THE BULL'S NOSE & STORM GATE, NORTH HARBOUR, CAPE CLEAR
EXISTING HARBOUR

- **Lack of Shelter**
  - Very turbulent conditions during storms
  - Bull’s Nose crucial for protection

- **Lack of Depth and Capacity**
  - Very limited berthing capacity

- **Road Access**
  - Access road exposed to wave overtopping and wave reflections

- **Vulnerability of Existing Structures**
  - Boom Wall
  - Duffy’s Pier

- **Stop Logs / Boom Wall**
  - Ability to protect Inner Basin
REASONS FOR DEVELOPMENT

- SOCIO-ECONOMIC – DEPENDENCE OF ISLAND POPULATION ON HARBOUR FACILITIES
- MAJOR STRUCTURAL CRACKS
- ONGOING SUBSIDENCE OF BULL’S NOSE STRUCTURE
- ONGOING DETERIORATION
- CONSEQUENCE OF COLLAPSE
  - Potential for serious damage to vessels in the Harbour
 SITE INVESTIGATIONS DATA

- Several boreholes, sampling and testing previously undertaken

 KIRK MCCLURE MORTON HYDRODYNAMIC STUDY 2001/2002

- Established that the most penetrating waves into the Harbour occur when the offshore wave direction is 280°
- Potential solutions were proposed but concerns remained that the solution proposed could result in more severe activity than predicted due to the omission of long waves from the study

 HMRC Wave and Harbour Development Study 2008

- 12 harbour layouts modelled in order to determine the most effective solution for protecting the Harbour Area. None resulted in calm conditions in the basins during storm conditions. Report concluded that a Storm Gate was necessary
- Developed the long term plan
PROPOSED LAYOUT – (DAFF MASTERPLAN)
- SITE INVESTIGATIONS
  - More targeted investigation of the work area

- WAVE DATA
  - Data collection and analysis

- WAVE ANALYSIS
  - Analysis and wave penetration
RESULTS OF STUDIES

➢ SITE INVESTIGATIONS
  ▪ Indicated variation in rock levels

➢ HMRC DATA COLLECTION AND WAVE ANALYSIS
  ▪ Provided much more information than previously available

➢ DELTARES STUDIES – ANALYSIS AND MITIGATION OF WAVE PENETRATION
  ▪ Wave penetration into the bay and harbour are a combination of sea, swell and longer waves
  ▪ The combination of swell waves and long waves appears to be the reason for the “draw” in the harbour referred to by local residents
  ▪ Provided input for the detailed design
Wave Height plots for a water level of 4.35 m +CD

Offshore wave conditions: $H_s = 7.9$ m, $T_s = 20.2$ s, MWD = 280°N

Upper panel: entire domain, lower panel: close up of harbour

Vector Maximum (Vx) = 0.016
Vector Minimum (Vx) = 0.006

1/100y condition

Run T7

Malone O'Regan

DELTARES

1204986  Fig C7
• New Slipway

• Demolition of Bull’s Nose

• Storm Gate support structure comprising of a replacement structure for the demolished Bull’s Nose and strengthening works to the outer end of Duffy’s Pier

• 12 metres wide hydraulically operated bi-parting storm gate

• Reclamation of part of the Inner Basin
Concrete armouring consisting of Tetrapods or X-blocks on rock armour consisting of 200-400mm stone.

Existing Bull’s Nose

New pier construction shown thus
KEY DESIGN REFERENCES

- Hydrodynamic studies by HMRC and Deltares
- US Army Core of Engineers; Shore Protection Manual
- BS 6349; Maritime Structures

DESIGN CONSIDERATIONS / PARAMETERS

- Critical Design Wave; 1/100 year;
- Variable forces on gate support hinges and ram during gate opening/closing
- Potential for buoyancy during construction

GATE

- Performance Specification and Exemplar Drawings provided by KGAL Consulting Engineers
- 7 Load cases to be considered
• PLANNING PERMISSION
  - Natura Impact Statement
  - Waste Management Plan
  - Archaeological Report
  - Flood Risk Assessment

