

出席第三屆國際海岸海洋空間利用會議報告



交通部運輸研究所

中華民國八十二年十月

交通部運輸研究所出版品摘要表

出版品名稱 中文：出席第三屆國際海岸海洋空間利用會議報告 外文：The Third International Conference Of Coastal Ocean Space Utilization			
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關鍵詞：海岸海洋空間、海域環境、環境監測、多目標海域開發、生物工藝學 海埔新生地、港埠技術			
摘要：國際國岸海洋空間利用會議係海洋科技較先進國家每兩年舉辦之會議，我國均有派人出席並宣讀論文，本次為第三次，在義大利熱內亞大學舉行，其盛況及國際海洋科技新知交流，均于本報告內敘述。會程及日本海域空間之開發利用足供我國借鏡。作者宣讀之人工海埔地海岸空間利用與其整體規劃亦刊于最後附錄供參考。			
出版日期	頁數	工本費	本 出 版 品 取 得 方 式
82年10月	50	100	凡屬機密性或限閱性出版品均不對外公開。一般性出版品、公營、公益機關團體及學校可函洽本所免費贈閱；私人及私營機關團體可按工本費價購。
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備註：本研究之結論與建議不代表交通部之意見。			

出席第三屆國際海岸海洋空間利用會議報告

報告人 侯和雄

國際海岸海洋空間會議一九八九年始于美國華盛頓特區舉行，第二屆則于一九九一年在加州長堤舉行，報告人亦出席該次會議並與本所張所長共同發表高雄港深水港之規劃，深得與會人士之注目與重視。一九九三年為第三屆，報告人經被邀提出論文題目為“人造島開發與其整體規劃”為我中華民國代表團唯一發表之文章，後來亦在International Sea Data Journal被剖析，給予甚高之評價。該文之詳細內容曾蒙張所長多次之修潤使得文字更精美，內容更通暢刊于附錄三，此次我國包括國科會等代表團七人深受與會禮遇，會議由三月卅日起至四月二日，四天的會程，論文多采多姿，尤其日本亦提出海域空間與港埠技術之發展甚有參考價值，故報告人摘譯如附錄二，以下為COSU III之整個會程目錄，特摘錄整理為附錄一供參閱。

附 錄 一

第三屆國際海岸海洋空間利用會議

會 程 目 錄

時間：一九九三年三月卅日至四月二日

地點：義大利，Santa Margarita，熱內亞大學

Coastal Ocean Space Utilization (COSU III) is the first in this symposium series to be held outside the United States. The theme of "Marginal Seas: Problems and Opportunities" encompasses and emphasizes harmonious, multiple uses of the world's many enclosed ocean regions. This symposium will present significant international developments which apply to coastal nations and regions facing similar environmental, political, social and economic challenges.

海岸海洋空間利用會議III (COSU III)這是第一次在美國本土以外所舉行的論文研討會"近海邊際問題與展望"的主題在圍繞並強調和協的重要，這是因為世界上許多海域正受圍繞週圍國家多重的運用，此次的座談會的結果將對臨海諸國和海域有相當的國際整合作用，共同來面對相同的環境、政治、社會和經濟挑戰。

一九九三年三月卅日 (星期二)

會議紀錄

記錄開始在 7:30am 臨近休息區的會議室，會議區到處備有咖啡和茶
召集座談會和介紹

=====

召集人 Dr. Joshe R Vadus (session moderator)

Senior Advisor

National Ocean Service

Nation Ocean and Atmospheric Administration (NOAA)

Washionton, D.C.

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開會致詞 OPENING ADDRESSES

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Dr. Norberto Della Croce 教授
COSU III Co-Charman 聯合主席
Director 院長
Institute of Marine Environmental Sciences
環境科學海洋學院
University of Genoa 熱內亞大學
Mr. Norman Caplan

前言
海洋及環境系統
國際科學基金會
Washington, D.C.
Sandro Pontremoli 教授

Rector 校長
University of Genoa 熱內亞大學
Keynote Address (專題演講) 10:15-11:30

=====

裡外的世界：海洋科學
Observation and Assessment (觀察與評估)

Dr. Sylvia a. Earle
Hydronaut and former Chief Scientist
海下技術專家，主任研究員
National Oceanic and Atmospheric Administration
國際大氣及海洋管理署
Washington, D.C.
華盛頓特區

=====

臨海國家沿海保護和經營
Ing. Giovanni Gallino

Assessorship for the Environment
Regione Liguria
Genoa, Italy

&

Prof. Norberto Della Croce

12:00-14:00

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LUNCH 午餐

SESSION 1 REGIONAL SEAS & EMBAYMENTS

議題一海域和港灣

14:00-18:00

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主席：PROFESORS Della Croce & Abel

First Approach for an Intergated Enveronmental Planning
at Regional Level of the Coastal Marine System
(Regione Liguria)
(首次嘗試整合國際海域環境的計畫)

Arch.Lino Tirelli

Assessorship for the Environment
Regione Liguria
Genoa

The Baltic Sea 波羅的海

Dr.Gotthilf Hempel

Director

Baltic Sea Research Institute
Warnemunde, Germany

Egypt-Israel Cooperative Program

Dr.Robert B Abel

Program Manager
New Jersey Marine Sciences Consortium
(紐澤西島近海科學交流)

Shared Solutions for Land-Based Pollution: Case of the
Gulf of Mexico

沿岸汙染解決方案：墨西哥灣案例

Dr. James Broadus

Director

Marine Policy Center

Woods Hole Oceanographic Institution

Woods Hole, Massachusetts

Page 3-

Rio de Plata Regional Maritime System:
Potential..

里奧德巴拉他河口 (在烏拉圭與阿根廷之間)

整合近海多功能聯合企業

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&

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..

The Special Case of the Gulf of Aqaba

"Aqaba灣"的特例

Latin America and the Caribbean:

拉丁美洲和加勒比海 (中美、南美和印度羣島間的海域)

Utilization and Development of the Coastal Zone

沿岸地區之利用與發展

Adjourn (散會)

18:00

International Reception (國際會議之晚宴)

18:00-20:00

1993 三月卅一日 (星期三)

KEYNOTE ADDRESS (專題演講)

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Russian Technology for Coastal....

俄國近海科學技術，觀察測量和評估

.....

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Session II New Concepts in the Governance of Ocean Space

議題二：海洋空間管理新觀念 09:15-11:30

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Management Issues in Coastal Lagoon 海岸鹹水湖環境管理問題

Ecosystem: The Case of Venice Lagoon

生態系統：-威尼斯鹹水湖之案例 (灣口等被沙州堵塞而成的淺水)

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.....

The Jersey Shore Partnership Inc:

澤西島 (海峽羣島(channel Islands)中最大的島)

近海公民營管理規則

.....

.....

Legal Rules, Administrative Planning and Negotiation to

Solve clashing Interests in Coastal

有關沿岸地帶利益衝突管理計畫和協商的法律條文

:義大利和地中海的遠景

.....

.....

Creative Financing for Coastal Ocean Ventures

沿海投資企業創造的財富

.....

The Coastal Use Framework as a Methodological tool for
Coastal Area Management

海岸使用架構為海岸地區管理之一方法工具

Improvement in mathematical Modelling for Shore Line
Chagnes Environment:

海岸線變化之數學模式推演評估

An application to the Veneto Coastal Case

"Veneto"海岸應用案例

EC02.... (海岸管理新觀念)

...

12:00-14:00午餐

Page 5,6

Session III the Coastal

Environmet: Assessment

Stand & Issues

議題三 海岸環境：評估標準和公告

14:00-18:00

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COASTAL OCEAN SPACE MANAGEMENT CHALLENGES FOR THE NEXT DECADE

未來十年海岸海洋空間管理之挑戰

....

REASONABLE APPROACH FOR SPACIAL REGULATION....

特別管制條例的合理辦法以促使沿岸開發符合環保

.....

A SEA CHANG FOR OIL TAKER SAFETY

運油船的安全對海洋的改變

SCIENTIFIC APPROACH FOR EVALUATING THE SITES OF COASTAL

THERMOELECTRIC POWER STATION

評估溫差熱發電場址的科學方法

.....

....

...
EVALUATION DYNAMICS AND GLOBEL CHANGE

評估全球海洋變化與動態

.....
COASETAL MANAGEMENT: A NEW APPROACH FOR THE EVALUATION OF
THE BEACH TREND

沿海管理：海灘走向評估新方法

.....
.....
OCEANOGRAPHY AND COASTAL ENVIROMENT....

海洋學與沿岸環境評估：地中海沿岸和亞得里亞海的兩個不同地區的案例研究

.....
...
COASTAL-DEPEND MARINE LEISURE ACTIVITIES:
CONSIDERATIONS OF ECONOMIC DEVELOPMENT AND ENVIRONMENTAL CONSERVATION

沿岸獨立開放之活動空間：環境保護和經濟發展之考慮

.....
...
WASTE MANAGEMENT IN THE COASTAL OCEAN

沿海廢棄物汙染管理

.....
...
IFREMER'S ACTIVITIES IN ENVIRONMENTAL MONITORING

IFREMER的環境監視活動

.....
...
MONITORING AND TESTING PROGRAMS FOR IDENTIFYING

利用"CIGUATERA"魚認定毒害風險之監測程序

.....
...
LARGE MARINE ECOSYSTEMS: A NEW CONCEPT IN OCEAN MANAGEMENT

大海洋生態系統：海洋管理之新觀念

.....

ADJOURN休會

18:00

今晚將有特別餐會供與會學者主講員，其他自由參加
收費 \$ 25

四月一日 (星期四)

KEYNOTE ADDRESS (專題演講)

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08:30-09:15 PAGE 7,8

AN INNOVATIVE POWER GENERATION SYSTEM FROM SEA CURRENT IN THE
MESSINA STRAITS

"MESSINA"海峽之海流動力產生系統之引進

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SESSION IV OCEAN RESOURCES & SUSTAINABLE DEVELOPMENT.

議題四：海岸資源與可持續之發展

09:15-11:30

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....

A MULT-PURPOSE APPROACH TO COASTAL ZONE DEVELOPMENT: A CASE STUDY
多目標海域開發：案例研究

....

.....

