The Potential of Parcel-Based GIS in Community Development and Urban Land Management

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Abstract

The past decade has seen notable improvements in the availability of data about land in America's communities. Local agencies have been automating their administrative records for some time, but it is only recently that improvements in technology—particularly in Geographic Information System (GIS) and web technology—have markedly enhanced the ability to manipulate and disseminate the data. Evidence about the state of this art, however, has been fragmentary. This paper reports on research by PolicyLink and the Urban Institute to examine the trends more systematically and to consider implications of the way the field is developing. Specifically, it describes the results of: (1) a web search to find out how frequently and in what ways the nation's largest cities are making parcel-level data available publicly on their web sites; (2) interviews with the managers of several of those systems to learn more about their structure, content, and local applications; and (3) a Consultative Session to consider the implications of the findings and develop recommendations as to how to respond to them.

Main Findings

1. An unexpectedly large share—almost three quarters—of America's top 100 cities now have integrated parcel-based information systems and are making a considerable amount of their data available to the public via the web. Specifically, the web search showed that 72 of the 100 largest cities had such systems in 2005.

2. Agencies bearing operational responsibilities for these systems differ across cities. Technical departments play the leading role in 51 percent of all cases (i.e., with Information Technology (IT), Management Information Systems (MIS) or Geographic Information Systems (GIS) in their titles) while 43 percent are operated by planning departments, community and economic development departments, assessors' offices, or other substantive agencies. Two-thirds were operated by agencies of city government, but 28 percent were operated by county governments and the remaining 5 percent were operated by formal partnerships between the city and one or more counties.

3. All of these systems allow users to view maps of parcel characteristics and over three-quarters allow them to access standard tables on characteristics of individual parcels they identify. Almost all (96 percent) have some sort of query form, although only 25 percent support queries about classes of parcels defined by user-selected attributes.

4. The extent of the data and parcel layers provided by these systems is mixed—only a few of them yet have a sizeable complement of the information ideally desirable for decision support in community development. Most have some data from assessors' records (e.g., 65 percent have data on value), but much smaller shares have data on land use (49 percent), lot size (44 percent), sales prices (18 percent), and vacancy (3 percent). Only a handful include actions the city agencies and others have planned for individual properties.

5. Interviews with managers of the systems examined in more detail indicate that the content and capacities of almost all of these systems are planned for expansion. They say that development processes appear to have accelerated since 2000 as web-services technology has vastly simplified the work involved. Reduced costs now generally couple with growing use incentives to override—if not eliminate—development constraints important in the past. None was planning to cut back.

6. The managers also note that the use of the systems is also accelerating, with routine administrative applications now well institutionalized in government and a widening number of outside users and applications. Managers told us that, in terms of sheer volume, government agencies are the most active users and the bulk of the applications at this point involve basic administrative processing. Several note that there has been a big impact in terms of efficiency—staff could never go back to the old ways of doing things. Although no manager we talked with was yet monitoring outside use in depth, they all talked about rapidly growing "hit rates" and offered anecdotal information on a growing variety of types of users and applications.

7. There are examples of advanced community development applications in some cities—applications where the system and the data have become a critical support for government and community collaboration in neighborhood improvement. These applications illustrate approaches that bring data to bear on real decision-making in new ways. Even though there is little evidence of major community impacts thus far, the likelihood of important change appears high in our view.

Conclusions

1. Dramatic progress has been made in the development of multi-source web-based parcel-level information systems in America's metropolitan areas over the past few years and, even though there are risks to be addressed, this development now appears poised for further acceleration.

2. Although not implemented in many places so far, there have been some innovative attempts to apply these systems to address the challenges of community development and urban land management. Enough experience is there to suggest that these approaches hold great promise—they could well transform the way business gets done in these fields.

3. National institutional networks are already in place to support the further development of parcel-level data systems. However, we conclude that additional efforts are needed to support the development and dissemination of advanced applications in community development and land management.

Recommendations

1. Support should be mobilized for a continuation of the types of evaluative activities initiated in this report—namely, the ongoing monitoring of the further development of parcel-level data systems and identification of emerging best practices in community applications.

2. New projects should be mounted to test options and expedite the development of advanced community applications in a limited number of cities that have well-developed parcel-based systems.

3. As innovative applications are developed and documented, existing intermediary networks should be supported to broadly disseminate the findings, mobilize interest, and train practitioners in their use.

4. Those concerned about community outcomes should advocate for a stronger policy environment to surround the further development and use of parcel-based systems; one that encourages broad release of data in the public interest but also guards against potential risks of poor data quality and misuse.

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Section 1
Introduction and Framework

Introduction

The past decade has seen notable improvements in the availability of data about land in America's communities. Assessor's offices and other local agencies have been automating their administrative records pertaining to individual land parcels for some time, but it is only recently that improvements in technology—particularly in Geographic Information System (GIS) technology—have markedly enhanced the ability to manipulate and disseminate the data. Stories have been published over the past few years indicating that several cities have started to integrate data across agencies and make selected information at the parcel level available to the public, most often via the web.

Evidence about the state of this art, however, has been fragmentary. In late 2004, with support from the Lincoln Institute of Land Policy, PolicyLink and the Urban Institute began a project to examine the trends more systematically and to think through the implications of the way the field is developing. Specifically, the work entailed:

- Conducting a web search to find out how many of the nation's 100 largest cities were making parcel-level data available publicly on their websites, and to documenting key characteristics of those systems;
- Interviewing the managers of several of those systems to learn more about their structure, content, and local applications; and,
- Reviewing the findings, together and with other knowledgeable professionals, to explore implications and develop recommendations for steps to be taken nationally to take advantage of the potential we see emerging. This culminated in a Consultative Session with the review panel (Annex A) at the Lincoln Institute on November 30, 2005.

The remainder of this section more fully discusses the purpose of this project and the conceptual framework that guided it—notions about the staging of system development, the possibilities for relevant applications at each stage, and hypotheses about future potentials. Section 2 presents the findings from the web search on the scope of systems development across the nation's 100 largest cities. The subsequent sections (Sections 3–8) present brief case studies, telling the stories of the development of the systems in six of these cities in greater detail: Charlotte, Indianapolis, Milwaukee, Philadelphia, Portland, and Providence. Finally, Section 9 draws conclusions and offers recommendations on ways to advance the field.

Focus: The Potential to Support New Approaches to Community Development and Land Management

How well a city manages its land resources is critical to its overall effectiveness. At least one author asserts that from "70 to 80 percent of the average local government's work involves land or geographically related issues or tasks" (O'Looney, ed. 1997). Another notes that at least 70 percent of the data processing of local government agencies involves spatially referenced data (Somers, 1987, as cited in Nedovic-Bucic and Godschalk, 1996). The effectiveness of city land management is also obviously critical to the fortunes of distressed inner city neighborhoods, which are a central concern of this project.

Experiences of the authors over the past few years hint that recent advances in parcel-level systems and GIS technology have brought us to a time of significant opportunity to improve local capacity to manage change. PolicyLink, in its work on *Community Mapping*,[1] and the Urban Institute, in its capacity as coordinator of the National Neighborhood Indicators Partnership (NNIP, a collaborative effort with local data intermediaries now in 27 cities), have both recently witnessed in a number of cities: (1) dramatic improvements in the accessibility of parcel level data, and (2) several efforts to apply such data in ways that importantly enhance conventional understandings of what is meant by "community development."[2] The latter entails new ways of using the data we think could lead not only to better-informed decisions by local governments, but also to new kinds of strategies for Community Development Corporations (CDCs) and other groups involved in neighborhood revitalization. They may also lead to new types of collaborations between governments and other actors in this process.

[1] See Kirschenbaum and Russ, 2002.

[2] To learn more about NNIP, visit http://www.urban.org/nnip. Concepts and history are found in Kingsley and Pettit, 2004.

The central purpose of this project has been to learn whether the emergence of these kinds of advances is becoming widespread, in order to better assess their potential. Considerable literature already exists on the diffusion of general GIS capacities in local government in the 1990s.[3] Our interests are more narrow. More specifically, we wanted to learn about:

- Integrated parcel level information systems (i.e., those that recurrently gather data on parcels from multiple agencies, rather than those maintained by agencies individually)—since we judge that integrated information is likely to be essential to support innovative applications in these fields;
- The provision of access to such systems via the internet (which has become a force mostly since 2000)—since we think web accessibility is probably essential to accelerating use; and,
- Applications that concern community development and land management, particularly with respect to distressed inner city neighborhoods.

The paragraphs below describe the reasoning that supports our approach to these issues: first, with respect to systems development and second, with respect to applications.

Systems Development

The taxation of real property has been a feature of urban life, virtually as long as there have been cities. This taxation has always required some form of cadastral records—record-keeping on individual parcels of land, at the minimum identifying the owners, the amount of taxes due and whether or not they have been paid.[4] Over time, local governments have also had to develop record systems that relate other types of transactions to specific properties; e.g., building permits, building code violations, the locations of structural fires. As long as all of these records were kept manually, it would have been unreasonable to integrate them across departments and apply them to uses beyond basic operational requirements.

While such records have been automated for some time, it is only over the past decade or so that computer and GIS capacities have advanced enough to afford a broader view of how they might be enhanced and applied. We judge that it is useful to see the development of these potentials in relation to four stages (although we recognize they may not always occur in this exact sequence):

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[3] See for example, Budic and Godschalk, 1996, Masser and Onsrud, eds., 1993, and more specifically, Wiggins, 1993.

[4] The record keeping requirements for property tax systems in the United States are outlined for International Association of Assessing Officers in Eckert, ed., 1990.

Stage 1 – Automated Administrative Records

Cadastral records (usually maintained by an assessor's office) and records of other required parcel-based administrative transactions are stored and regularly updated in automated databases. Almost all of the top 100 U.S. cities had reached this stage by the year 2000.

Stage 2 – Integrated System Across Agencies

In this stage, the automated administrative records of the assessor and other departments are brought together and regularly updated to create one integrated system. It is also important to point out that such integrated systems rarely incorporate *all* of the data in the separate agency databases, but in many cases they incorporate a large share of them.

Stage 3 – Desktop Accessible Integrated System

A logical next step is putting the integrated system on an internal network within city government so that a wide range of city employees can access it from their desktop. The technology has only made doing so possible over the past few years. We believe that this step—shifting the data from a cumbersome mainframe to a distributed system with desktop access—has been the impetus for a marked increase in breadth as well as the volume of system use.

Initially, these systems incorporate only data that are required for operational purposes. Stage 3, however, is sometimes accompanied by the addition of new data (from surveys or variables derived by transforming data already on the system). Three types of additional information are particularly useful: (1) results of property surveys (several of our cities have undertaken special surveys to identify vacant properties—a condition not automatically decipherable from administrative records); (2) plans (agencies can identify properties they expect to act on in some way—e.g., demolish or rehabilitate); (3) derived variables (modeling and other analytic work using data from the system can yield other indicators that can be added to the database—e.g., estimated risk of abandonment).

Stage 4 – Web-based Integrated System Accessible by the Public

Moving from Stage 3 to Stage 4 is technically simple, but has profound implications. In the limited experience of the authors, with a few cities before this project, it appeared that most were experimenting with making some of the data available to the public. Where this happened, they allowed public users access only to selected facts from the departments that have parcel-level information, rather than the full datasets. Information was presented in the form of maps, but some allowed users to look up tabular information about individual parcels (e.g., finding out who

owns a specific property, its assessed value and whether it is up to date on its tax payments). The sites generally did not allow users to add up or manipulate data about groups of parcels. Another opportunity at this stage could be for the public (or at least some groups outside of government) to contribute data to the system. For example, CDCs and other community groups could share the lists of properties they are assisting and their plans for them.

Possible Applications

In the late 1990s, the International City and County Manager's Association (ICMA) sponsored a monograph on the potential of GIS for decision-making in local government (O'Looney, 1997). The author recognized the possibility of a continuum of applications. At the low end of the use spectrum, GIS is used mostly to streamline basic administrative tasks that were being done before, such as preparing and updating zoning maps. He also foresaw, however, the possibility for sophisticated applications at the high end, such as simulation models that could forecast various aspects of neighborhood change, although few actual examples existed near that end of the scale. Below, we speculate about possibilities in relation to the stages of system development outlined above.

Basic Administrative Applications

Improving the efficiency of basic administration is no small achievement. As the system becomes integrated across departments, the benefits are broadened. For example, not only can the tax assessor process records related to the sale of a property more efficiently and reliably, but someone from the housing department scanning properties for rehabilitation assistance can find out about the sale and its price. As systems advance through the stages, the data become easier to access and apply, particularly after the system becomes internet-based. Perhaps the most important change occurs at Stage 4, when the data are released to the residents and commercial users, who can then significantly improve the efficiency of a number of their own administrative tasks. People interested in acquiring properties for development, for example, have traditionally found searching official records—normally at city hall—to be an onerous and time-consuming task. Being able to obtain the same information from their home computers notably reduces their costs of doing business.

Decision Support Tools

Decision support tools in this context are software components that further manipulate the data found on the website into a format that makes them easier to use in decision making. Suppose the task is to identify properties at risk of abandonment. The simplest sort of tool might just allow users to pull down a screen of pre-selected indicators about individual properties—

indicators drawn from a variety of different source files that city staff think are likely to be correlated with abandonment. Staff might look over these screens for a number of properties one-by-one and then categorize them by hand into any of a number of action-categories they find useful. A more advanced tool would let the computer do more of the work. For example, an estimated "risk of abandonment" rating could be calculated for each property (generated by a model based on prior analysis), and the computer could generate lists of properties that exceed different abandonment risk thresholds in neighborhoods in response to user queries.

A yet more advanced tool might actually simulate decision making. If clear decision rules are specified, the computer could actually allocate properties in the high-risk group to different treatment options. For example, a mix of property and neighborhood characteristics would suggest that some properties are promising candidates for various preventative actions while others look like better candidates for boarding up or, alternatively, ownership change and rehabilitation. Responsible officials would not (and should not) accept any such computer-generated allocations automatically. They would need to review the lists themselves and, in doing so, their "street knowledge" (incorporating valuable information that can never be fully quantified) would probably lead them to appropriately override some of the assignments made by the computer. Nonetheless, having the computer allocations to start from would certainly save time and, because of the systematic nature of the process, probably reduce the range of error.

Stage 4 systems as we have defined them are still quite new and, understandably, the development of decision support tools that make use of them is in its infancy. But there are some notable efforts along these lines. For example, several cities have developed "early warning" capabilities using parcel level data (e.g., warnings of abandonment and neighborhood decline—see Snow, Pettit and Turner, 2003). The idea of bringing this type of data to bear on decisions more forcefully has also been emphasized by the Brookings Institution's Urban Markets Initiative (UMI) under the general theme of "making information actionable." (Sabety and Carlson, 2004). Consistent with that theme, UMI has sponsored an Urban Institute project explicitly focusing on the development of decision support tools utilizing Stage 4 systems in five NNIP cities.[5] The project is not yet complete, but progress to date has been viewed as promising (Kingsley and Pettit, Forthcoming).

[5] Three of these—in Indianapolis, Milwaukee and Providence—are described as examples later in this report.

Advanced Decision Support Applications in Community Development – Families of Tools

It seems to us that these sorts of developments hold the seeds of yet broader applications—ones that could well transform the process of community development as we have known it. As decision support tools with recurrently-updated data on results and performance are developed to address individual issues, they create the opportunity to share information among, many more actors working towards improvement and to coordinate actions in individual neighborhoods and perhaps across neighborhoods.

Factual profiles on the characteristics of individual properties would be used in somewhat different ways by the government agency planning intensive code enforcement and the agency deciding which unsafe buildings to board up, demolish or rehabilitate. If both are using decision tools applied to the same database, however, it would make sense for them to share plans with each other—in fact, to work collaboratively to design their strategies. Given the existence of orderly computer based information of this kind, it should become harder not to share information.

The same logic suggests that relevant non-governmental actors should be brought into the decision making process, and that decision support tools could also be devised to help them do their own jobs better. Community development corporations (CDCs) and other neighborhood groups would share their plans (identifying the individual properties they are working on or interested in) with each other and learn about the property specific plans of government agencies. With access to all of this information, tools to help them sort across all properties to identify attractive candidates for rehabilitation or new construction should be much facilitated. The system should make it much easier for all actors to check for gaps, conflicts, and overlaps in activity. In short, it should also become harder not to coordinate.

