OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF ENVIRONMENTAL SERVICES
RESEARCH IMPLEMENTATION PLAN

Title: Archaeological Study Methodology and Results

State Job Number: 14776
PID Number: RFP No. 01-60
Research Agency: University of Cincinnati
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Study Start Date: 10/1/2001
Study Completion Date: 12/31/2003
Study Duration: 27 Months
Study Cost: $99,998.00
Study Funding Type: 80 Federal / 20 State, ODOT SPR (2)

STATEMENT OF NEED: ODOT has determined that one of the best ways to optimize Phase I cultural resource survey data is to test the feasibility of using advanced technology for project planning. Depending on the quality and coverage of existing archaeological survey data, it is thought that new tools, such as remote sensing and GIS-based predictive modeling, might help ODOT personnel employ archived data more effectively and develop well informed decisions about the allocation of future funding dedicated for cultural resource management. Such an approach would help ensure that increasingly scarce resources are spent wisely on project planning, the formulation of effective scopes of work, and on the conduct of archaeological survey itself.

RESEARCH OBJECTIVES: (1)To compile a state of the art summary of current procedures for assessing the adequacy of the quality and coverage of data to be used for the purpose of developing archaeological predictive models; (2)To develop a computer based database management system for implementation by ODOT, reflecting the best available approaches used by other states, and aimed at ensuring that the most effective predictive tools are developed with the least amount of additional expenditures for additional data collection and management; (3) To assist ODOT in implementing the database management system using a computerized framework involving the latest GIS and GPS technologies;
(4) To establish an on-going program for the refinement of existing predictive models and the development of new ones, principally in response to the financial constraints and practical needs of ODOT; (5) To integrate the findings made under Project 14775 (*Best Management Practices of Archaeological Study Methods*) with this research; (6) To test the feasibility of using GPS and GIS for predictive model development, the team will select a study area where the UC capabilities for simulating landscapes with GIS and GPS acquired data will be applied to assess the feasibility of using such technologies in the development of effective predictive modeling tools.

RESEARCH TASKS: This project and Project 14775 were developed as related, integrated research. For this project to move forward, Project 14775 had to be nearly completed first; and we had to have those results near finalized so that the consultant could build upon those results. Based on the results of 14775, the consultant examined the data characteristics of 14 study areas described in that investigation to construct an analytical sample for this project. Problems were encountered in designing a sample that would be suitably representative and yield results that would be interpretable.

First, with the exception of 74 sites in Study area 14, a total of 3472 sites in 13 study areas combined were not located with GPS technology, which limited the usefulness of a whole range of high resolution remote sensing media. Because there was some uncertainty regarding exact positions on the earth's surface, the research team decided to us an archived LANDSAT 7 image.

Second, examination of the data from the 14 study areas, which included 13 study areas defined in Project 14775 as well as Study Area 14 that was added subsequently, revealed considerable variation in the number of sites, landforms, the variety of site types, discovery methods, etc. Consequently it was unclear how comparable the results of either the GIS or the remote sensing investigations would be among the study areas.

Third, the coverage of the digitized data pertaining to vegetation, soil, and surface glacial geology is highly uneven, which would have made the inter-study area GIS analyses largely meaningless.

The solution to these constraints was the decision to select Study Area 8, located in Fairfield County, as the most analytical venue to develop models about the distribution of unknown archaeological phenomena based on the attributes of known sites. It was then decided that the research team should focus on the most common types of archaeological phenomena, i.e., lithic scatters and isolated finds, that have been found historically on ODOT projects. This decision was supported by the fact that lithic scatters and isolated finds constitute at least 90-100% of the archaeological phenomena discovered in all 14 of the study areas.

RESEARCH DELIVERABLES: The research focused on creating archaeological predictive models that are based on the characteristics of lithic scatters (n=580) and isolated finds (n=214) from a study area in Fairfield County, Ohio. Six GIS models forecast the presence or absence of lithic scatters and isolated finds from spatial variation in soil type, land cover, and surface glacial geology. For the same study area, a remote sensing model stressed the spectral characteristics of lithic scatters and isolated finds that are located in two land cover classes (agricultural fields or uplands) that registered on a 2001 LANDSAT 7 "leaf off" image near Lancaster, Ohio.

RESEARCH RECOMMENDATIONS: Significant patterning was detected in the extent to which either certain combinations of environmental variables or spectral imaging parameters predict lithic scatters, isolated finds, or neither site type. For example, lithic scatters, which represent the most common type of archaeological site statewide, are more reliably modeled that isolated finds when landform is held constant. These and other findings suggest that archived archaeological data and remote sensing imagery hold great promise for ODOT planning, particularly in identifying alternative corridors for future Phase I surveys. However, this study determined that, at the time of the study, it was not sure whether a GIS based approach, which requires extensive and time consuming compilation of disparate data files, or a remote sensing approach, which requires advanced technical knowledge, is the most cost effective approach. The final report also contains recommendations for evaluating the predictive models' usefulness and the need for further study to assess how changes in land use patterns affect the designation of archaeological and environmental phenomena.

