Location Analytics Research Project

Findings and Results White Paper

Information Technology Department
401 Oak Street, Suite 404
Roseville, CA 95678

6/20/2014

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1 Introduction

This white paper presents findings and recommendations from the Location Analytics Research Project completed during FY14. The project was initiated and sponsored by the GIS Steering Committee and subsequently approved by the Technology Governance Committee (see Appendix A for the governance Concept Paper). The purpose of this project was to begin preparing the enterprise GIS team for growth in business intelligence (BI) and business analytics (BA) use.

This paper describes the trends driving these changes, outlines how these trends are impacting the City of Roseville, and then presents location analytics as a recommended solution to address these changes. It contains information about key success factors, strategies, and recommendations that will be useful for further developing location analytics capabilities. The intended audience of this paper is the core team that will be responsible for this development effort, as well as the GIS Steering and Technical Committees. It also serves as documentation of the research project outcomes for the Technology Governance Committee.

2 Trends

The GIS Steering and Technical Committees, through a review of external studies and industry research, identified that increased business demand for information is shifting the focus of the technology industry from systems and infrastructure to information creation and use. This broad industry trend parallels what is seen occurring in the City with increased demand for data-driven decision support. However, these changes will continue to drive significant changes in technology use in other areas of the City as well. These demands can be met through the location analytics capability of GIS.

Gartner, Inc. ranked BI as the number one technology priority by business CIOs in one survey ahead of mobile technologies, cloud computing, and collaboration technologies. They also predicted 7% growth in the BI market in 2013, following a year of 7% growth in 2012, which makes BI and analytics one of the fastest growing software markets as end users continue to prioritize BI and information-centric projects to improve decision making and analysis.

3 Problem

The GIS Program in the City of Roseville is not well positioned to respond to this increase in analytics demand. The FY14 Annual Work Plan for enterprise GIS recommended developing analytics as an essential GIS capability.

The complimentary natures of BI and GIS have led to a blending of these technologies into what is called location analytics. Location analytics is defined as the analysis of geographic information to improve business decision making. It combines business intelligence (BI) technologies with GIS techniques and methods. Using this combination of technologies, the City can answer questions like these:

- What are the needs and preferences of our residents?
- Are there geographic patterns to these needs and preferences?
- For a particular City service, who are our best customers and where are they located?
- Where can I find potential customers similar to existing customers?
- Where have our marketing efforts been the most and least successful and why?

Answers to these questions can be delivered through visual outputs such as maps and dashboards. Correlating these answers with demographics, lifestyle factors, and consumer information can be used to optimize service delivery and do more with less. With these types of insights organizations can improve decision making and create a competitive advantage.

4 Business Benefits

Location analytics address the growing BI demand and the need for better decision making, but there other business benefits as well. These are described below along with the alignment of location analytics with other City efforts and their demand in the City.

Increasing Returns

In addition to the decision making advantages described above, location analytics also increase the return on investment (ROI) of the enterprise GIS, which is another recommendation of the last two annual GIS work plans. Increasing ROI is a crucial indicator of an enterprise GIS that is growing and maturing, the result of which are maximized efficiency and returns from the GIS. ROI increases with this type of work because analytical and decision-making uses of GIS generate more return than other GIS uses such as mapping.

Alignment

The trend toward an increasing focus on BI and location analytics is well aligned with other efforts in the City. It aligns with the following initiatives from the Strategic Technology Plan for the City:

- eGovernment and Citizen Interaction – through the use of enriched geographic data our engagement with City residents can be improved by better understanding their needs and preferences;
- Emerging Technologies – this initiative also includes a component focused on expanding opportunities for connecting with citizens;
- Enterprise Systems – ensuring that the use of existing systems is optimized by capitalizing on existing or under-utilized functionality to meet data, processing, and reporting needs across the City; and
- Information Management – supporting immediate and future needs for decision support and data sharing.

It also aligns with the 2012 Economic Development Strategy, which recommends as strategies GIS solutions that provide up-to-date demographic data, market statistics capabilities, access to consumer data, and associated analytical tools and reports.