U.S. OCEAN RESOURCES & TECHNOLOGY DEVELOPMENT

美國海洋資源與技術開發

WEALTH FROM THE OCEANS: A.U.K. PROGRAM

來自海洋的財富 - 英國計畫

....

COASTAL OCEAN SPACE DEVELOPMENT IN KOREA

朝鮮半島之海洋空間開發

....

POTENTIAL IMPACT OF ALGAE BIOTECHNOLOGY ON THE UTILIZATION OF
CAOSTAL AREA

生物工藝學 ((利用工程學和科技的資料及技術來研究或解決有關事物體
的問題)利用在近海利用的衝擊潛力)

.....

12:-14:00

午餐

SSION IV OCEAN RESOURCES & SUSTAINABLE DEVELOPMENT
(CONTINUE)

議題四：海岸資源與可持續之發展 (續)

14:00-18:00

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LOBSTER RANCHING IN COASTAL WATERS

近海水域龍蝦養殖事業

.....

...

DERIVATION OF BETA- CAROTENE FROM MARINE ORGANISMS

海生有機物之BATA紅蘿菠素萃取

.....

...

MARINE BIOTECHNOLOGY APPLICATION IN THE COASTAL OCEANS

近海生物工藝學之應用

.....

...

POTENTIAL OF WAVE ENERAGE FOR COASTAL APPLICATION

沿岸海潮發電之應用潛力

.....

...

SINGLING OUT OF NEW BREESING SPECIES FOR A BETTER STRATEGY IN
AQUACULTURE AND MARICULTURE

近海隔間養殖法創造農業及海洋事業新的養殖空間

.....

....

ARTIFICIAL HABITATES FOR REARING SLOW-GROWING MARINE INVERTEBRATES
海產無脊椎（動物）的人工養殖地

.....

..

SUSTAINABLE COASTAL DEVELOPMENT THROUGH INTEGRATED COASTAL POLICY,
VIA BUILDING WITH NATURE
透過整合海岸政策使海岸永續發展—順自然而建造

.....

THE ENVIRONMENTALLY SOUND DISPOSAL OF WASTE IN AN OFFSHORE ISLAND
DEVELOPED FOR MULTIPURPOSE USES
開發多用途魚場環境汙染監控

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.....

ADJOURN (休會)
(EVENING FREE)

四月二日（星期五）PAGE 9, 10

KEYNOTE ADDRESS（專題演講）08:30-09:15

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COASTAL DEVELOPMENT IN HARMONY WITH THE ENVIRONMENT
配合環境保護開發近海事業

.....

SESSION IV OCEAN SPACE DEVELOPMENT & RELATED TECHNOLOGIES

議題五：開發海岸空間與相關技術

09:15-11:30

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VERY LARGE PLATFORMS FOR FLOATING OFFSHORE
廣大的浮養近海漁業臺地

.....

TECHNOLOGY FOR CASTAL DEVELOPMENT ACTIVITIES IN JAPAN

日本開發近海事業活動之技術，全文經本人摘譯成中文如附錄二

.....
....
ADVANCE IN COASTAL OCEAN SPACE UTILIZATION:

ARTIFICIAL ISLANDS AND FLOATING CITIES

近海空間利用之發展：人工島嶼和浮體城市

.....
....
LARGE SCALE, MULTI-PURPOSE ARTIFICIAL ISLAND DEVELOPMENT NEAR
THE GAZA STRIP

加薩走廊（地中海東岸之一狹長地帶）開發大型多目標人工島嶼

.....
....
CHANGING NATURE OF PORTS IN COASTAL MANAGEMENT

近海管理-改變自然之港灣建設

..
TECHNOLOGICAL INNOVATIONS FOR MARINE GEOLOGY:

GENERAL VIEWS AND APPLICATIONS OF ADVANCED ROBOTICS

海洋地質學之技術開創：應用機器人之先進技術概述

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.....
DEVELOPMENT OF ARTIFICIAL RECLAIMED LANDS AND THEIR INTEGRATED
PLANNING IN TAIWAN, R.O.C.

台灣地區開發海埔新生地與整合計畫，

主講人：侯和雄，交通部運輸研究所運輸工程組組長，全文登于附錄三

.....
.....
UNDERWATER ROPE LINK IN THE GULF OF NAPLES: A CASE STUDY FOR
ELA IN COASTAL ZONE

那不勒斯（義大利南部的一個港都）過港隧道：

臨海區域之案例研討

12:00-14:00

午餐

SESSION VI. SUMMING UP COSU III

議題VI：總結

14:00-15:30

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主持人：PROFESSOR DELLA CROCE & DR. ABEL

議程：* 由聯合主席報告所有議題

- * 開放討論發問與解答

- * COSU III 下次會議計畫評論

- * 由DELLA CROCE 教授閉會致詞

COSU III 閉幕

附 錄 二

日本海域空間開發與港埠技術發展概述

侯 和 雄

交通部運輸研究所運輸工程組組長

摘要：

在利用近海岸之海域空間的方法中，建造人工島嶼是主要的方式之一，此人工島嶼可被用做海港、飛機場、工業區或休閒住宅區等等……，在本篇文章中，主要是在敘述日本的人工島嶼。

許多人工的島嶼常被利用作為港埠，基於此，為有效利用海洋空間而建造人工島嶼的技術，與建造港埠所需的技術，是大同小異的。另外，由運輸省為開發港埠技術而建立的長期政策將隨時代背景一同敘述。本篇文章同時也敘述一些主要的組織為發展港埠技術而工作。

一、緣起

近海岸的海洋空間可被很多不同途徑所利用，其中一個途徑是建造一個人工島嶼，並將此土地空間善用規劃為遊憩區、住宅區、運輸設施與工業區。在日本，已建造了很多的人工島嶼並有效的利用中。此外，有很多計劃在研究建造人工島嶼，並將這些資料用在不同的目的，本文的第一部份介紹一些人工島嶼。

建造人工島嶼與建造港埠的技術是十分類似的，因此，港埠的技術發展將有益於近海之海域的利用率。日本運輸省的港灣局為港埠技術的發展設立了一個長期的政策，本文的第二部份將敘述這些長期政策的概要。

二、日本人工島嶼的歷史

日本人工島嶼的建造始於十九世紀為防禦東京灣而建造的人工島嶼，在五十年代，人工的島嶼是用來開採海洋的煤礦的。在1960年代高經濟成長的時期，日本各地圍墾開發海洋空間供工業用途，基於環境的因素考量已經轉變到建設近海的人工島嶼，更進一步，由於技術的進步，人工島嶼已經漸漸地應用到海岸區域較不適宜的自然狀況，諸如：較深的海域、柔軟的土壤及洶湧的波浪。圖表1是展示一些的主要的島嶼於日本。

三、人工島嶼的使用

人工島嶼的計劃能夠刺激經濟的活動，經過如此島嶼的使用可做為地方發展的規畫部分，如工業的發展，漁業促銷，旅遊事業發展及能量和天然資源有關的使用。人工的島嶼也被利用於都市設備的新構造（建設）或改善運輸設備。

特別顯著的應用是基於社會的改善，經由標示更好的土地及提供市民能量的供給場所而增強可居住性與便利性同樣重要地運用是基於能源供給的國家的政策。

以下的個案中其目的和概念，乃針對人工島嶼的規劃來調查研究：

基於不同的種類來分佈人工島嶼，

基於觀光與休閒的活動，

基於教育與科學上的研究，

新的城市（住宅區與旅館），

考量工業的發展與廢物的傾倒，

基於近海採礦的需求，

考量牧場與養殖漁場（海洋漁業、牧場與加工廠）

考量自然災害之避難，

基於建造遠洋結構物之考量，

其它。

由此可見，多重用途的人工島嶼將比單一用途更有利，而計畫一個多重用途之人工島嶼的方法是視其周圍須為平靜的海域，使其與周圍空間溶為一體。

四、海域人工島之發展計畫

日本運輸省及縣政府，研究了十三個計畫來發展人工島，其中一個計畫已經建造中，即和歌山遊艇港市，一些主要計畫將於此扼要概述。

和歌山遊艇港市 —

位於和歌山縣內，為一國際的海事遊艇基地，經規劃研究，其主要設施為一遊艇港。除遊艇港外，並規劃各項體育運動設施人文、交通、休憩及住宅等供應設備。本人工島之建造始於1989年，各項設施將於1994年部份開放使用。

海域 Shimonoseki人工島 —

在 Kitaura海域範圍內之 Shimonoseki市，正規劃一人工島，旨在建立一東亞地區綜合文化交換中心，為達到此目的乃規劃下列項目：交

通運輸中心、一國際渡輪基地、貨櫃中心、國際文化交換中心與資訊中心，海事工業與國際水產養殖中心、漁類生產製造中心、科技文化交流與國際會議廳、展示館以及海上休憩地帶。

五、日本港埠的新觀念

運輸省港灣局港埠發展建立一長期的政策，即於1985年提出“港埠朝向21世紀發展”，其目的在建立便捷暢通之濱海地區。並輔以1990年提出之另一長程的政策“海岸區域朝向21世紀現代化發展”，新的長程政策次子題為“創造富裕、環境優雅的濱海地區”。

這些長程政策考慮港埠區域為綜合用途的海域空間，而意向著空間之品質使維持海上運輸及陸上客貨集散，供工業製造成品及人類生活之使用空間。因此，依日本港埠的新觀念，為一供運輸集散空間擴至上述三種用途（運輸、工業用地與人類活動）之使用空間。因此，以日本在海岸、海洋空間利用之促進，則顯然與港埠發展效用相重疊。

六、港埠技術發展之長期政策

背景：如上所述，日本運輸省已建立包括港埠之海岸地區未來發展之長期政策。為支持此項發展，促進港埠技術發展益形重要。如果關於港埠發展的組織與人員必須對於未來海岸發展技術方面有如此此種技術方能有效率獲得並極有效的落實在港埠建造及海岸空間之建築上，基於此，日本運輸省乃建立港埠技術發展的長期政策，名為“港埠技術友善於人類及全球”（Port Technology Which is Friendly to Human Beings and the Globe）。

過程：港埠技術政策初步由日本運輸省港灣局與港灣技術研究所之成員擬定。這些研究成員在研究及草案擬定過程中乃接受一技術委員會的指導，委員則包括大學教授以及港埠發展與作業方面的專家。此政策乃於1992年6月經港灣局核定並於1992年9月政府印刷發行。

