

# **Collaborative Capital Investment Planning**

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The City of Charlotte is using ArcIMS GIS technology to support collaboration with Capital Investment Planning (CIP) activities across multiple departments and agencies. The effort is a multi-phased initiative designed for CIP submittal request data entry, multi-agency collaboration and reporting. Data management is enhanced by the centralization of CIP project requests via a web-based interface that populates and updates the CIP data model in SQL Server geodatabase format. CIP projects that have a spatial component, such as infrastructure or facilities, are identified by creating locations on a map. The collaboration component delivers view, query and overlay mapping functionality to identify opportunities for project timing, funding and other collaborative efficiencies. The application allows City budget staff to create funding status reports and track the CIP project lifecycle from a budgetary perspective.

## **Introduction**

In Spring of 2002, the City of Charlotte established a City Council priority to develop the organization and process needed to maximize coordination among 12+ Key Business Units (KBUs; also referred to as departments) in planning and implementing all capital projects. The purpose of this Council Priority was to identify opportunities for collaboration, minimize project costs through schedule synchronization and lessen the negative project impact on citizens. Amongst the many suggestions for achieving this goal came one key component: provide KBUs access to updated and appropriate levels of CIP data with the means to view, compare and collaborate.

In an attempt to accommodate all aspects of the City's Capital Investment Planning process, the simple idea of data access grew to incorporate all components of the CIP submittal process: 1) submitting the request, 2) adding appropriate geometry, 3) collaboration, and 4) producing investment and status reports. The desired outcome was an application that would allow each of these items to be performed in as seamless and easy a manner as possible. The concept of an ArcIMS Intranet application was introduced as a solution to the CIP Staff Review Team—the multi-departmental KBU representatives responsible for CIP submittals. In addition, the need for a robust CIP data model was identified in order to accommodate the business needs of submitting, collaborating and reporting.

## **The CIP/GIS Project**

A multi-year phased approach was implemented for the Collaborative CIP/GIS project to ensure annual incremental successes that were easily adopted by the CIP Staff Review Team. Additionally, impact on the CIP/GIS project team needed to be minimized since development of this enterprise GIS effort fell outside of their normal job responsibilities. Phases to date are described as follows.

### ***Phase I***

Phase I of the CIP/GIS project incorporated an interim CIP submittal form (spreadsheet), modified from the original Word document format, that included necessary common data elements for the GIS database. As a result, a common CIP database was designed in SQL Server. The CIP data model was tested on a subset of CIP submittals in Phase I. Normally, the City prepares a 5-year CIP and a 10-year Capital Needs Assessment (CNA) on alternate years. Since Phase I fell in the 5-year CIP process, in order to test the CIP

data model, only a 3-year subset of CIP submittals were entered into the GIS database -- those that offered the greatest potential for collaboration. All submittals were converted from the modified spreadsheet to the GIS database format by the CIP/GIS production team. From the converted data, interactive ArcGIS maps were displayed in the CIP Staff Review Team meetings to provide on-request data viewing, overlays, zooms, record queries and spatial queries. Maps were produced for final CIP publication and the data was published on the Spatial Data Warehouse, the City's enterprise database based on the ArcSDE-SQL Server technology platform.

### ***Phase II***

Enhancing data management and delivery of an internal application was the intent of Phase II. Consultants from ESRI were hired to develop a more robust data model to support CIP submittals based on the CIP process workflow, including data maintenance, and to develop the application based on functional requirements gathered during CIP Staff Review Team meetings.

### ***The Application***

The user interface chosen for this project is a standard web browser, Microsoft Internet Explorer 6.0+. The application is written in ASP.net and uses SDE Java API to write to the CIP geodatabase with the map service in ArcIMS. The applications development is focused on simplicity with the end users—the non-technical CIP Staff Review Team and the staff of the Budget & Evaluation KBU—in mind.

Users of the CIP/GIS application have three (3) high-level functions: a) add or edit CIP submittal information, b) collaborate by means of an embedded map viewer, or c) run CIP reports on entered submittals.



Figure 1. Simple 3-choice interface for ease of use.