In the past, the real estate-related work of CDCs and other neighborhood improvement groups has been dominated by selecting, designing, funding, and implementing a series of individual bricks-and-mortar projects affecting only a few properties in their neighborhoods. The new data systems give rise to an expanded vision: one in which these practitioners have a tremendous amount of information at their fingertips about *all* of the properties in their neighborhoods and can engage in the orchestration and ongoing management of a much wider array of programmatic tools to address the variety of challenges facing these environments.

Focus for this Research

This vision may well not be realized in full anywhere in the short term, but we think it much less fanciful than it might have sounded even five years ago. Our experiences of late suggest that when systems development moves through the stages we have outlined and reaches Stage 4, the costs of these sorts of applications drop dramatically; therefore, they are much more likely to be experimented with in practice. Once some decision support functions begin to pay off evidently, they are likely to stimulate others. Our guess is that the recent acceleration of web service capacities is creating an environment with much enhanced potential.

The focus for this research, then, has been on finding out whether these initial suppositions are borne out in fact: first, by determining what share of our major cities have reached the advanced stages of systems development we have defined and then seeking evidences of new applications.

Section 2
Web-Based Parcel GIS for Large Cities

Our research team conducted a scan of the nation's 100 largest cities in pursuit of two main objectives. First, we wanted to determine how many of these cities were making parcel-level data available to the public on their websites. Second, for those cities that did make such data available, we sought to classify and understand the key characteristics of those systems.

Our scan revealed that 72 out of 100 cities have interactive mapping systems featuring data at the parcel level, a finding that exceeded our initial expectations.[6] We also found that these parcel level systems exhibited wide variation in terms of the following important characteristics:

- the agencies or institutions that man age them;
- the parcel data that they make available;
- the sophistication of the queries that they support; and,
- the mapping functionality they permit.

[6] See Annex B for a list of cities for which parcel systems were identified and not identified, and more detailed tables on the characteristics of these systems.

Methodology

We collected the data summarized in this report in two phases. The first phase involved simple identification of which cities made parcel GIS available to the public. The second phase consisted of an analysis of the identified parcel systems, both for the data sets that they made available as well as their mapping and querying capabilities.

Our research began with a web-based scan conducted in March through May 2005. Initially, we accessed the websites for the local city governments. If, using multiple search methods, we did not discover a parcel GIS at the city site, we then proceeded to the website for county government agencies, including, in particular, websites for county tax assessors and auditors.

If we were not able to identify a system at the city or county level, we broadened our search. In particular, we were looking for systems managed by entities other than cities or counties, including universities, private companies, and non-profits. For these broader scans, we utilized the following search keywords, in various query structures: Geographic Information Systems, GIS, Parcel, Mapping, Online Mapping, Interactive Mapping, and Geographic Data. If we were unable to detect any parcel GIS for a particular city after this scan, we listed the city in Annex B.2 as having no parcel GIS identified.

The following sections offer a more detailed examination of the parcel GIS we identified according to the characteristics and features described above.

Agencies Responsible for Parcel GIS

Several kinds of agencies and institutions house and maintain parcel GIS for U.S. cities.[7] For the purpose of this analysis, we grouped agencies that manage the 72 systems we identified into three broad categories:

- **Technical government agencies** including all those with Information Technology or Services (IT/S), Management Information Systems (MIS), or Geographic Information Systems (GIS) in their titles.

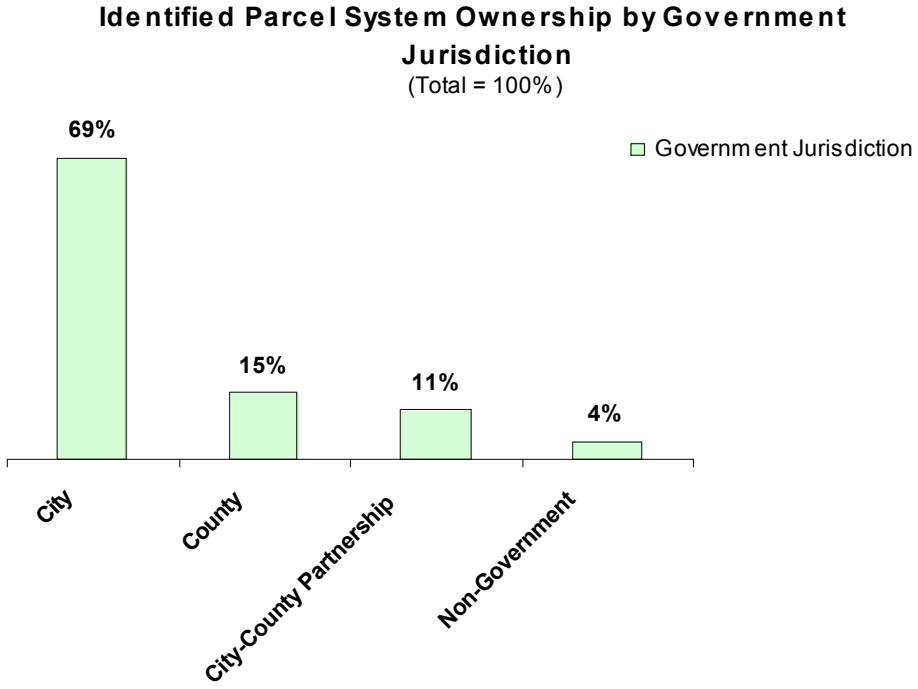
[7] For a more detailed breakdown of agencies responsible for managing parcel-based GIS, see Annex Table B.3.

- **Substantive government agencies** including those with substantive functions in addition to managing GIS. These included planning departments, economic development agencies, zoning departments, assessors, auditors, and appraisers.

- **Non-governmental agencies** including one private company and two university departments.

As Figure 1 below illustrates, city agencies and departments manage the vast majority of parcel-based systems (69 percent). County agencies manage 15 percent; partnerships between cities and counties manage 11 percent; and non-governmental entities manage 4 percent.[8]

Figure 1



Furthermore, we found that the systems managed by city departments were almost evenly split between technical government agencies and substantive government agencies (see Table 1). Systems managed by county agencies alone are located for the most part in county assessor's or auditor's offices rather than other types of agencies. For systems managed by city-county

[8] It is possible that cities that have a parcel GIS at the city level may also have such as a system managed by county agencies as well. The research scan for this report, however, did not extended to more than one system per city.

partnerships, they are more likely to be housed at technical agencies or "users groups" rather than substantive departments.

Table 1. Web-Based Parcel Systems by Agency Type Responsible

	% Total (count)	City	County	City-County Partnership/ Users Group	Non-Govern.
Total	**100% (72)**	**69%**	**15%**	**11%**	**4%**
Government-Technical	**49% (35)**	**35%**	**4%**	**10%**	**-**
IT/MIS/GIS	49% (35)	35%	4%	10%	-
Government-Substantive	**47% (34)**	**35%**	**11%**	**1%**	**-**
Planning/Development	30% (21)	26%	1%	1%	-
Assessor/Auditor/ Appraiser.	11% (8)	1%	10%	-	-
Other	7% (5)	7%	-	-	-
Non-Government	**4% (3)**	**-**	**-**	**-**	**-**
University	3% (2)	-	-	-	-
Private Company	1% (1)	-	-	-	-

Based on our scan, it appears that the agency that manages a parcel GIS wields substantial influence in terms of that system's purpose and design. We will revisit this theme in future sections as we examine how various systems' data sets and functionality vary according to the agency responsible.

Data Made Available by Parcel GIS

Our scan revealed great variation among parcel systems in terms of the quantity, type, and access mechanisms for the data they offer. This section provides an overview of the geographic scope of the parcel data available; the content of parcel reports; and the method by which parcel reports are generated.

Geographic Scope

Whatever the quantity of data they include, parcel systems for the most part limit the geographic scope of their parcel data to the jurisdictional level of the agencies that manage them. At the city level, 86 percent of parcel GIS managed by city agencies provide data covering only the city. However, seven systems managed by *city* agencies provide parcel data covering the *entire county or region* in which the city was located.[9] All county parcel systems, including city-county partnerships, cover their entire counties, while one county system covers a multi-county region.

Content of Parcel Reports

Nearly every parcel GIS surveyed presents data about selected parcels in a report. Parcel reports are tabular reports that include three principal types of data:

Parcel Attribute Data describe the various attributes of a specified parcel. Typical parcel attributes include current value, parcel size, parcel use, building size, year built, and living area. Rare attribute data included in some systems include lot vacancies, building permits, code violations, water utility account histories, and whether parcels are owner-occupied.

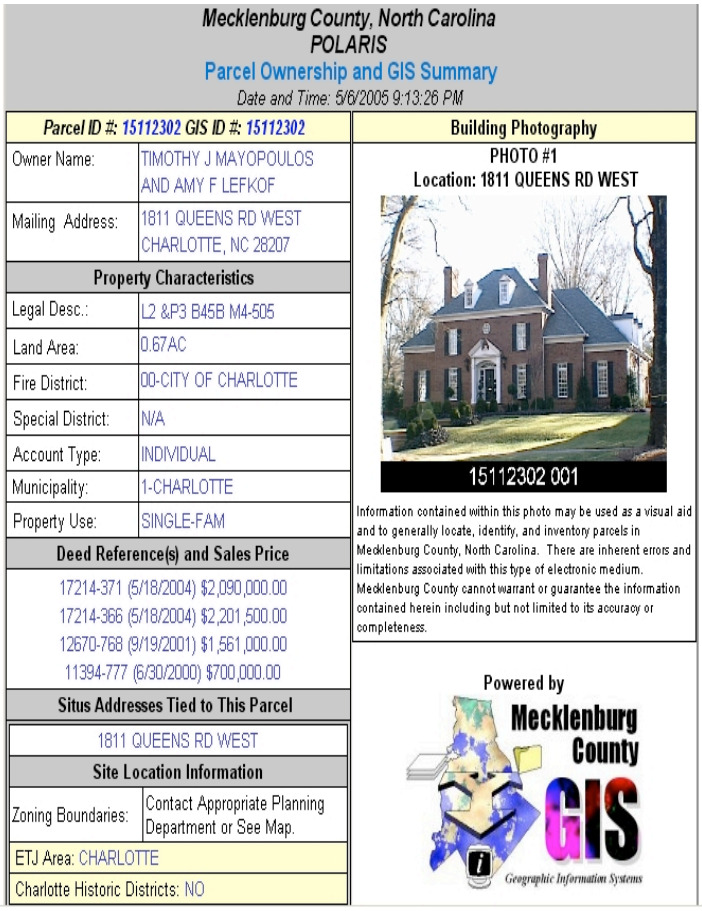
Geographic Contextual Data are descriptive data that identify institutional or jurisdictional boundaries within which a parcel is located. Typical data in this category include zoning district, local legislative district, census tract, institutionally defined neighborhood, and enterprise or empowerment zone.

Substantive Contextual Data refer to data within a spatial context, particularly individual units that are summarized within defined geographic boundaries like census tracts, block groups, or buffer zones. Examples include census variables, consumer expenditures, crime, and civic associations.

We found that the parcel reports of the GIS we surveyed vary widely in terms of how much of these data sets they include and in how they are presented. In some cases these reports contain as little as the parcel's identification number. In other cases they may contain as much as a complete assessor profile of the property, along with census data on the surrounding area. Figure 2 is an example of a parcel report that offers only limited information, while Figure 3 shows a parcel report featuring a richer supply of data.

Figure 2. Parcel Report with Relatively Little Data

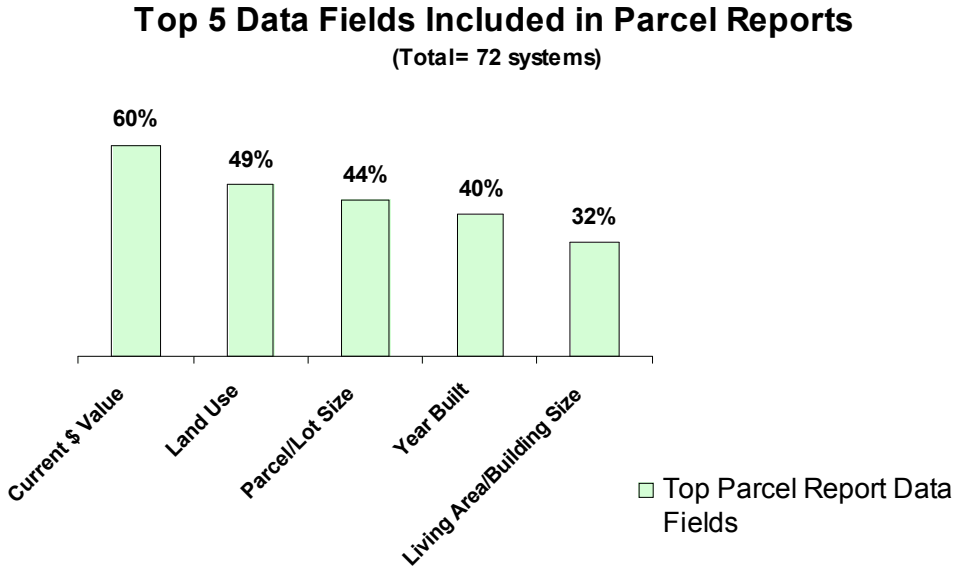
Figure 3. Richer Parcel Data Report



The top five data fields included in the parcel reports of the 72 systems we surveyed all correspond to parcel attribute data. Nearly two-thirds of these systems' parcel reports include data on the current value of the parcel. Nearly half feature data on land use. Figure 4 shows the top five data fields.

[9] Note the fact that seven parcel GIS developed or managed at the city level covered the entire county or region. They are: Honolulu, HI; Lincoln City, NE; St. Louis, MO; Tucson, AZ; Jacksonville, FL; Las Vegas, NV; and Portland, OR.

Figure 4.



The likelihood that these top five data fields are included in any particular parcel report depends in part on the type of agency that manages the parcel system. For example, Table 2 shows that while over two-thirds of technical agencies provide data on the current value of parcels, only half of substantive agencies do. However, substantive agencies at 47 percent are substantially more likely than technical agencies (37 percent) to include data about a parcel's land use. Systems housed at assessor or auditor agencies are more likely to include data on the year a parcel building was constructed than are systems in technical departments or planning and development agencies.

Table 2. Percent of Systems with Selected Parcel Data by Agency Type Responsible

	Total (Count)	Current $ Value	Parcel Size	Land Use	Year Built
Total	**72**	**60%**	**49%**	**44%**	**40%**
Government-Technical	**35**	**69%**	**43%**	**37%**	**43%**
IT/MIS/GIS	35	69%	43%	37%	43%
Government-Substantive	**34**	**50%**	**50%**	**47%**	**38%**
Planning/Development	21	48%	52%	57%	24%
Assessor/Auditor/Appraiser.	8	75%	75%	38%	88%
Other	5	20%	20%	20%	20%
Non-Government	**3**	**67%**	**67%**	**100%**	**33%**
University	2	50%	50%	100%	50%
Private Company	1	100%	100%	100%	-

Generating Parcel Reports

Our scan found that over three-quarters (78 percent) of the parcel systems enable users to retrieve a report by clicking on a parcel's location on a map. The report is usually either stored on the GIS server itself, or at another site which, in most instances, is the website for the city or county tax assessor. The use of queries to generate parcel reports is discussed in the following section.

Figures 5 and 6 show screenshots from the City of Grand Rapids, Michigan, which illustrate how a parcel is selected by clicking on a map, as well as the report generated when the parcel is selected.