內容：長期政策評估日本港埠與港埠技術的歷史背景與目前情況，並描繪港埠的長期發展政策名為“港埠朝向21世紀發展”及“海岸地區朝向21世紀發展”，該政策對於港埠技術發展考慮兩項基本原則。由重要性及迫切性觀點提出10個主題之優先性，此政策乃提出綱領分配這些主題給政府機關、學術單位及政府可協助並促進技術發展之民間企業。

基本原則：有兩項原則考慮為未來海岸空間發展之根據。一為設立有利的濱海地區對於人類全球有助益。另一為經由有效的人力與資訊

，幫助國際的傳播，進而對世界有貢獻。

七、港埠技術進一步發展之主題

社會需求的技術主題是：

1) 海岸地區利用的重新組織

① 利用科技改善港埠空間之品質。

② 利用科技集中港埠空間的利用。

③ 利用科技方法保養和管理港埠空間。

④ 利用科技方法設立適用於人類的設施。

⑤ 利用科技對海岸空間的利用建造新陸地和維持海岸的平靜水域。

2) 有效率的輸送網

① 利用科技去發展高效率的輸送站。

② 利用科技在港埠的建造和作業上增加可工作天。

③ 利用科技設立港埠空間交通設備。

3) 休閒時間的增加

① 利用科學方法設計—允許人們接近水域的濱海區。

② 利用科技規劃公園和保持位於濱海區的周圍綠化環境。

4) 高齡人口的增加

① 利用科技設計—適於老年人和身體有障礙的人們有安全的濱海區。

② 利用科技增加濱海區設備的安全性。

5) 最經濟人力資源和機械化

① 利用科技對人力資源最經濟情形作調查並且實行。

② 利用科技可產生高效率的效用。

③ 利用科技提高管理的效率。

6) 資訊化的社會

① 利用科技去增加和利用資訊。

② 資訊網應用的技術。

③ 資訊的傳遞的科技。

7) 環境的保護和改善

① 利用科學方法去做考察，預測和評估。

② 利用科技方法找出關於全球升溫的對策。

③ 利用科學方法對廢物的處理方法找出對策。

④ 利用科學方法改善海水品質和河床土質。

⑤ 利用科學方法避免海水受到污染。

⑥ 利用科學方法建造更好的環境。

⑦ 利用科學方法使建造時對環境的影響達到最小。

8) 資源和能源

- ① 利用科學方法計畫和建設港口以獲得與能源有關的物質：油料、天然氣、煤等
- ② 利用科技方法使港埠能源的消耗達到最小。
- ③ 利用可再生的能源。
- ④ 廢棄物可再生的利用。

9) 多功能設施

- ① 多功能設施，例如防波堤附屬波浪發電設施。

10) 保存和修護

- ① 利用科技增加設施的堅固性。
- ② 利用科學方法去修護和強化現有的設備。
- ③ 利用科學方法去修護設備。
- ④ 利用科學方法防止航行水道淤沙產生及清除污泥。
- ⑤ 利用科學方法找出防止海裡冰塊產生的方法。

11) 基礎科技的提升

- ① 港口規劃的技術。
- ② 自然環境的調查和預測。
- ③ 設計港口設備和海岸地區的科技
- ④ 對於災害的預防和準備的技術

12) 國際的訊息和貢獻

- ① 提升國際科技上的合作
- ② 注意發展中國家對於科技的需求

在以上主要科技技術並不全然是新的，也存在著某些技術的發展。因此我們應了解社會的需要，而去改良目前存在之技術，並發展新的技術。

在長期的政策下，我們有以下十個較重要的課題。

1. 港灣空間品質改良的技術。
2. 對於海岸空間而需創立土地面積及海面控制的技術。
3. 發展高效率運輸港埠站的技術。
4. 使研究和完成所需人力減到最小的技術。
5. 防止全球溫度過熱的技術。
6. 防止損耗的技術。
7. 創造更美好環境的技術。
8. 增加設備耐久性的技術。
9. 對於災害的預防準備的技術。

10. 需要與發展國家合作的技術。

八．科技發展的角色定位

運輸省（中央政府）港埠管理機構（地方政府或港灣局），第三等部門，私人企業，大學院校和公共服務社團，應各自發展他們考慮所需要的技術，撥出他們的服務和科技發展的能力，一般來說，科技發展應該爲了確保資金，人類的資源及科技之發展，行使他們的自治力量。在運輸省港灣技術研究所由政府負責的研究機構以及港埠建設的調查及設計單位、機械設備中心均屬於各地區建設工程的區域性港灣建設局，以上這四個部門都相互配合，以全面性地發展港灣各項科技工程，並充分運用各自所具有的特長。

在這個特色之下，港灣技術研究所（PHRI）已經被指引成一個涵蓋整個有關於港灣和港埠技術的綜合性研究機構，廣泛的調查研究，技術的交換，涵蓋了從基本原理的領域，而到實用性的階段。

在日本，PHRI有一個累積港灣和港埠技術的組織性的角色。此研究發展結果和累積的資料可提供給國際性的機關和港灣管理當局，同樣地也提供給軍事防禦區，而當准許部分國際性的技術合作時，該等資料可轉換成適當的形式，提供給發展中的國家。

然而科技的發展已至新紀元，並且需要去結合相關特殊技術，諸如：碼頭、港口、電腦、新材料、生化技術及其他科技。如此看來，科技的發展，需要能擁有包羅萬象的能力，並能在各該項目中密切合作，俾將來更有效率，更滿意，更經濟，且更短的期間獲致成果。

在運輸省這案例中，將利用公共服務合作切合需要，並能廣泛地於國內、國外、私人的、學術的及政府間研究相關港埠與港口及其他問題。

如此，將提昇聯合研究及技術發展之水準。

表一 日本的人工島嶼

地 名	用 途	水 深 (米)	浪 高 (米)	構造物距離 (Km)	土 壤 種 類	建築基間	面 積 (1000m ²)
OGISHIMA	工業用地	0.15	3.4	0.4	粘土	1971-1975	5,150
HIGASHI OGISHIMA	港口及 運輸設施	0.10	-	0.7	沈泥	1972-1984	4,340
橫濱 DAIKUKU	港口設施及 海岸公園	12	5.5-6.0	0.5	沈泥	1965-1985	3,210
名古屋港島	**	6-7.5	2.0	1.2	粘土、沈泥	1975-1987	1,140
NAGOYA KINJO	港口及外貿設 施展覽場公園	0.5	1.0	1.4	軟弱土壤	1963-1985	1,910
YOKAICHI KASUMIGAURA	港口設施及 工業用地	4.5-12	4.0	0.1	軟弱土壤	1967-1988	3,870
GOBO 火力發電廠	發電廠廠址	5-18	17.5	0.2	砂岩& 砂質土	1980-1983	350
南大阪港	港口設施 都市發展區域 商業設施 海岸公園	10	3.3	0	粘土	1958-1984	9,370
北大阪港	港口設施 工業用地 廢棄物處理設施	10 -	3.3	0.45	粘土	1972-1988	6,150
神戶港、島	港口設施 國際交易所 都市發展區域	10-13	-	0.4	粘土	1966-1981	4,360
ROKKO 島	港口設施 都市發展區域	10-14	-	0.2	粘土	1971-1985	5,830
KANDA 棄土場	浚砂棄土公園	7.5	2.5	3.5	軟弱土壤	1977-1986	1,530
長崎機場	機場	10-18	2.0	1.5	粘土、玄武岩	1971-1974	1,630
MITSUI-MIIKE 3 號島	***	10	3.3	6.0	軟弱土壤	1969-1970	6
關西新 國際機場	機場	20	-	5.0	軟弱土壤	1985-	1,200

附 錄 三

※
※ DEVELOPMENT OF MAN-MADE ISLAND ※
※ AND ※
※ ITS INTEGRATED PLANNING ※
※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※ ※

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DEVELOPMENT OF MAN-MADE ISLAND AND ITS INTEGRATED PLANNING

Abstract:

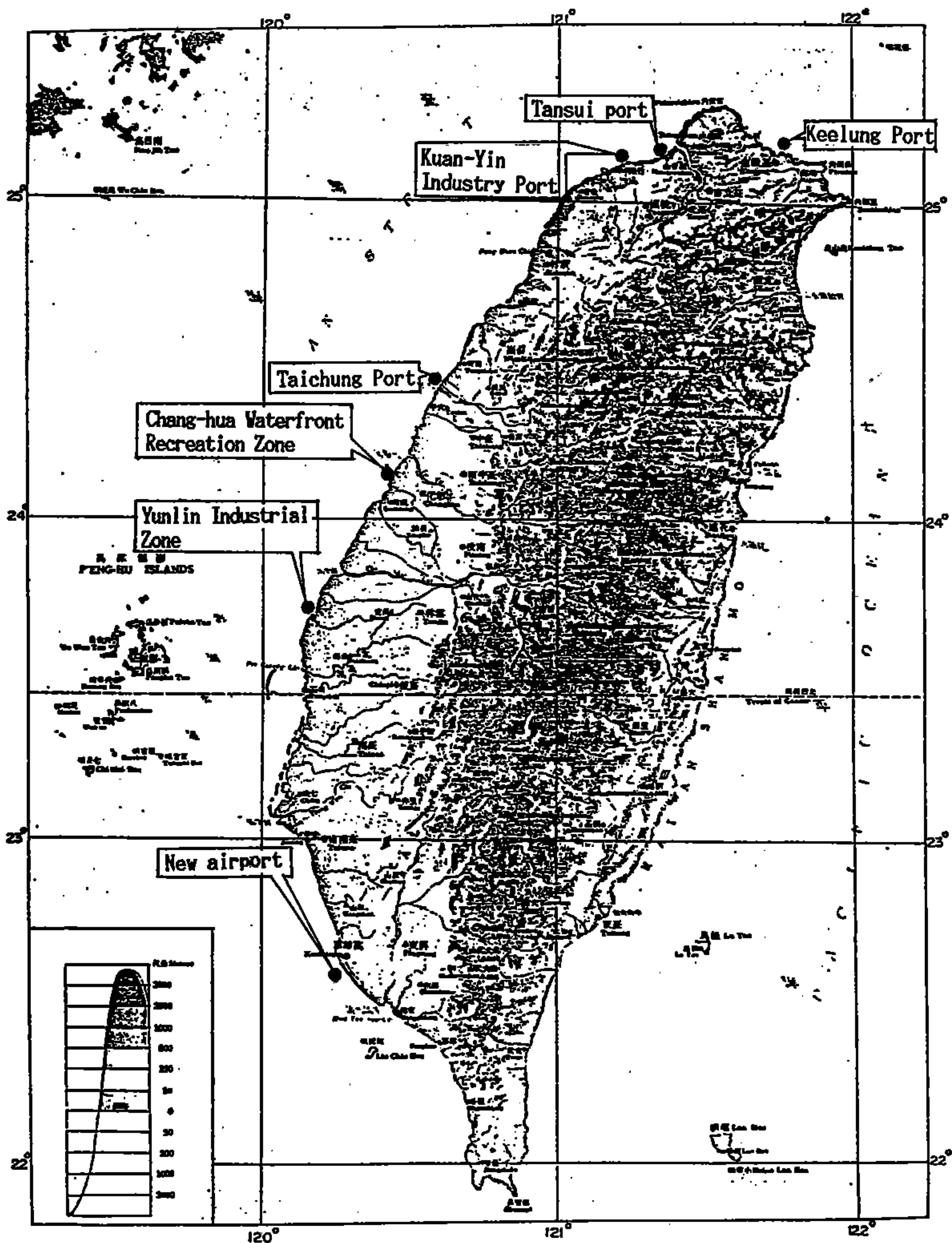
As a result of the economic prosperity following the industrial development during the last three decades, living space has become more crowded and sphere of daily activities narrowed day by day. The land acquisition thus has become also more difficult than ever before. Under such circumstances people have started finding the new living space in ocean and coastal area. Reclamation and man-made islands have also turned to be a modern trend. Lands are badly needed for the regions that are densely populated like Japan, Hongkong and Taiwan in particular. So far some 20 man-made islands have been completed in Japan. (see Chart 1). The construction of the international airport at Chek-Lap-Kok, a man-made island in Hongkong is being under way. (see Figure 1). While in Taiwan an exploitation of man-made island has been planned to proceed on a large scale. It aims at meeting the requirements of developing the recreation ground in industrial area of coast and planning the fundamental industrial area as well as deepwater harbour. In this project some governmental agencies such as Ministry of Economics, Ministry of Transportation and Communications and Council of Agricultural Development are all involved. Since the land

resources on coastal area of Taiwan are limited, the plan must be deliberated integratedly. Only by this way the plan can help solve the problems in the adverse impact on sea that has ensued from the development of man-made island. It serves also the purpose of improving the living quality. This article deals mainly with the development planning of man-made island and countermeasures in this respect for the reference of the authorities concerned in their planning process.

I. Introduction

Recently the problem of insufficient land here in Taiwan has become more serious than ever before. The heavy pollution of environment made it impossible to improve the living quality. The large expenditure on land acquisition for the various projects of the 6-year National Construction Programme had embarrassed the Central Government. Transportation problem has put the authorities concerned in a dilemma. The insufficiency of parking lots, space reserved for parks (trees and meadows) as well as the large recreation quarter always remain insolvable.

To deal with those problems some effective measures have been taken for years. Beside as the larger use of space by developing the construction toward the underground and high rise. The reclamation has proved to be another more effective way to exploit the resources of land.



Location of artificial reclaimed land in Taiwan

The project of reclamation is carried out by erecting the breakwater, dredging the navigational channel and harbour basin, and taking Taichung Harbour as a sticking example, hydraulic fill a reclaimed land of 4,000 ha. has just emerged there. As the man-made island is suitable for the comprehensive projects for development, a large reclamation for a new international airport was planned after the pattern of Japanese one that covers an area as large as 1,100 ha. The offshore airport once completed will solves a lot of problems in noise, exhaust and air pollution. It can also serve the purpose of diminishing the danger of the eventual collision of air transportation. So far an area of 511 ha. has been reclaimed and the expansion work keeps on going. This project may be considered as a model for the planning of large international airport on the sea shore of Taiwan (for detail see Figure 2)

During the last thirty years this country has made every possible effort to the development in the fields of industry and business while ignoring the pollution of the environment. The result of such concentration is that the pollution of the environment becomes serious year after year. Since the last ten years people have sensed the importance of the environmental protection. They started to demand for a better living quality. For this end they rejected all creators of environmental