Search | Add New

Submitting RBU: Charlotte  
 Strategic Focus Area: Transportation  
 Project Type: Intersection  
 Contact Name: Bill Freger  
 Program/Project:  Program  Project

Project Name: Dixie Berryhill & Skoptos  
 Priority: 5  
 E-mail: bfrager@ci.charlotte.nc.us  
 Status: Unfunded  
 Construction Type: New  
 Phone: (704)665-1212  
 Base Year: 2004

Description:  
 Construct a new intersection at Dixie River Rd & Skoptos Rd W

Type	2002	2003	2004	2005	2006	2007	2008	Total
Planning/Design	\$5,800,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$5,800,000.00
Land Acquisition	\$0.00	\$20,000.00	\$0.00	\$0.00	\$2,800,000.00	\$0.00	\$0.00	\$2,820,000.00
Construction	\$0.00	\$0.00	\$2,400,000.00	\$2,400,000.00	\$0.00	\$0.00	\$0.00	\$4,800,000.00
Equipment	\$0.00	\$0.00	\$100,000.00	\$0.00	\$0.00	\$0.00	\$1,800,000.00	\$1,900,000.00
<b>Total:</b>	<b>\$5,800,000.00</b>	<b>\$20,000.00</b>	<b>\$2,400,000.00</b>	<b>\$2,400,000.00</b>	<b>\$2,800,000.00</b>	<b>\$1,800,000.00</b>	<b>\$0.00</b>	<b>\$13,120,000.00</b>

Type	2002	2003	2004	2005	2006	2007	2008	Total
Capital Reserve	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$130,000.00	\$0.00	\$130,000.00
Federal Congestion Mitigation and Air Quality Grant	\$0.00	\$0.00	\$0.00	\$2,000,000.00	\$0.00	\$0.00	\$0.00	\$2,000,000.00
Two-Thirds Bonds	\$0.00	\$0.00	\$0.00	\$0.00	\$3,000,000.00	\$0.00	\$0.00	\$3,000,000.00
Airport Discretionary	\$0.00	\$2,500,000.00	\$0.00	\$1,000.00	\$0.00	\$0.00	\$0.00	\$2,501,000.00
Future Revenue Bonds	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,000,000.00	\$1,000,000.00
NCTP	\$4,500,000.00	\$0.00	\$400,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4,900,000.00
<b>Total:</b>	<b>\$4,500,000.00</b>	<b>\$2,500,000.00</b>	<b>\$400,000.00</b>	<b>\$2,001,000.00</b>	<b>\$3,000,000.00</b>	<b>\$130,000.00</b>	<b>\$1,800,000.00</b>	<b>\$13,551,000.00</b>

Action	Date	Type	Text
<a href="#">Edit</a> <a href="#">Delete</a>	4/29/2004 12:23:14 PM	Justification	To reduce air quality and improve connectivity in the Dixie Berryhill region.
<a href="#">Edit</a> <a href="#">Delete</a>	4/29/2004 12:23:40 PM	Collaboration	This project can be constructed at the same time as the Dixie River Rd Extension.

Action	Name	Description	Type	Status	RBU	Base Year	Est	Contact	Phone	E-mail	Focus Area	Program/Project
<a href="#">Edit</a> <a href="#">Delete</a> <a href="#">Delete</a>	Dixie Berryhill & Skoptos Rd W	Construct a new intersection at Dixie River Rd & Skoptos Rd W	Intersection	Unfunded	CDOT	2004	5	Bill Freger	(704) 665-1212	bfrager@ci.charlotte.nc.us	New	Transportation Project

Figure 2. "Add/Edit CIP Information" interface

Adding or editing a project is encompassed in the interface shown in Figure 2. All information from the base project to the revenue and justifications are entered here. Drop downs eliminate mistypes in the database and rules are set in place so funds are not to exceed documented amounts. Searches are also available from this screen. The rule of thumb is ease and simplicity; the purpose is to have people use it.