Figure 5. Selected Parcel for Grand Rapids, Michigan

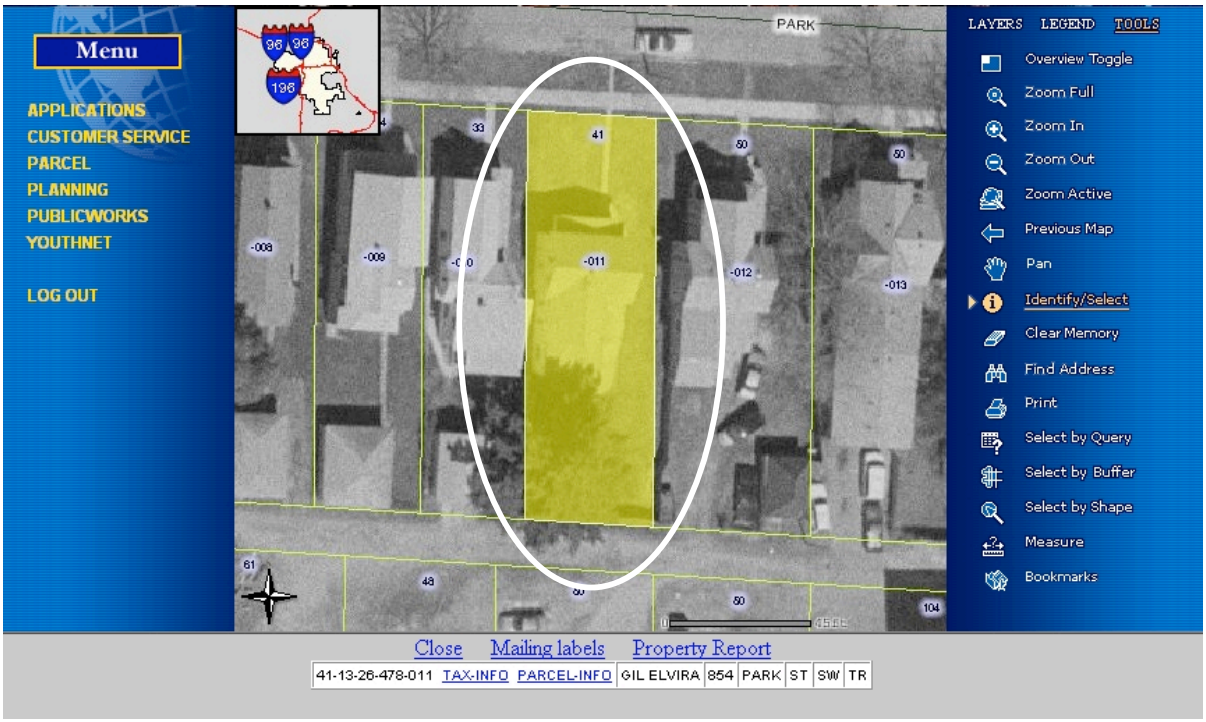
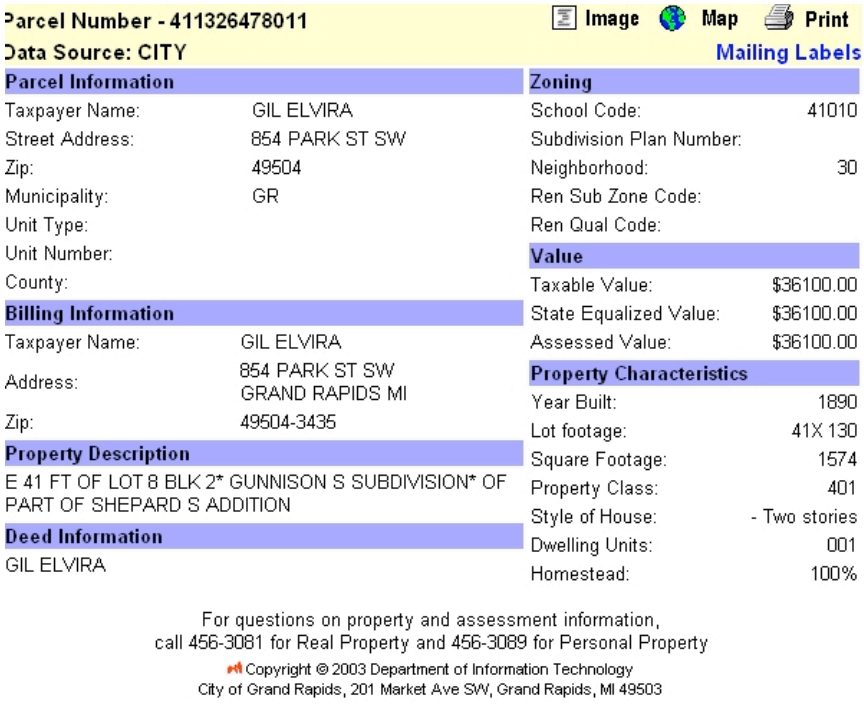


Figure 6. Parcel Report for Grand Rapids, Michigan



Parcel Number - 411326478011 — Image — Map — Print
Data Source: CITY — Mailing Labels

Parcel Information

Taxpayer Name:	GIL ELVIRA
Street Address:	854 PARK ST SW
Zip:	49504
Municipality:	GR
Unit Type:	
Unit Number:	
County:	

Billing Information

Taxpayer Name:	GIL ELVIRA
Address:	854 PARK ST SW GRAND RAPIDS MI
Zip:	49504-3435

Property Description

E 41 FT OF LOT 8 BLK 2* GUNNISON S SUBDIVISION* OF PART OF SHEPARD S ADDITION

Deed Information

GIL ELVIRA

Zoning

School Code:	41010
Subdivision Plan Number:	
Neighborhood:	30
Ren Sub Zone Code:	
Ren Qual Code:	

Value

Taxable Value:	$36100.00
State Equalized Value:	$36100.00
Assessed Value:	$36100.00

Property Characteristics

Year Built:	1890
Lot footage:	41X 130
Square Footage:	1574
Property Class:	401
Style of House:	- Two stories
Dwelling Units:	001
Homestead:	100%

For questions on property and assessment information,
call 456-3081 for Real Property and 456-3089 for Personal Property

Types of Queries Supported by Parcel GIS

When navigating through the map interface, the method we described above for obtaining a parcel report is generally most useful for getting parcel-specific data for one or a few parcels. Entering queries is an alternative way of retrieving information and can be used for both basic and elaborate information needs. Ninety-six percent of the parcel systems we surveyed offer users the ability to enter simple or complex queries as a means of retrieving parcel reports.

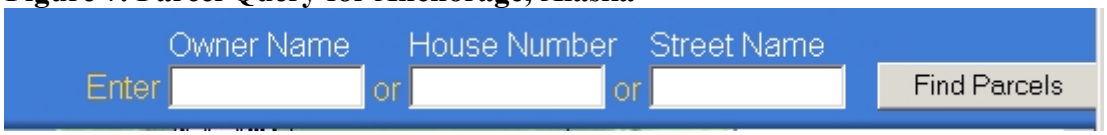
In the systems we surveyed, there are three fairly standard search fields for constructing simple queries: parcel identification number, parcel address, and the parcel owner's name. Most query forms have all three query fields. These fields are primarily intended for finding a single parcel, not classes of parcels sharing certain attributes in common.

Some systems allow users to conduct complex queries, for example, identifying all parcels that are vacant or all parcels within a certain range of assessed values. These types of queries thus provide information on a class of parcels with certain attributes. We found that one-quarter of the parcel systems offer users the ability to make queries based on single or multiple attributes.[10]

[10] See Annex B.6 for more detail.

Figure 7 shows a fairly simple parcel query form provided with the parcel GIS for Anchorage, Alaska.

Figure 7. Parcel Query for Anchorage, Alaska



In contrast, the parcel GIS for the city of Richmond, Virginia, Figure 8 below, offers a more complex query form featuring several search fields and query forms.

Figure 8. Parcel Query for Richmond, Virginia

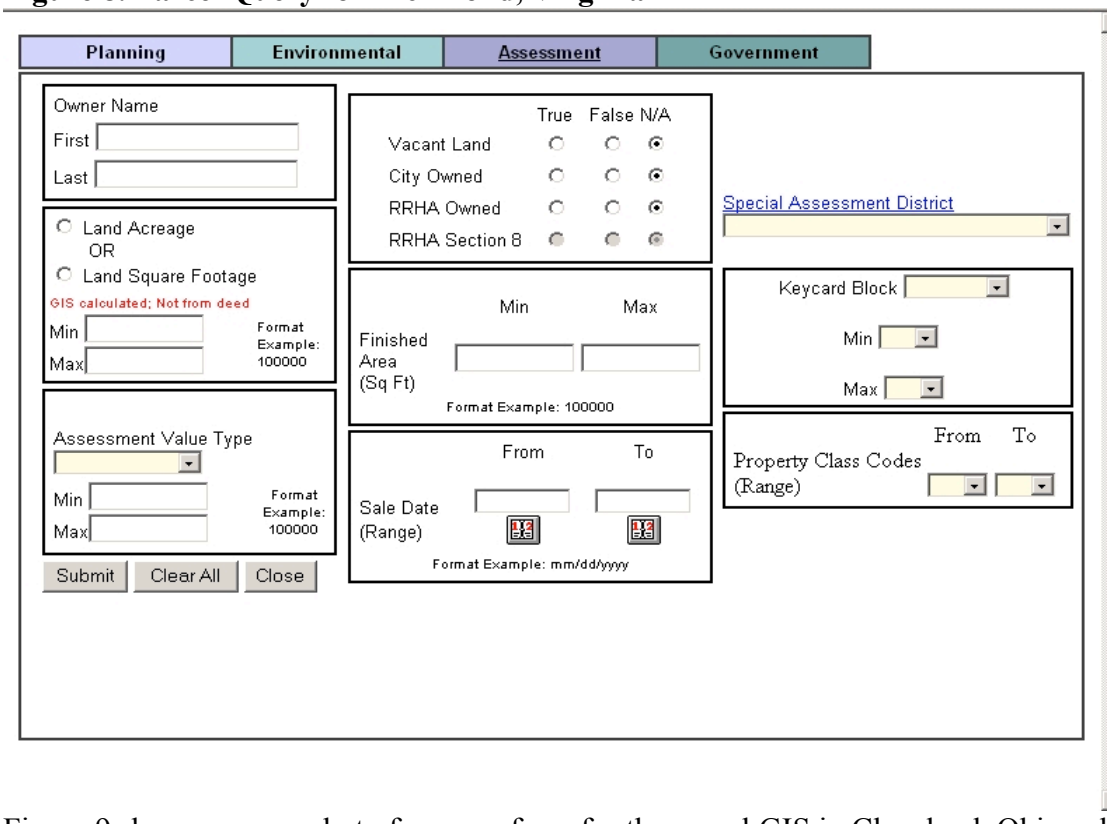
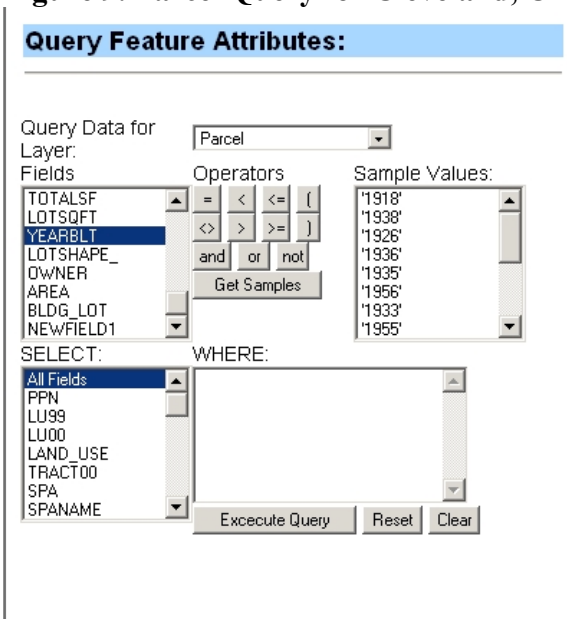


Figure 9 shows a screenshot of a query form for the parcel GIS in Cleveland, Ohio, which allows users to build sophisticated and complex queries. The drawback to such a sophisticated form is that it may be appropriate for more advanced GIS users and present some usability challenges for novice users.

Figure 9. Parcel Query for Cleveland, Ohio



We then examined the top five query fields available (Figure 10). The most common is parcel/lot size, followed by land use, and then by current value. We compared these query fields to the percentage of parcel systems that include the same data field in their parcel reports (see Figure 11). It is significant that while nearly half of the systems' parcel reports include land use as a data field, and 60 percent include current value of the parcel, data fields supporting *queries* for this same parcel data are much less widespread (15 percent and 10 percent respectively). This discrepancy between data that is available in parcel reports and data that can be queried through search forms reflects the fact that much of the parcel data available through parcel systems is actually not incorporated into the GIS database itself. Rather, these data are often only retrievable through a link to an entirely separate web-based database housed at the website of the local assessor's office.

Figure 10. Top Five Query Fields Included in Query Forms

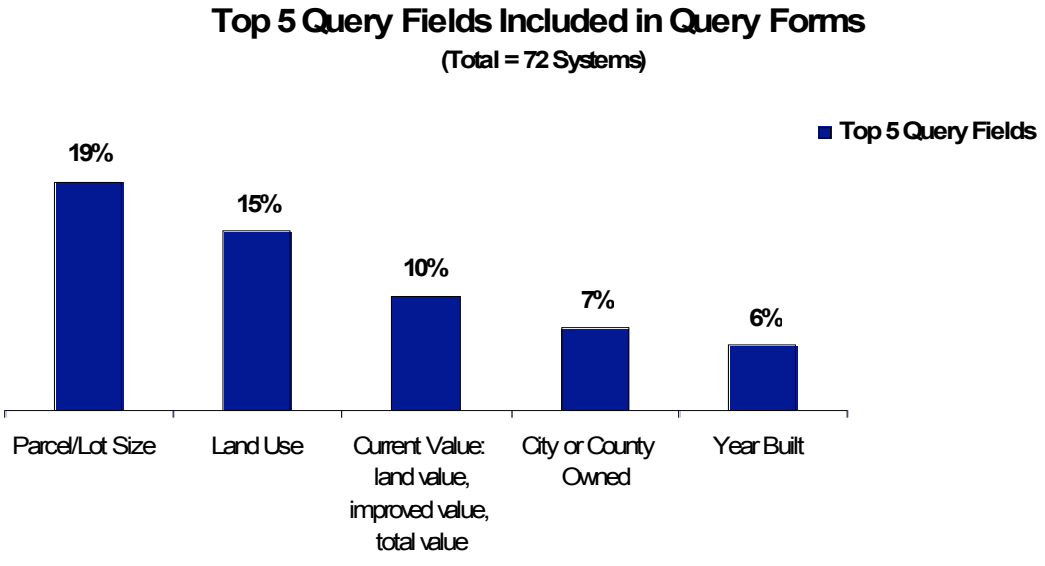
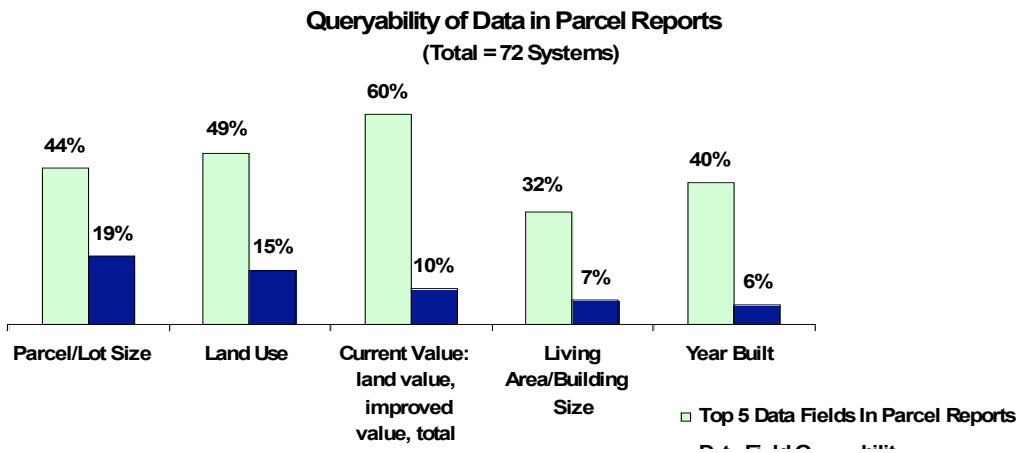


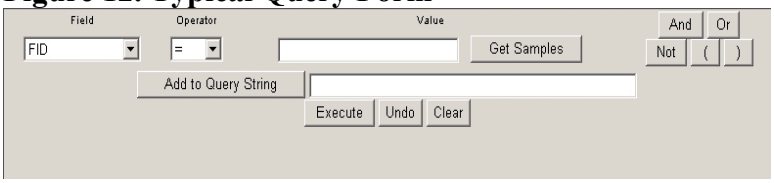
Figure 11. Data Types Included in Parcel Reports Compared to Top Five Query Fields



We also examined the systems in terms of their ability to support multi-attribute queries. While one quarter of the systems surveyed allow users to restrict their queries to at least one attribute at a time, fewer systems (21 percent) allow users to search for parcel data using multiple attribute fields simultaneously.11 The systems that do support the latter enable the user, for example (assuming that the query fields are available), to search for all parcels built before a certain year, with assessed values within a specified range, and with a specified number of bedrooms. The ability to group parcels into different "classes" based upon a set of attributes is a critical analytical and decision support tool for community development.

