IPRO It takes a team INTERPROFESSIONAL PROJECTS PROGRAM

IPRO 312

FINAL REPORT

01 MAY 2008

Sponsors:
Wight & Company
Metropolitan Water Reclamation District of Greater Chicago
IIT Facilities

Faculty Advisors:
Fouad Teymour Ph.D. Chem. E.
Said Al-Hallaj Ph.D. Chem. E.

Faculty Consultant
John Anderson, PhD, IIT President

Teaching Assistant:
Gregory Weipert

Team Leader:
Shawn Shoulders

Sub Team Leaders:
Sarah Johnson
William Lewis
Helen Yeung

Members:
Misha Chavazha
Chance Lebron
James Myers
Karl Rybaltowski
Nan Wang

Revised Objectives

The objectives of IPRO 312 have not changed since the formation of the team, a few short months ago. We continue our dedication to incorporating hydro-gel technology as a solution to: combined sewer overflow (CSO), storm water flooding of the streets and pedestrian areas of Chicago, and a more dynamic and eco-friendly use of captured rainwater throughout the city. We believe that our objectives are in line with that vision.

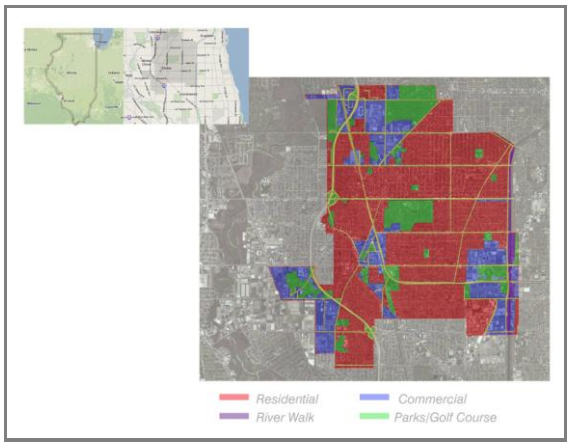
Objectives:

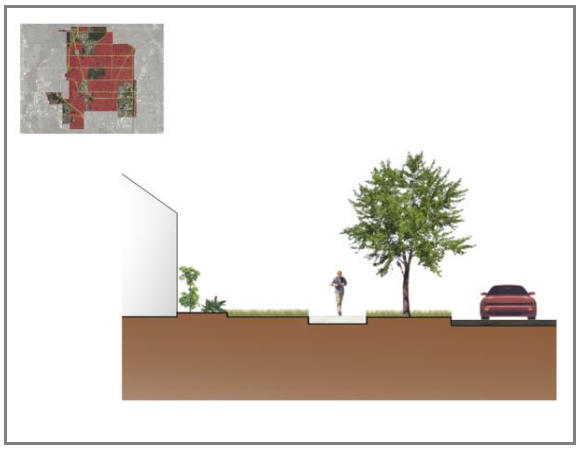
- Create a "plug and play" cell-based design incorporating hydro-gel technology, renewable energy sources and porous pavement.
- Construct a working prototype.
- Compare and contrast our design with current technologies.
- Forecast the ecological/economic impact of our design on a Chicago-land neighborhood.

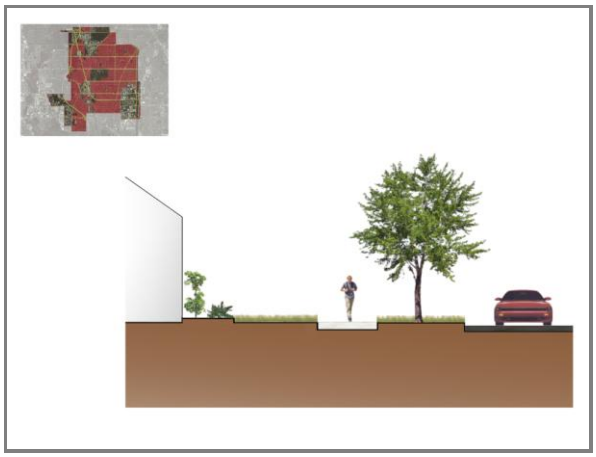
Results to Date

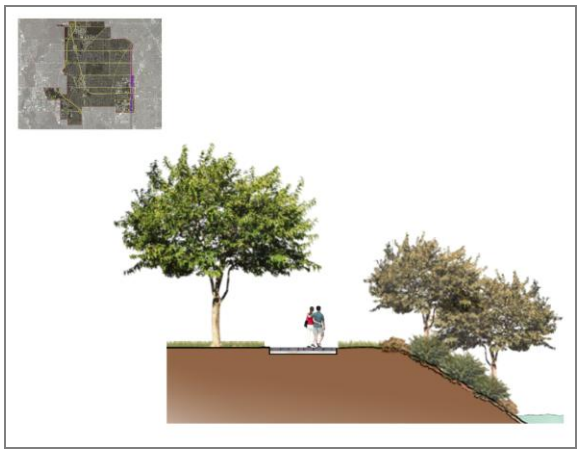
Completed Milestones:

- We held a meeting with Catherine O'Connor, Ph.D. PE, of the Metropolitan water reclamation District of Chicago to discuss the history, operation, and needs of the MWRD.
- We have indentified and began mapping a Chicago-land area (Skokie) for case study and research into implementation. We have begun to compile the local MWRD storm statistics in order to project optimal implementation and impact of our system.