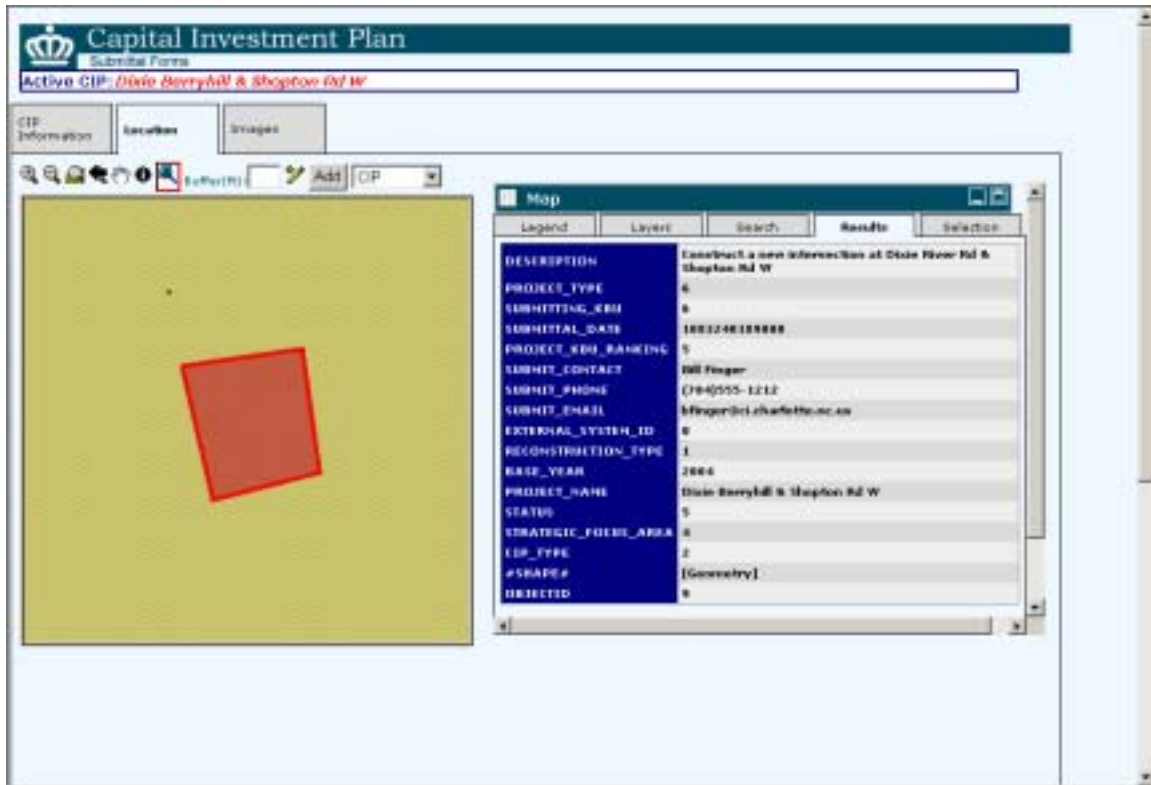


Figure 3. View/Edit submittal related geometry

Once a project is submitted and entered in the database, the end user can then enter a geometry through the CIP/GIS GUI by selecting parcels, streets or any other data layers and buffering by a predefined distance, or they may edit by manually defining the area. The geometry will then be written to the geodatabase along with the associated project information.

Some CIP Staff Review Team members rely on existing departmental staff to create the geometries and incorporate them. In this instance, one may create geometry as a shapefile and import it into the CIP geodatabase and associate it to the project with the appropriate project identifier. Although the concept is to keep the application as simple as possible, it is not the purpose of the project to limit how the geometry can be incorporated.

Projects are also searchable and identifiable as you can see in Figure 3; the results are shown in the adjacent window. What was once a simple form of data entry has now become a robust application with GIS functionality.