Demand and Opportunities

The demand for data-driven decision making and analytics in the City is growing. Related to this, the Information Technology Department has identified Business Intelligence, Information, and Big Data technologies as three of its performance objectives for innovation. Elsewhere in the City are other indicators:

- Electric Department – currently building a data warehouse of power supply, financial, and regulatory data that will help staff focus their time on using data to make decisions rather than managing its integration;

- Fire Department – with a strong record of data-driven decision making, is currently evaluating additional investment in strategic planning tools to help decision-makers with the challenges they face;
- Economic Development – online solutions and data have been acquired to perform location analytics and support growing economic development needs;
- Urban Forestry Management Plan – community focus on environmental sustainability has resulted in many opportunities for GIS and analytics to support urban forest management;
- Enterprise Asset Management (EAM) – implementing a single EAM solution across the City will create a valuable and accessible data source that will be highly valuable for analytics-based decision making; and
- Environmental Utilities – implementing a location analytics solution called RouteSmart that will optimize solid waste pick up routes.

There are also numerous other business areas within the City that have a high potential for location analytics use. One of these areas is using geo-enriched data along with demographic and consumer spending profiles to better understand our customers and to deliver improved services that are tailored to their needs. Among these opportunities are:

- Electric power consumption;
- Grant writing;
- Long range planning;
- Service optimization in Parks, Recreation, and Libraries;
- Service optimization in Public Safety;
- Urban forestry and outreach; and
- Water conversation and drought management.

5 Capability Development

Developing a location analytics capability under the GIS Program will allow new services and products to be provided by the enterprise GIS team. The planned approach leverages the existing analytic skill sets and business knowledge of the team. Existing hardware and software are also leveraged. Requests for service or products will be made through the current service request process.

Resource Needs

The resources required to implement this new capability are discussed in this section. These needs were identified in the pilots conducted as part of the Location Analytics Research Project completed from June to August 2013.

Staffing and Training

A core team of location analytics experts will be developed from the existing enterprise GIS team and work requests will be assigned to the team for completion. Priorities will be set using the work management processes already in place for GIS.

Existing analytics skills will be leveraged wherever possible. However, new skills will be required for specific software solutions such as Business Analyst Desktop. Training needs will be met with a combination of GIS Program funding (baseline competencies training) and departmental funding. Other business and soft skill training that will be beneficial and in some cases required includes:

- Business skills – to identify the needs and requirements associated with a particular analysis and to develop a business case for successfully applying location analytics to solve a problem;
- Project management skills – to manage the scope and timeline of an analysis task or project, and to keep efforts on track when the data and analysis possibilities are rich and varied;
- Communication skills – to understand the business processes and needs clearly in order to formulate problem statements and accurately frame the question with the customer as well as to document, summarize, and present findings;
- Economic development principles – to understand and apply available analytical tools, many of which are developed around economic development ideas; and
- Data skills – the analyses are data intensive and skills such as statistics will assist in interpreting results and providing additional insight and understanding.

These skills are detailed further in the Geospatial Technology Competency Model developed by the U.S. Department of Labor. This model is being used as the basis for developing baseline competencies on the enterprise GIS team. The following areas of that model are particularly relevant to the location analytics skills discussed above:

- Tier 2 – Academic Competencies (writing, communication – listening and speaking, critical and analytical thinking);
- Tier 3 – Workplace Competencies (teamwork, creative thinking, problem solving and decision making, business fundamentals); and
- Tier 5 – Industry Sector Technical Competencies (analysis and modeling).

Software

The GIS software platform that is already used to provide other GIS services to the City – including an existing subscription to Business Analyst Online (BAO) – will be leveraged for these new services. However, additional tools and data will also be required to perform the work associated with location analytics:

- Business Analyst Desktop – provides software and extensive data to support advanced location analytics;
- ESRI Maps for Office – adds dynamic mapping capabilities to Microsoft Office allowing users to map data, access demographics and lifestyle data, and perform geographic analysis;
- Business Analyst Online Reports – connects the ESRI ArcGIS Desktop software to demographic reports and data from BAO; and
- SAP Business Objects (optional) – business intelligence (BI) software that provides access to data and visualizations needed to help make decisions and improve processes.

Under a separate project, professional services will be acquired to develop a custom BAO application to support the business community with demographic and lifestyle analysis and reporting.

Financial

The hours to implement software and data are minimal (less than 40). Additional costs associated with the training and software are listed below:

Budget Item	One Time Costs	Funding Source	Ongoing Costs	Funding Source
Business Analytics Desktop Software	$18,405	Economic Development	$14,720	GIS Operating Budget
Business Analytics Training	$1,010	Economic Development		
	$1,010	GIS Operating Budget		
Total	**$20,425**		**$14,720**	

6 Lessons Learned

Pilot projects were conducted with the Library, Parks Maintenance, Fire, and Information Technology. The pilots yielded much information useful for developing a location analytics capability under the GIS Program. Key success factors, threats, and strategies identified in the pilots are discussed in the sections below. Appendix B contains a presentation given at the end of the pilots, and Appendix C contains a summary of the lessons learned.

