : A quarantine boat and a pilot boat.

Local traffic in the Turkish Straits also contains service boats such as agent boats and ship chandler's boats. Agencies in the Turkish Straits provide all kinds of maritime agency services including crew change, repatriation, representing the vessel to the maritime authorities, arranging all kind of supply including bunker, fresh water, spare parts, nautical charts, providing all kind of technical assistances, providing and exchanging all necessary information between the vessel, owner, charterer, harbour master, ministry of health, other authorities and all other related parties. Agents can arrange also delivery of mail, removal of slop/sludge/garbage. During passage through Turkish Straits, vessels shall not make agent contact except anchorage areas in compliance with the items 40 and 48 of TSMTR unless it is obligatory. In obligatory cases; the most starboard side of their traffic separation schemes by taking permission from VTS Center, obeying traffic separation schemes and without affecting navigational circumstances, and within the time period and position defined as follow: While passing through Istanbul Strait; In the South, at the west of the longitude passing through the Kumkapı Barınak Light, not exceeding one hour; In the North, on the north of the line connecting Hamsi Limanı and Fil Burnu, not exceeding fifteen minutes; While passing through Çanakkale Strait; In the south of the line connecting Kanlidere Light to Karanfil Light not exceeding one hour; vessels can make agent contact. (Turkish Straits Maritime Traffic Regulations, 1998).

An agent boat and a vessel making agent/ship chandler contact on the way are shown in the Figure 4.28.

Figure 4.28 : Agent boat and a vessel making agent contact/supply on the way.

There are local traffic guides for İstanbul and Çanakkale Straits. They are separately prepared for the users of local traffic. One is "Çanakkale ve Gelibolu Liman Başkanlıkları Yerel Deniz Trafiği Rehberi" (Maritime Local Traffic Guide of Harbour Masters of Çanakkale and Gelibolu), other is "İstanbul Liman Başkanlığı

Yerel Deniz Trafiği Rehberi” (Maritime Local Traffic Guide of Harbour Master of İstanbul). They are written in Turkish language and can be easily downloaded from the internet by any user as open resources (Çanakkale ve Gelibolu Liman Başkanlıkları Yerel Deniz Trafiği Rehberi, 2011; İstanbul Liman Başkanlığı Yerel Deniz Trafiği Rehberi, 2011). There are also compulsory training seminars for the seafarers of the vessels working as a part of the local traffic. Candidate pilot also may read these guides of local traffic to improve his/her awareness about the facts, rules and other information about the local traffic.

Beside the local maritime traffic, sometimes, swimmers also can be another risk factor for navigation in the Turkish Straits with blue clean seas and suitable weather especially in hot summer days as shown in the Figure 4.29.

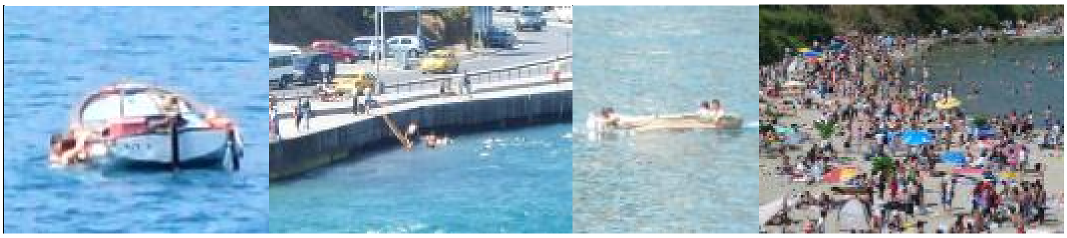

Figure 4.29 : Swimmers in the Turkish Straits.

4.3.29 International and national legislation

Objective: Each applicant for Turkish Straits (Strait of Çanakkale, Strait of İstanbul) pilot license should demonstrate that he or she has necessary knowledge of the international and national legislation related to the Turkish Straits, maritime pilots and pilotage.

Reference: IMO Resolution A.960(23), Annex 1, 7.1.28: (any other relevant knowledge considered necessary.)

Content: Candidate pilots should have necessary knowledge of the international and national legislation related to the Turkish Straits, maritime pilots and pilotage including but not limited with the followings items.