Multi-attribute query forms vary widely in their characteristics and can present usability issues for novice users. Figure 12, below, is a query form that is typical of many systems we surveyed. It allows users to perform very sophisticated queries, using Boolean syntax to string together, in some instances, up to 10 to 15 parcel attributes.

Figure 12. Typical Query Form

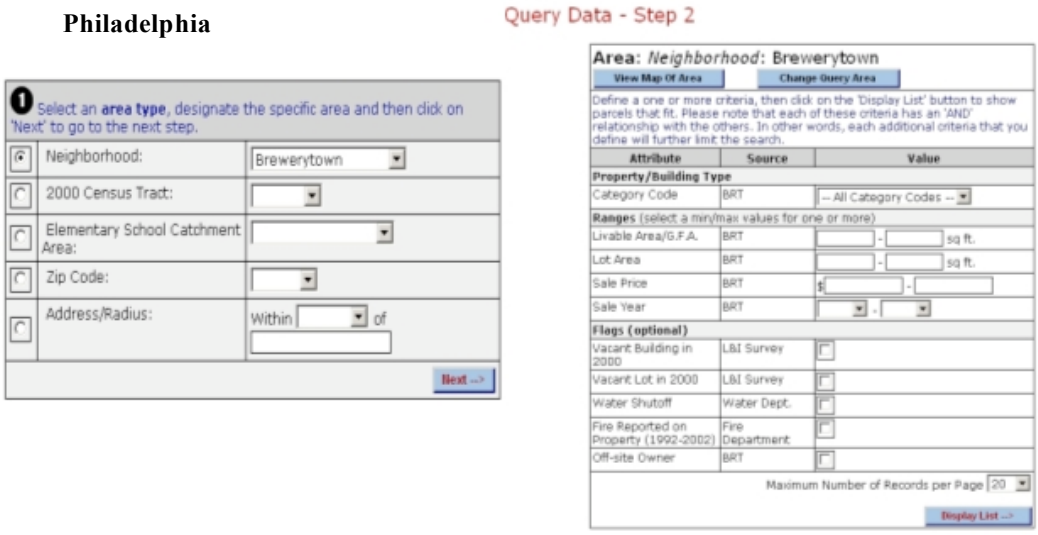


In contrast, the Philadelphia Neighborhood Information System provides a more user-friendly alternative (see Figure 13). It features an easier-to-use menu-driven interface for building

11 For a list of systems offering multi-attribute queries, see Annex B.7.

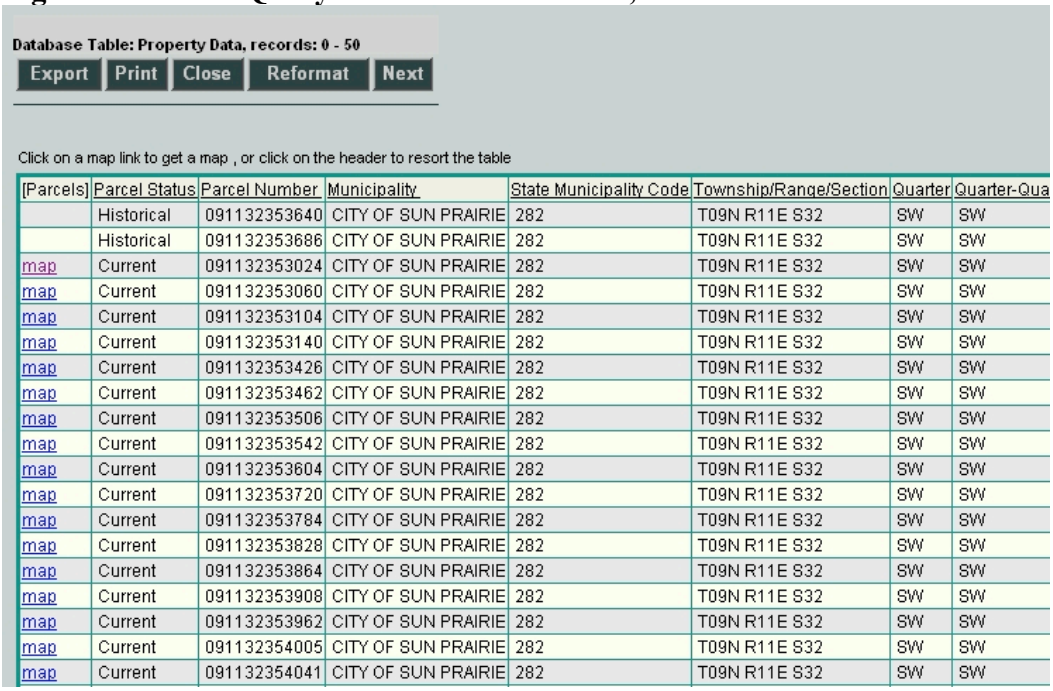
complex multi-attribute queries, making this powerful query capability available to a broader range of users.

Figure 13. Philadelphia Neighborhood Information System



The 15 systems we identified that offer multi-attribute queries usually display results in a tabular form. Figure 14 provides an example of this from the Madison, Wisconsin online parcel GIS.

Figure 14. Parcel Query Result from Madison, Wisconsin



[Parcels]	Parcel Status	Parcel Number	Municipality	State Municipality Code	Township/Range/Section	Quarter	Quarter-Qua
	Historical	091132353640	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
	Historical	091132353686	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353024	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353060	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353104	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353140	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353426	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353462	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353506	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353542	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353604	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353720	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353784	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353828	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353864	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353908	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132353962	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132354005	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW
map	Current	091132354041	CITY OF SUN PRAIRIE	282	T09N R11E S32	SW	SW

Parcel Mapping Functionality

In addition to including geographic and contextual data in parcel reports, several systems surveyed offer these data as map layers that can be turned on and off using a layer menu. The most common layers that can be turned on and off are parcel boundaries, aerial photos, and zoning designations, respectively. Table 3 below shows the top six map layers among the 72 systems identified and depicts how they differ in terms of whether they offer the specified layer. (It should be noted that the parcel boundary statistic cited in Table 3 refers only to whether a user can turn parcel boundary layers on or off. Nearly all of the sites for which this feature is not available include, at the very least, *static* parcel boundaries.)

Table 3. Percent of Systems with Selected Parcel Map Layers by Agency-Type Responsible

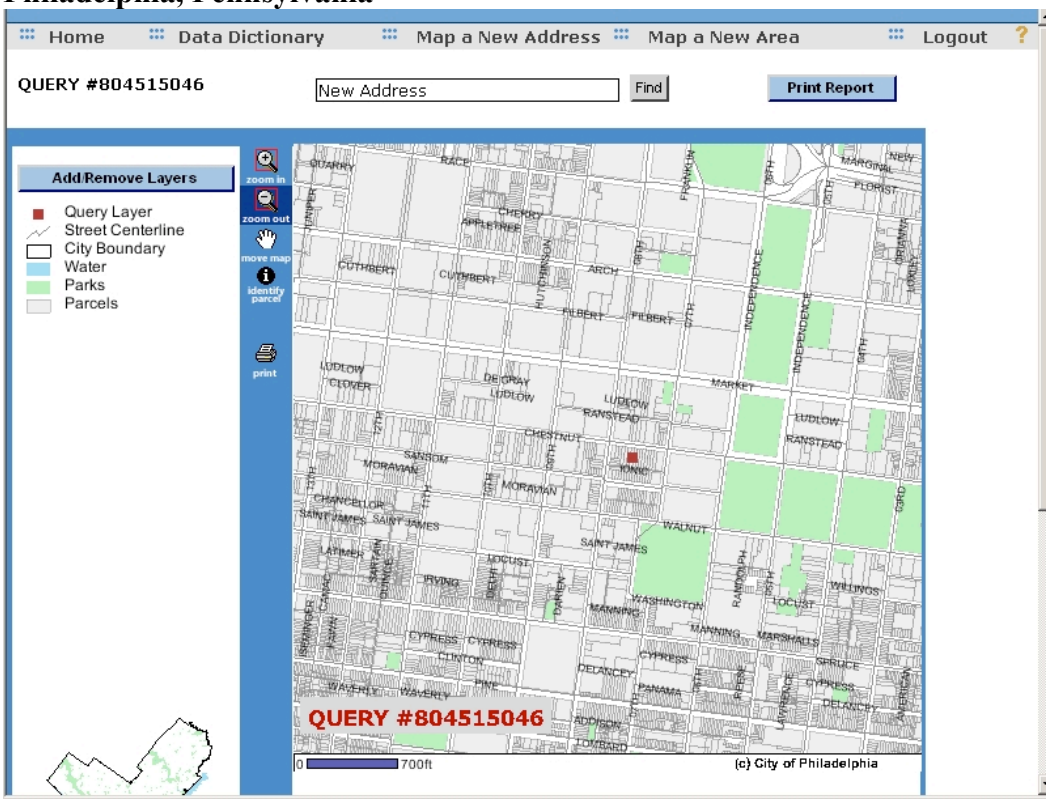
	Total	*Parcel Boundaries*	*Building Footprint*	*Zoning*	*Aerial Photos*	*Census Tracts or BG*	*City or Council District*
Total	**72**	**74%**	**19%**	**39%**	**40%**	**25%**	**22%**
Government-Technical	**35**	**83%**	**26%**	**37%**	**34%**	**17%**	**14%**
IT/MIS/GIS	35	83%	26%	37%	34%	17%	14%
Government-Substantive	**34**	**62%**	**12%**	**44%**	**50%**	**32%**	**29%**
Planning/Development	21	62%	14%	57%	43%	38%	29%
Assessor/Auditor/ Appraiser	8	63%	-	25%	63%	25%	13%
Other	5	60%	20%	20%	60%	20%	60%
Non-Government	**3**	**100%**	**33%**	**-**	**-**	**33%**	**33%**
University	2	100%	50%	-	-	50%	50%
Private Company	1	100%	-	-	-	-	0%

As Table 3 illustrates, the vast majority (83 percent) of technical agencies offer parcel boundaries that can be turned on and off, but far fewer of these technical agencies offer map layers depicting census tracts or city council districts. Few planning/development departments (14 percent) offer a map layer depicting building footprint, compared to more than a quarter of technical agencies offering this capability. Not surprisingly, 57 percent of planning/development agencies include a map layer depicting zoning boundaries, while only a quarter of assessors/auditors' agencies do so.

Finally, a few of the most advanced parcel systems enable users to view a map that depicts their query results. Eleven percent of the systems we surveyed offer this capability.[12] Screenshots from parcels systems in Philadelphia, Milwaukee, Chicago and Tacoma provide examples of this feature (See Figure 15).

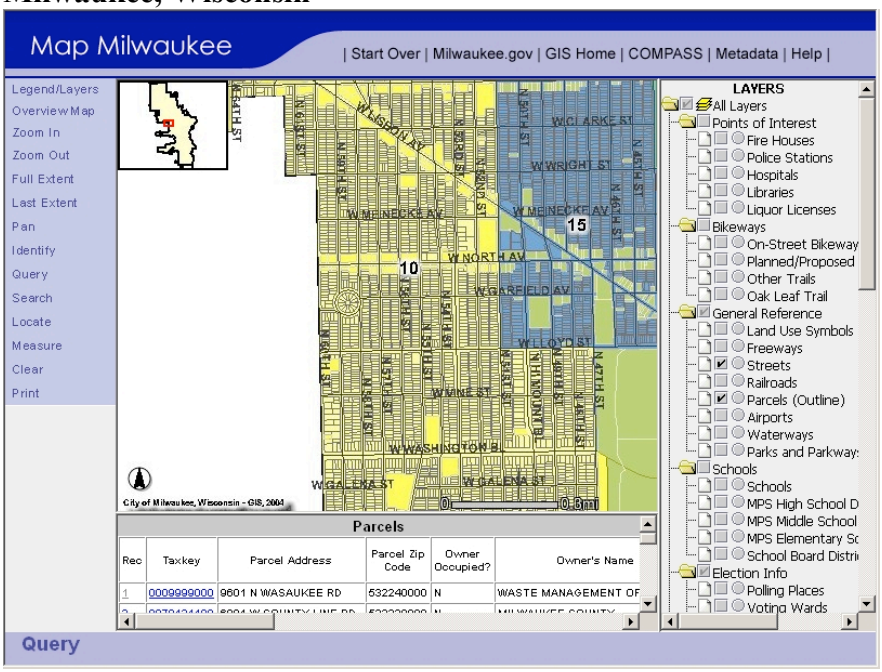
Figure 15. Query Results Depicted on Maps

Philadelphia, Pennsylvania



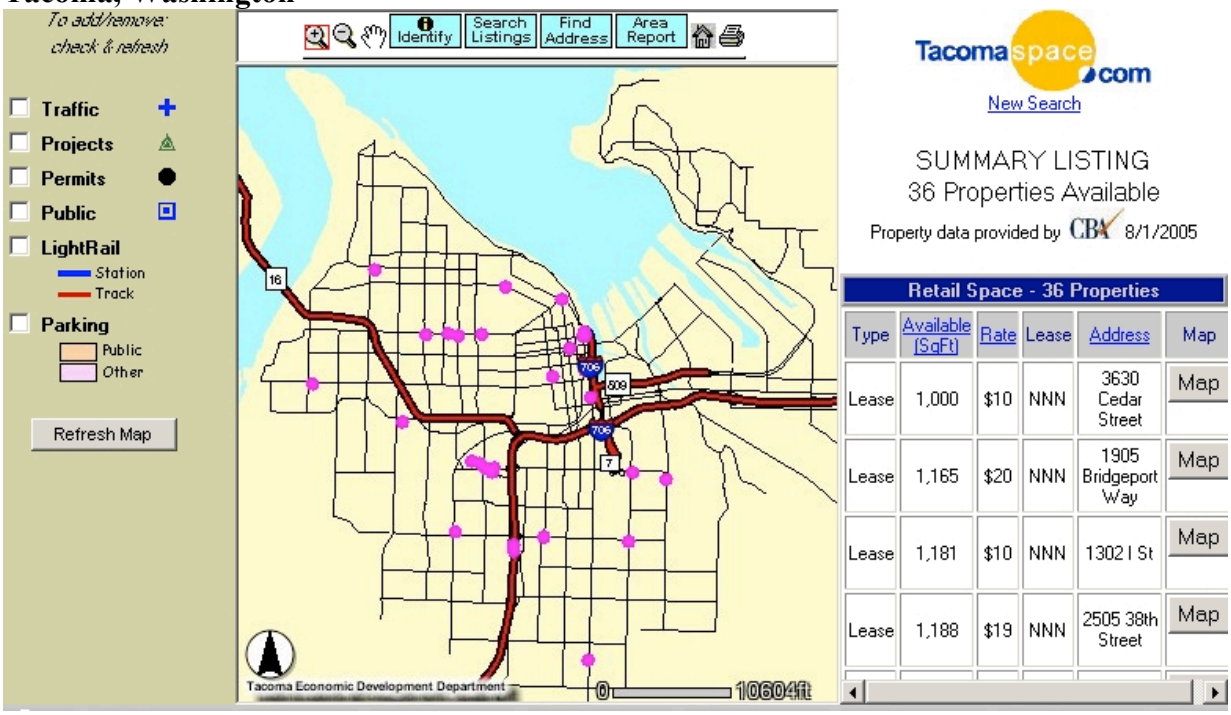
[12] For a list of parcel systems see Annex Table B.8.

Milwaukee, Wisconsin



Chicago, Illinois

Tacoma, Washington



Conclusion

Our scan revealed that nearly three quarters of the nation's hundred largest cities offer parcel based GIS accessible to the public. The development of these systems—as well as their widening use—bode well for increased information sharing, collaboration and effectiveness among public and private actors working for community development and revitalization of older urban areas.

Among the parcel GIS surveyed for this study, the most sophisticated ones share the following key characteristics:

1. They offer rich, integrated databases that incorporate parcel data and neighborhood contextual data gathered from multiple agency sources.