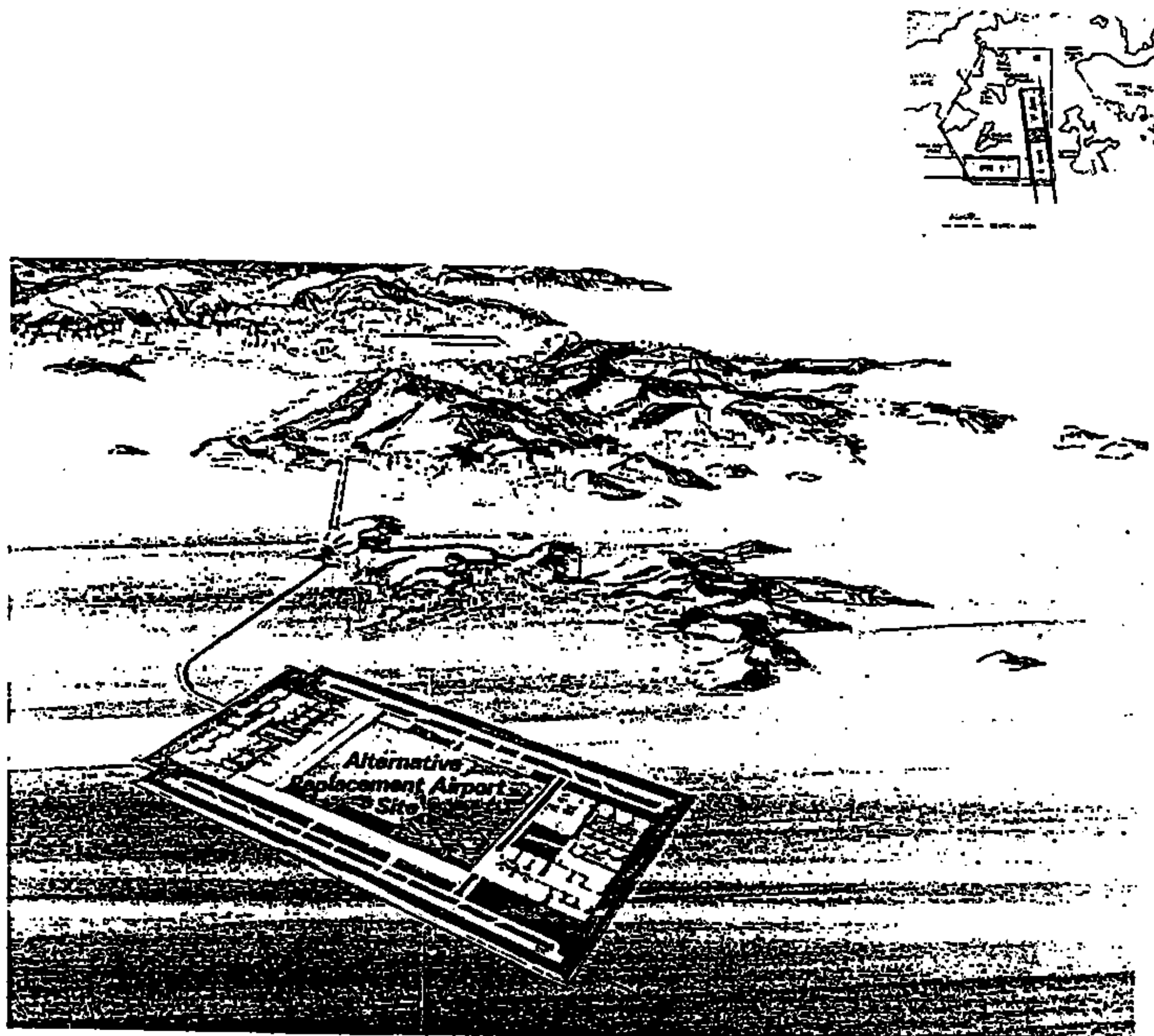


Fig. 1 Chek-Lap-Kok new airport in Hong Kong

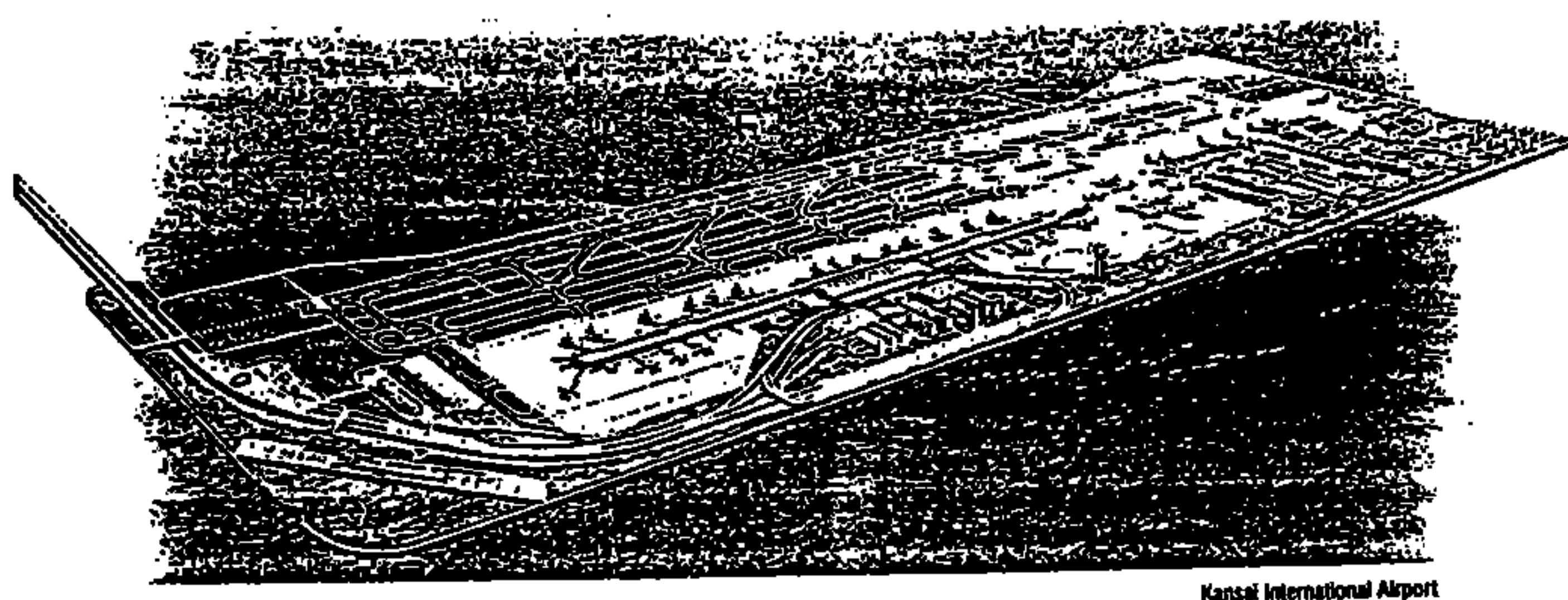


Fig. 2 Kansai new airport in Japan

pollution, or any media that may cause the pollution like industrial plants or facilities. Their targets are aimed at as large as airport, nuclear power plant, thermopower plant, petroleum refinery and petrochemical industrial zone. As to the smaller ones they comprise refuse incendiary, waste water treatment works, wastelots, cement plant, chemical plants, disposal plant of used non-ferrous, etc. Measures that people are taking for this end are simple but effective. They surround the annoying target, make protest and claim for damages. Being unable to operate as usual the ill-fated plant suffers a great loss plus a large sum of compensation. Sometimes they would be even forced to move or close down in the end. Selection of site and construction of new plants which may cause the pollution are also delayed once and more for people's obstruction and objection. It affects seriously the process of economical construction and facilities for environmental protection.

To solve such a problem it is advisable to select a plant site that is located far away from the common community in addition to the improvement by the plants themselves. For instance, to minimize the discharge of pollutants in the process of manufacture and set up the anti-pollution facilities. By so doing it is convinced that people's instinctive rejections will be slackened for the construction of airport, power plant, petroleum refinery, refuse incendiary and other public installations.

Ironically enough, it is known to everybody that all these things are indispensable to the modern society. But nobody wants to fall victim of the noise of airplane and pollution by the refuse incendiary in the vicinity of his residence.

Exploitation of man-made island has many advantages: It helps reduce the pollution of environment and alleviate the objection and harassment against the selection of the site for plants since it is located far away from the inhabitant area. Besides, the man-made island can also be used for the functioning of the local government, industry, port and harbour, deepwater harbour, sea recreation ground, storage base for petroleum, ore and coal mine, as well as ventilation for submarine transportation systems (railway and highway). In comparison with the lower cost, these advantages will become more salient in the area which suffers from the insufficient land sources and the gradually serious pollution. Based on this concept the integrated development project is proceeding actively for the construction of an international airport in Southern Taiwan and a new harbour in Kaohsiung.

Japan and the United States have set up their new airports and power plants at the man-made islands for a long time. Since Taiwan is so handicapped by a much smaller land and higher population density, it is therefore most urgent for her to develop the project for reclamation.

II. The constitution of the man-made island

The man-made island comes into being by taking the low-lying shore with the sea-bottom of moderate slope or barrier island as its foundation. The former is constituted by the offshore barrier and many other geographical features (to include the salt lake). At the tidal inlet it is very often that the sand dunes deposit in the shelter of the barrier island.

The main feature of the level shore is that the slope at the sea bottom is relatively moderate regardless its flowing direction toward sea or land. According to Dr. D. W. Johnson, the formation of the level shore could be the result of the coastal emergence. (1919). But this happens only when the sea bottom slopes moderately. Most of the level shores are scattered in the zones of lower and medium latitudes. Their feature is abundant in sand-drift. Should the terrain be of erosive nature, the artificial barriers would better serve the purpose of diminishing the pounding of waves.

Barrier islands emerge easily under the condition that the tide range is low. But sometimes they would probably come into being even the tide range is high. Nevertheless, the sufficient quantity of sand drift is a prerequisite for their emergence. Taichung Harbour and Chang-Pin Water-Front are the two most striking

examples for this theory. The emergence of the barrier islands depend largely upon the wave movement. It happens most often in the area with the sea rolling in immense surges. Of course, they might appear in the sea of close pattern. Therefore, the conditions for the barrier island to emerge in the low-lying shore can be summed up as follows:

1. Abundant source of sand.
2. Favourable condition of topography, i.e. low-lying shore.
3. The most favourable one is the open coastal area with the surge pounding in the sea.

Only the western coast of Taiwan is suitable for the reclamation and man-made island. The said coast is categorised as the continental shelf with a level shore. There exist also quite a few tidal zones of deposit nature. While on the eastern coast the concept of reclamation is unfeasible. The slope of seabottom is too steep ($i=10\%$).

Furthermore, in some areas, only four to five kilometers away from the coast the water is as deep as 1,000 meters. All are infavorable for the project of reclamation.

In Europe, America and Australia, man-made islands emerged from the seabottom are scattered as shown on

Chart 2. In those areas the use of man-made islands is emphasized on the oil drilling (setting up the platform in deep water by means of steel pipe pile and steel sheet pile). The islands are also used as the ground to pile residual soil when constructing the harbour, wharf and airport (which may turn to be breeding ground for wild animal, plants and water birds through a slight settlement. They may be also destined for recreation or scientific use like the research space development.

In Japan the man-made islands are built for the use of airport, power plant and wharf. Some are purely for industry use or business residence, roads, parks and recreation quarter of urban area as Japan is densely populated.

Summing up the newly reclaimed lands have many advantages. The capital for their investment is rather low. They themselves are kept away from inhabitants. The pollution of environment alleviated to a certain extent.

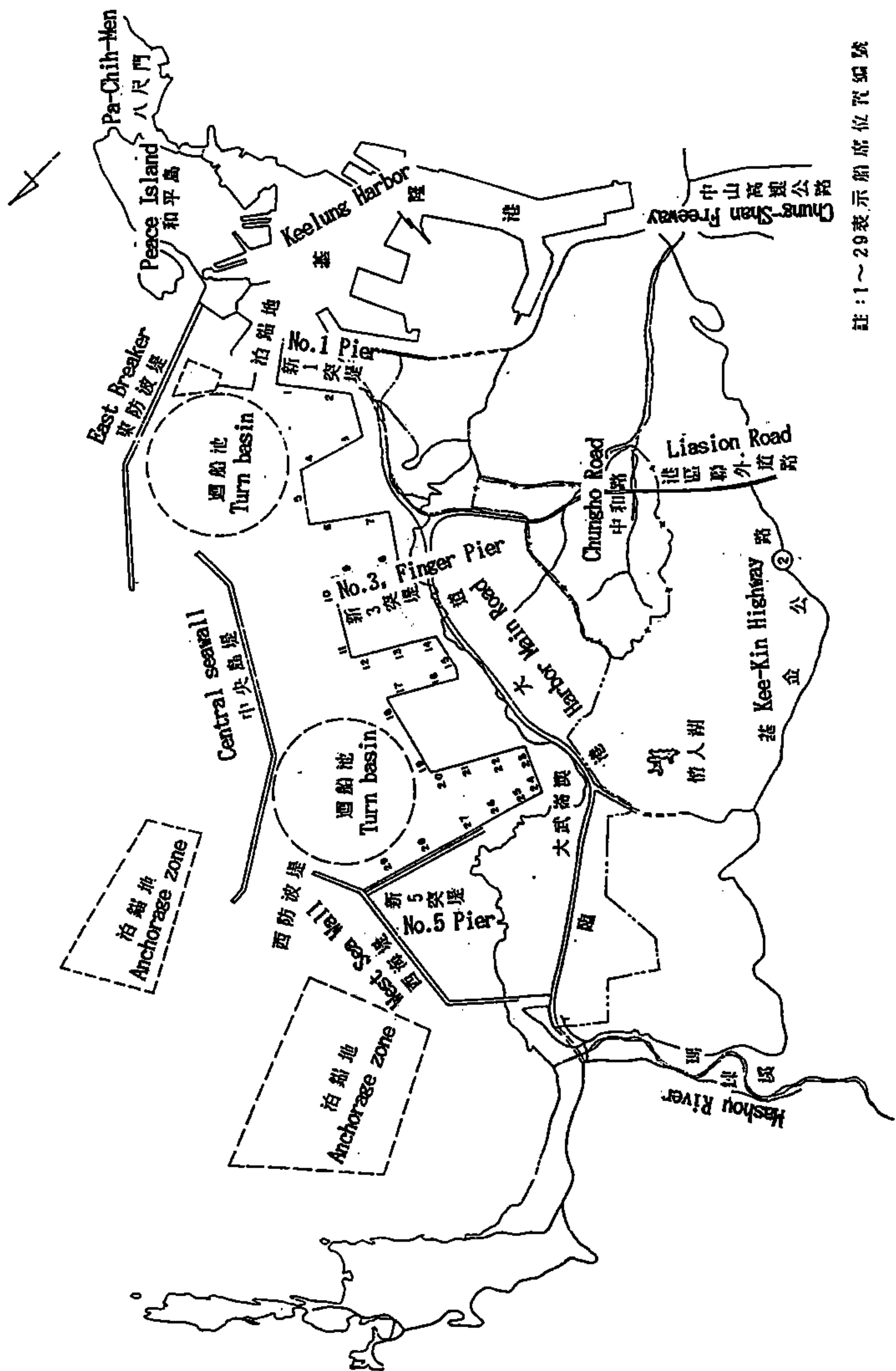
III. Prospect of reclamation and man-made island in Taiwan

During the last twenty years, Japan has completed many projects for the reclamation and man-made islands with an area totalling 20,000 ha. Such an experience is so valuable that we may take as a lesson for our own projects, since the geographical conditions in Taiwan are almost the same as those in Japan.

Nevertheless the steep slope, inclement weather and swell tide make it impossible to carry out the project on the eastern coast. The geographical conditions are relatively favourable on the western Taiwan.