Key Success Factors

Several key success factors have been identified from the research project:

- Translating the corporate business orientation of the available tools to local government applications;
- Having strong business knowledge of the area for which services are being provided;
- Developing a business mindset to "frame the question well" and to ensure that the objective of the analysis remains focused on business benefit and value;
- Committing ample resource time to developing this capability and developing the skills to generate results; and
- Keeping a strong focus on outcomes and results.

Threats

Several threats have also been identified:

- Having a poorly formed business mindset when performing analytics results in an unfocused and wandering analysis that does not fully meet customer needs;
- Lack of understanding about what the tools are doing or what data variables are being used causes results to be misinterpreted;
- Resource constraints interfere with the focused and dedicated attention that the analyses and data interpretation require, or with the customer meetings that require significant time to frame the questions and review results;
- Incomplete communication with customer and lack of business knowledge results in outcomes that do not show outcomes or quantify benefits for the customer;
- Lack of training in business skills, project management skills, soft skills in communication and listening, economic development principles, and data skills such as statistics results in inefficient and ineffective analyses; and
- Poor data quality leads to poor results.

Strategies

Several strategies have been identified for developing location analytics capabilities as part of the GIS Program.

Growth and Data Quality Strategies

This strategic approach was identified by the Steering and Technical Committees as necessary to guide the growth of location analytics in the City:

- Data Quality – providing high quality location analytics services and products depends on high quality data. Therefore, as analytics use grows in the City, our ability to create and maintain high quality data should also grow;
- Quality Assurance Plan – with the previous point in mind, the GIS team should begin now to assemble the pieces of a GIS Quality Assurance Plan and incorporate them into GIS operations;
- Data Foundation – the team should adopt an evolutionary model for analytics growth that does not overbuild on the existing data foundation.

Using this approach, developing a location analytics capability might be carried out in a series of phases as shown below:

Time Frame	***Activity***
Short term	Leverage off-the-shelf data
	Leverage database versioning
	Leverage other efforts for data clean up and improvement
Mid term	Begin using quality assurance tools (processes, audits, define roles)
	Increase use of data quality tools such as Data Reviewer
Long term	Improve and market our own data quality
	Evaluate new data quality tools such as Workflow Manager

Implementation Strategies

Strategies related to implementing location analytics in the City were also developed as part of the Location Analytics Research Project:

1) Leverage and align future location analytics efforts with other strategic initiatives in the City that have similar goals or have analytics components in common. Several opportunities for this include:
    - Strategic Technology Plan – this effort aligns with several technology initiatives such as Information Management (decision support) and Emerging Technologies (capitalizing on trends and developments in the technology field); and
    - Economic Development Strategy – several strategies in this plan contain GIS components such as Strategy 1.2 – Business Attraction, Strategy 1.6 – Marketing, and Strategy 4.3 – Economic Development Strategy Review & Role of EDAC.

2) Develop a strong core team focused on providing location analytics expertise. There are several related components such as developing a charter, conducting training, and obtaining resource commitments.

3) Develop an analysis methodology or framework that adopts the corporate business approaches used in location analytics to local government and identifies desired objectives and outcomes for local government.

4) Work with the City departments and teams to ensure location information is collected in surveys whenever possible so the datasets are geographically enabled and suitable for analysis with location analytics tools.

5) Strengthen relationships with the Business Application Team in the IT Department to leverage their customer relationships, business knowledge, and systems expertise.

6) Keep a repository of completed projects with quantified results and other location analytics resources in SharePoint.

7) Combine training in location analytics with training in data quality and statistics to move toward developing data and information professionals.

7 Conclusion

Business intelligence and location analytics are complementary technologies that are undergoing strong growth in the technology industry. Demand for these technologies is also growing within the City. However, the capabilities to meet this demand are not developed under the GIS Program.

The location analytics research project completed during FY14 identified use cases, strategies, and recommendations for next steps to further develop this capability. Developing this capability has numerous business benefits including increasing ROI of the enterprise GIS. This capability is also well aligned with the goals of the GIS Program as well as other City efforts and strategic plans.