Montreux Convention (1936): The Montreux Convention Regarding the Regime of the Straits was a 1936 agreement that gives Turkey control over the Turkish Straits and regulates the passage of naval warships. The Convention gives Turkey full control over the Straits and guarantees the free passage of civilian vessels in peacetime. It restricts the passage of naval ships not belonging to Black Sea states.

The Convention Signed on 20 July 1936. It went into effect on 9th of November, 1936 and was registered in League of Nations Treaty Series on 11th of December, 1936 and it is still in force. The Convention consists of 29 Articles, four annexes and one protocol. Articles 2 – 7 consider the passage of merchant ships. Articles 8 – 22 consider the passage of war vessels.

International Regulations Preventing Collision at Sea, 1972 must be very well learned and known by every pilot.

General knowledge on the Convention for the Safety of Life at Sea (SOLAS), 1974, and specialised knowledge about its related parts on pilotage services, navigation, manoeuvring and the Turkish Straits, maritime pilots and pilotage are also very important for maritime pilots.

General knowledge on the International Convention for the Prevention of Pollution from Ships (MARPOL) 1973 (Convention), 1978 (1978 Protocol), 1997 (Protocol - Annex VI); Entry into force: 2 October 1983 (Annexes I and II), and specialised knowledge about its related parts on pilotage services, navigation, manoeuvring and the Turkish Straits, maritime pilots and pilotage must be always considered as necessary knowledges for maritime pilots.

General knowledge on the International Convention on Load Lines, 1966, as Amended by the Protocol of 1988 (LOAD LINES, 1966/1988), and specialised knowledge about its related parts on pilotage services, navigation, manoeuvring and the Turkish Straits, maritime pilots and pilotage are also required for maritime pilots.

IMO Resolution A.960 (23), (Recommendations on Training and Certification and on Operational Procedures for Maritime Pilots other than Deep-Sea Pilots) is one of the most important text of legislation for maritime pilots.

IMO Resolution A.1045 (27), (Pilot Transfer Arrangement) is vital and extremely important for maritime pilots and their organisations.

IMO Resolution A.827 (19), (Ships' Routing), Annex 2, (Routing Measures other than Traffic Separations Scheme, Rules and Recommendations on Navigations through the Strait of İstanbul, the Strait of Çanakkale and the Marmara Sea) is very important for the maritime pilots working in the Turkish Straits, to know about the IMO recommendation about the Turkish Straits and to give this information to the ships' captains to encourage them to use the pilotage services in the Turkish Straits.

Maritime Traffic Regulation for the Turkish Straits (1998), İstanbul, Çanakkale and Gelibolu Port Regulations, Turkish Straits Vessel Traffic Servises User Guide, Maritime Local Traffic Guide of Harbour Master of İstanbul, Maritime Local Traffic Guide of Harbour Masters of Çanakkale and Gelibolu, Regulations of Competencies, Trainings, Certifications and Working Standards of Maritime Pilots (2006) are good examples of important national legislation. Also any other rules and regulations related to the Turkish Straits, maritime pilots and pilotage should be considered important for maritime pilots working in the Turkish Straits.

Resources about the international conventions and other international legislation related to and/or which can be applied to the Turkish Straits are (COLREGs, 1972; IMO Res. A.827(19), Annex 2, Para. 3, 1995; LOAD LINES, 1966/1988; MARPOL, 1973; Montreux Convention, 1936; SHOD, 2000; SOLAS, 1974; STCW, 1978; IMO Doc. MSC 63/7/2 and Annex, 1994).

Resources about the national legislation related to and/or which can be applied to the Turkish Straits are (Act of Ports, 618, 1941; Act of Protection of Life and Property at Sea, 4922, 1946; Çanakkale ve Gelibolu Liman Başkanlıkları Yerel Deniz Trafiği Rehberi, 2011; İstanbul Liman Başkanlığı Yerel Deniz Trafiği Rehberi, 2011; KEGM, 2012; SHOD, 2003; Turkish Straits Maritime Traffic Regulation, 1998).

Some of the studies, IMO resolutions and other resources about the pilotage, general resources about the pilotage and the resources which can be also applied to or related to the Turkish Straits, are (EU Directive 2009/16/EC, Article 23, 2009; IALA, 2007; IMO Res. A.159(ES.IV), 1968; IMO Res. A.480(XII), 1981; IMO Res. A.486(XII), 1981; IMO Res. A.668(16), 1989; IMO Res. A.710(17), 1991; IMO Res. A.960(23), 2003; IMO Res. MSC.138(76) Annex 1, 2002; IMO Res. MSC.138(76) Annex 2, 2002; RCTCWSMP, 2006).

