



## DuPage County, Illinois GIS Division

### 2009 NSDI Cooperative Agreements Program Category 7

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# Illinois NSDI GIS Data and Standards Coordination System Demonstration Project

## *Final Report*

February 28, 2011

**DuPage County, Illinois GIS Division**  
2009 NSDI Cooperative Agreements Program - Category 7  
Illinois NSDI GIS Data and Standards Coordination System Demonstration Project  
*Final Report*

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**Executive Summary:** The purpose of this project was to design a system for GIS professionals in the State of Illinois that could be used as a model for standardized data sharing between local, regional, state, and federal agencies.

Many impediments exist today which severely limit the success of designing and implementing such a program. The State of Illinois government has available a very limited number of resources to serve in the coordination of GIS activities between these various levels of government. The Federal government presently does not offer a set of definitive GIS standards that could be used as a common means of data exchange. In many cases GIS users are not even aware of the limited number of existing standards available on a national level.

There has been a great deal of collaboration in Illinois between GIS agencies on a local level, but as of this date there has been no sustainable program developed to coordinate all GIS activities throughout the State.

This report will outline a series of practical, achievable steps that can be taken today by GIS agencies throughout the State to successfully coordinate these independent GIS programs until such time that the Federal government and/or the State government fulfills this role.

**Projects Goals:** This project was designed to accomplish the following goals necessary to build a comprehensive GIS data sharing system that does not require either major new funding or the creation of new government agencies to operate:

- **Data Required:** Identify the major categories of GIS data that are required for the majority of GIS operations in the State, and offer recommendations on how to develop these datasets for all areas of the State.
- **Data Standards:** Determine what Federal and/or State GIS standards are presently available, what potentially might be available in the near future, and what can be done in the near term to support the lack of said standards.
- **Data Coordination:** With the lack on a State agency to coordinate GIS data standards, data collection and distribution, a mechanism must be developed to make all users aware of all GIS activities throughout the State.
- **Data Distribution:** Availability of current GIS data is contingent upon two factors, reasonable charges for the cost of providing copies of the GIS data, and the establishment of a central repository system to distribute large amounts of data.

**GIS Framework Data Required:** The Federal Geographic Data Committee (FGDC) has outlined on their website ([www.fgdc.gov](http://www.fgdc.gov)) the seven types of data it considers essential for a nationwide geographic data network that will meet the requirements of most users:

- Geodetic Control
- Cadastral
- Orthoimagery

- Elevation
- Hydrography
- Governmental Units
- Transportation

During the development of this project in 2010, it was determined that a very high percentage of the FGDC GIS Framework data had been compiled for the entire State by a wide variety of governmental, private and non-profit agencies. The lack of data standardization and a coordination / distribution system has made it extremely cost prohibitive to use GIS data from more than one source.

**GIS Data Standards:** A great amount of resources have been expended by the Federal Government towards the development of national standards for GIS during the past decade. Many of these standards are comprehensive and well documented, while many still languish due a lack of urgency by some of the Federal agencies. The following is a summary of the current state of these standards along with a series of recommendations for their improvement. In areas where DuPage could reasonably compensate for the lack of a Federal GIS standard, the solutions developed by the County are explained.

**Geodetic Control:** The United States National Geodetic Survey (NGS) has made a major transition from the use of a network of physically monumented geodetic control points to a system of virtual control in the form of Global Position System (GPS) Continually Operating Reference Stations (CORS). This change was made to reduce the high costs of maintaining physical monumentation as well supporting the efficiencies of GPS surveying. As of 2010 there are over 1500 of these CORS sites providing geodetic control throughout the United States. The vast majority of these sites are maintained by private companies and state / local governmental agencies. NGS provides the standards, certification, and monitoring services for this nationwide GPS CORS network.

DuPage County has installed seven GPS CORS sites which have been accepted by NGS into the National CORS network. These seven DuPage CORS sites will provide for the majority of our geodetic control needs and have dramatically reduced the costs of GPS field data capture operations.

The website links to the NGS CORS Program and GPS Field Data Capture Standards are:

<http://www.ngs.noaa.gov/CORS/>

<http://www.ngs.noaa.gov/OPUS/>

[http://www.ngs.noaa.gov/PUBS\\_LIB/pub\\_GPS.shtml](http://www.ngs.noaa.gov/PUBS_LIB/pub_GPS.shtml)

**Cadastral:** DuPage County is developing three major GIS datasets related to Cadastral data; land parcels, addresses, and the County's portion of the United States Geological Survey (USGS) Geographic Names Information System (GNIS) database:

**Parcels:** There presently are no Federal Standards for maintaining a GIS parcel database. While the FGDC has published some general Cadastral standards, no comprehensive national standard exists yet for the maintenance of parcel data.

In 2007, the National Research Council published the report "*National Land Parcel Data*" ([http://www.nap.edu/catalog.php?record\\_id=11978](http://www.nap.edu/catalog.php?record_id=11978)) which outlined the current state of parcel mapping in the United States, along with a set of recommendations for developing a nationwide system. DuPage County has already implemented most of the recommendations documented in this report.

