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PROCEDURES FOR DEALING WITH SEISMICALLY INDUCED  
SETTLEMENTS(U) CORK GEOTECHNICS LTD CASTLEMARTYR  
(IRELAND) W D FINN APR 84 DAJA45-84-C-0021

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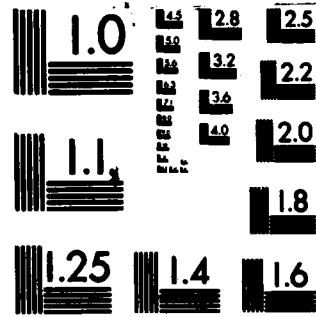
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RESEARCH PROJECT: PROCEDURES FOR DEALING WITH SEISMICALLY INDUCED SETTLEMENTS

PRINCIPAL INVESTIGATOR: W.D. LIAM FINN

CONTRACTOR: CORK GEOTECHNICS LTD.

CONTRACT NO.: DAJA45-84-C-0021

FIRST PERIODIC REPORT

MARCH 20, 1984 - APRIL 7, 1984

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) <b>Earthquakes; settlements; soil dynamics; seismic effects; centrifuge testing; soil embankments.</b>		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <b>→ Plans for a series of 7 centrifuge tests have been developed which define model geometry, materials and instrumentation. Four basic model designs were adopted, dry and saturated embankments with and without surcharge loading.</b> <i>↑ include</i>		

FIRST INTERIM REPORT: Contract No. DAJA 45-84-C-0021

by W. D. Liam Finn, Cork Geotechnics Ltd.

Plans for a series of 7 centrifuge tests have been developed which define model geometry, materials and instrumentation. Four basic model designs were adopted, dry and saturated embankments with and without surcharge loading. For the initial series of 4 tests the following models were used.

Unloaded Models Plane strain model embankments were selected to provide basic data for subsequent analyses. The base width was 720 mm, the height was 105 - 110 mm and side slopes were nominally 1 horizontal to 2 vertical. These dimensions ensured a crest width of 230 mm. The thickness of the model normal to the plane strain section was 460 mm. The construction material selected was No. 120 - No. 200 Leighton Buzzard Sand, placed at a density corresponding to a nominal relative density  $D_r = 65\%$ . Each model was subjected to a series of different simulated earthquakes. The unloaded models were tested both dry and saturated. To ensure proper scaling of the drainage effects silicon oil of appropriate viscosity was used in the saturated model instead of water. One dry and one saturated unloaded models were tested.

Loaded Models To simulate the effects of a heavy rigid structure on the embankment during an earthquake, mild steel plates were placed on the embankments creating model pressures on the surface up to 31 kPa. During heavy shaking it was possible for sliding motion to occur between plates and embankment. This slip will provide information on the effects of relative motion between soil and structure on seismic response during an earthquake. One dry and one saturated loaded model were tested.