A core team of GIS professionals that are trained to deliver these services will be required. Training is required in several critical areas such as business, data, and soft skills. A strong commitment to developing this capability will be required from team members and stakeholders of the GIS Program. Software resources and data will also be required. These resources are funded as part of the GIS operating budget as well as through the Economic Development budget, which is a key stakeholder.

To ensure high quality results from these services, data quality assurance is an important corresponding capability that must be developed in parallel to location analytics. Off the shelf data will be leveraged initially while our own internal data program grows and develops.

Appendices

Appendix A – Governance Concept Paper

Received mm/dd/yyyy
Sequence No. yy-###

Concept Paper

Technology Governance

Note: Additional documents may be included as attachments. If supporting documents are attached, please reference the attachment in the project proposal. If appropriate, flag specific related information in the attachment for easy reading. Even when attachments are included, each numbered section below must be addressed in your response.

1 Project Title / Sequence Number

Business Analyst Desktop Implementation

Type

- Technology Project (initial/kick-off)

2 Project Summary and Objective

In the FY14 GIS Annual Work Plan, the GIS Steering and Technical Committees identified business analytics and business intelligence as an important growth area over the next several years. Last year in response, a location analytics research project was completed. One of the outcomes of that research was identifying next steps, one of which was to implement software required to support location analytics.

Intent

- What is the intent of the proposed project? This project will implement Business Analyst Desktop, which is a data package and software extension to the ESRI ArcGIS software currently being used in the City for GIS.

Present

- What does the current process look like? There currently is no solution for location analytics in GIS. There are also no business, demographic, or life style data available in the City for these types of analyses. The lack of these tools makes location analytics work impractical.

Future

- How will the business function operate differently after the proposed project is complete? The tools available in Business Analyst Desktop will provide the capability for performing work such as trade area analysis or demographic reporting.

Legal

- Are there regulatory or legal requirements that necessitate this project? Describe and include key dates if applicable. None.

Hours

- What are the estimated implementation hours? 0 – 40 hours
- What are the estimated ongoing annual maintenance hours? 0 – 20 hours

Costs

Will this project exceed $20,950? No.

Other

- Does this project align with technology standards, best practices, strategic directions, and support?* Yes
- Do you have a proposed solution in mind? Yes

3 Submitted by

Scott Adrian, GIS/Internet Manager, x5164, Information Technology Department

This project proposal has been approved by:
Hong Sae (pending review)

Supporting Departments (if applicable):
GIS Technical Committee Enterprise GIS team members will help support this effort.

4 Date

5/27/2014

5 Project Sponsor

GIS Steering Committee/Mike Isom, Committee Chair, x5527, City Manager's Office

6 IT Support Contact

Scott Adrian

Submit this page to Governance@roseville.ca.us for review before continuing.

Appendix B – Pilot Final Presentation

EGIS Brown Bag

BUSINESS/LOCATION ANALYTICS

Agenda

- Business/Location Analytics Introduction – Scott
- Parks Case Study – Marc
- Library Case Study – Angeleaux/Scott
- Software Demo – Angeleaux
- Close out and Q&A

Theme

Business Analytics

Data and analysis that drives decision making

Business Analytics Drivers

- Shifting focus from technology infrastructure to information and analysis
- Availability of rich geographic data
- Importance of economic development
- Improving the return on EGIS
- Doing more with same or less

EGIS Mission and Vision

The mission of the City EGIS team is to add value and create solutions through analysis, innovation, and technology.

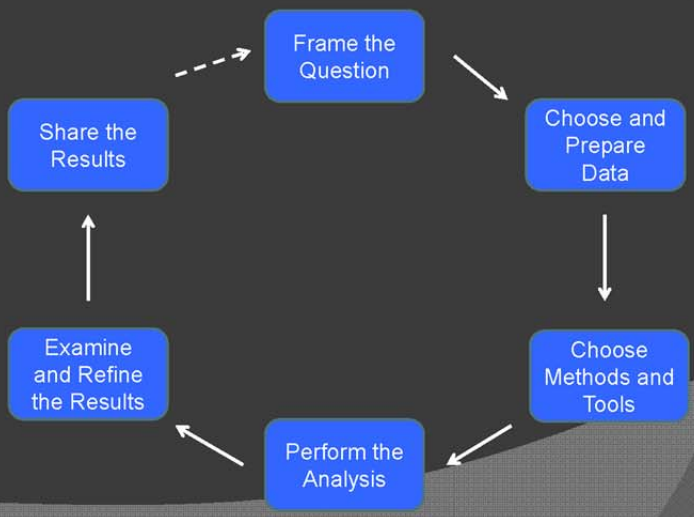
GIS Mission and Vision

Deriving knowledge from geographic data to advance and differentiate the City.

