SYNOPSIS

Results of theoretical and experimental investigation of the effect of entrance geometry on wave induced seiche in a rectangular harbour are presented. A simple geometry and idealized conditions are assumed in the study as only basic information is sought for. The limitations and deficiencies of earlier two- and three-dimensional theories are discussed and an analytical solution of the problem of coupling of a rectangular harbour with the open sea through a communicating channel is presented. The theoretical development utilises the classical assumption of irrotational motion and small amplitude wave.

The following aspects of the coupling problem are investigated both analytically and experimentally, the latter in greater detail.

Series I - Effect of moving the entrance gap along the width of the harbour (No entrance channel).

Series II - Effect of widening the entrance gap (No entrance channel).

Series III- Effect of increasing the length of a rectangular entrance channel.

For each series, the number of studies reported in the thesis are listed below :

	Series	Resonant Modes	Variations in Entrance Geometry and Wave Period.
Theoretical	I	L,T	6 entrance locations, fixed entrance width, variable wave period.
	II	T	4 entrance widths, fixed entrance location, variable wave period.
	III	T	15 channel lengths, fixed entrance width and location, fixed wave period.

	Series	Resonant Modes	Variations in Entrance Geometry and Wave Period
Experimental	I	L,T,M	6 entrance locations, fixed entrance width, variable wave period.
	II	L,T,M	6 entrance widths, 3 entrance locations, variable wave period.
	III	L,T.M	20 channel lengths, 3 entrance locations, fixed entrance width, variable wave period.

In above, L and T are used to designate the second modes (first closed basin modes) that are excited, respectively, along and perpendicular to the direction of the incident wave travel. M stands for the 'first (closed basin) mixed' mode of the basin in which a nodal line exists in each of the above two directions.

The results of the numerical studies reported in the thesis show that both the amplitude of harbour oscillations and the entrance velocity at the harbour mouth become infinitely large at resonance. Their ratio, however, remains finite and the effect of varying entrance geometry on the response characteristics of the harbour is evaluated by comparing the strengths of the associated resonances through the use of this ratio.

Results of tests conducted in a wave channel agree with the theoretical results with fair accuracy. Both theoretical and experimental studies show pronounced influence of length, location and width of an entrance channel on the response of the harbour system at resonance. Of these, the effect of channel length is most significant. For a given harbour entrance, an increase in the length of the entrance channel (from zero) is found to reduce the shift of the resonant frequency from the corresponding closed basin eigen-frequency and the resonance in the given mode is stronger than when the entrance is simply an opening in a plane barrier; the most severe resonance in the given mode occurs with a channel length for which the shift of the resonant frequency is zero. The effects of varying location and width of entrances are studied in a harbour without an entrance channel. It is observed that, for resonant modes that are predominantly transversal, the location of an entrance gap towards or away from a nodal line produces significant modifications of the response characteristics. Theoretical studies with varying width of entrance gaps show that the protection from seiche disturbance decreases as the harbour mouth is gradually closed; but results of laboratory investigations indicate that this harbour paradox remains largely unrealised in wide harbours and in all harbours with narrow openings in which the entrance losses are significant. In general, both internal dissipation and non-linearity of the wave motion tend to limit the high amplitude magnifications predicted from the potential theory.

In addition to the experimental studies listed previously, the effect of basin orientation relative to the direction of the incoming waves is studied in a few tests by turning the basin through 90 degrees. The results of these studies show that both longitudinal and transversal modes are more effectively excited in the direction of the longer dimension of the basin.

The thesis consists of seven chapters with two appendices. A summary of conclusions arrived at is reported in Chapter VII of the thesis.