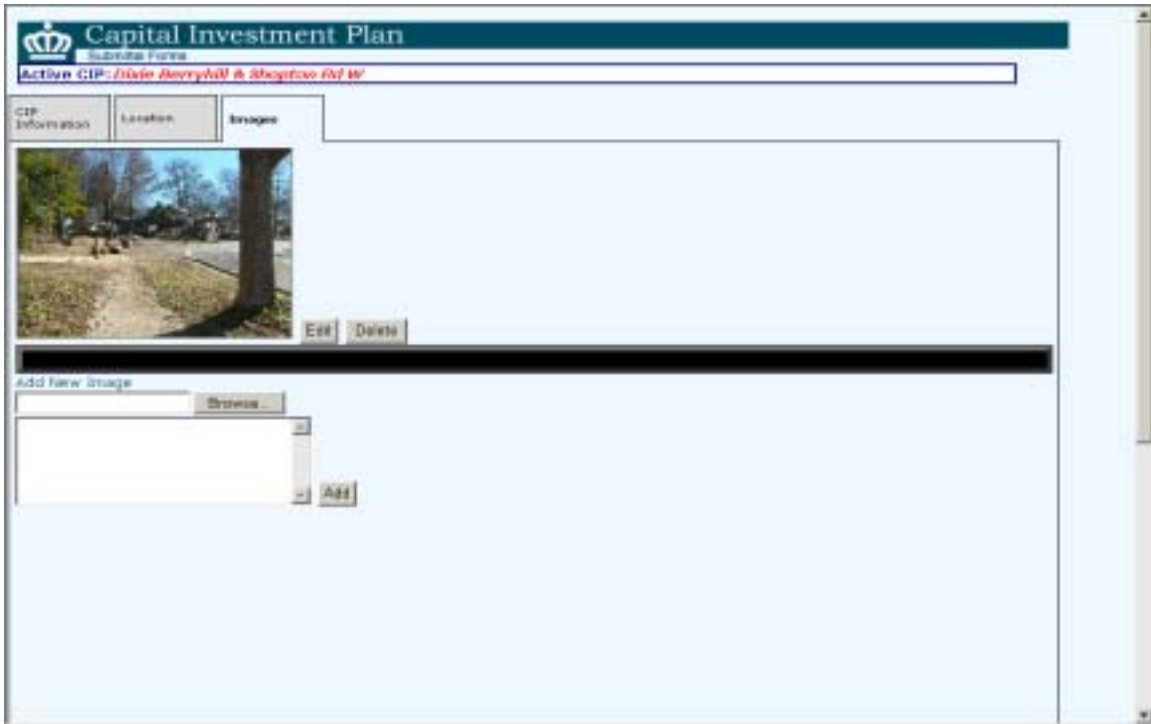



Figure 4. Add project images for reports

An image can be embedded into the project as well for easy identification of items such as building maintenance, fire station renovations, new sidewalk projects, etc. The primary purpose in this application is for inclusion in Budget & Evaluation's final CIP reports (Figure 5), that are run through the initial start up interface "Run CIP Reports."

**CIP Category:** Transportation  
**Description:** Dixie Berryhill & Shopton Rd W

- TO reduce air quality and improve connectivity in the Dixie Berryhill region.
- This project can be constructed at the same time as the Dixie River Rd Extension.



**Costs**

Type	2002	2003	2004	2005	2006	2007	Total
Planning/Design	\$5,000,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$5,000,000.00
Land Acquisition	\$0.00	\$20,000,000.00	\$0.00	\$0.00	\$2,000,000.00	\$0.00	\$2,020,000.00
Construction	\$0.00	\$0.00	\$2,500,000.00	\$2,500,000.00	\$0.00	\$0.00	\$5,000,000.00
Equipment	\$0.00	\$0.00	\$100,000.00	\$0.00	\$0.00	\$1,000,000.00	\$1,100,000.00
<b>Total:</b>	<b>\$5,000,000.00</b>	<b>\$20,000.00</b>	<b>\$2,600,000.00</b>	<b>\$2,500,000.00</b>	<b>\$2,000,000.00</b>	<b>\$1,000,000.00</b>	<b>\$13,120,000.00</b>

**Revenue**

Type	2002	2003	2004	2005	2006	2007	2008	Total
Capital Reserve	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$150,000.00	\$0.00	\$150,000.00
Federal Congestion Mitigation and Air Quality Grant	\$0.00	\$0.00	\$0.00	\$2,000,000.00	\$0.00	\$0.00	\$0.00	\$2,000,000.00
Two-Thirds Bonds	\$0.00	\$0.00	\$0.00	\$0.00	\$5,000,000.00	\$0.00	\$0.00	\$5,000,000.00
Airport Discretionary	\$0.00	\$2,500,000.00	\$0.00	\$1,000.00	\$0.00	\$0.00	\$0.00	\$2,501,000.00
Future Revenue Bonds	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,000,000.00	\$1,000,000.00
NCTIP	\$4,500,000.00	\$0.00	\$400,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4,900,000.00
<b>Total:</b>	<b>\$4,500,000.00</b>	<b>\$2,500,000.00</b>	<b>\$400,000.00</b>	<b>\$2,001,000.00</b>	<b>\$5,000,000.00</b>	<b>\$150,000.00</b>	<b>\$1,000,000.00</b>	<b>\$13,551,000.00</b>