Pilot Project Goals

- Use enriched geographic information
  - Demographic, consumer, and lifestyle data
- Explore data and generate ideas
- Understand software capabilities and potential City applications

Spatial Analysis Workflow

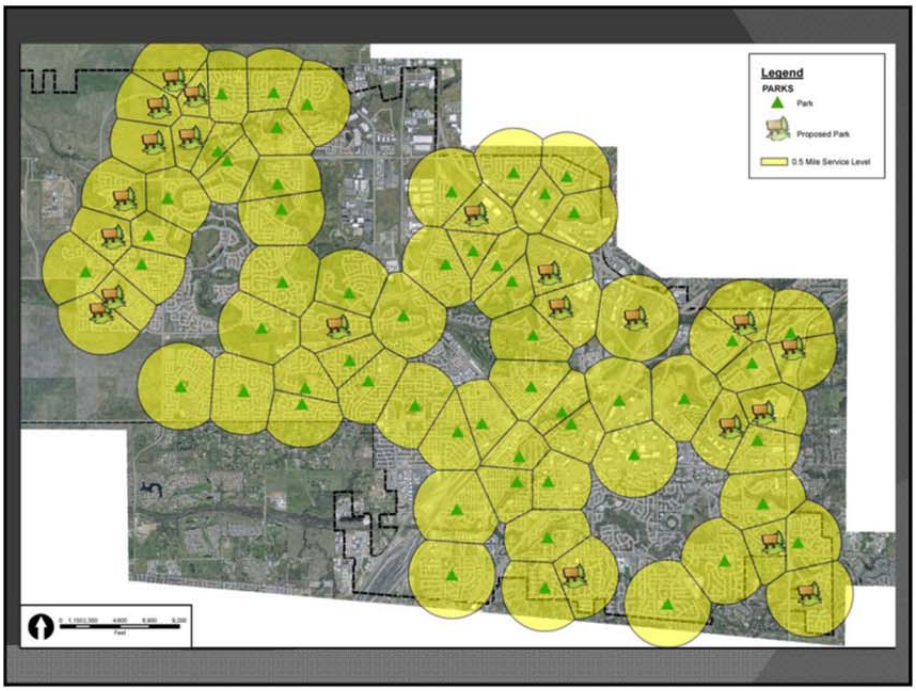


Parks Case Study

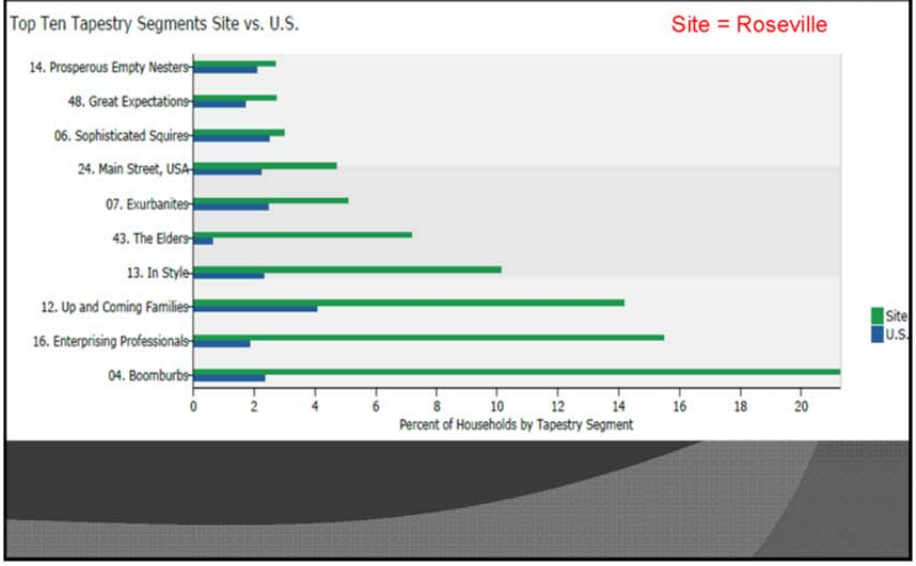
- Partnered with Tara Gee

Questions:

1. How can the City plan neighborhood park development more effectively?
2. How can the City improve upon and help facilitate major sports event planning?
3. How can the City better market and gear recreation programming towards the needs of our citizens?