1. New Keelung Harbor through reclamation

Entrusted by the Keelung Harbor Bureau, the China Engineering Consultants began their investigation for planning of a new Keelung Harbor in July 1984 and finished the work two years later. The planned site of the Harbor is located at the waters between the west of the present Keelung Harbor and Yeh Liu "Peninsula". (see Figure 3). Fishing harbours are scattered along the coastline at Wan-Li, Ta-Wu-Lun and Wai-Mu-Shan. The Hsieh-Ho Power Plant of the Taiwan Power Company is situated between the fishing port of Wai-Mu-Shan and the present Keelung harbor. Sandy beach stretches from the public sea bath "Wan-Li", east of Ma-Shou Brook to Fei-Ts'ui Bay. After that comes the Peninsula Yeh-Liu. This section of beach is an important quarter of recreation for the inhabitants in northern Taiwan. The harbour covers an area of about 1,300 ha. in total. The reclaimed island-like pier covers an area as large as 400 ha. The levelled hill would be reclaimed for the urban development as in the case of port island of Port of Kobe in Japan and that of container wharf



註：1~29表示船席位置編號

Fig. 3 The planning of Keelung Harbor for Reclamation

in Malacca. However, for the new Keelung Harbour a further study has to be made on its engineering technique and construction method. Its breakwater at the ends of east and west and in the central part are to be erected in the deep water. In some places the water is as deep as some 60m. Besides, the slope at the seabottom is rather steep. Fortunately, some foreign cases of the same nature can be taken as an example to follow. In Japan the water depth of Port of Kamaishi is 63m and in Portugal the water depth of Port Sines is 50m.

2. Deep water Port of Tamsui

According to the preliminary planning for a deep water harbour in Tamsui, the new harbour will be located in an area stretching northward from the Tamsui Estuary about 7.5km in length apart from the seashore about 2.5km in width.

Harbour area is separated from the coast by a 150m long "green belt".

The wharf area of the artificial harbour covers an area of 1,500 ha. Its priority of construction is only next to the deep harbour of Kaohsiung and that of Wai-San-Tin-Chou. The necessity of the port is to be further estimated.

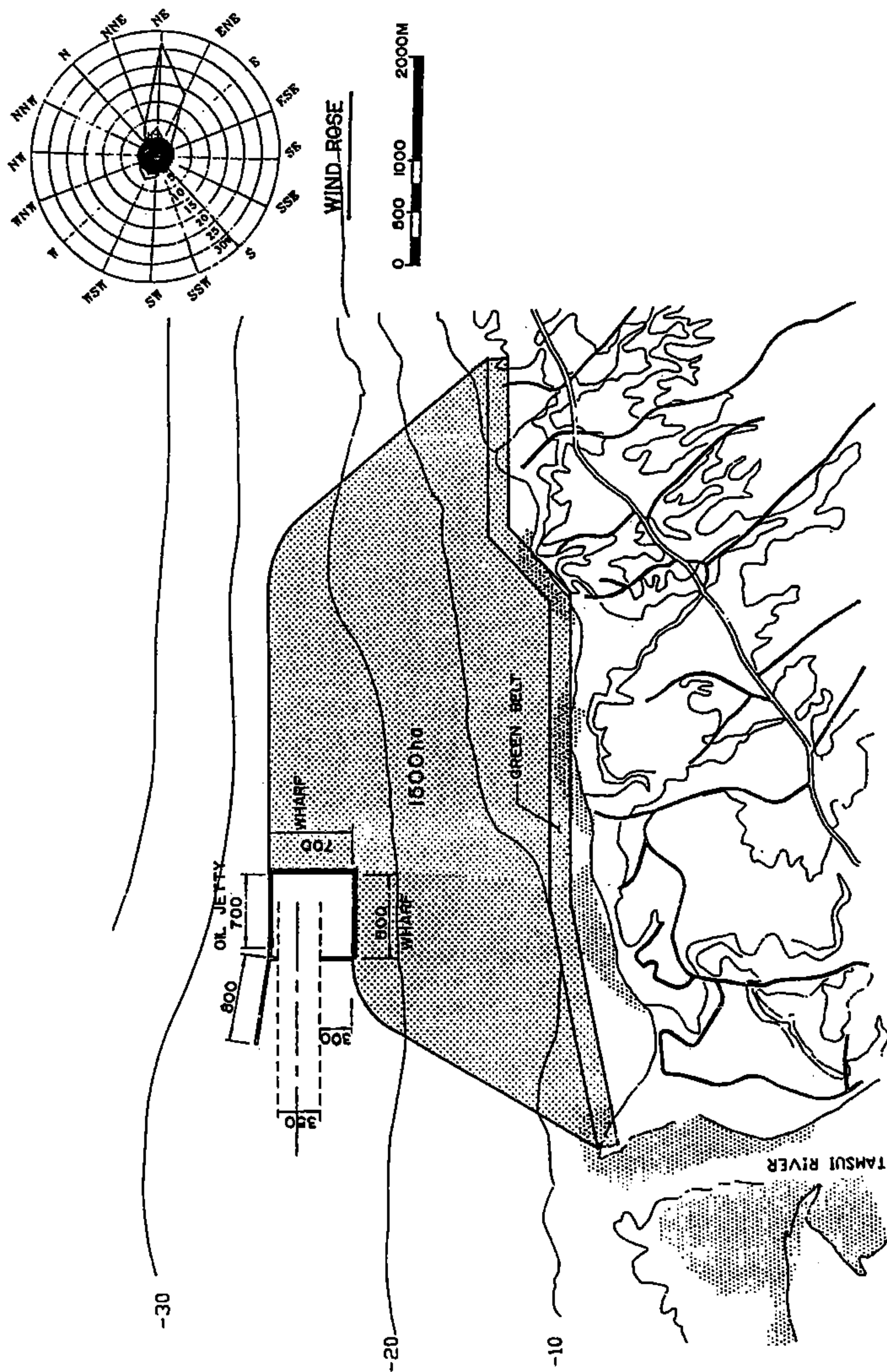


Fig. 4 The Planning of Deep Harbor, Tamsui

3. Petroleum port of Kuan-In in northern Taiwan

According to the requirements of the Chinese Petroleum Corporation and the related petro-chemical industries, it is estimated that the port should have various installations to handle the imported cargo in dry bulk (coal, salt and sulfate) and liquid ones (crude oil, refined product oil, liquified ammonia NH_3 OH). An area of some 1,000 ha. has to be exploited to set up all the necessary installations and facilitate the moving of cargo in the space. A 400-ha. area will also be reclaimed for oil tankers and bulk-freighters. The tonnage of them is under 150,000 tons (see Figure 5)

4. Taichung Port -- A great success of man-made harbour

The Taichung Port is about 4,300 ha. For water area it is shaped by constructing the "contour facilities" comprising breakwater, groin, sea wall and sea protection. As to the land, the wharves and reclaimed land are formed by backfilling with the soil taken during the dredging operation of navigational channel. This way of reclamation, economic and effective, can be taken as an example. The rate of return of investment is considerably high. The present throughput of port is 17,000,000 tons per year, greatly exceeding the expected goal of 1,200 tons. The "Deeper Channel" project is now under way for the 125,000 ton coal freighter. This project also helps reclaim more lands. (see Figure 6)

	X	Y
A	266960	2775061
B	265420	2776240
C	264900	2776630
D	262765	2776580
E	263000	2776000
F	262270	2774280
G	261570	2774050
H	262090	2773780
I	262215	2773880

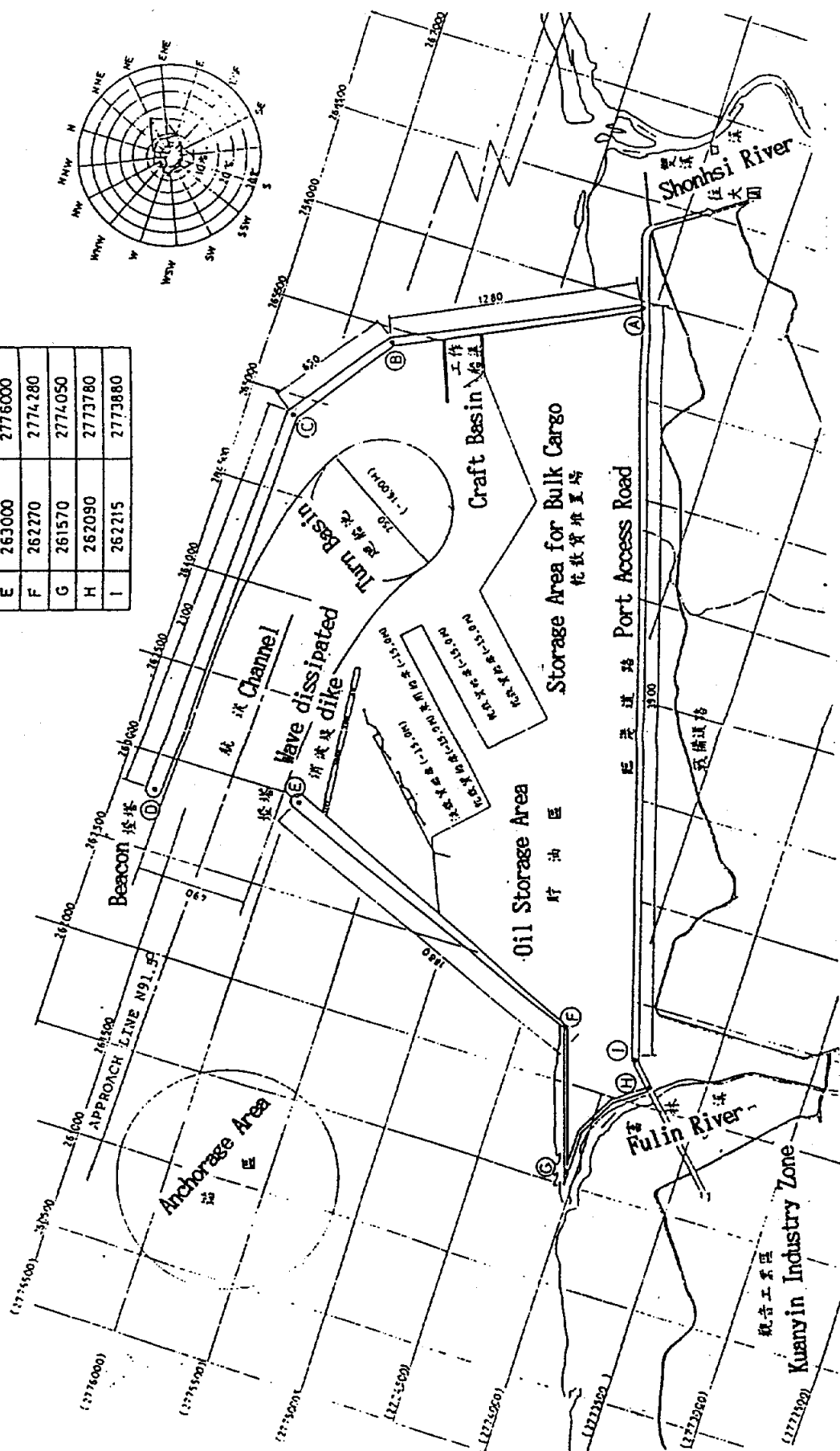


Fig. 5 Yuanyin Harbor, Petroleum

5. Development of industrial and recreation zones at Chang-Pin.

a) Industrial zone

Development project for the water-front along Hsien-Hsi, Lun-Wei and Lu-Kang has been carried out by the Industrial Development Bureau (IDB) of Ministry of Economic Affairs (MOE) after the reclamation in 1979.