Figure 5. Producing reports in a pre-defined format

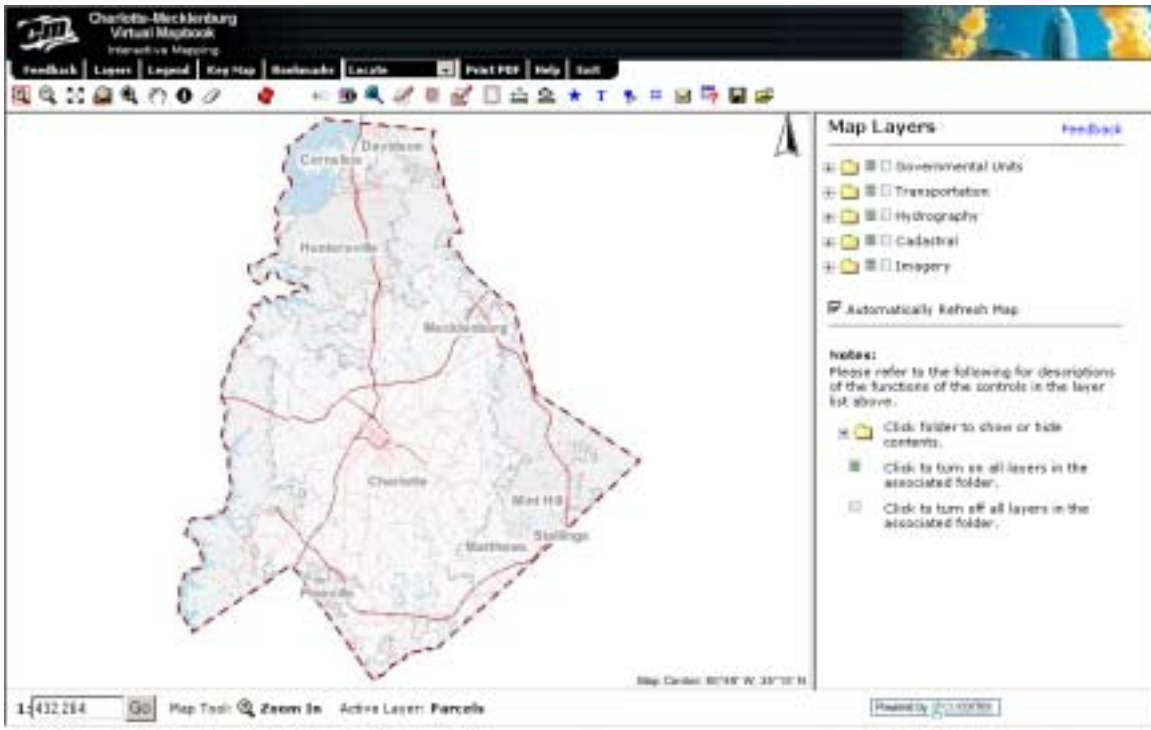


Figure 6. View opportunities for collaboration in this embedded Virtual Map Book (courtesy of Latitude Geographics)

When a project submittal is entered, a notice may appear stating it is within a particular distance of another project; an opportunity for collaboration exists. Collaboration can begin by opening the viewer (Figure 6) from the main page (*Collaborate*). This viewer has all the functionality that an end user would need, including attribute and spatial queries, zoom, select, print, and even export functions.

### **Future Plans- Phase III**

Incorporating Department Master Plans, defining the project lifecycle and the supporting business processes, expanding the geography to the surrounding region and integrating existing project tracking management applications have been targeted for enhancements in Phase III.

Each project has a lifecycle and moves through its lifecycle by business processes. CIP projects begin as identified needs, are submitted during the CIP budget phase, are accepted for funding, and eventually end at construction completion. Two of the City KBUs, Engineering & Property Management and Charlotte-Mecklenburg Utilities use PrimaVera P3E project management software to track City projects when they begin the implementation phases. These KBUs would like a way to geographically view each others construction projects and their associated database from P3E to avoid construction conflicts. To add to the complexity of City construction project activity, departments are always in the field on repair and/or routine maintenance projects. Phase III will address the needs for an integrated solution that moves beyond the focus on budgeting for collaborative solutions, to multi-departmental situational awareness of active projects.

In addition, several departments have Master Plans or future build-outs. Because the objective is to collaborate, the concept of incorporating Master Plans into the geodatabase will allow each department to identify CIP project submittals from their long-range master plans and to collaborate more proactively by viewing other departmental Master Plans.

### **Conclusion**

The goal of the CIP/GIS project is focused on facilitating multi-departmental collaboration on capital investments in the City of Charlotte. The CIP/GIS project meets this goal by delivering improved data management through a common, shared CIP database and a user-friendly software application that can be used to collaborate, not only amongst KBUs within the City, but in the future amongst external agencies. The phased approach for implementation of the CIP/GIS project fits into the culture of Charlotte by stepping into process improvement with increments of success.

### **Acknowledgements**

The CIP/GIS Team would like to thank ESRI-Charlotte for their time, support, and ideas in making this application a reality. We would also like to thank the Charlotte Budget & Evaluation Team and the CIP Staff Review Team for their continued support and ongoing recommendations to make the application a success.



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