Tapestry Segment Report



Proposed Park (W-53)

Demographic & Income Report

Sports and Leisure Report

0.50 mile service level (W-53)

Demographic Summary		2011	2016
Population		1,748	2,333
Population 18+		1,233	1,665
Households		731	970
Median Household Income		$66,471	$77,817
Product/Consumer Behavior	**Expected Number of Adults**	**Percent**	**MPI**
Participated in aerobics	167	13.5%	136
Participated in archery	23	1.9%	72
Participated in backpacking/hiking	133	10.8%	114
Participated in baseball	80	6.5%	125
Participated in basketball	148	12.0%	128
Participated in bicycling (mountain)	54	4.4%	118
Participated in bicycling (road)	138	11.2%	116
Participated in boating (power)	87	7.1%	115
Participated in bowling	203	16.5%	141
Participated in canoeing/kayaking	60	4.9%	102
Participated in downhill skiing	33	2.7%	91
Participated in fishing (fresh water)	182	14.8%	114
Participated in fishing (salt water)	67	5.4%	119
Participated in football	94	7.6%	123
Participated in Frisbee	95	7.7%	141
Participated in golf	165	13.4%	130
Play golf < once a month	71	5.8%	145
Play golf 1+ times a month	78	6.3%	119
Participated in horseback riding	36	2.9%	96
Participated in hunting with rifle	59	4.8%	100
Participated in hunting with shotgun	46	3.7%	89
Participated in ice skating	50	4.1%	140
Participated in jogging/running	186	15.1%	141
Participated in martial arts	16	1.3%	92
Participated in motorcycling	44	3.6%	98
Participated in Pilates	56	4.5%	137
Participated in roller skating	20	1.6%	78
Participated in snowboarding	25	2.0%	105
Participated in soccer	74	6.0%	139
Participated in softball	64	5.2%	132
Participated in swimming	289	23.4%	121
Participated in target shooting	52	4.2%	110
Participated in tennis	59	4.8%	111
Participated in volleyball	57	4.6%	132
Participated in walking for exercise	417	33.8%	114
Participated in weight lifting	199	16.1%	136
Participated in yoga	92	7.5%	127

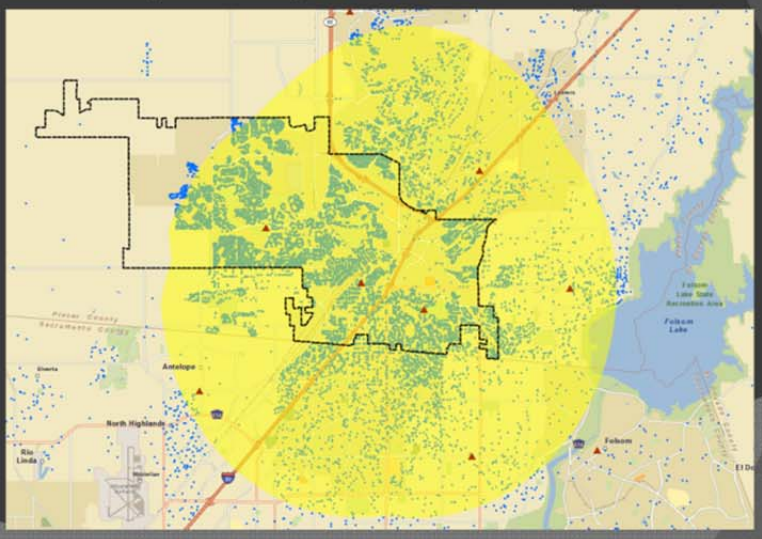
Library Case Study

Partnered with Chris Rohde/Jessica Huff

Questions:

1. Do customer profiles vary by location?
2. Where are good locations to send the book mobile?
3. What is the demographic and lifestyle profile of Library customers?