Pilot transfer is a subject of an international regulation. The Regulation 23 of the Chapter V (Safety of Navigation) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 is related to the pilot transfer arrangement. Resources about the pilot transfer arrangements' international rules and regulations including IMO resolutions and standards including the ISO standards which can be also applied to the pilot transfer in the Turkish Straits are (IMO Res. A.1045(27), 2011; IMO Res. A.130(V), 1967; ISO799:2004, 2004; SOLAS, 1974).

4.4 Epilogue

In order to improve maritime safety, to reduce the risks of navigation, and to protect the sensible maritime environment in the Turkish Straits, most low cost and high benefit measure is utilising the existing high standard pilotage services for any passages and any manoeuvring in the Turkish Straits.

Using the pilotage services in the Turkish Straits is also strongly recommended by the International Maritime Organisation. Maritime pilots in Turkish Straits are very important members of the vessel's bridge team in the way of safety and efficiency. Pilot in bridge team has important role with his/her local knowledge and experiences. Pilot is the additional manpower for a difficult passage. Pilot is a native language speaker with local traffic, tugs, mooring gangs, other parties, entities and authorities.

All aspects and any measure must be considered to maintain and improve the standards related to the pilotage services using all available resources and ship's masters, owners and operators and all other related parties should be encouraged to use and be aware the benefits of the pilotage services.

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APPENDICES

APPENDIX A.1 : Strait of Istanbul Surface Currents, from (H.D.,1941)

APPENDIX A.2 : Strait of Çanakkale Surface Currents, from (H.D.,1941)

APPENDIX A.1

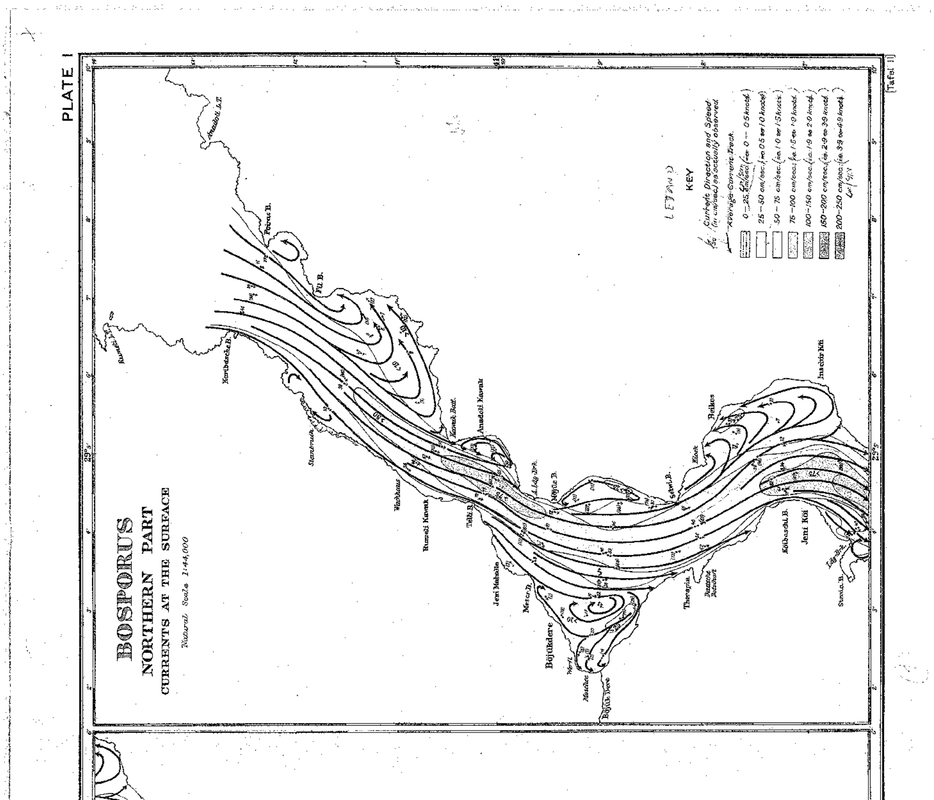

Figure A.1 : Strait of Istanbul Surface Currents, from (H.D.,1941)