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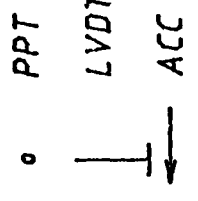
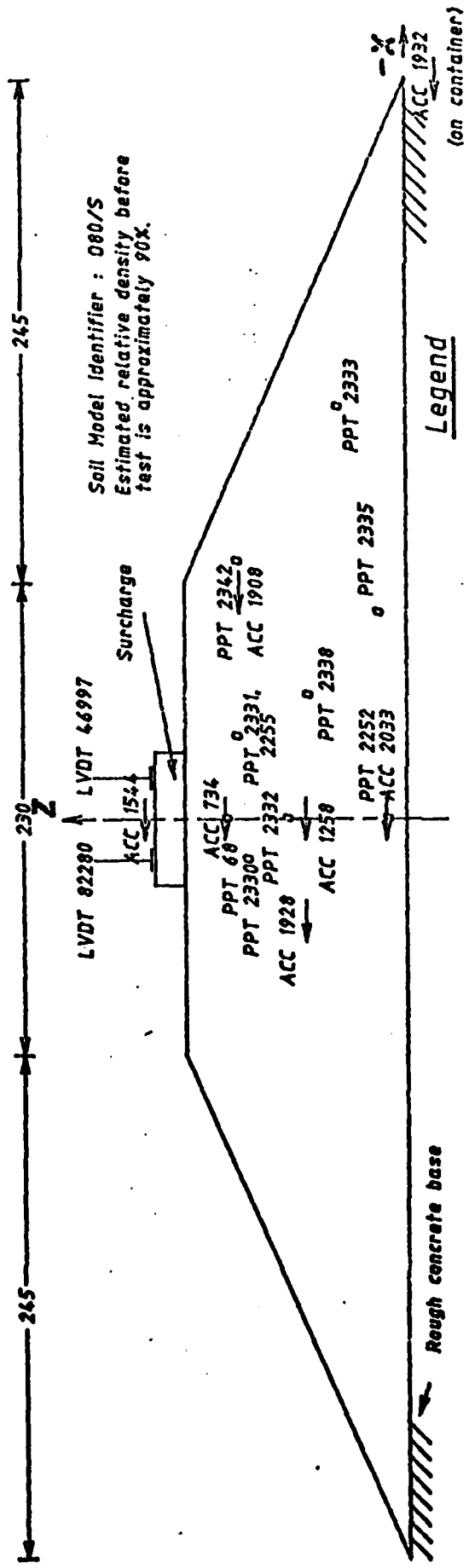
Instrumentation: The accelerations in the models were measured by DJB A23 piezoelectric accelerometers (ACC); pore fluid pressures by Druck PDCR pressure transducers (PPT) and the displacements by displacement transducers (LVDT). A typical layout of instrumentation is shown in Fig. No. 1. The pattern of instrumentation will vary from test to test. Typical output data is shown in Fig. 2.

#### More General Models

The plane strain models are 2-dimensional and are most amenable to computer analysis. Data from these models will be used to check the basic elements of the computer program TARA-2 being developed as part of the contract. When a satisfactory program has been developed it will be desirable to check its capability to analyse models with 3-dimensional response. For this reason a further 3 tests have been designed in which models can undergo 3-dimensional deformations. Again these tests will test both dry and saturated models with and without load. In this series the unloaded model will be tested dry only.

#### Program Development

Procedures have now been integrated into a computer program to perform a combined static and dynamic model analysis. These are basic procedures to provide the framework on which the final program TARA-2 may be developed. Work has started on the development of special program elements to model slip between structure and soil. A 2-dimensional pore pressure model is being developed to generate seismically induced pore-water pressures.



Notes:

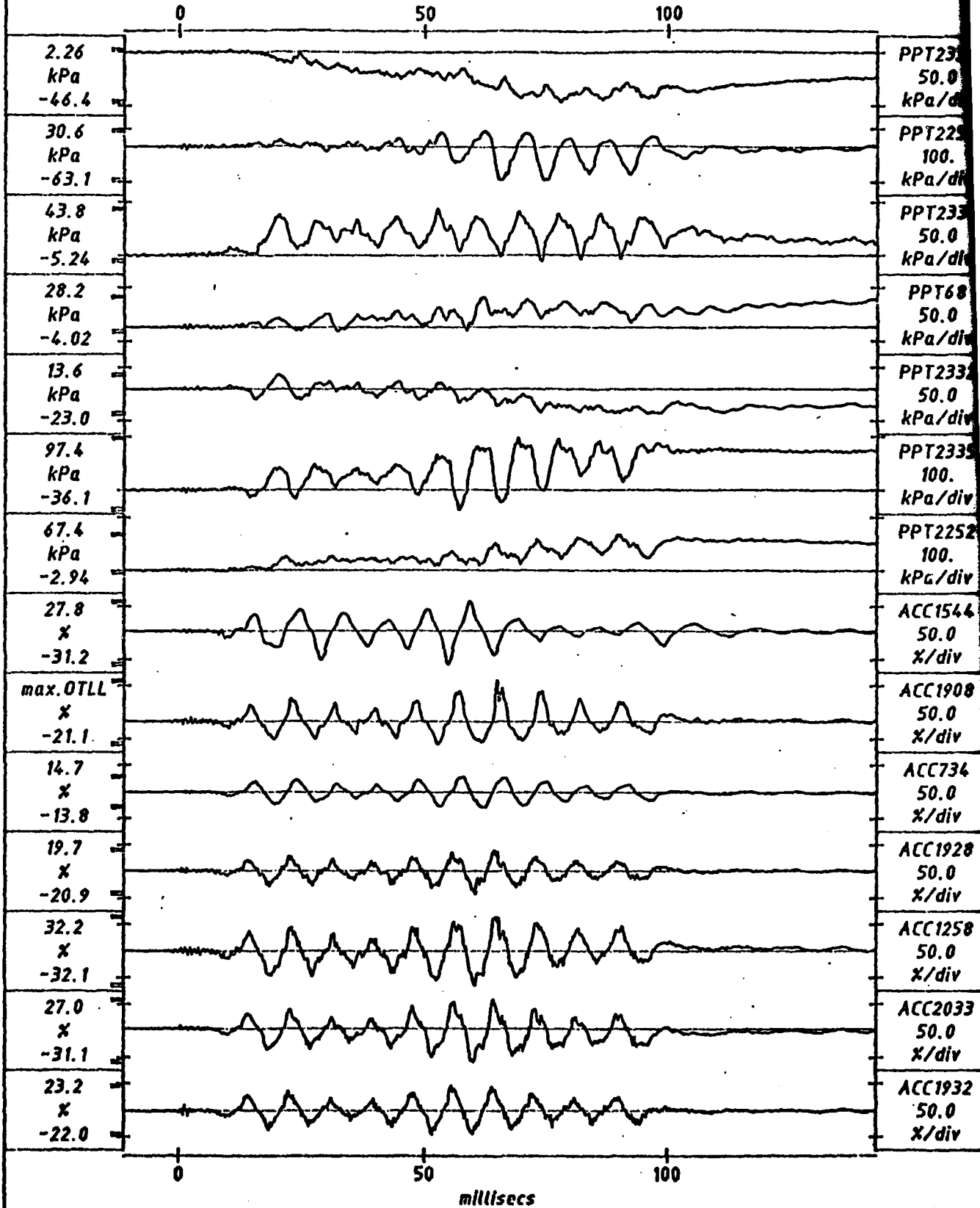
- (i) Transducer positions shown are approximate. Refer to Tables after test. Transducer positions before test cannot be measured.
- (ii) Surcharge consists of three mild steel plates. Refer to text for dimensions of these plates.

Flight	Earthquake	Earthquake Strength/x	G-Level
1	1	14.5	79.2
2	2	16.5	79.2
2	3	18.0	79.2
2	4	23.0	79.2
2	5	11.0	39.2
2	6	29.0	39.2
2	7	34.0	39.2
2	8	32.1	39.2

Test LD04 Model, All Flights.	REFERENCE STRUCTURE, TRANSDUCER POSITIONS AND EVENT SCHEDULE.	Scale approx. 1/3 All dimensions in mm.	Based on Figs.	Slides:	FIG. NO. 1
				Photos:	
FIG. NO.					

1024 data points per transducer, plotted after 1 smoothing pass

millisecs



Scales : Model

TEST LD04 MODEL 080/S FLIGHT 2	EQ4	SHORT-TERM TIME RECORDS	G = 79.2g Km = 22.6% Kp = 23.2%	FIG. NO. 2
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**A N N E X**

At the end of the period covered by the first periodic report the amount of funds remaining in the Contract DAJA45-84-C-0021 is \$45,000.00.

No property has been acquired by Contract funds.

*W.D. Liam Finn*

**W.D. Liam Finn  
for Cork Geotechnics Ltd.**

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