Library Analysis



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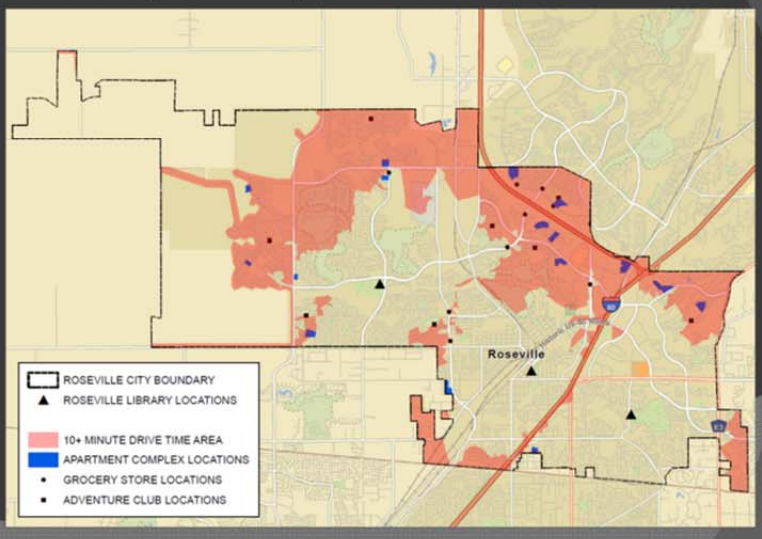
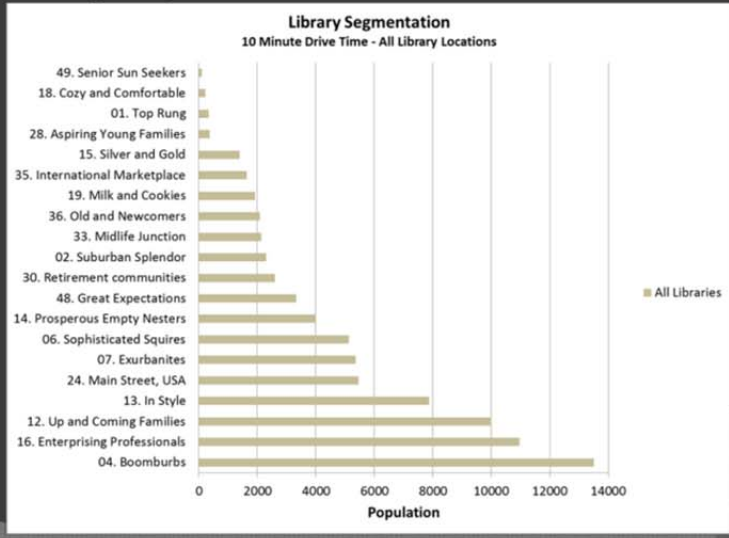


Output/Results



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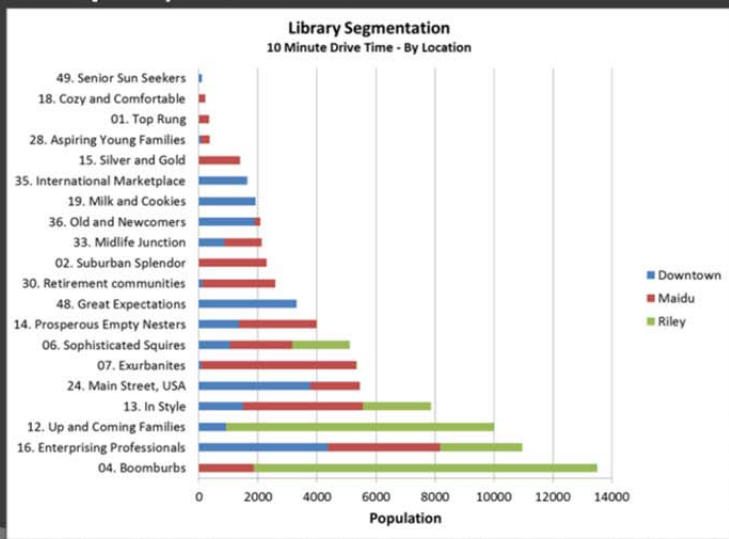

Business Analyst Desktop DEMO

Idea Generation (Exploration)

- Library location matters
- Identify underserved areas
- Modularized service
- Data validation of instinct and gut

- Sports Center competitors
- Regional soccer facility market potential
- Trending, fringe sports --- Rugby and Lacrosse
- Park balloting analysis

Close Out and Q&A

THANK YOU!!!

Appendix C – Pilot Lessons Learned

Business Analyst Pilots – Lessons Learned

10/8/2013

The following information was compiled by the project team after completing the Business Analyst pilot projects. The team focused this lessons learned exercise on four areas: lessons learned from the pilots, potential strategies for further location analytics development, opportunities for further location analytics work, and next steps.

Lessons Learned

1) A business mindset is necessary to "frame the question well" and to ensure that the objective of the analysis remains focused on business benefit/value.