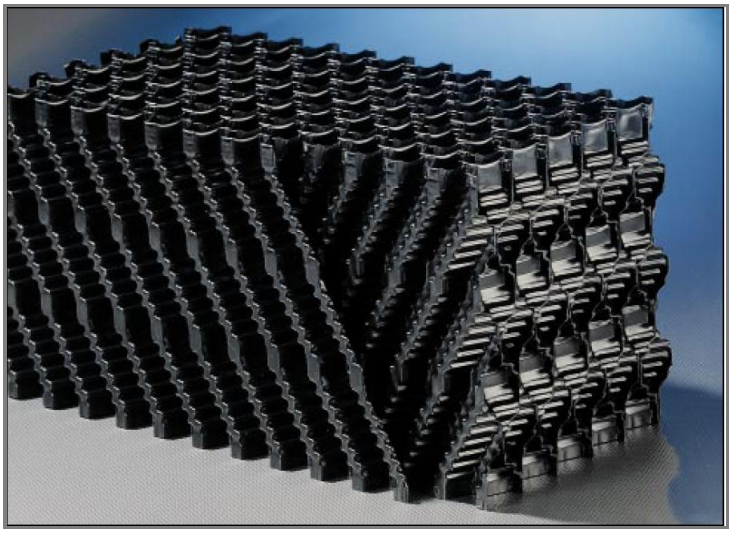




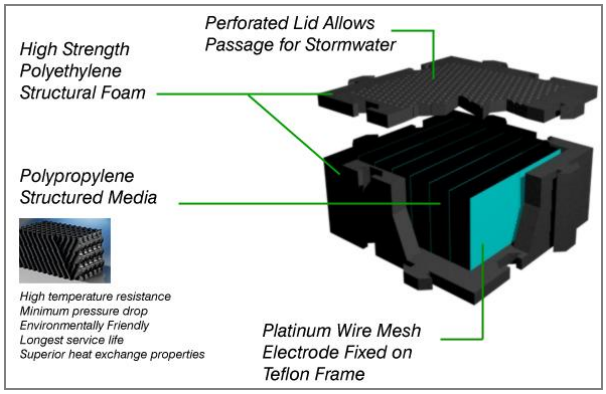


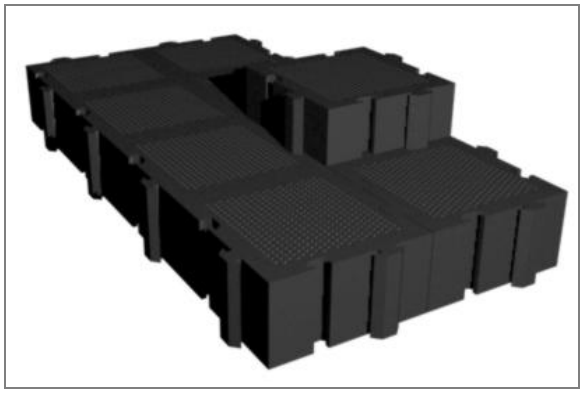


- We have begun research on alternative rain water retention technologies, to compare and contrast to our design.
- We have identified and procured a possible structural polypropylene product to incorporate into our design, while fostering a relationship with *Biomicrobics Inc*., the supplier of the product.

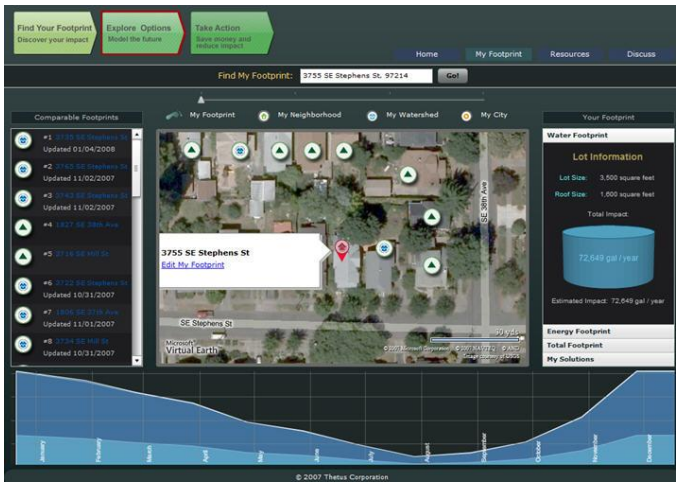


- We have completed initial designs of both the structural and electrical aspects of our system, emphasizing “plug and play” capability and a cell based structure.





- We have procured demonstration software from *Thetus Corporation* to assist us in technology comparisons of the various systems currently being used to manage storm water.