2. They allow for advanced query ability by enabling users to generate complex queries using multiple attributes and permitting parcels to be distinguished into discrete "classes" for analysis.

3. They offer a query database that is integrated with the mapping interface so that users can not only retrieve their query results in tabular form, but display them as an active layer on a map. A map display of complex queries serves both as a powerful analytical tool and presentation feature for community development practitioners.

As this section describes, certainly not all systems surveyed are capable of the most sophisticated operations. However, their continuing evolution indicates tremendous potential for the emergence of an array of both information and programmatic tools to address community development and land management issues.

Section 3

Charlotte/Mecklenburg County

System Development

The Property Ownership Land Records Information System (POLARIS) is an Internet mapping application designed for access and retrieval of maps and GIS data layers associated with real property in Mecklenburg County, North Carolina. Mecklenburg County's Information Services and Technology Department maintains and operates POLARIS.

Mecklenburg County initiated development of a web-based GIS application in 1997, which was a precursor to its current system. Called the GIS Real Estate System it was a parcel-based mapping system on the internet. That system debuted in 1998 and was well received and heavily used (up to six million hits a month by 2002.) However, its older software limited the system in terms of the volume of concurrent users it could handle. In addition, the size and quality of the maps were less than optimal.

In 2003, the County significantly overhauled and redesigned the system, renaming it POLARIS. Key goals motivating the development of POLARIS included the following:

- Provide comprehensive mapping and GIS services to the community;
- Provide more accurate and timely access to parcel information form the Mecklenburg; County Real Estate Lookup application;
- Provide a higher level of service to professionals who use the application on a daily basis; and
- Provide stable and reliable access to the public 24 hours a day, seven days a week.

POLARIS uses a distributed system architecture comprised of a database server and an application server. It was written with GIS software (ESRI's ArcIMS), Microsoft Visual Basic, Active Server Pages, and JavaScript (to web-enable the application and provide database access).

To help guide decision making on what specific new features POLARIS should offer to improve on the old system, the County convened four industry-specific focus groups composed of professionals who used the old system daily. These professionals included realtors, developers, paralegals, and local government GIS technical users. Some 150 individuals attended the focus groups and provided extensive input regarding what they wanted from the new system. A review committee then met over a period of two months to review and prioritize the comments, and determine what features would be included. The final system was launched in January 2003.

POLARIS represents an improvement to the previous system in several respects. The size of the maps is larger and the quality is distinctively better. The new system is also more robust in its ability to handle high transaction volumes and concurrent users. It also has 34 data layers that can be individually turned on and off in almost any combination. Finally, POLARIS stores and retrieves more up to date tax information (downloaded nightly versus weekly).

System Content

POLARIS draws from data sets housed in a variety of city and county departments. It has 13 GIS data layers viewable from a full-county view. These include county boundaries, annexation areas, engineering grids, census tracts, ZIP codes, and 100-year flood plains, among others. There are 29 layers available from a parcel view. These layers include parcel number labels, lot dimensions, zoning, census tracts, ZIP codes, flood plains, streams, building footprints, sales by deed year, tax parcel land use, and aerial photography among others.

POLARIS links directly to online tax bills, online tax lookup, online deeds, online voting information, online school assignments, online park facilities, online driving directions, photographs of residential properties, and the online FloodZone Application.

The system has eight different search capabilities to locate property on the map:

- Parcel number search
- Owner name search
- Address search
- Street name lookup
- Street intersection lookup
- Interstate exit selection
- Engineering grid selection
- Preliminary plan selection

The POLARIS parcel report offers a number of different types of data when a particular parcel is pulled up. In addition to the parcel number and address (the standard minimal information offered in the parcel reports of most systems), POLARIS includes the owner name and mailing address; the size of the property; the property use; deed references and sales price; the fire district; and whether it is in a historic district.

Uses and Users

The highest volume users are city and county agencies. The different planning agencies within the county utilize the system for rezoning applications and to obtain property ownership information for rezoning notification letters. City real estate agencies obtain information about rights of way acquisition. The city transit agency uses POLARIS for obtaining owner information, parcel information, address, railroad rights-of-way, and deed lookup. Other public agencies that use POLARIS include the County Board of Elections; the County departments of Parks and Recreation and Storm Water; the City of Charlotte Fire Department and the City of Charlotte Solid Waster department.

Other users include legal professionals, appraisers and land developers. Lawyers, paralegals, and surveyors use the system to perform research for property transfers. Residential and commercial appraisers perform sales analysis to locate comparable sales to back up their appraisals. Land developers use the system to help inform siting decisions for development projects. In addition, homeowners use the system to compare their property values to other properties in the area.

In terms of community organizations, the Charlotte Region Realtor's Association is the biggest user. Realtors use the system to locate properties, view current tax information, assist in determining how to price new real estate, and to obtain school assignments. The Charlotte Chamber uses the application to assist large firms interested in relocating to the County, and making optimal siting decisions.

Advanced Applications in Land Management and Community Development

POLARIS includes an advanced search tool called Market Analysis. While it is unclear to what extent the tool has been used for community development purposes (as opposed to appraisals or establishing a selling price for a property) the potential is clear. The tool provides a means to query the tax database by address, by neighborhood, and further specify approximately 20 different criteria. These additional queries may include square footage range, property use type, sales price range, etc. For example, a query might consist of the following: "Locate all the vacant land parcels on a specified highway that are 15–50 acres in size." The system would return a list of properties satisfying the criteria. This result set also links the parcel to the map so complete information about any of the selected properties can be obtained. This type of information would serve as a useful tool to community-based development entities working on a development strategy for a given neighborhood. It could also serve as a basis for partnership and information sharing between the City and community organizations regarding land use and development in a given community.

Section 4
Indianapolis [13]

System Development

Indianapolis Mapping and Geographic Infrastructure System (IMAGIS) is a public-private consortium for geographic information about Indianapolis and Marion County, Indiana. Its primary purpose is to maintain and share an accurate, updated geographic information system to serve the public good. It provides a single source of aerial photography and property, planimetric and topographic maps, and coordinates infrastructure management and GIS applications development among its partners. In addition, IMAGIS develops GIS data standards, policies, and procedures for its members, and provides leadership in setting data standards.

IMAGIS was formed in 1986 by several partners, including the City of Indianapolis; Marion County Offices (Surveyor, Auditor, Treasurer, Assessor, Recorder, and Voter's Registration); the local utility companies; Marion County Health & Hospital Corporation; Indiana University-Purdue University at Indianapolis (IUPUI – the local NNIP partner); and other public and private organizations. In 1988, IMAGIS received an Honorable Mention from URISA's *Exemplary Systems in Government* award program, which recognizes excellence in government agencies' use of automated information systems to improve services for citizens.

[13] Adapted from materials prepared by Sharon Kandris from the Polis Center in Indianapolis.

A year after its creation, IMAGIS hired Mid States Engineering to digitize the parcel layer. Their primary sources were plats from the Recorder's office, the Assessor's list of parcels, and hardcopy base maps from the city's Department of Metropolitan Development (DMD). The final file only contained the parcel identification number and address. IMAGIS became the distributor of the data, giving each partner organization a free copy of the file. The Department of Metropolitan Development took over maintenance of the parcel layer after its completion.

Around 1991, the Assessor's office hired RW Armstrong Engineers to create an AutoCAD system to map parcels. Using the parcel layer developed by IMAGIS in conjunction with the Assessor's hand drawn maps, they created a new parcel boundary with more information than the original GIS layer (e.g., easements, property dimensions, etc.). Around this time, the Assessor's Office joined IMAGIS and started sharing their digital parcel boundary file with DMD via IMAGIS (and vice versa) to reconcile and clean up the layer. While this step established a better level of cooperation, the nine Township Assessors continue to retain boundary layers separate from DMD's version.

To update the parcel layer, DMD maps out a new or modified parcel before assigning and officially recording any new address. Starting approximately in 2000, DMD began downloading the master property list from the Property System (known as the "counter book file") monthly and comparing it to their parcel layer to check for splits or other changes.

IMAGIS offsets the costs of maintaining the maps by marketing GIS products and services to the public. Non-members can purchase a digital copy of the parcel layer covering the county for $900. Since 2000, the city has also offered a free limited interactive mapping web site for the public.

System Content

The information on the base parcel layer maintained by IMAGIS is very limited, with just parcel ID and address. The city agencies do collect and share electronic files with typical parcel characteristics (assessed value, code violations, and permits) in systems separate from the GIS layer. One major deficit is that only the realtors' association collects sales data electronically, and this is not shared with city agencies or other outside groups. As described below, users have independently merged the geography layer with attribute data for one-time analysis, government operations, or to build web sites for specific audiences and purposes.

Uses and Users

The city and county government partners listed above are the primary users of the parcel layer. For example, the parcel map is essential to the functions of the Township Assessors to map real property. The Indianapolis Department of Metropolitan Development also uses the map for general operations (such as mapping zoning and permit applications) and for land use and transportation planning. The Police Department maps emergency calls, and uses the ownership information in investigations.

Private companies also benefit greatly from the parcel layer. Utility companies map their systems and work orders, plan emergency outage scenarios, and design utility layouts for new subdivisions. Environmental firms and title research firms research property boundaries. Developers identify properties and design subdivisions. The Metropolitan Indianapolis Board of Realtors incorporates the parcel information in a GIS-based Multiple Listing Service for mapping and reporting for realtors.

Largely to serve the needs of commercial users, the city and county governments contracted with a for-profit firm to develop CivicNet, an online system that provides public access to parcel ownership and characteristics. It combines Real Property (real estate) data from the Auditor, Treasurer, and Township Assessor Offices including owner, assessed value, and payment history. Users can access the owner name for free, but must pay for other information, e.g., property characteristics, owner history, etc. The developers have designed the site's content and functions to largely serve the needs of commercial users.

In 2004, Indy Site Finder was launched as a free web service to facilitate the search for commercial and industrial properties. Brokers submit available commercial and industrial properties with the property characteristics. The interactive mapping site uses a static version of the parcel layer, and allows for searches based on zoning, neighborhood, and lot size.

The non-government use has been limited to date. As one of the founding partners, the Indiana University-Purdue University at Indianapolis (IUPUI) has used the parcel maps in teaching and to map community assets. Community development corporations have used the parcel map to conduct inventories of building conditions and vacant properties for specific neighborhood areas.

Advanced Applications in Community Development

Under the leadership of Mayor Peterson, the Indianapolis city government has a stated goal of being more strategic about community development. As a step in that process, the City has constructed a neighborhood typology based on parcel information (vacancy, assessed housing value, and owner-occupancy) that suggests which kinds of development and other revitalization actions are likely to best fit the market circumstances of the different types of neighborhoods.

In a related effort, the Polis Center, DMD, and the Indianapolis Coalition for Neighborhood Development (the CDC coalition) are working together to improve the process for evaluating Community Development Block Grant (CDBG) applications – an effort supported by the Brookings Institution's Urban Markets Initiative as well as local funders. In the past, CDCs and other neighborhood groups submitted over 400 applications, with no consistent information on the needs and conditions of the individual property or of the surrounding area. Now all parties agree in principle that CDCs applying for city funds will be required to use a standard analysis based on the Social Assets and Vulnerabilities Indicators (SAVI) property and neighborhood information to support their proposals. Once the new system is in place, the city officials can judge the relative merits of the proposals based on not just the project characteristics, but on a fuller understanding of how the project goals fits with the parcel and surrounding neighborhood conditions.

The Polis Center, as a neutral party, has been providing conceptual and technical know-how along the way. The Indianapolis Local Initiatives Support Corporation (LISC), a proponent of data-driven decision-making, has acted as a champion of the revised CDBG process over the past few months. The city first had to clarify its goals for the program, drawing explicit items from the Comprehensive Plan, Blueprint to End Homelessness, and other city documents. The Polis Center then paired the policy goals with project-level information and appropriate available neighborhood level indicators. The report will automatically code which typology category that the parcel falls into, helping the city officials determine if the proposals are appropriate for the market condition of the area. And they will be able to analyze how the funding is distributed across different market types.

The team is now reviewing the indicators proposed for the report, and the Polis Center is developing the user interface for the tool. The applicants will type in the parcel or multiple parcels they are proposing to develop, and the system will return with a report listing the Polis-based indicators relevant to the policy goals the project addresses. The applicant will then fill in the project level information required. A printed version will be submitted with their application, and the report contents will be saved to the system to form a master file for the evaluators. In

this way, city officials can sort applications by program goal and scan to see, for example, which projects proposing owner-occupied units are in areas with low homeownership rates.

The city will disseminate information about the application process and new evaluation criteria in April and May 2006, and issue the formal Call for Proposals in June. A next stage for the team is to adapt the evaluation system to monitor the grants that were awarded. For indicators that can be updated annually or more often, both the city and CDC staff can see how the indicators are progressing in relation to the program goals. The process has already forced the city to be more transparent about the list of goals and objectives it wants to accomplish, but to date there has not been much setting of priorities or general proportions among goals on the list. As the process moves forward over the next few months, it will provide a testing ground to see if the city and its nonprofit partners can achieve its ambitions of being more strategic about community development.

Next Steps

The parcel system for Marion County has not yet reached its full potential. Integration with a variety of property-level information would expand the uses for land management and strategic planning. The Polis Center at IUPUI will likely play a key role in collecting and presenting data sources from across various organizations—city agencies, realtors, assessors, and utility companies. They, along with the Department of Metropolitan Development, are taking the next steps in integrating administrative data with the parcel boundary layer. The *My Neighborhood* website will combine parcel level data from the city with neighborhood level data from SAVI Community Information System, such as crime, health and education. The property system database will still reside within the city system, but will be accessed in real-time by the SAVI system through web services. Once complete, users can query parcels by their attributes, as described in the Providence section. The site will be free, and oriented towards nonprofit and public users.

Section 5
Milwaukee[14]

System Development

The City of Milwaukee Master Property File, or MPROP as it is commonly referred to, is a computerized inventory of all properties in the city of Milwaukee. It contains more than 90 elements of data describing each of the approximately 160,000 properties in the city. The file was created to provide current and accurate property information with enough flexibility to be accessed in a variety of ways. Since it was implemented and made available, the data have become invaluable and are currently used by nearly every city department for a variety of purposes.

MPROP was developed in 1975 from records from the Office of the Tax Commissioner, Department of City Development, and the Policy Development Information System (now GIS). The project's initial objectives were:

1. Design and implementation of an information system to support comprehensive city planning;
2. Construction of a land parcel/structure file (the Master Property File) as the central information carrier for land use description and analysis;
3. Standardization of addresses used in key city data files to facilitate the use of information from these files in the land parcel/structure file; and
4. A feasibility study for the implementation of an interactive graphics design and data analysis capability.

At the time of planning, the project was designed to benefit the Department of City Development, the Department of Public Works, the Assessor's Office, and the Department of Building Inspection. The initial version ran on an IBM database management package with SPSS and ASI-ST software. The MPROP file was modified significantly in 1978 and then revised five more times through May 1982. In 1983, corresponding with a major revision to the tax system, MPROP was modified significantly to add more data, update it more frequently, and provide more standard reports. These modifications enabled the addition of new data elements to each property record.

[14] Adapted from materials prepared by Michael Barndt from the Nonprofit Center in Milwaukee.

MPROP is now housed within an ORACLE system, which periodically pulls data from various departmental data sets. Processes have been put into place that extract summary data from more transaction intensive files. For example, the building inspection system is tapped to create an indicator: total number of active "orders."[15] The City of Milwaukee Department of Administration's Information and Technology Management Division (ITMD), Citywide Information Systems Section, currently maintains the system.

The development of a polygon-based parcel file for the city took place from 1980 to 1982, when quarter section maps created by draftsmen were first digitized as CAD based files. Parcel-level data could be mapped as symbols. Although a citywide parcel file was created in 1998, the official mapping system remained a CAD system without polygons. Edits were difficult with as many as 300 parcel revisions per year. A routine process to incorporate parcel changes into a map system when the legal description is modified was not established until 2005.

From 1988 through 1998, detailed building inspection transactions were accessible over a private dialup system. In 1998, this data was moved to a website and made available to the general public. MPROP was available to the public from 1994 to 2000 on CD-ROM. Before that point, data sharing was accomplished through the distribution of a main-frame computer tape file. MPROP was first made available on a website in 2000. The site provides data as individual parcel records, as entire files for download and as elements in an ArcIMS mapping system.