• FORESHORE LEASE / LICENCE

• CERTIFICATE OF REGISTRATION
• CIVIL WORKS
  - 2 Stage Process
  - Suitability Assessment of Candidates for Civil Works
  - Short Listing of Candidates
  - Tender Process

• GATE
  - Single Stage Process
  - Design and Build Contract
  - Performance Specification with Exemplar Drawings
  - Novation of Specialist Contractor to Main Contractor
THE GATE

• Need – protection for vessels in the Basins
• Location – optimum location chosen
• Type – Biparting gate – efficient design. Loads and size for single gate option were both considered excessive
• Operation

ROADS INFRASTRUCTURE

• Existing roads infrastructure between existing slipway and the North Harbour inadequate

SLIPWAY

• Existing slipway too far from the North Harbour
• Need to construct new slipway first to facilitate deliveries

SAC DESIGNATION

• Roaring Water Bay and the Islands
PROCUREMENT ISSUES

➢ SHORTLISTING
  ▪ Challenge by Unsuccessful Candidates
  ▪ Debriefing

➢ TENDER EVALUATION
  ▪ Non compliance issues
CONCLUSION / LESSONS LEARNED / BENEFITS

- **COMPLEXITY**
  - The entire process more complex than envisaged

- **TIME**
  - Project duration longer than projected due to the need for further surveys and studies, regulatory requirements, access and weather issues

- **COST**
  - Project cost increased as a result

- **BENEFITS**
  - Basins protected
  - Safe haven for vessels
  - Facility to carry out future works in the harbour in dry conditions
  - Facility to provide dry dock for maintenance of the gates insitu
Cape Clear Island Harbour – Storm Gate Installation

Richard Browne
BE(Hons) BEng Nat Cert CEng MIEI

Thursday, 6th April 2017
Introduction

- Company introduction
- Cape Clear
  - Structural arrangement
  - Key engineering elements
- Questions & answers
Company factsheet

- Established 1987 in Kilmihil, Co. Clare by Louis Keating
- 110 direct employees
- Offices in Dublin, Cork & Clare
- Turnover €60M
- Marine clients include:
Company factsheet
Market sectors

Building

Civil

Plant Hire

Marinas
Marine civil engineering

Floating Concrete Harbour, Valentia Island, Co. Kerry. 2007-2008
Marine civil engineering

Knightstown Harbour, Valentia Island, Co. Kerry 2007-2008
Marine civil engineering

- Doolin precast pier technique
- 50t precast units
Innovative approaches

Castlefore Weir Repairs, Co. Leitrim
Temporary retaining 1.6m water

Grand Canal Dredging, Dublin City
Siphon bypass & specialist plant
Current works
Current works
Cape Clear

- Project scope
- Structural arrangement
- Design management
- Logistics
- Lock chamber
- Gate installation
Tender notice

- 70x10m slipway
- New pier & plant room
- New pier head & plant room
- Lock chamber & gates
- Xbloc revetment
Environment
Design parameters

Key design parameters
• 12m clear opening
• 4m wave height whilst closing
• Central latching mechanism
• CE Mark (EXC2)
• Low maintenance
• Intuitive

Key constraints
• Special Area of Conservation
• Island working
• Maintain harbour access
Structural arrangement
Structural arrangement
Structural arrangement
Structural arrangement
Structural arrangement
Structural arrangement
Structural arrangement
Design management

- Structural
- Mechanical
- Naval
- Structural
- Regulations
- HPU design
- Ram design
- Electrical
- Structural
- Geotechnical
- Temporary works
Design management
Design management
Design management
Design management
Logistics
Chamber / prefabrication

Sheet piling

Lock chamber

PCC ‘L’ walls
Concept design
Lock chamber construction
Lock chamber construction
Lock chamber installation
Gate installation
Gate operation

Hydraulic power pack

Touchscreen HMI
Gate operation