APPENDIX A.2

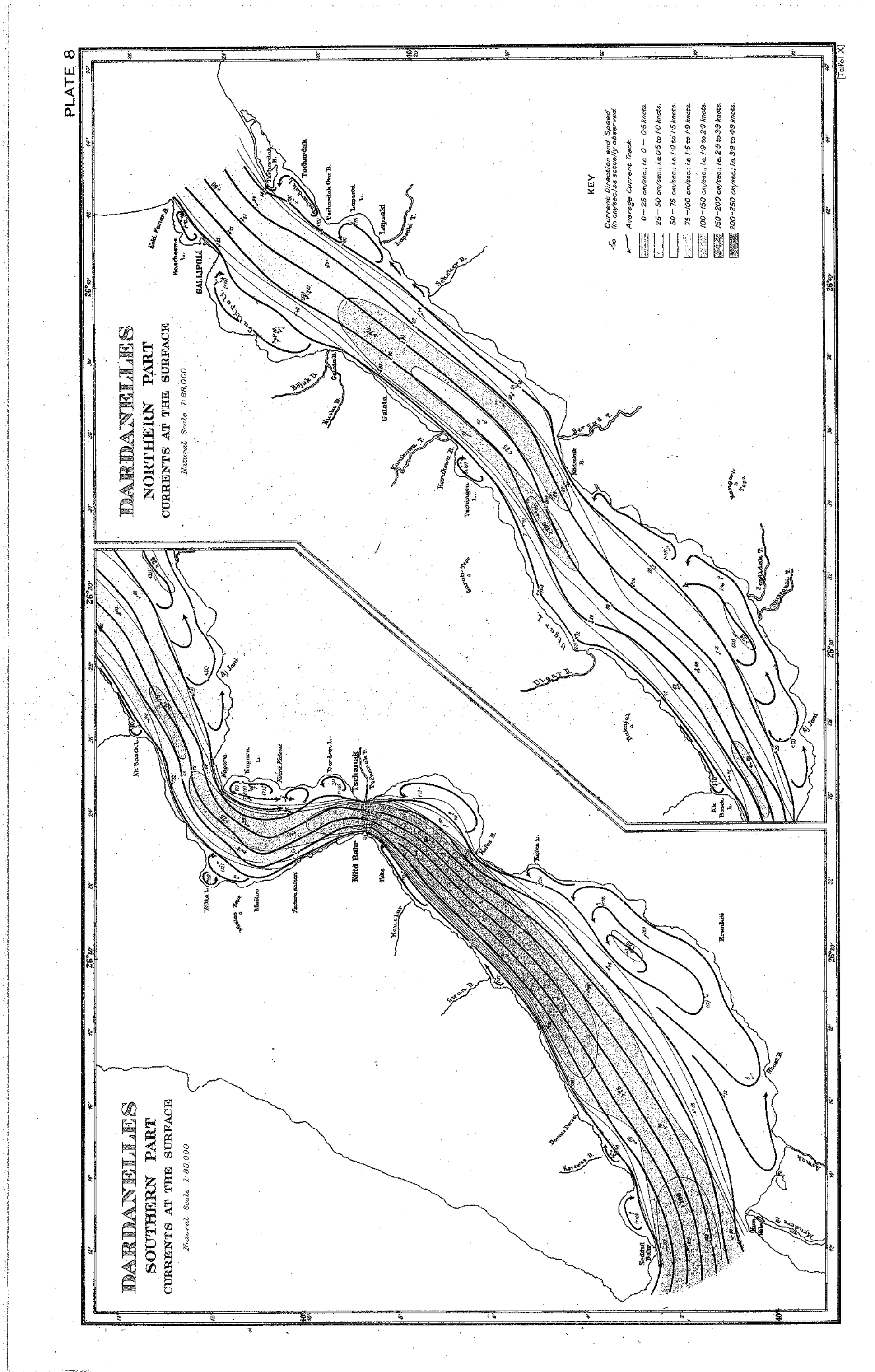

Figure A.2 : Strait of Çanakkale Surface Currents, from (H.D.,1941).

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List of Publications and Patents:

Cömert, A. (2001). *Deniz Kazaları ve Çatma Analizi (Marine Casualties and Collision Analysis).* Yayımlanmamış Yüksek Lisans Tezi (ITU M.Sc. Thesis), İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü, YÖK Tez Merkezi, Tez No: 103994.

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