The total area of the said zones is 3,643 ha. In which 2,330 ha. are for industrial use: 1,248 ha. for wind-break and 65 ha. for liaison roads.

b) Recreation zone

It covers an area of 2,844 ha. in total, comprising 804 ha. of Shen-Kang: 2,040 ha. of Fu-Hsing. Its development is being under the planning of the Urban Housing Bureau, Taiwan Provincial Government. Promotion committee has been established by the Government for the development of the zone. (author of this article is one of its members). The zone is for multi-purpose use, namely, raising, recreation, sporting park, racing course and ground for rubbish to be compressed and damped in the sea for reclamation (see Figure 7)

For the above said two (2) zones an area of some 6,500 ha. has to be reclaimed. It is proposed that a co-ordination unit be set up to handle the problems in all the related matters of development and the adverse impact on the oceanic environment.

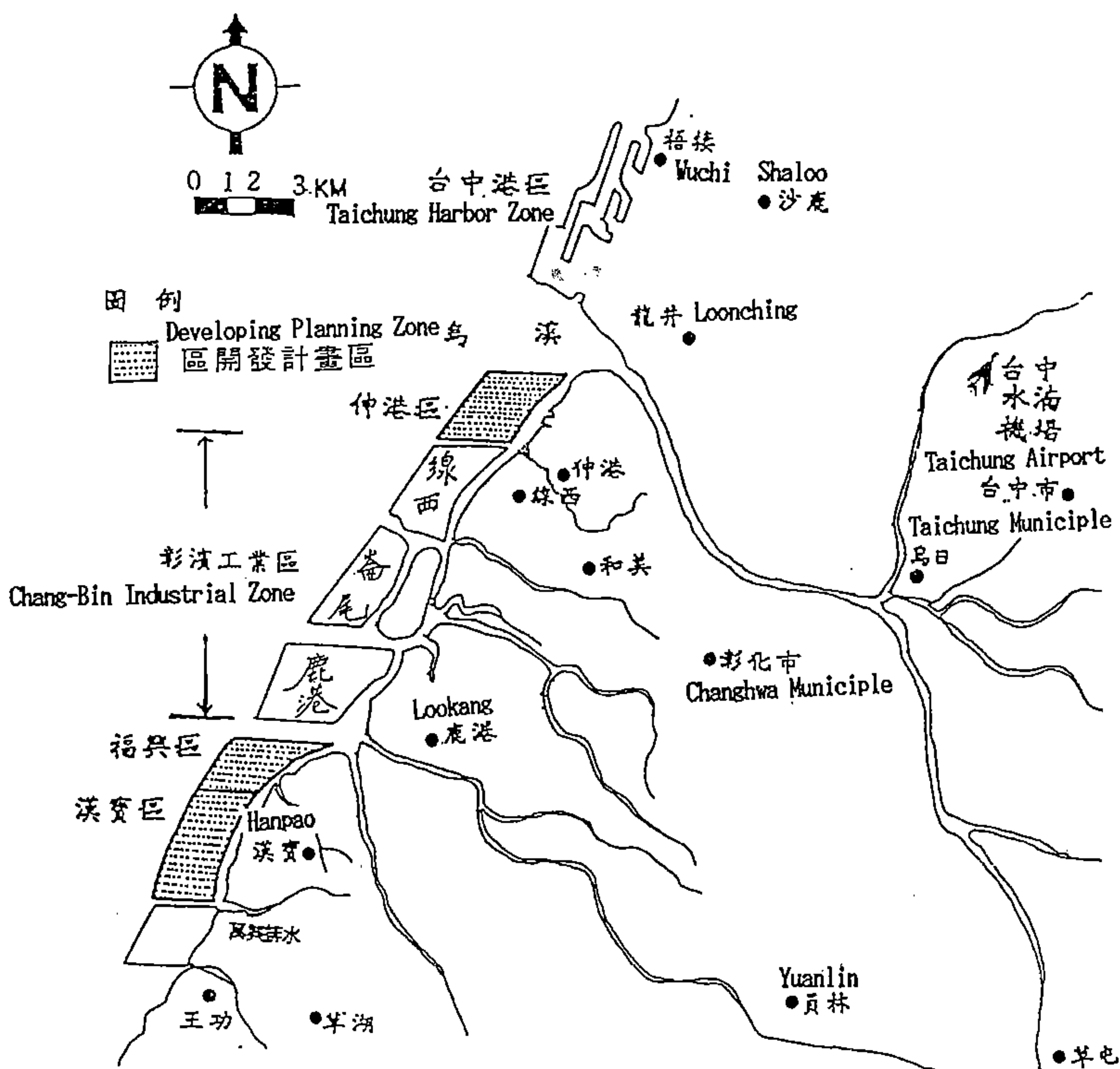


Fig. 7 Planning for Chung-Bin Industrial & Recreation Zone

6. Development of coastal areas of Yun-Lin, Chia-I and Tai-Nan, and reclamation for a base of industries.

The development of basic industrial zone and reclamation at Wai-San-Ting Chou near Yun-Lin and Chia-I counties need to be planned integratedly and simultaneously. It is also suggested that the project be carried out gradually from the South to the North.

With a view to offering the basic industries and their down-stream factories and plants with a good environment necessary for further development, the Industrial Development Bureau (IDB) has planned to develop the coastal area of Yun-Lin county and reclaim a tract from the sea at the Wai-San-Ting-Chou of Ao-Ku district of Chia-I County. With the producing activities of industry as the motivity the quarter will develop to an industrial base of multi-functional nature: industrial operation, housing and environmental protection. By this way, the producing operation will be ensured and the efficiency of management, enhanced. According to the plan, an area of 7,000 ha. will be reclaimed for industrial use, that is to say, petroleum refinery, steel mill, petro-chemical industry, thermopower plant, mid and down stream plants of steel industry and many other technical operations. Another area of 4,000 will be for residence quarter, business, cultural and educational activities, recreation, wind-break, green belt, environmental production center,

industrial harbour, water-storing pond and other public utilities. Summing up, an area of 10,000 to 15,000 ha. has to be reclaimed for the development of the industrial base. (see Figures 8, 9)

As planned by the Industrial Development Bureau (IDB) the Yun-Lin industrial base would be gradually reclaimed southward from Mai-Liao Hsiang, north of Yun-Lin county.

Off the Tainan shore there exist two tracts of reclaimed land, i. e. 1,000 ha. at Pei-Men and 2,800 ha. at Ch'i-Ku. Some proposals are made that they might be chosen for the development of the petro-chemical industry.

However, as estimated by the Industrial Development Bureau, the area of a reclaimed land for this end must be as large as 10,000 ha. in total. The reclaimed lands near Yun-Lin and Chia-I are most suitable for being given the first priority to develop into a petro-chemical industrial base. Over there 1,000 ha. of land are available to the Taiwan Sugar Corporation. The land acquisition is easier. Besides, large tracts have been naturally reclaimed from the sea. The Industrial Development Bureau (IDB) has also considered the shoal Wai-San-Ting of Chia-I county as the most hopeful place for the heavy chemical industry area. With the 1,000 ha. of land available to the Taiwan Sugar Corporation as the core a special base for the heavy chemical industry covering an area of some 8,000 ha.

