IN WITNESS WHEREOF, the parties have executed this document.

UNITED STATES OF AMERICA

BY: _____

Kellogg V. Morton, Chief
Research Contracts Branch
(title)

Nuclear Regulatory Commission

CORNELL UNIVERSITY

BY: _____

Thomas R. Rogers, Director
Office of Sponsored Programs
(title)

I, *Joyce W. Cima* (attester), certify that I am the

Assistant Secretary (title) of the Contractor named

under this document; that *Thomas R. Rogers* (signatory)

who signed this document on behalf of said Contractor was then

Director, Office of Sponsored Programs of said Contractor; that

this document was duly signed for and on behalf of said Contractor by

authority of its governing body and is within the scope of its legal

powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of

said Contractor.

_____

(SEAL)

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CONTRACTOR: CORNELL UNIVERSITY

APPENDIX A

For the Contract period October 1, 1978 through December 31, 1979

Article A-I RESEARCH TO BE PERFORMED BY CONTRACTOR

(a) The unclassified scope of work entitled, "Seismic Membrane Transfer and Punching Shear in Secondary Containment Vessels" is as follows:

Membrane Shear Plus Tension:

Perform experiments on two specimen configurations: (1) specimens with 4-way reinforcement (orthogonal and diagonal), and (2) orthogonally reinforced (2-way) specimens with tension applied to the bars in one direction only.

Perform experiments on six specimens of type (1). Conduct three tests on specimens that have been cracked by tensioning the orthogonal bars, but with the tension reduced to zero during the application of shear load. Load two identical specimens incrementally with cyclic shear and load the third monotonically to failure. Apply a tension of either $0.6f_y$ or $0.9f_y$ to the orthogonal bars of a second set of three specimens.

Test twelve specimens of type (2) (three each at the four different stress levels of 0, 0.3fy, 0.6fy, and $0.9f_y$). At each stress level test one specimen w monotonically increasing shear to failure, and test two identical specimens under a cyclic shear loading history similar to that used in the current research.

Correlate the parallel experimental program underway at the Portland Cement Association Laboratory with the Cornell results to assess any differences that may exist as a function of specimen and reinforcing bar size.

Provide a preliminary review of the current criteria for the seismic shear for reinforced concrete structure including the development of the necessary data base for Regulatory Guides. Include the following subjects:

(1) Consideration of new limits and possibly new formulas for shear stresses listed and defined in CC-3421.4.1, page 188, CC-3421.5, page 189, CC-3421.5.1, page 189, of the ASME Boiler and Pressure Vessel Code, Section III, Division 2;

(2) Consideration of strain limits, which are not considered in the above code;

(3) Consideration of the need, the effect (positive and negative) of th diagonal reinforcement and consideration of the possibility to illuminate the diagonal reinforcement, particularly if the diagonal reinforcement produces a negative effect;

(4) Consideration of the effect of strain (displacement of the containment walls caused by seismic load) on the behavior of the liners.

The above work scope will include consideration of the loads and load combinations defined in Articles CC-3240 (CC-3241, CC-3242 and CC-3243) of the ASME Boiler Code and Pressure Vessel Code, Section III, Division 2.

Punching Shear Plus Tension:

Extend the pilot study on combined punching (peripheral) shear and biaxial tension being conducted under the current contract to systematically evaluate the many variables involved and thereby accumulate the information needed to properly formulate an engineering predictive model for this type of behavior.

Dynamic Response of Containment Models:

~~Perform experiments on reduced scale complete containments~~. Develop detailed specimen designs as well as finalize plans for the testing techniques and procedures. Choose the scale of the model to optimize the conflicting requirements of adequate representation of the full size structure, and the cost of the experiments. Run analyses on the computer to provide a preliminary indication of the magnitude of response characteristics expected and to assist in identifying critical locations for instrumentation.

~~Dynamic Shear Transfer in Tensioned Walls~~:

~~Perform a preliminary study of dynamic shear transfer in cracked walls by testing two walls loaded with a dynamic shaker (to be rented for these tests only).~~

(b) The Principal Investigator expects to devote the following approximate amount(s) of time to the contract work:

R. N. White: 100% of his time for 1½ summer months and 20% of his his time for 9 academic months.

P. Gergely: 100% of his time for 1 summer month and 20% of his time for 9 academic months.

ARTICLE A-II WAYS AND MEANS OF PERFORMANCE

(a) Items for which support will be provided as indicated in A-III, below

(1) Salaries and Wages $ 60,450.00

(2) Equipment to be purchased or fabricated by the Contractor $ -0-

(3) Travel
(i) Domestic $ 2,653.00

(ii) Foreign $ 3,200.00

(4) Other direct costs including staff benefits

(5) Indirect costs based on a predetermined rate of 72 percent applicable to salaries and wages.

(b) Items, if any, significant to the performance of this contract, but excluded from computation of Support Cost and from consideration in proportioning costs:

Dynamic recording equipment for high speed slab punching test.

(c) Time or effort of Principal Investigator(s) including indirect costs and fringe benefits contributed by Contractor but excluded from computation of Support Cost and from consideration in proportioning costs:

R. N. White - 20% of time for 9 months of academic year.
P. Gerely - 20% of time for 9 months of academic year.

Article A-III

The total estimated cost of items under A-II(a) above for the contract period stated in this Appendix A is $135,000.00 ; the Commission will pay 100 percent of the actual costs of these items incurred during the contract period stated in this Appendix A, subject to the provisions of Article III and Article B-XXVIII. The estimated NRC Support Cost for the contract period stated in this Appendix A is $ 135,000.00 .

The estimated NRC Support Cost is funded as follows:

(a) Estimated unexpended balance from prior period(s) $ 35,000.00

(b) New funds for the current period 457 256 100,000.00

(c) The new funds being added in A-III(b) constitute the basis for advance payments provided under Article B-X.