Scope of Work for

Phase I: Development of a Recycled Materials Web Map to Connect Consumers and Producers

I. Background and Problem Statement

Over half a billion tons of recyclable material such as foundry sand, coal combustion products and construction and demolition debris, are produced each year in the United States (EPA, 2009). Many of these materials have beneficial use in transportation construction projects. Unfortunately, the widespread use of these materials is hindered by a lack of information; either an understanding of the beneficial use of the recycled material or simply finding an adequate source of the recycled material. Providing potential consumers of recycled materials an on-line location-based information system that includes recycled material sources, past projects that used recycled material, and regulations pertaining to the use of recycled material in construction projects is needed. Information about recycled material including: type(s) of material, availability, producer throughput, cost, and material characteristics should be included in the site. In addition to the map of recycled material sources, two additional map layers: case studies and regulations, need to be available on the site. The case study layer will focus on past projects that employed recycled material in the design and construction. The regulations layer will display state regulations pertaining to the beneficial use of recycled material. By providing locations and quantities of available recycled materials, examples of past case studies, and regulations governing recycled material, a single source to promote the use of recycled material will be created.

II. Objective

The objective of Phase I of this study should be to develop a beta version of an on-line recycled materials Geographic Information System (GIS) map and supporting web site. The map and web site should be interactive and allow registered producers of recycled material to enter, update, and maintain recycled material source information. Potential consumers of recycled material, such as contractors, should be able to use the web map to search for local recycled material that meets specifications. Select sources and stockpiles of recycled material should be entered into the beta site for testing purposes during this Phase of the study. Feedback about the site should be solicited from interested parties within RMRC and participating states. In future Phases of this study, the site should be expanded to include case studies and regulations layers, and add additional data and functionality to the site.

III. Scope of Work

Task 1: Research Advisory Group: Establish an Advisory Group of RMRC and Department of Transportation (DOT) personnel from the Environmental, Materials, and Information Technology Divisions. An initial project kickoff meeting should be held followed by monthly progress meetings. The Advisory Group's primary responsibility will be to help generate site requirements

and provide feedback to improve the site. As a beginning step to the research, it is expected that the researcher will review similar existing databases/tools used to connect materials to projects. A few suggested sources include TxDOT, WVDOT and EPA Region 3.

Task 2: Requirements Collection: Web site requirement collection shall be performed through interviews with stakeholders and potential site users. A requirements list with web-site priorities and level-of-effort ranking should be developed. Use cases for the web site should also be developed and should include DOT, private material suppliers, and public recycled material users.

Task 3: Database Schema Design: The recycled material web map will be an online, editable database with a user-friendly interface. Because of the importance of the underlining database, a database schema including tables, fields, and data linkages should be developed and documented. See Task 5 for additional information.

Task 4: User Interface Design: The user interface for this site will be very important and needs to be properly designed to be easy to use yet still contain all the important information to make informed decisions about recycled material use. Mockups of the user interface should be created and presented to the advisory group for feedback. Help screens and popup help tips should also be designed during this task. See Task 5 for additional information.

Task 5: Site Design and Development: Development of the recycled material web site should follow a typical software development life cycle and use up-to-date software technology. The proposal should clearly explain the programming environment that will be employed for this research, an example of which is provided below.

> *The web site will employ a model-view-controller (MVC) architectural design pattern, and will be implemented with Microsoft's ASP.NET MVC framework. HTML5, which includes the markup language, Cascading Style Sheets 3 (CSS3), and JavaScript, will be utilized in conjunction with the noted framework to construct the user interface. The user interface will be optimized for viewing purposes based on the screen size of the device in use (i.e. desktop, mobile device, tablet, etc.). The interactive map will be embedded in the web site using Environmental Science Research Institute's (Esri) ArcGIS API for Javascript, and all data will be stored in a Microsoft Sequel Server relational database management system (RDBMS). Spatial data within the RDBMS will be with Esri ArcGIS for Server and Arc Spatial Database Engine (ArcSDE) technology.*

Task 6: Map Functionality: The online map and map functionality are critical to the success of this project. Basic map functionality such as locating facilities, stockpiles, and construction projects must be intuitive and robust. Roadway routing functionality from selected stockpiles to the construction site should be included as a tool on the map. Proper design of the map along with help screens and help tip popups should be created during this task.

Task 7: Recycled Material Data Collection and Beta Site Testing: DOTs are both consumers and producers of recycled material. Because of this, DOTs are an excellent source of data and

users to test the recycled material web map. DOT stockpile data including: location, contact information, material type, material characteristics, and quantities should be entered into the site. DOT projects that could benefit from the use of recycled material should be located in the site and used as test cases.

Task 8: User's Manual and Final Report: Prepare a User's manual, final report, and make a final presentation to the RMRC-3G Executive Board and Advisory Group. The final solution should be easy to update online and ongoing, and could be administered by any appropriate individual or entity. It is expected that the researcher will propose options for h

IV. Project Team

The scope of work presented herein will be managed under the direction of Dr. Andrew Graettinger, Associate Professor, Civil, Construction and Environmental Engineering, University of Alabama.

References:

EPA (2009). *Using recycled industrial materials in roadways* (EPA-530-F-08-024). Retrieved from website: www.epa.gov/osw/conserve/rrr/imr/pdfs/roadways.pdf