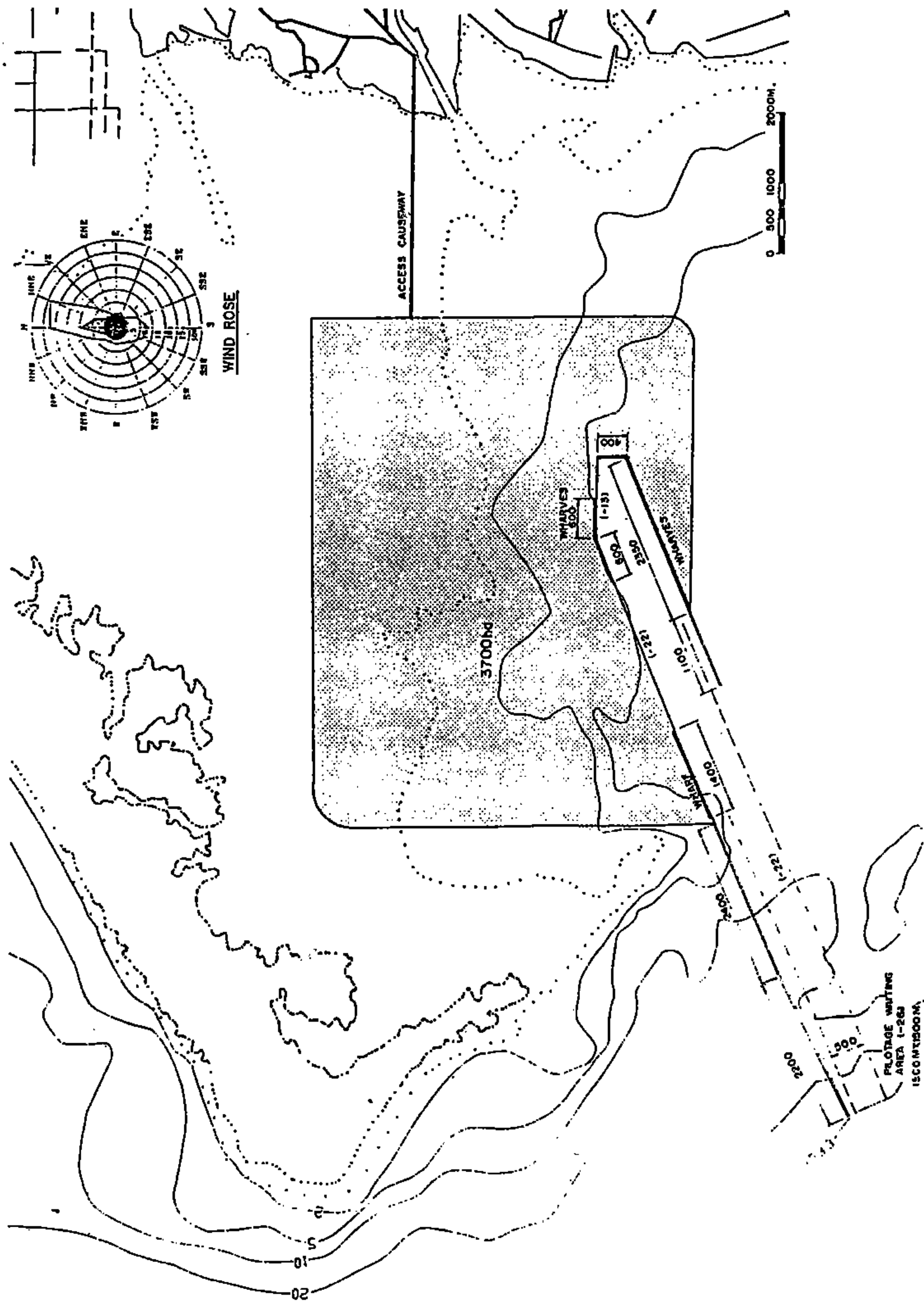


Fig. 9 Yun-Chia Integrated Development Plan

may be established by adding the already reclaimed land at shoal Wai-San-Ting. Although it is easier to acquit the land for the development, the technical know-how of reclamation is still to be introduced from Japan and the Netherlands and technology for development to be improved.

7. Integrated planning for international airport in southern Taiwan and new Kaohsiung Harbour

To meet the local shipping requirements in the future and the trend of the larger freighters in the whole world, a study is under way to explore the possibility of constructing a deep-water harbour. Among the harbours along the western coast of Taiwan the kaohsiung Harbour is deemed the most suitable place for it. The site planned to cover an area stretching from the southern breakwater of Kaohsiung Harbour second entrance to near the mouth of the Kao-p'ing River. In other words, a 1,868 ha. tract will be reclaimed in the area. The plan of a deep-water harbour comprises actually two parts: the harbour itself and reclamation works including offshore airport (see Figure 10)

Harbour project includes the construction of breakwater, sea wall, loading and unloading facilities navigational aids, shore protection, channel, turning basin, etc.

Reclamation project includes the construction of borrow pit, temporary isolated belt, green belt, isolated

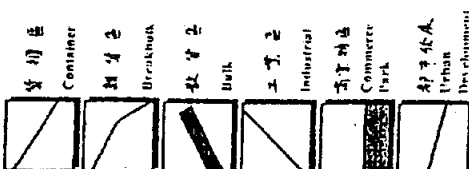


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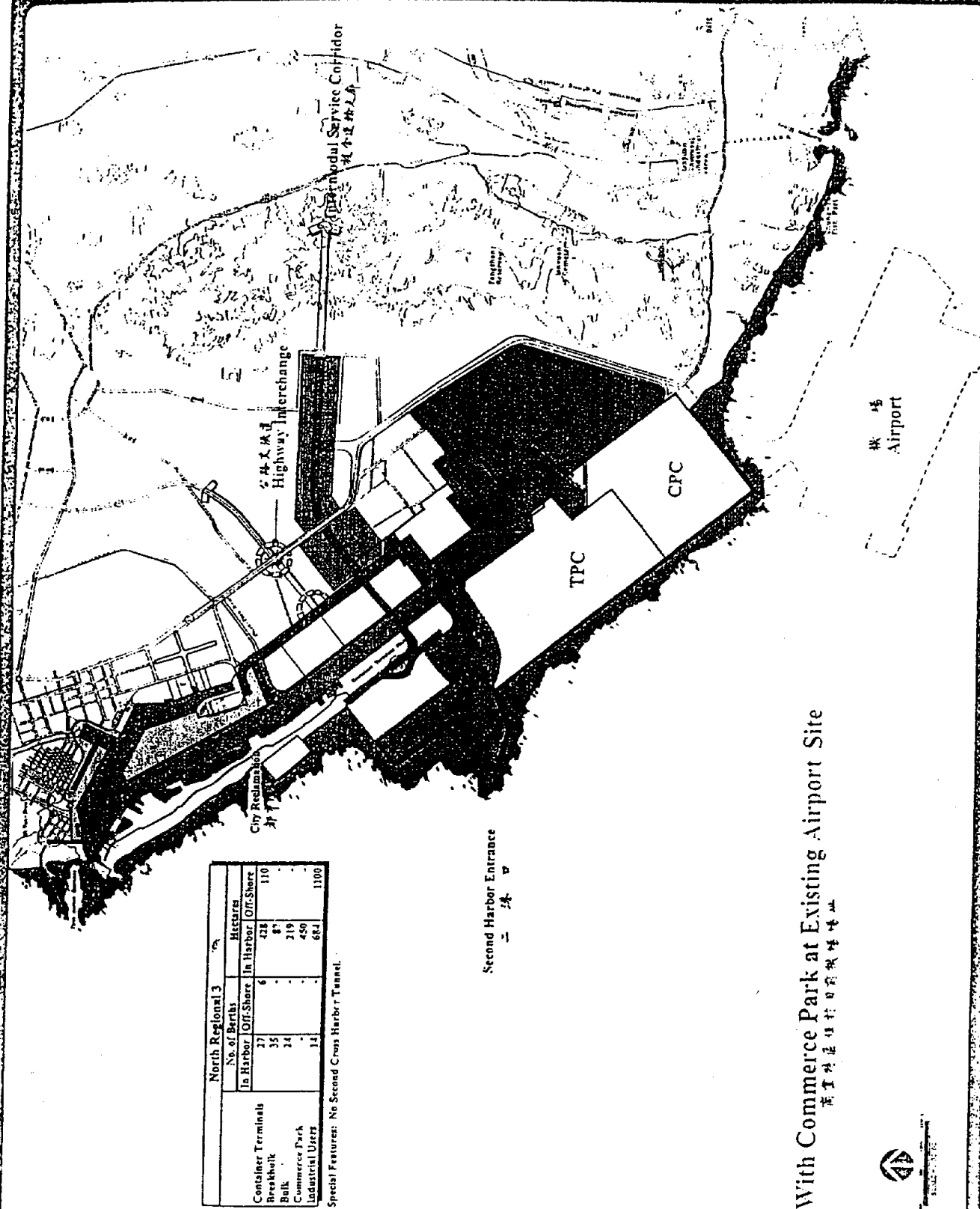


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NOTES : LEGEND



DATE: December 1992



North Regional 3			
	No. of Berths		Hectares
	In Harbor	Off-Shore	
Container Terminals	27	6	428
Breakbulk	35	-	87
Bulk	24	-	219
Commerce Park	-	-	450
Industrial Users	14	-	684
			1100

Special Features: No Second Cross Harbor Tunnel.

Second Harbor Entrance
二 港 口

With Commerce Park at Existing Airport Site
商業特區位於現有機場地址



Schematic Plan 2020 - North Regional 3 二〇二〇年計畫—北部區域性港口 三

Fig. 10 Integrated Planning of Southern International Airport and Kaohsiung Harbor

belt, anti-pollution facilities and public utilities such as systems of water discharge, power, transportation.

On the man-made land a special project is needed for the construction of an international airport covering an area of 1,000 to 1,500 ha.

IV. Integrated planning of man-made island

It is obvious that constuction of man-made island shows significant impact upon the sea environment, regardless of the site being in the sea or close to the shore. It causes the change of water quality, fishing activities, current condition etc. The emergence of the man-made island also changes the terrain of the shore.

The western coast is a continuous beach, a zone of high wave energy. The drift-sand is carried away from the north to the south. In the normal condition, the existence of a building nearby the sea will make the driftsand depositing on the upper stream while being washed away on the lower stream. Such phenomenon becomes more obvious after the appearance a man-made island. Especially, the serious erosion on the downstream.

It is therefore suggested that man-made island and reclamation works on the western coast of Taiwan be planned integratedly through communication and co-ordination among all the governmental agencies at various level from

central down to local. Also, for the interest of the whole nation, the plan has to be prepared by co-ordinating all the projects for the development of coastal areas. Only in this way can this plan be made feasible and reasonable.

In summary, reclamation seems to be the most appropriate way to acquire the land for the project. Still, there are a number of environmental problems need to be resolved, such as the noise, air and water pollutions, and tide range. It is necessary to conduct more detailed studies to minimize the ensuing damage to natural environment from the work of reclamation.

V. Conclusion

Along the western coast of Taiwan the slope of sea bottom facilitates the flow of the large quantity of sand drift from the river to the sea, and makes the coast a sandy beach. This is most favorable to the reclamation of land from the sea.

Judging from the viewpoint of the development, five (5) areas could be taken into consideration as follows.

1. Coastal area of Taoyuan (Kuan-Yin & Yung-An)
2. Area covering from Taichung Harbour to the north of the estuary of Ta-Chia River.
3. Coastal area of Wang-Kung. (Chang-hua Water front Area)
4. Coastal areas of Tung-Shih and Pu-Tai.
5. Coastal area of Tseng-Wen.

The governmental agencies concerned are actively planning and developing the reclamation of lands. As the space on land becomes limited day by day and the environmental pollution, serious gradually, the reclamation of land from the sea will help exploit the territory of nation and diminish the environment impact. Nevertheless, as the west coast is in the face of the Taiwan Strait, the reclamation works would have some oceanological effect and environment impact.

Therefore, it is a subject not only for the study on the reclamation project but also for a new concept of the industrial and recreative development.

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