PROJECT PANEL COMMENTS: The project review panel consisted of the AEA over the OES Cultural Resource Section, all five OES staff archaeologists, and the archaeology reviewer for ODOT projects from the Ohio Historic Preservation Office (OHPO). Comments were given at the time of the research.

IMPLEMENTATION STEPS & TIME FRAME: ODOT already has implemented some recommendations that came out of this 2003 study in a number of ways. For example, ODOT funded a project with the OHPO to establish a joint GIS system for archaeological (and other) data so that accurate site location information will be recorded at the OHPO. This included the correcting of the UTM coordinates on all their site inventory forms, then that data was put into the GIS system for joint use by ODOT and OHPO staff. Another project with OHPO digitized all areas in the State of Ohio that have been subjected to prior

archaeological survey. With just these two initiatives, ODOT now has accurate location data, plus data on areas already surveyed on which to base evaluations of the necessity and intensity of any survey actions that may be needed in an area of the state. In 2004 ODOT published a Cultural Resources Manual. One of the many requirements of that manual is that a GPS equipment standard is now required of all consultants doing ODOT project work. The manual requires that all archaeological site locations have GPS data recorded. All of that data is fed into the GIS system shared by ODOT and OHPO. ODOT also requires consultants to test existing predictive models when we have a project of sufficient areal extent to do so, and to make recommendations on modifying and improving upon any models. Consultants are also encouraged to develop and test new models for areas in which none exist. All of these initiatives (and more) allow ODOT and OHPO to better focus archaeological research and utilize and refine predictive models for archaeological sites and address one of the issues raised in this study about the paucity of reliable, GPS based field data. The environmental streamlining benefit is ongoing.

Regarding the remote sensing aspect of the recommendations, this office has not pursued that course aggressively up to this point in time. While the use of the LANDSAT 7 imagery seems to hold promise, our focus has been in correcting, then building the reliability of our GPS data. From there more reliable testing of existing predictive models (and development of new ones) can be pursued. Since our research is now 2+ years old, we have just begun to look at different, new technologies (such as aerial and ground based Lidar types of technology) to see what kind of applications those may have for this type of work. This doesn't mean that ODOT couldn't go back to use LANDSAT 7 imagery or some other technology such as infrared to pursue some of these research ideas, but the developments with some of these newer technologies have become more the focus.

EXPECTED BENEFITS: Many benefits are already being realized in the sense that based on the previously mentioned information, we have streamlined our process, gained accurate and dependable GPS information, have a system that can be constantly added to, all of which allow ODOT personnel to better scope the necessary archaeological work that is required on projects. All of this research and the means we've already employed to make sure we have reliable data allow us to do so much more investigative and predictive work from our work stations. As we gain more data and more knowledge, ODOT does realize a benefit in the basic sense that staff time is better focused and better utilized from a time management perspective. Our ability to scope projects for Districts and consultants continues to grow exponentially with the increasing quality and quantity of our data collection, data recordation and data analysis techniques.

EXPECTED RISKS, OBSTACLES, & STRATEGIES TO OVERCOME THEM: As with the other research conducted for ODOT by this team, the only obstacles that we have are time and equipment based. In other words, staff time to work on many of these initiatives with the OHPO and consultants is paramount. Much of the work gets done on specific projects as opposed to just doing hard research. Equipment based obstacles are mainly the challenge to keep up with GIS, GPS, Lidar, etc., technology so that ODOT can stay on top of the best information collection and management practices.

OTHER ODOT OFFICES AFFECTED BY THE CHANGE: All ODOT Districts have projects on which these initiatives are used, implemented, refined, and processed.

PROGRESS REPORTING & TIME FRAME: Already in place, being used, and being improved upon.

TECHNOLOGY TRANSFER METHODS TO BE USED: ODOT-OES archaeology staff and ODOT-OES' GIS specialist work very closely with their counterparts at the OHPO on an ongoing basis. With the above mentioned initiatives (and more), it has been a seamless transfer of information. Our staff has also met with Aerial Engineering to get a briefing on some of the capabilities of Lidar technology. That is something the office is pursuing as a general initiative (i.e., not specific to just one section of OES).

IMPLEMENTATION COST & SOURCE OF FUNDING: Most of the work that has been put in place with the OHPO has been paid for by ODOT from various sources, primarily SPR funds. This is an ongoing process of building and refining the GIS system we've put in place. Some funding has come from FHWA as well. A sizable portion of the work has been done via project specific research, so we've integrated the day to day, year to year project work and results with the GIS system we've built with OHPO.

Approved By: (attached additional sheets if necessary)

Office Administrator(s):

Signature: *Timothy M. Hill* Office: OES Date: 11/9/05

Division Deputy Director(s):

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