- We have and continue to meet all IPRO imposed "deliverable" standards and deadlines.
- We have completed preliminary models of our designs.

Updated Task Assignments and Designation of Roles

There have been no changes to the task assignments and or designation of roles from the structure set forth in the *IPRO 312 project plan*.

IPRO 312			
Name	**Major**	**Assignment**	**Role**
Misha Chavazha	Physics	Electrical	
Sarah Johnson	Architecture	Design/Logistics	Leader of Design
Chance Lebron	Architecture	Design	
William Lewis	Mechanical Engineering	Electrical	Leader of Electrical
James Myers	Mechanical Engineering	Electrical/Design	
Karl Rybaltowski	Civil Engineering	Design	
Shawn Shoulders	Materials Engineering	Logistics/Electrical	IPRO Team leader
Nan Wang	Electrical Engineering	Electrical	
Gregory Weipert	Chemical Engineering	Logistics	IPRO TA
Helen Yeung	Civil Engineering	Logistics/Design	Leader of Logistics

IPRO 312		
Team	**Goals/Responsibilities**	**Members**
Design:	1. Investigate and design porous pavement structure capable of supporting hydrogel system.	Sarah Johnson Chance Lebron James Myers
	2. Construct working protype for display	Karl Rybaltowski Helen Yeung
	3. Create map of case study area including hydrogel application points.	
Electrical:	1. Research renewable energy sources to use as system	Misha Chavazha James Myers
	2. Test and verify the electrical properties of the hydrogel.	Shawn Shoulders William Lewis
	3. Design cell structure, control apparatus and power supply for system.	Nan Wang
Logistics:	1. Complete and provide all *deliverables* to IPRO office.	Shawn Shoulders Helen Yeung
	2. Complete all administrative tasks, such as *minutes* , etc.	Sarah Johnson Greg Weipert
	3. Organize and maintain *IGROUPS web* page.	
	4. Organize and maintain budget.	

Designation of Roles:

- IPRO Faculty Advisor: Said Al-Hallaj
- IPRO Faculty Advisor: Fouad Teymour
- IPRO Faculty Consultant: John Anderson
- IPRO Teaching Assistant: Greg Weipert
- Team Leader: Shawn Shoulders
- Minutes: Helen Yeung
- Agenda: Shawn Shoulders
- Status report: Shawn Shoulders
- Scheduling and hours Greg Weipert

Barriers and Obstacles

Obstacles to date:

- ***Initial design process:*** In the beginning of the project it was a challenge to identify the proper avenues to begin our research. The initial scope of our project seemed so broad that it was

increasingly difficult to devise a proper plan of attack. After meeting with Dr. O'Connor of the MWRD we were able (with her guidance) to limit our scope and focus on one single case study in Skokie, IL. Identifying a case study allowed us to refine our product design from both a flexible and a rigid design down to one rigid, "plug and play" design.

- ***Acquiring the right information:*** As with any project, we were initially swamped with information and ideas. Through our meetings and conversations with Dr. O'Connor we were able to begin the process of weeding out the unnecessary data. Further brainstorming sessions and discussions allowed our team to focus on our objectives and only the ideas and info pertinent to those goals.

- ***Circuitry design:*** Since we are dealing with a situation involving water and electricity it is rather complicated to design a system that is both safe and efficient. Given our general novice abilities in this area, we were facing a huge learning curve. Through a team structure and independent study we were able to achieve an initial circuitry design. With experimentation we will continue to refine our design.

- ***Flexibility of design:*** A major obstacle was coming up with a way to allow our system to be incorporated into various situations, whether it is under sidewalk structures, within curb-side water inlets or implemented into building architecture, etc. Our cell-based design seems to have alleviated that issue for us. The identification of a polypropylene support media has also aided in our plans of a dynamic design.

- ***Design to prototype:*** We faced issues with our electrical design and incorporation of the hydro-gel polymer into the polypropylene support media. Completion of a working prototype proved to be difficult but was accomplished through a team structure and repeated experimentation. Design refinement and re-engineering will take place as necessary.

- ***Accurate modeling:*** Given the nature of hydro-gels and the size of our prototype it was a challenge to correctly forecast the type of impact our system will make in a real situation. By using current MWRD information and holding to our ethical standards, we were able to make the most accurate and reliable forecast possible.

Recommendations

We strongly recommend continuation of this IPRO in the summer and fall. We would like to see further work done on creating a working prototype and incorporation of the prototype into a porous pavement system on the IIT campus. We would also suggest further research into the hydrogel to better ascertain its properties in different environments. We would also recommend the procurement of an IDOT renewable energy pole to facilitate its use in the project.

Acknowledgements

IPRO 312 would like to thank our sponsors: Wight and Company, The Water Reclamation District of Greater Chicago, and IIT Facilities. We would also like to extend a special thanks to IIT President, and our faculty consultant, Dr. John Anderson. We also acknowledge the considerable efforts on behalf of our teaching assistant, Greg Weipert and our advisors, Dr. Al-Hallaj and Dr. Teymour. Without any of you, this project would have been a lot more difficult.