System Content

MPROP draws from administrative data sets maintained by the City Assessor's office, the Department of City Development, the Department of Neighborhood Services, the Department of Public Works, and the GIS Department.

MPROP does not incorporate information representing the administrative processing of government work on individual properties—this includes data from Building Inspection, Building Permits, Lead Abatement, Housing Court, "Nuisance Property" enforcement by the Milwaukee Police Department. Each of these systems is independent of each other, although all files do share the common parcel tax-key and standardized address system.

[15] Full MPROP documentation is available at http://www.city.milwaukee.gov/display/router.asp?docid=3496.

The frequency of update varies depending upon the current tax cycle. Year-end tax processing and tax assessment (March, April) periods require more frequent updates than other times of year. The current policy is to provide at least monthly maintenance throughout the year.

Uses and Users

Local government departments are the most intensive users of the system. Primary among them are:

- The Department of Neighborhood Services which uses the MPROP as a first source of owner names, and then augments their own files with registered landlord names;
- The Department of City Development uses the file in all aspects of planning;
- The Common Council uses the file for notification of owners for changes in ordinances or new resolutions; and
- The Department of Neighborhood Services Board of Zoning Appeals (BOZA) uses the file for zoning change notifications.

Every city department in the city now uses the Master Property file. As envisioned in 1975, MPROP has provided a standardization of addresses and parcel information including ownership data. The standardized method of referring to a particular parcel, as well as universally available metrics for a parcel across departments, has resulted in more streamlined inter-departmental coordination.

The system also has many users outside of government. The most significant known extra-governmental users are:

- The Nonprofit Center of Milwaukee Data Center Program (the NNIP partner in Milwaukee), which repackages the MPROP with value-added functionality. The Data Center provides a series of housing reports which are used by Community Development Block Grant and other agencies in their strategic planning, program operation and grant writing efforts;
- The Menomonee Valley Benchmarking Initiative has developed a set of indicators in the areas of economic and environmental health of the Menomonee River Valley area, some of which are based on MPROP data;
- The Southside Organizing Committee and Sherman Park Community Association use the file in their community revitalization and organizing efforts, with help from the Nonprofit Center;
- Numerous CDCs operating in various neighborhoods use the system in neighborhood planning and to identify properties for project activities;

- Local realtors make extensive use of the data in conjunction with commercial datasets such as MLS; and
- Many data resellers access the file to enhance their commercial data sets.

Advanced Applications in Community Development

The system is being used intensively to plan and implement improvement of the west-side neighborhood of Washington Park. The City government, the Local Initiatives Support Corporation (LISC), and the Nonprofit Center of Milwaukee are all involved in the process, as is the Annie E. Casey Foundation which has made the neighborhood the focus of its Making Connections initiative.

LISC catalyzed the formation of the key development entity, Washington Park Partners (WPP), which is a coalition of CDCs and other nonprofits focused on the revitalization of the area. In 2004, LISC involved the WPP, residents, and other stakeholders in the preparation of a "Quality of Life" plan to envision ways to improve the neighborhood. This process made extensive use of data from MPRP and other city systems. The plan's housing program component has been emphasized in implementation, and all participants are most actively using system data in this component.

Two advanced applications are noteworthy.[16] The first is a data display product that features tables, charts, and maps illustrating thresholds when (based on analysis of recent trends) sub-neighborhoods may become ripe for reinvestment. This application has already shown how prospects have improved in one sub-neighborhood in ways local CDCs had not foreseen. The second application is a project management tool that enables data-sharing among community developers. The software program allows CDCs and other groups to access data on the characteristics and development schedules for each others' current projects. By seeing this work in process, they and city officials can implement overall revitalization in a more coordinated and effective manner. The software supports queries and displays project information and schedule milestones on tables and maps. Its "case management" framework facilitates the relation of project status to needs for various types of corrective actions.

[16] These also were supported in part by Brookings Institution's Urban Markets Initiative.

Next Steps

The City plans a series of field changes for MPROP during 2006, including modifications to better differentiate the growing condominium market, as well as an overhaul of the building type classification system. A number of additional issues have been identified:

- Each of the legacy systems used by individual departments (noted above) remain the primary administrative date source for each department. The MPROP is a point of access to information from other departments, but case management functions have not been transferred to a common database environment;
- The Oracle system could be developed as an "enterprise-wide" administrative system, but the city has no specific plans to build the operational software systems this would require;
- The posting of data to MPROP may take months. Property sales, for example, are filed at Milwaukee County, recorded by a private firm, transferred to an assessor's office legacy system, and finally extracted to MPROP;
- Property ownership can be masked and difficult to trace. Efforts to track owners, managers, "agents" or others responsible for a property have not been entirely successful;
- Although annual "snapshots" of data sets are archived, few tools exist to permit tracking trends in data, and none on the website. The emphasis has been on immediate access to "current" data; and
- Until 2002, properties in suburban Milwaukee county were not well organized. Now a common database and new parcel map system have been built. But the system is out-sourced, making information access subject to significant fees and unable to be integrated with the city's system or those of adjacent counties.

Section 6
Philadelphia

System Development

The Philadelphia Neighborhood information System (NIS) is an online mapping, reporting and analysis tool created and maintained by the Cartographic Modeling Lab at the University of Pennsylvania. Four different applications make up the NIS:

- ParcelBase consists of parcel-level housing and real estate data covering over 500,000 properties in Philadelphia. This application draws on a variety of data —e.g. ownership, code violations, tax delinquency, and vacancy—to generate profiles for individual properties

- NeighborhoodBase provides information about housing and neighborhood conditions aggregated by census tract, zip code, council district and other geographies.
- MuralBase is an interactive database and website used to locate Philadelphia murals, photographs, and artists' biographies and to learn about the communities surrounding murals.
- CrimeBase uses police data to generate profiles describing crime rates for any geographic area.

This case study will focus on the first two applications, ParcelBase and NeighborhoodBase, as those most relevant to community development and urban land management.

The Philadelphia NIS was first developed in 1998 by a team at the Cartographic Modeling Lab of the University of Pennsylvania. At the time, Philadelphia maintained much of its municipal and parcel data in separate systems located in separate departments. The purpose behind creating NIS was to enable city data to be accessed and coordinated across departments, made available in a centralized way, and mapped.

NIS was also conceived as a tool to assist Philadelphia's Neighborhood Transformation Initiative, a high-profile, multi-year effort spearheaded by Mayor Street to counter urban decline and revitalize older core neighborhoods.
The NeighborhoodBase application in particular is geared for use by community based planning and development organizations, government agencies, researchers and concerned citizens in their efforts to analyze and transform Philadelphia's neighborhoods.

NIS was first published on the web in 1999.

System Content

ParcelBase is a password-protected service used primarily by city agencies for property level information. ParcelBase includes 36 data layers regarding individual properties. The ParcelBase website enables users to research ownership, sales, housing code violations, and vacancy status by "clicking" on a property. The map interface also makes it easy to gather data about nearby parcels.

NeighborhoodBase is open to the public and displays interactive maps, tables, and charts based on 150 indicators drawn from the underlying parcel data, census data, and other data at larger geographic levels. Map layers that the user can "turn on" or "off" include vacant lots and buildings; private schools, public schools, charter schools, libraries, Public Housing Authority

developments, Zoning, Census tracts, aerial photography, building footprint, and location of greening projects of the Philadelphia Horticultural Society.

NIS draws from administrative data sets maintained by a number of City departments, including:

- City Planning Commission: city-wide parcel coverage
- Licenses and Inspections: housing code violations, demolitions, clean and seals, vacancies
- Philadelphia Gas Works: shutoffs, housing characteristics
- Revenue Department: property tax arrearages, lien sales
- Water Department: shutoffs, suspended service, delinquency, vacancy
- Board of Revision of Taxes: owner's name, sales date/price, land and building characteristics
- Office of Housing and Community Development: digital photographs of vacant lots and houses, vacancy survey

NIS data is updated quarterly. The Cartographic Modeling Lab and the City of Philadelphia have developed detailed data sharing and license agreements governing the publishing of parcel data.

Uses and Users

The primary users are city agencies, CDCs, other neighborhood groups, and housing researchers. The Cartographic Modeling Lab trains users and has more than 100 community organizations and 40 city agencies registered as users of the password-protected ParcelBase application.

Although ParcelBase is password-protected, local nonprofits and interested citizens can obtain a password from the system administrator and log on. For the private sector, (mainly the real estate and insurance sectors) there is a fee-based subscription service under development.

Users access the system to research individual properties; run queries to locate "comparables" (properties used as comparisons to determine the value of a certain property); gather information for use in siting housing development programs; and study neighborhood conditions with user-defined maps, charts and reports. The integrated database also supports extensive housing and vacancy research at the University of Pennsylvania.

Users are able to take advantage of a feature that allows them to "create" their own neighborhoods for the purposes of planning and analysis. This feature enables users to create aggregated statistics for any area that they define. Community development professionals in

particular have found this helpful: they can specify and analyze an area of interest, as opposed to relying on areas officially designated as "neighborhoods" as their unit of analysis.

Advanced Applications in Community Development

NIS brings together sufficient data to provide a kind of early warning system about property abandonment, a key problem in many older neighborhoods. The system can be used to model the likelihood of abandonment based on various indicators. These might include, for example, the presence of neighborhood drug markets, crime clusters, and homeowner financial distress. This kind of analysis has tremendous potential to provide the basis for intervention to forestall abandonment. For example, city agencies could initiate actions against owners or plan for redevelopment before a property is foreclosed, mitigating tax losses, property deterioration, and neighborhood decline.

Community development groups are also using NIS as a key tool in support of their neighborhood revitalization efforts. In North Philadelphia, New Kensington CDC uses NIS to research recent sales price information for area properties, and with this information makes decisions about which sub-areas may require particular kinds of intervention. New Kensington also uses NIS to research all the vacant buildings in its area of influence and then ascertains, based on their characteristics, which ones may be appropriate for specific kinds of development. Once a building is selected, the CDC uses NIS to identify the present owner and tax status in order to initiate the acquisition process.

The Office of Community Development of the Archdiocese of Philadelphia uses NIS to gather information regarding individual parcels and the surrounding neighborhood to aid them in the site selection and acquisition process. In particular, the organization looks at vacancy indicators, such as the vacancy survey, gas and water data, and whether or not there is a tax lien against the process. This information guides decision-making regarding properties that would be suitable for acquisition and rehabilitation.

Next Steps

This NIS team anticipates building interfaces for Google Earth with the system, as well as a 3-D mapping project. There are also continual efforts to add new data to the system.

Section 7
Portland

System Development

The City of Portland is home to one of the nation's most sophisticated parcel-based GIS applications delivered through an Enterprise GIS model. The Enterprise model, which employs a centralized hub of data and mapping servers, provides GIS services to city agencies and the public at large through a web interface. Initiated in 1998, the Enterprise GIS project has followed three phases: business case, pilot project, and final implementation for production. The hub and spoke model—maintained by the Corporate GIS group in the city's Bureau of Technology Services—was designed to improve efficiency, reduce cost, and enable access to GIS applications and data across all city agencies.

The Corporate GIS group has a four-part mission in deploying Enterprise GIS:

1. Provide leadership and policy direction for the use of GIS and related technologies at the City of Portland;
2. Be responsible for the development and maintenance of the Enterprise GIS Hub architecture and infrastructure;
3. Provide application development resources to the city bureaus and staff; and
4. Coordinate multi-participant GIS efforts across the city and region.

The inception of the Enterprise GIS Hub project was a strategic plan in 1992 that aimed to build citywide GIS capacity across all departments and agencies. The city was a step ahead of the rest of the nation in building a parcel-based GIS, since Multnomah County was the first in the country to digitize all of its tax parcels through its participation in a pilot effort by the federal Department of Revenue. Since the 1970s, the region has also been a national forerunner in developing GIS for strategic planning. In 1994, the City of Portland continued its efforts to convert tax assessor maps into closed polygon and centroid maps linked with tax identification numbers—thus began the construction of the citywide GIS application. It took the city two additional years to create accurate and useable shape files for a complete parcel system.

The City of Portland chose an Enterprise GIS model after supporting GIS applications within independent bureaus for over a decade. To address the issue of emerging GIS silos, the City Council conducted an inventory and review of GIS activities within the city. The 1995 report, known as the "GIS Business Analysis," highlighted the inefficiencies in running ad hoc GIS programs. It described how the city had invested $9.5 million on GIS-related activities between 1990 and 1994. Despite this investment, data integration and sharing among departments

remained challenging at best and in some cases impossible. In addition, smaller agencies like Parks and Recreation and 911 service did not have the resources to have GIS.

To address these inefficiencies, the Enterprise GIS concept was developed and implemented. One outcome of the Enterprise GIS Hub was the development of the publicly-accessible GIS portal PortlandMaps (www.portlandmaps.com). PortlandMaps provides user-friendly public access to GIS data that integrates additional information from multiple bureaus and jurisdictions. Using this application, citizens can query, analyze, and review data from all bureaus that produce data. One of the primary goals of the system is to provide information and GIS mapping to all users—not just the experts—through an easy-to-navigate system.

Currently the system maintains over 20 diverse internal and external applications that draw from over 250 layers of data. It supports large GIS users such as the Water Bureau, Office of Transportation, the Bureau of Environmental Services (BES), and the Bureau of Planning, as well as smaller departments such Parks and Recreation and the Portland Development Commission. Data sharing agreements are in place with Multnomah, Clackamas, and Washington Counties, and the regional governing bodies. These agreements enable real-time data sharing and up-to-date data access. The Enterprise system has proven to be an efficient model of delivering GIS services, saving the City almost $1 million per year.

System Content

PortlandMaps provides an easy-to-use, streamlined interface for property selection and navigation. Features include:

Locate property quickly and easily by address or intersection;

- Access to over 50 GIS data sources including aerial photography;
- Access assessment information for Multnomah, Clackamas, and Washington counties;
- Query an area or individual property for environmental, utility, political, or other information; and
- Create and print detailed reports including maps.

In addition to PortlandMaps, the Raptor Search Engine was developed to give City staff access to GIS data that is integrated with other information from all bureaus. Raptor was designed for the frequent user who needs to access information in a fast and reliable format. The Raptor Search Engine provides a streamlined interface for text-based queries to locate property in Multnomah, Clackamas and Washington counties quickly and easily by address, state identification, account or legal description.

A wide variety of data is available for the Portland Metropolitan area. Some of the data sets include:

- Assessor/Tax lot Information
- Aerial photography
- Elevation
- Schools
- Parks
- Zoning maps
- Water/Sewer
- Natural hazards

Traditionally, users would need to acquire each of these datasets from multiple sources, and in many different formats. Now, with Enterprise GIS, they can access all of this information through a single application.

Uses and Users

PortlandMaps receives 1.5 million page views per month. Users include residents, developers, businesses, and city agencies. Government bureaus and agencies are the highest-volume users of the system. Parcel maps are central to planning efforts at different bureaus within the city. The fire, police, BES, water, and transportation departments all rely on parcel maps. CGIS also creates custom mapping applications for different agencies. Through customizing applications for agencies, CGIS has gained a great deal of experience in tailoring GIS applications for a variety of uses and users. For example, the application now enables people wishing to relocate to Portland to get a sense for the city's housing and real estate markets. Several insurance and title businesses use the system to check parcel records and conduct title analyses. The Portland Development Commission also uses the data and GIS for community development purposes.

The City of Portland provides Web access to many sources of spatial and other information in addition to the primary PortlandMaps interface. These include:

- Crime Mapper allows users to view crime maps of Portland, as well as detailed graphs and reports that display crime data by month, day of week and time of day (http://www.portlandpolicebureau.com/crimemapper.html); and,
- CarPoolMatchNW provides an easy and convenient way to find someone to share a ride in Oregon and southwest Washington (www.carpoolmatchnw.org).

