AG Contract No.KR97 2216TRN
ADOT ECS File: JPA 97-160
Project No. SPR-471
TRACS No.: R0471 ~~10P~~ 09P
Research: Specific Applications of
Shotcrete to Enchance Rock Stability

**INTERAGENCY AGREEMENT**
BETWEEN
THE DEPARTMENT OF TRANSPORTATION
AND
THE ARIZONA STATE UNIVERSITY

THIS AGREEMENT is entered into 22 OCTOBER, 1997, between agencies of the State of Arizona, to wit; the DEPARTMENT OF TRANSPORTATION (the "DOT") and the ARIZONA BOARD OF REGENTS, acting for and on behalf of ARIZONA STATE UNIVERSITY, (the "University").

I. RECITALS

1. The DOT is empowered by Arizona Revised Statutes Section 28-108 to enter into this agreement and has by resolution, a copy of which is attached hereto and made a part hereof, resolved to enter into this agreement and has delegated to the undersigned the authority to execute this agreement on behalf of the DOT.

2. The University is empowered by Arizona Revised Statutes Section 15-1626 to enter into this agreement and has delegated to the undersigned authority to execute this agreement on behalf of the University.

3. The DOT and the University desire to conduct research and achieve the development and implementation of a low cost rock slope stabilizing technique to enchance rock mass stability, at an estimated cost of $13,508.00, all at DOT expense, hereinafter referred to as the Project.

THEREFORE, in consideration of the mutual agreements expressed herein, it is agreed as follows:

## II. SCOPE OF WORK

1. The DOT will:

a. Appoint a Project coordinator within the DOT's Transportation Technology Group to interface with the University relating to the research and development.

b. Provide the University with information and data as may be reasonably available to assist in the Project research and development.

c. Reimburse the University within forty-five (45) days after receipt and approval of monthly invoices, in a total amount not to exceed $13,508.00.

2. The University will:

a. Appoint a Project coordinator at the University (ASU) to interface with the DOT relating to the research and development.

b. Accomplish the research and development generally in accordance with Exhibit A, which is attached hereto and made a part hereof, including the development of a low cost rock slope stabilizing technique, and a final report documenting the program, data derived, and the final results. Such reports will be in a format compliant with the DOTs "Guidelines for Preparing Research Reports."

c. No more often than monthly, invoice the DOT in the form of Exhibit B attached hereto, supported by narrative reports and an accounting of monthly costs and expenditures on the Project. Upon completion of the Project, provide the DOT with a detailed final report.

## III. MISCELLANEOUS PROVISIONS

1. Title to all documents, reports and other deliverables prepared by the University in performance of this agreement shall rest jointly with the DOT and the University.

2. This agreement shall become effective upon signature by the parties hereto, and shall remain in force and effect from 1 October 1997 until completion of said Project and reimbursements; provided, however, that this agreement, may be cancelled at any time prior to the commencement of performance under this agreement, upon thirty (30) days written notice to the other party.

3. The parties agree to comply with all applicable state and federal laws, rules, regulations and executive orders governing equal employment opportunity, immigration, nondiscrimination and affirmative action.

4. This agreement may be cancelled in accordance with Arizona Revised Statutes Section 38-511.

5. The provisions of Arizona Revised Statutes Section 35-214 are applicable to this contract.

6. In the event of any controversy which may arise out of this agreement, the parties hereto agree to abide by required arbitration as is set forth for public works contracts in Arizona Revised Statutes Section 12-1518.

7. All notices or demands upon any party to this agreement relating to the agreement shall be in writing and shall be delivered in person or sent by mail addressed as follows:

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|---|---|
| Department of Transportation<br>Joint Project Administration<br>205 S. 17th Avenue - 616E<br>Phoenix, AZ 85007 | Arizona State University<br>Research & Creative Act.<br>PO Box 871603<br>Tempe, AZ 85287-1603 |

8. The parties recognize that performance by ASU under this Agreement may be dependent upon the appropriation of funds by the State Legislature of Arizona. Should the Legislature at any time fail to appropriate the necessary funds for such performance, the, by written notice to the DOT, ASU may cancel this Agreement.