2) Developing a small, well trained, and experienced analytics core team will be more effective than broad deployment of location analytic skills and tools across the entire team. This is because the learning curve is steep and the skills to apply the tools effectively require significant investment.

3) Case studies are a valuable way to understand how location analytic tools can be applied, the range of their capabilities, and to recognize good use cases.

4) Understanding what the tools are doing is critical to interpreting the results. In addition, the data variables are extensive and each report and output needs to be evaluated and understood.

5) Resource constraints made it difficult to move the pilots forward for at least two reasons. First, the analyses and data interpretation required focused attention. Second, meeting with customers required significant time to frame the questions and review results.

6) The pilots were susceptible to scope creep because of the rich opportunities for data exploration. Defining expectations up front and managing the scope tightly were necessary.

7) Focusing on outcomes and results is necessary. It was a challenge to identify metrics that would show success and quantify benefits. A strong business mindset and working closely with the customer to discover how they measure success were both necessary.

8) Translating the business orientation of the tools to local government applications was an initial challenge. There is a necessary reorientation to local government. For example, what does the trade area concept mean to a City?

9) Several training needs were identified during the pilots:

   - Business skills – to identify the needs/requirements and to develop the business case;
   - Project management skills – to manage scope and timeline, which is difficult because the data and analysis possibilities are so rich;
   - Soft skills in communication and listening – to understand the business processes well enough to help the customer formulate problem statements and frame the question. Also writing and documentation skills to summarize and present findings;
   - Economic development principles – to understand and help apply the tools, which are developed around and geared to economic development ideas; and

- Data skills – the analyses are data intensive and skills such as statistics will help interpret the results and provide additional insight and understanding.

Strategies

8) Leverage and align future location analytics efforts with other strategic initiatives in the City that have similar goals or have analytics components in common. Several opportunities for this include:
   - Strategic Technology Plan – this effort aligns with several technology initiatives such as Information Management (decision support) and Emerging Technologies (capitalizing on trends and developments in the technology field).
   - Economic Development Strategy – several strategies in this plan contain GIS components such as Strategy 1.2 – Business Attraction, Strategy 1.6 – Marketing, and Strategy 4.3 – Economic Development Strategy Review & Role of EDAC.

9) Develop a strong core team focused on providing location analytics expertise. There are several related components such as developing a charter, conducting training, and obtaining resource commitments.

10) Develop an analysis methodology or framework that incorporates adopting standard business approaches to local government and identifies desired objectives and outcomes for local government.

11) Work with the City to ensure location information is collected in surveys whenever possible so the datasets are geographically enabled and suitable for analysis with location analytics tools.

12) Strengthen relationships with the Business Application Team in the IT Department to take advantage of and leverage their customer relationships, business knowledge, and systems expertise.

13) Keep a repository of completed projects with quantified results and other location analytics resources in SharePoint. Evaluate using the SharePoint My Sites capability as a means for identifying and accessing team members with location analytics expertise.

14) Combine training in location analytics with training in data quality and statistics to move toward developing data/information professionals.

Opportunities

1) There are several areas to explore for further location analytics opportunities:
   - Grant writing;
     - Meet with Sean Bigley to show capabilities
     - Have Sean promote GIS team as a resource for data support
     -
   - Economic development/gardening;
   - Electric utility consumption;
   - Environmental Utilities water conversation;
   - Urban forestry and outreach; and
   - Long range planning.

2) Look for opportunities in past “failed” efforts and outreaches.

Next Steps

1) Complete a business plan for developing location analytic capabilities in the City. Incorporate the lessons learned, strategies, and opportunities documented here.

2) Identify executive sponsors for further location analytics development.

3) Meet with other stakeholders to discuss future uses and development. Several resources in key areas include:

    - Public Safety – Brian Diemer/Rob Baquera
    - Economic Development – Mike Isom, Mark Riffey, Chris Robles
    - Parks and Libraries – Tara Gee/Chris Rohde, Dominick Casey
    - Development Services – leverage budgeted Business Analyst training in Planning, Kathy Pease (long range planning)
    - Utilities – John Peterson (leverage business intelligence/analytics expertise), EU water conversation, discuss Electric opportunities with Mark Riffey

4) Incorporate ESRI for Microsoft Office and SharePoint into ArcGIS Online project as a use case.

5) Research additional software toolsets such as Business Analyst Online Reports add in, SAP Business Objects, and business intelligence/analytics developer tools.