Advanced Applications in Community Development

Housing Connections, launched in 2003, is a web-based community service that seeks to connect providers of housing and housing services to renters who are looking for affordable, accessible and special needs housing. Sponsored by the City of Portland Bureau of Housing and Community Development, the portal provides access to up-to-date housing information with user-friendly tools. These tools are customized for each user group: renters, landlords and property managers, and housing agency staff that help people find and keep housing. As a housing information and business center, Housing Connections is a virtual location where all players in the housing industry can connect and do business. Housing Connections offers a number of tools and services:

- The Housing Locator: Landlords can list, and renters can search for, affordable, accessible or special needs housing;
- The Housing Calculator: A tool that renters can use to determine their affordable monthly rent payment and their median family income (necessary for eligibility for some rentals);
- The Housing Services Locator (coming soon): Anyone can search for services provided by local agencies that address a variety of housing barriers and issues;
- The Waitlist Management Tool (coming soon): This tool will allow renters to apply for multiple property waitlists online through one form, and keep their contact information up-to-date with one tool. This same tool will allow to property managers to manage property waitlists electronically; and
- The Online Rental Application (coming soon): Renters can apply to multiple properties with one electronic application.

Housing Connections serves Portland Metropolitan Area including Multnomah, Washington, and Clackamas Counties in Oregon, and Clark County in Washington. The following local governmental jurisdictions participate in Housing Connections:

The City of Portland
The City of Gresham
Multnomah County
The City of Beaverton
Washington County
Clackamas County
The Housing Authority of Portland
Vancouver Housing Authority
Housing Authority of Clackamas County
Washington County Housing Authority

Section 8
Providence[17]

System Development

The Providence story is unique in that the Providence Plan (TPP, the local NNIP partner) played a sizeable role in helping the city develop its first integrated parcel-level system PROLIS (the Providence Land Information System) in 1997. Starting with assessor's records as a base, the system now includes regularly updated information from 10 agencies on the city's 42,000 parcels.

The process began when the City contracted with a private firm for a needs assessment and original parcel linework. Initial funding was provided by the State Department of Administration, with matching funds from the Providence Department of Planning and Development. Along with the Providence Plan, government partners in PROLIS design and development included several City departments (the DPD, Assessor, Recorder of Deeds, Data Processing, DPW/Traffic Engineering, Police Department, Fire Department, Communications, and DIS) and some at the State level (the DLT, Health, and Human Services). (It should be noted, however, that most were active partners only during the conceptual/needs assessment phase of PROLIS).

The system was developed and used for many administrative purposes over the next several years, but commitment to improvement has been substantially enhanced under the administration of Mayor David Cicilline in its efforts to bring more transparency and efficiency to city governance. The theme is exemplified by "ProvStat," modeled after Baltimore's CityStat system, which was launched in January 2002 with Providence Plan technical assistance. It uses data intensively in recurrent reviews of the demands on and performance of city departments.

Starting in 2004, improvements in data integration and other enhancements have been implemented to the parcel-level system as it is transitioning to become the broader "Govern" system. The Assessor's Department has taken the lead in Govern implementation, but the City's Information Technology Department now maintains the system and the Department of Planning and Development maintains the parcel boundary lines.

The first release of system data on the web actually occurred via the "Neighborhood Mapper" feature on the Providence Plan's website in early 2002—a development funded by a U.S. Department of Commerce Technology Opportunities Program (TOP) grant. The feature offered several map layers and permitted users to pull down fixed tables of characteristics for individual

[17] Adapted from materials prepared by James Lucht from The Providence Plan.

parcels by clicking the parcel's location on the map. The Providence Plan has since done work to provide more intuitive presentation and flexible search options so as to broaden the municipal data audience (with funding from the Rhode Island Foundation, an Urban Institute/Brookings Institution project, and the Fannie Mae Foundation). TPP has also undertaken secondary data gathering on vacancies and related indicators and made the data available as a part of the broader system.

System Content

The core of the system is data provided for all parcels by the Assessor's office (e.g., owner name and address, assessed value, land use, other characteristics, dates and other data on sales transactions). Other data provided by city departments include: tax liens/lien advertisements, code violations, building permits, the location and date of structural fires, and dates and other data pertaining to boarding up and demolition liens. The system also now incorporates data from the special survey on vacant properties conducted by the Providence Plan and other Providence Plan data on "problem building" classifications. The Providence Plan has also provided photographs of all properties in the City, keyed to parcel identifiers and also accessible via look-up features on the web site.

While they not all have yet been incorporated into overall system and web site, several other varieties of parcel level data are now being provided recurrently. These include data from local sources (Providence Police and School Departments) and state sources (Health and Human Services).

Uses and Users

The system has developed many regular users, the most active being agencies of local and state governments. These agencies, and main uses, include:

- The Administration finds the system helpful for property reference and tax rate modeling;
- The Inspections & Standards department staff access the parcel information when dispatching inspectors and researching property history;
- The Department of Planning & Development employs the parcel system for re-zoning and neighborhood planning work;
- The Assessor's Office and City Council both use the system for property reference and mapping;
- The Communications Department relies on the system as a reference for revision of CAD system;
- Parks & Recreation uses the system for general mapping and mailing notifications;

- ProvStat performs extensive mapping and analysis with the parcel system, particularly DPW work output, such as rat baiting and environmental tickets;
- RI Economic Development Corporation refers to the system when determining site suitability for economic development; and,
- RI Health Department uses the system for Property reference for their Lead Program.

There are also a growing number of users outside of government. Inquiries by the Providence Plan have evidenced the following:

- Community Development Corporations—uses: expanding the breadth of understanding CDCs about the spatial relationships and property events (sales, foreclosures, liens, Notices of Violation, Environmental Tickets, etc.) that are affecting property owners; discovering emerging opportunities to assist homeowners or acquire properties for affordable housing (re)development
- Neighborhood Associations—uses: similar to CDCs
- Annie E. Casey Foundation Local Learning Partnership/Making Connections—uses: info tool feeds into the neighborhood indicators which are a central requirement of this initiative.
- Chamber of Commerce—uses: information for prospective business owners and tenants in the Downcity district

Advanced Applications in Community Development

Land management issues have been receiving considerable attention in Providence over the past few years and data from the parcel-level system have been used in a number of ways to help address them. In response to a 2003 report by the Rhode Island Governor's Growth Planning Council highlighting the seriousness of blighted property and abandonment, the Providence Plan and the City's Department of Planning and Development established the Urban Land Reform Initiative (URLI). The purpose of the initiative is to develop an urban land reform strategy for the city, and its activities rest heavily on making better use of the parcel-level information system. An early step to prepare for the URLI, was the Providence Plan's survey of vacant and abandoned structures, noted above. The survey provided staff with the opportunity to think through the factors influencing property decline and problem buildings status and to build those lessons into subsequent tool development.

Another early effort was analysis of data from the system to identify and measure problems resulting from inadequacies in local legislation pertaining to sales of properties with serious tax

arrears. The analyses have led to significant changes in the law, the first preventing the easy acquisition of properties by slumlords and, more recently, amendments (S-0478 and H-6020) which authorize the State housing agency to have first rights to acquire a tax lien on residential property while assisting the owner of that property to retain ownership.

In addition, the Providence Plan has developed a new web-based Urban Land Reform (ULR) tool, to help CDCs, city officials and others deal with problem buildings and plan for neighborhood improvement.[18] Users can create listings of properties based on criteria they select (for example, using characteristics that might help identify candidates for rehabilitation, demolition, or some other intervention) and then narrow down their criteria (for example, by number of code violations or recent tax lien sales) to create priority sequences for different kinds of program actions. They can then choose properties either from the list or the mapping application showing detailed data about individual properties on the lists. Two innovative features are: (1) a comments box to enable users to write in their own observation about the property, and (2) a "surrounding properties analysis" showing for each property whether properties in the immediate vicinity are also showing signs of distress.

The tool is now being applied by a number of different types of users, including prominently the Elmwood and the Olneyville collaboratives which are devising building-by-building action strategies for neighborhoods where multiple CDCs and other community organizations are active.

As knowledge of the system and its capabilities has spread, the number of clients for applications has grown. The City administration, for example, asked the Providence Plan to use devise a new algorithm for property reassessment—one that would be much more efficient and reliable than the by-hand methods used in the past. In addition, combined with permitting records, the data have been used as the base for the recent Inclusionary Zoning advocacy work by PolicyLink, and the neighborhood improvement strategies focusing on children and family issues planned for the Annie E. Casey Foundation Making Connections Initiative. The system is also given substantial credit as a key "enabler" of the Mayor's ProvStat "good government" initiative.

[18] Although the development of this tool received support from a number of local funders, it was also one of the group that was supported by the Brookings Institution's Urban Markets Initiative.

Next Steps

Providence Plan and City URLI staff see outreach to promote broader and deeper use of the system as the highest priority at this point. This includes outreach:

- To champions in local government who can help ensure the longevity of the information tool as well as find ways to institutionalize its use and maintenance
- To the community constituency—demonstrate utility among current CDC partners and new partners; build a constituency that demands timely data from the city; strive for permission to include many of the data items exclusive to the land reform database in the Neighborhood Mapper property database that is available to all citizens
- To the "investor community"—develop relationships to sustain financially the information tool through underwriting or other monetary arrangements.

Section 9
Conclusions and Recommendations

The experience of this project suggests that policy makers, as well as GIS specialists and community development practitioners, need to pay attention to the development and application of parcel-based systems as a trend. In this section we draw three conclusions from this research and offer four recommendations to further the progress of the field.

Conclusions

1. Dramatic progress has been made in the development of multi-source web-based parcel-level information systems in America's urban areas over the past few years and, even though there are risks to be addressed, this development now appears poised for further acceleration.

As pointed out in Section 2, before this project began, the authors sensed that the extent and capacities of parcel level data systems in urban America were developing rapidly. Nonetheless, the central finding from our web search surprised us, as it did the participants in our November 2005 Consultative Session: that almost three-quarters of the nation's largest 100 cities now have integrated parcel-based information systems and are making a considerable amount of their data available to the public via the web.

To be sure, the capacities of these systems are uneven. In some cases, they are fairly rudimentary at this point. Yet, the pace of development over the past few years has been remarkable and all the signs point to a continuation of the trend. The systems managers we interviewed (Sections 3-8) and Consultative Session participants from other cities were unanimous in confirming that systems enhancements were now underway and plans for additional improvement had been made. There were no indications of cut-backs.

Given general budgetary pressures on local governments, worries were expressed about funding to sustain expansion. However, expanded local government reliance on these systems would make it hard to alter plans dramatically. Developments so far have yielded automated processes that improve both the efficiency and the reliability of many necessary routine administrative tasks. For a very large share of these, it might well be impossible to go back and do things the old way. Reducing systems budgets would imply notable added costs for staffing and other resources.

In addition to budgetary worries, Consultative Session participants noted other risks; e.g., concerns about some governments selling parcel data to private firms who then turn around and charge high fees to end-users for the same data, and concerns that not enough emphasis was being given to safeguarding data quality before release in some cities. While they saw it as critical to build an advocacy base and take other steps to address these issues, they felt it should be possible to address them—these did not have to become formidable barriers to further development.

2. Although not implemented in many places so far, there have been some innovative attempts to apply these systems to address the challenges of community development and urban land management. Enough experience is there to suggest that these approaches hold great promise – they could well transform the way business gets done in these fields.

Section 1 offered ideas about new and more effective tools and approaches that might theoretically emerge, given the existence of mature parcel-level information systems such as those reviewed in Sections 3-8. It described computer-based tools that could be used by city agencies to help sort and categorize troubled properties in relation to programmatic actions that might be most appropriate for them. It also talked about a broader vision for community development—one in which CDCs and other neighborhood groups would look up from their prior focus on project-by-project activity and use the impressive new information resources to strategically orchestrate the deployment of a broad range of program actions, taking into account the circumstances of all properties in the neighborhood.

We did not see this full potential being implemented in any of the city experiences we looked at closely. However, seeds of it were evidenced in several. Providence's web-based Urban Land Reform (ULR) tool is a good example. It allows users to create listings of properties based on criteria they select (for example, using characteristics that might help identify candidates for rehabilitation, demolition, or some other intervention) and then sort the listings to identify priority orders for action. Portland's "Housing Connections," which provides computer support for a number of basic housing market transactions, is another example.

A more comprehensive prospect is illustrated by developments in Milwaukee's Washington Park initiative. There, the LISC has mobilized a sizeable number of CDCs and other players to collaborate in a community improvement effort, and they are using inventive information tools supported by parcel-level data at several points along the way. The trend analysis tool, to help determine the best time path for reinvestment in various sub-neighborhoods, is one example. Another is the database in which the players share information about their current property-by-property plans so they can better coordinate actions, avoid duplication, and take advantage of opportunities for synergy in specific block groups. Also, it seems likely that when Indianapolis has fully implemented its tools to aid in assessing CDBG project applications and monitoring the progress of those selected, little adaptation will be needed to create a family of tools that can then be used for fact based neighborhood planning and coordinating implementation.

One opportunity we did not recognize at the outset is that, while the information and tools may be developed initially to support the making of plans, the same account structures and data flows can be used as the basis for recording implementation events as they actually occur. Thus these mechanisms could be an automatic framework for tracking performance, and for feeding performance data back in as inputs to the design of corrective actions and to the next planning phase in the cycle. They create a built-in opportunity for improved accountability.

3. National institutional networks are already in place to support the further development of parcel-level data systems. However, we conclude that additional efforts are needed to support the development and dissemination of advanced applications in community development and land management.

We have shown that there is considerable momentum behind each of the individual city experiences we have documented. Will the potentials suggested by this research be achieved as a matter of course, or will new national support efforts be needed to move them forward?

As to the *development* of the systems and their progress through the stages of improvement outlined in Section 2, our judgment is that new support initiatives are probably not required. We have noted that these efforts are already developing rapidly in more cities that we had suspected,

that they are buoyed by seemingly unrelenting improvements in the technology (particularly web services), and that there are other built-in incentives for their expansion.

Furthermore, national networks already exist in this area to support relevant research, experimentation, documentation, and dissemination of best practices, technical assistance, and training. National organizations whose missions are to improve local government practice generally—e.g., International City and County Managers Association (ICMA), National League of Cities (NLC), American Planning Association (APA) —are a part of this mix. Of special importance here, however, is the range of services offered by the Urban and Regional Information Systems Association (URISA). And private firms play strong roles in the support network for this field, particularly ESRI on the GIS side.

The same is not true, however, for systems *applications*, at least not in the areas that motivated this project: community development and urban land management. First, as evidenced in this report, the new advanced approaches and techniques in these fields are at an earlier stage than the systems technologies – more at the experimental end of the product development cycle. Those that are emerging are doing so in a fragmented manner without much coherent support or guidance.

Second, while there are national intermediary networks that are interested in this work and have relevant capabilities, they are not now being funded to advance these particular opportunities. The one project that focused on this topic so far was that funded by the Brookings Institution's Urban Markets Initiative (UMI) in several National Neighborhood Indicators Partnership (NNIP) cities (noted earlier), however that was a one-time effort with no plans for follow-up. As a network of local data intermediaries with missions to advance the application of data in local policy and that already has experience in community development applications of parcel-level data, NNIP should be well suited to do more work in this areas. Three strong intermediary networks that exist to further community development practice in general should also be involved in other work along these lines: the Local Initiatives Support Corporation (LISC), the Enterprise Foundation, and NeighborWorks. In addition, PolicyLink, which played a leading role in this project, similarly has considerable relevant experience in the technical (GIS) aspects of the work as well as established working relationships with intermediaries in a number of cities.

Third, other national entities exist that support better use of community data in general, but none has plans to support the particular niche this report has identified. These include: Living Cities (formerly the National Community Development Initiative), the Fannie Mae Foundation (already working closely with NNIP), and the Community Indicators Consortium.

Recommendations

Our recommendations have not attempted to cover the universe of possible supports. Rather they focus on a few aspects the authors believe would yield high payoff, but are not on the agenda of any existing organization at present.

1. Support should be mobilized for a continuation of the types of evaluative activities initiated in this "one-shot" report—namely, the ongoing monitoring of the further development of parcel-level data systems and identification of emerging best practices in community applications.

No organization has yet accepted the ongoing monitoring and evaluation of development in this particular activity—the intersection of the development of parcel level data systems and advanced applications in community development and land management—as an explicit part of its mission. Yet such monitoring is a necessary basis for the effective design of any other support for such developments.

Relying on the experience gained in this research, the monitoring process would not have to be elaborate. First, we propose an annual update of the scan of websites of U.S. cities to see how the capacities reported in this report are enhanced in the future. Our approach turned out to be simpler and less expensive than we anticipated. We propose expanding the list of cities scanned (probably to 200) to see whether and how the number of cities that have web based systems at all has grown. For the systems identified before, the new scans would pinpoint any new capabilities added or capacity expansions since the last review.