IN WITNESS WHEREOF, the parties have executed this agreement the day and year first above written.

STATE OF ARIZONA

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| THE ARIZONA BOARD OF REGENTS<br>acting for and on behalf of<br>ARIZONA STATE UNIVERSITY | DEPARTMENT OF TRANSPORTATION |
| 10-13-97<br>By Janice D. Bennett<br>JANICE D. BENNETT, Director<br>Office of Research and<br>Creative Activities | By Tim Wolfe 10/22/97<br>TIM WOLFE<br>Ass't State Engineer |

**PROJECT DIRECTOR APPROVAL**
I have reviewed the terms of this contract and they are acceptable to me. I request that an authorized signatory execute this contract on behalf of the university.

Project Director: Tim Wolfe Date 10/13/97

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RESOLUTION

BE IT RESOLVED on this 12th day of September 1997, that I, the undersigned LARRY S. BONINE, as Director of the Arizona Department of Transportation, have determined that it is in the best interests of the State of Arizona that the Department of Transportation, acting by and through the Intermodal Transportation Division, to enter into an agreement with the Arizona State University for the purpose of defining responsibilities for conducting research for developing a low cost rock slope stabilizing technique.

Therefore, authorization is hereby granted to draft said agreement which, upon completion, shall be submitted to the Director of Transportation Research for approval and execution.

for LARRY S. BONINE
Director

EXHIBIT A

PROPOSAL
TITLE: SPECIFIC APPLICATION OF SHOTCRETE TO ENHANCE ROCK MASS STABILITY, PHASE I

September 4, 1997

TO: ARIZONA DEPARTMENT OF TRANSPORTATION

FROM: Dennis Duffy, of ARIZONA STATE UNIVERSITY

Summary

This research would be the initial step in the development of a low cost rock slope stabilizing technique. "Micro shotcrete" is the technique which would be used to enhance rock element interaction. Rock falls would be reduced because of the enhanced inter particle interaction. Approximately 80 sub-slope areas selected from the twenty rock cut slopes will be photo documented. Rock falls and precipitation will be monitored at these sub-slope areas for 12 months. The monitored slopes will later be used as either stabilization or control segments. A literature review will also be completed on shotcrete additives and a preliminary examination of permeability enhancing additives would be made.

Once Phase I data is available the second phase would proceed. Phase II would involve:

- An experimental program resulting in "micro shotcrete" applied as a minimal invasive stabilizing technique.
- Developing additives to address ascetic concerns.
- Selection of additives to maximize shotcrete life, strength, and permeability.

Objectives of Phase I

1. To select approximately 80 sub-slope areas on twenty different cut slopes for inclusion in this study. These slopes would fall within a wide climate range in Arizona.

2. To create a detailed photo data base of the sub-slope segments selected. This data would be used to help select slope segments for "micro shotcrete" stabilizing.

3. To create a base line slope performance record through monitoring rock falls and precipitation over a 12 month period. This data would be used to evaluate the effectiveness of "micro shotcrete" on rock slopes.

4. To complete the started review of shotcrete as a rock slope fragment stabilizing technique. The "micro shotcrete" technique proposed by this research will function by assisting the rock mass's initial resistance to movement. This literature review will focus on application techniques and additives that are likely to enhance the performance of shotcrete. To began the examination of permeability enhancing techniques to increase shotcrete permeability will be developed.

5. To define slopes ready for inclusion in the Phase II study.

Schedule

Work to start on 10-1-97 and to be completed on 5-31-98.

Budget

Personnel costs (includes fringe benefits)
Dennis Duffy, 1 week at end of semester to prepare report.....$1899
Undergraduate students 20 hrs /week, 30 weeks..... ...4992

Expenses
Film & developing.....280
Rain gauges & modification..... .....100
Mileage to sites, 4500 miles at @.30/mile 1350
Shotecrete and lab materials.....2000
Report reproduction.....100

Indirect costs @ 26%.....2787

Total = $13,508