Secondly, it should be profitable to search for any new case experiences of the type that are the focus of this work (advanced applications in community development and land management). This could be done via a standardized set of interviews with leaders of NNIP and the three national community development intermediary networks identified in the previous section. These organizations are already interested in these topics and would tend to hear about any innovative "natural experiments" of this sort being implemented by their local affiliates. Where new cases are identified, they would be written up and made available through existing dissemination networks.

2. New projects should be mounted to test options and expedite the development of advanced community applications in a limited number of cities that have well-developed parcel-based systems.

While, there are now some natural experiments underway in this area, and more are sure to emerge, these together are likely to be too slow and fragmented to advance the state of the art as effectively as possible. In our judgment, a few sponsored projects—designed to illustrate replicable high payoff applications—could fill in key gaps and give needed focus and direction the broader work underway.

These projects would have two things in common. First, they would be implemented where strong ongoing parcel-level data systems, with a wide range of indicators, already exist; i.e., so they can take advantage of and illustrate powerful uses of the best capacities likely to be available in more cities in the future. Second, they would entail applications that use data to support joint efforts of: (1) city agencies that deal with land and property management issues (those responsible for actions to deal with problem buildings, neighborhood improvement, land acquisition and marketing city owned land to private investors, development regulations, etc.); and (2) neighborhood associations, CDCs, and other nonprofits working to revitalize urban neighborhoods. In our judgment, it is the joint work by such entities that is likely to offer the highest probability of success in addressing the key issues facing America's cities at present. These include preserving affordable housing in neighborhoods where private investment is already strong, and laying the groundwork for market interest where it is not.

3. As innovative applications are developed and documented, existing intermediary networks should be supported to broadly disseminate the findings, mobilize interest and train practitioners in their use.

As new lessons are learned from monitoring the natural evolution of this field (recommendation 1) and from focused efforts to advance the state of practice (the projects in recommendation 2), there will be a need for more effective efforts to get the word out on the results to practitioners throughout the nation. This includes informing and training local data intermediaries who are bringing together the relevant data and searching for valuable applications as well as those (residents, nonprofits, and city employees) working to improve neighborhoods directly.

Fortunately, in this recommendation, there is no need to reinvent the wheel. Mechanisms for dissemination and peer-learning already exist through the relevant intermediary networks we have noted above: NNIP, LISC, Enterprise, and NeighborWorks. In addition, the Fannie Mae Foundation has developed impressive tools for dissemination in housing and community development via its KnowledgePlex and DataPlace web portals. What is recommended here is

mobilizing additional support to encourage these networks to give more emphasis to the particular opportunities highlighted in this report and to allow them to incorporate the new lessons in their programs of documentation, technical assistance, and training.

4. Those concerned about community outcomes should advocate for a stronger policy environment to surround the further development and use of parcel-based systems; one which both encourages broad release of data in the public interest but guards against potential risks of poor data quality and misuse.

While we have said there is no need to provide additional support to *promote* the development of parcel-based systems in American cities, we judge there is need for those interested in community outcomes to join with others in opposition to forces that could hamper or distort their potential.

First, is the concern that local governments may overly restrict the amount of their parcel-level data that they make available to the public. Public access has many benefits (see section 2) — without which, the community applications discussed here are infeasible. A particular worry in this regard is the decision by local governments in some places to sell parcel data to commercial firms that are willing to pay for exclusive rights to re-sell the data to the public, often for quite hefty fees. Systems managers interviewed for this project see this practice as seriously shortsighted for the jurisdictions that follow it, as do the bulk of the nation's GIS professionals (GITA, 2005).

It can be argued that the taxpayers have already paid for the creation of the data and should not have to pay for access to them again. It can also be argued that the use of the data by community practitioners as well as real estate professionals (along with the further application of decision support tools as discussed in this report) create enormous benefits to localities through more efficient workings of the land market and that these by far outweigh the actually quite limited revenues the localities can obtain from selling rights to the data.

Second, there is a need for outside advocacy to encourage the maintenance of high data quality in all cities. Our observations suggest that local governments are not doing enough to document their data files, and apply strong standards in data development and cleaning. In this project, this concern arose in our discussions with systems managers in Providence. They discovered that some of the data they thought important for their work was of much lower quality than they expected. They felt they had to avoid making it available to most users because bad data even in one area might destroy the credibility of the overall system. The conclusion of the team, however, was not to drop the weak data from the system altogether. Rather, while the higher quality data can be placed on the "front page," it is useful to maintain a "back page" for weaker

data accessible to only a few internal users. The rationale is that moving the weak data inside the system and having some professionals outside of the source agency analyzing it would be more likely to lead to its improvement than simply leaving it out.

Data intermediary networks should be supported to develop tools and technical assistance efforts that will support improvements in data quality. This work should begin with the development of guidebooks on how local agencies can do a better job of documenting their data files; i.e., preparing "metadata." The act of writing down the definitions of all variables, information about how they are to be collected, and other information about them, in itself encourages data providers to do more about quality control. Also helpful, would be a guidebook for local users that would help them evaluate the quality of the data.

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Annex A

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Annex B
Supplemental Tables

Table B.1. Cities with Parcel GIS Identified

No.	Parcel GIS Found
1	Akron, OH
2	Albuquerque, NM
3	Anchorage, AK
4	Arlington, TX
5	Bakersfield, CA
6	Baltimore, MD
7	Baton Rouge, LA
8	Birmingham, AL
9	Boston, MA
10	Buffalo, NY
11	Charlotte, NC
12	Chicago, IL
13	Cincinnati, OH
14	Cleveland, OH
15	Colorado Springs, CO
16	Columbus, OH
17	Corpus Christi, TX
18	Dallas, TX
19	Denver, CO
20	Des Moines, IA
21	Detroit, MI
22	Fort Wayne, IN
23	Fremont, CA
24	Grand Rapids, MI
25	Greensboro, NC
26	Honolulu CDP, HI
27	Houston, TX
28	Indianapolis, IN
29	Irving city, TX
30	Jacksonville, FL
31	Kansas , MO
32	Las Vegas, NV
33	Lincoln, NE
34	Long Beach, CA
35	Los Angeles, CA
36	Louisville, KY
37	Madison, WI
38	Mesa, AZ
39	Miami, FL
40	Milwaukee, WI
41	Mobile, AL
42	Nashville, TN
43	New Orleans, LA
44	New York, NY
45	Oakland, CA
46	Oklahoma City, OK
47	Philadelphia, PA
48	Phoenix, AZ
49	Portland, OR
50	Raleigh, NC
51	Richmond, VA
52	Riverside, CA
53	Rochester, NY
54	Sacramento, CA
55	San Antonio, TX
56	San Diego, CA
57	San Francisco, CA
58	San Jose, CA
59	Scottsdale city, AZ
60	Seattle, WA
61	Spokane, WA
62	St. Louis, MO
63	St. Paul, MN
64	St. Petersburg, FL
65	Stockton, CA
66	Tacoma, WA
67	Tampa, FL
68	Toledo, OH
69	Tucson, AZ
70	Virginia Beach, VA
71	Washington, DC
72	Wichita, KS

Table B.2. Cities without any Parcel GIS Identified

No.	No Parcel GIS Identified
1	Anaheim city, CA
2	Atlanta, GA
3	Augusta-Richmond County, GA
4	Aurora, CO
5	Austin, TX
6	Chesapeake, VA
7	El Paso, TX
8	Fort Worth, TX
9	Fresno, CA
10	Garland, TX
11	Glendale, AZ
12	Glendale, CA
13	Hialeah, FL
14	Jersey City, NJ
15	Lexington-Fayette, KY
16	Lubbock, TX
17	Memphis, TN
18	Minneapolis, MN
19	Montgomery, AL
20	Newark, NJ
21	Norfolk, VA
22	Omaha, NE
23	Pittsburgh, PA
24	Plano, TX
25	Santa Ana, CA
26	Shreveport, LA
27	Tulsa, OK
28	Yonkers, NY

Table B.3. Home Agency of Parcel-Based GIS

City Parcel GIS	Count
IT/MIS Department (central)	16
Community and/or Economic Development Department	6
GIS Department	5
Planning Department	3
Unidentified City Department	2
Public Works Department	2
Planning Commission	2
IT and Finance Department	2
Zoning Department	1
University	1
Tax Assessor	1
Private Company	1
Office of the Chief Technology Officer	1
Fleets and Facilities Department	1
Federal, state and local, public and private partnership	1
Community Development Division	1
City Office of Strategic Planning	1
Chamber of Commerce	1

County Parcel GIS	Count
County IT Department	4
County Tax Assessor	4
County GIS Department	2
County Auditor	2
County Planning Department	2
Consortium of Land and Infrastructure Agencies in the City and County	1
County Appraiser	1
County Land Information Office	1
GIS Team employed by both City and County	1
GIS Team, Indianapolis/Marion County	1
Planning, Police and Revenue Staff	1
Ramsey County GIS Users Group	1
University GIS Center	1
Louisville/Jefferson County Information Consortium—multi-agency	1
Metropolitan Planning Department for Nashville and Davidson County	1

Table B.4. Data Included in Parcel-Based GIS

Data Types	Count	%
Parcel-Specific Data		
Valuation and Taxation		
Current Value (market, assessed, land, improvements)	47	65%
Sale Price	13	18%
Sales History	6	8%
Tax History	4	6%
Parcel or Building Characteristics		
Parcel/Lot Size	32	44%
Year Built	29	40%
Living Area and/or Building Size	23	32%
Number of Rooms, Bedrooms, or Bathrooms	19	26%
Number of Units	10	14%
Building or Parcel Photo	9	13%
Parcel Improvement and Use		
Parcel Use	35	49%
For Lease or Sale	2	3%
Building Permit	2	3%
Lot Vacancy	2	3%
Noteworthy Parcel-Specific Data		
Owner-occupied	Buffalo, Grand Rapids	**
Utilities: gas service, water service (shutoffs, suspensions, vacancies)	Philadelphia	**
Licenses and Inspections	Philadelphia	**
Demolitions	Philadelphia	**
Code violations	Philadelphia	**
Water bill payment history	Rochester	**
Water and sewer utilities account	Virginia Beach	**

Table B.4. Data Included in Parcel-Based GIS (continued)

Data Types	Count	%
Geographic Contextual Data		
Geographic Area		
Census Tract, Block or Lot Number	12	17%
Neighborhood	13	18%
Subdivision	8	11%
Enterprise or Empowerment Zones	7	10%
Political or Agency Jurisdictional Boundaries		
Zoning	22	31%
Local Legislative District (City Council, Aldermanic District, etc)	19	26%
Jurisdiction	11	15%
Other District	9	13%
School District or Zone	5	7%
State Legislative District	2	4%
Federal Legislative District	2	3%
Planning District	1	1%

Data Types	Count	%
Substantive Contextual Data		
Census Data Only Reports	2	3%
Census Data Reports with Business Location and Consumer Expenditure Data	3	4%
NAICS Code for Business Establishments **(Baton Rouge)**	**	**
Crime **(Dallas)**	**	**
Civic associations **(Richmond)**	**	**

Table B.5. Map Data Layers Included in Parcel-Based GIS

Data Layers	Count	%
Parcels	53	74%
Aerial Photos	29	40%
Zoning	28	39%
Street	24	33%
City or County Boundaries	22	31%
Parks and Recreational Areas/Centers	21	29%
Census Tracts or Block Groups	18	25%
Schools	18	25%
City & Council Districts	16	22%
Buildings	14	19%
Zip Codes	12	17%
Enterprise Zones	11	15%
Neighborhoods	11	15%
Fire and EMS stations and districts	10	14%
Designated Development, Revitalization areas	10	14%
Police Stations or Districts	10	14%
Political Jurisdictions	9	13%
Lot Number, Boundaries, or Size	9	13%
Libraries	8	11%
Transit (Bus, Subway, etc.) Stops or Lines	8	11%
City Owned and/or Lease Property	7	10%
Land Use	6	8%
School Districts	5	7%
Planning Jurisdictions/Districts	5	7%
Hospitals and Clinics	5	7%
Subdivision	5	7%
Roads	4	6%
Political/Legislative Districts: Local	4	6%
Special Districts: Central Business District	4	6%
Industrial Park or Corridor	4	6%
Empowerment Zones	3	4%
Highways	3	4%
Vacant Land/Lots	3	4%
Permits	3	4%
Public Housing	2	3%
Shopping Center	2	3%
Community Service Centers	2	3%
City Facilities	2	3%
Vacant Buildings	1	1%
Political/Legislative Districts: State	1	1%
Political/Legislative Districts: Federal	1	1%
Community District	1	1%
City Development Projects	1	1%

Table B.6. Query Attribute Fields in Parcel-Based GIS

Attribute Field	Sites Containing Attribute Field
Empowerment and/or Enterprise Zones	
Enterprise zone	Tucson
Empowerment zone	Tucson
Parcel/Lot Size	
Parcel Size (acreage, area, lot square footage, etc.)	Buffalo Charlotte Chicago Cleveland Honolulu Milwaukee Oakland Philadelphia Richmond Riverside St. Paul Stockton Tacoma Tucson
Parcel Use and/or Zoning	
Parcel type	Buffalo Charlotte Cleveland Fremont Honolulu Oakland Philadelphia Stockton Tacoma Tucson
Land use	Cleveland Buffalo Milwaukee
Zoning	Honolulu Milwaukee
Building Characteristics	
Building area	Milwaukee
Building square footage	Cleveland Charlotte Philadelphia
Total residential living area	St. Paul

Table B.6. Query Attribute Fields in Parcel-Based GIS (continued)

Attribute Field	Sites Containing Attribute Field
Building Characteristics (continued)	
Number of units	Milwaukee Stockton St. Paul
Number of rooms	Milwaukee St. Paul
Number of bedrooms	Charlotte St. Paul
Number of full baths	Charlotte
Number of stories	Charlotte St. Paul
Year Built	Charlotte Cleveland Milwaukee St. Paul
Parcel Sales	
Sale price	Buffalo Philadelphia St. Paul
Sale date	Charlotte Philadelphia Richmond St. Paul
Lease/sale	Fremont Stockton Tucson
Parcel and/or Building Value	
Land value	Buffalo Charlotte Grand Rapids Honolulu Madison St. Paul
Improved value	Madison
Building value	St. Paul Grand Rapids Honolulu
Total value	Fremont Madison St. Paul

Table B.6. Query Attribute Fields (continued)

Attribute Field	Sites Containing Attribute Field
Land and Building Assessment	
Land assessment	Cleveland
Building assessment	Riverside
Total assessment	Cleveland Milwaukee Riverside
Noteworthy Query Fields*	
Vacant lot or building	Chicago Philadelphia Richmond Riverside
Infill	Riverside
Owner-occupied/offsite owner	Buffalo Milwaukee Philadelphia
Census data	Richmond
Section 8	Richmond
Public housing	Richmond
City or county owned	Seattle Chicago Buffalo Richmond St. Paul
Political District	Richmond
Water Shutoff	Philadelphia
Fire Report On Property 1992-2002	Philadelphia
Years Tax Delinquent	Milwaukee
Civic Association	Richmond
Project Search	Chicago

Table B.7. Selected Functionalities in Parcel-Based GIS

	Total	Query Interface Functionality	
		Simple	Complex
Total	**72**	**96%**	**25%**
Government-Technical	**35**	**94%**	**23%**
IT/MIS/GIS	35		
Government-Substantive	**34**	**97%**	**26%**
Planning/Development	21	95%	38%
Assessor/Auditor/Apprais.	8	100%	-
Other	5	100%	20%
Non-Government	**3**	**100%**	**33%**
University	2	100%	50%
Private Company	1	100%	-

Table B.8. Cities offering Parcel GIS with Multi-Attribute Query Capability

No.	City
1	Chicago
2	Cleveland
3	Fort Wayne
4	Fremont
5	Grand Rapids
6	Miami
7	Milwaukee
8	Oakland
9	Philadelphia
10	Richmond
11	Riverside
12	St. Paul
13	Stockton
14	Tacoma
15	Tucson

Table B.9. Cities Supporting the Mapping of Multi-Attribute Queries

All Parcels
Philadelphia, PA
Milwaukee, WI
Oakland, CA
Chicago, IL
Non-Residential Parcels Only
Stockton city, CA
Tacoma city, WA
Tucson, AZ
Fremont city, CA