In the absence of a national standard for GIS parcel data, nine county GIS government agencies in the Chicago metropolitan area are working together to develop a set of standards for the regional sharing of this data. To the accomplish this, the Northeastern Illinois GIS Cooperative Program (NEIL) counties are working on the following to create standardized parcel data:

**Standardized Public Lands Survey System (PLSS) Data:** All property and governmental boundaries in Illinois are based on the positions of the monuments marking the locations of the PLSS township, section, and quarter section corners. The NEIL counties are using Professional Registered Land Surveyors to update the positions of the PLSS corners along the boundaries between counties to provide an accurate basis for the edgematching of parcels and roads.

The development of the updated PLSS corner database will be in compliance with the United States Bureau of Land Management (BLM) Geographic Coordinate Data Base (GCDB) standards:

<http://www.blm.gov/wo/st/en/prog/more/gcdb.html>

**Three Dimensional Parcel Data:** The vast majority of new parcel development in the Chicago area today is in condominium developments. DuPage County is redesigning its parcel geodatabase to support the storage of 3D attributes such as floor name and elevation in order to view the geometry of all parcels.

**Parcel Naming:** All parcel naming within the State of Illinois is regulated and standardized by the Illinois Department of Revenue. The simple addition of the USGS GNIS county identifier to each parcel record will create a unique national parcel identifier.

**Parcel Boundary Input Standards:** DuPage County is working with a team of Professional Land Surveyors to develop a set of parcel data input standards that will improve the accuracy of parcel boundary data in the geodatabase. Based on Illinois land surveying professional practices, case law, and new GPS control, these standards will also assist any surveyors performing work in our County in the future.

**Addresses:** Arguably, the most important GIS dataset maintained by government agencies are property addresses. This data is critical to all emergency management operations, and is the most widely used means of identification when assisting the public.

In January of 2011, the FGDC approved a new set of comprehensive address data standards that fix almost every deficiency of prior standards:

<http://www.urisa.org/about/initiatives/addressstandard>

The only shortcoming of this new standard identified so far is the lack of support in the database design for addresses that exist along roads with multiple names or route identifiers.

**USGS Geographic Names Information System (GNIS):** One of the oldest and most important national GIS databases in use today, the GNIS is a collection of over two million place names that includes the latitude and longitude for each location. The GNIS has grown considerably in importance in the past decade as the official Federal replacement for the FIPS codes, and as a base for Homeland Security critical infrastructure inventories.

<http://geonames.usgs.gov/>

Much of the GNIS data for locations in Illinois is over 30 years old. A check of points within DuPage County has revealed hundreds of records that must be added, deleted, or modified. The County has set a goal of completing the update of their portion of the GNIS by the end of 2011.

The USGS Geospatial Liaison for Illinois, Shelley Silch, has taken the lead in providing technical and data exchange coordination between the Federal government and DuPage County for the updating and continued maintenance of this mission critical data.

**Orthoimagery:** One of most useful and expensive GIS data resources is aerial imagery that has been corrected to accurately represent the locations of features on the ground. During the past couple of decades there have been hundreds of orthoimagery data capture projects conducted in the State. Some of these have been done on a statewide basis, while the majority of have been performed by municipal, county, and regional entities.

The following are national detailed specifications on the capture of orthoimagery:

[http://www.asprs.org/society/committees/standards/standards\\_comm.html](http://www.asprs.org/society/committees/standards/standards_comm.html)

<http://seamless.usgs.gov/hro.php>

<http://www.ndop.gov/maintenance.html>

<http://rockyweb.cr.usgs.gov/nmpstds/doqstds.html>

**Elevation:** Most digital elevation data captured today is acquired through the use of Light Detection and Ranging (LIDAR) systems.

Recently USGS published a set of specifications for the capture of LIDAR data:

<http://lidar.cr.usgs.gov/USGS-NGP%20Lidar%20Guidelines%20and%20Base%20Specification%20v13%28ILMF%29.pdf>

**Hydrography:** DuPage County is working towards the development of its hydrography data to be in compliance with two USGS national GIS data standards:

- National Hydrography Dataset (<http://nhd.usgs.gov/>) for vector features (points, lines and polygons).
- Geographic Names Information System (<http://geonames.usgs.gov/>) for hydrography feature names.

**Transportation:** Despite the fact this GIS data type is one of the most widely used of the Framework datasets, the Federal government has not completed or endorsed a comprehensive national transportation data model standard. In 2010 the United States Department of Transportation (USDOT) announced that it was starting an initiative named "Transportation for the Nation" (TFTN) to develop a national GIS transportation network standard:

<http://www.transportationresearch.gov/TFTN/default.aspx>

As of this date, the development of the TFTN is only in the investigative stage, and the USDOT has not committed to any completion date for the standard.

In the absence of a national transportation data standard, DuPage County has committed the following substantial resources to develop an interim system to meet its needs:

- **Data Model:** A substantial part of any GIS transportation data model are the road name and address range components. The County is adopting the road name and address components of the recently approved FGDC Address Standards for its interim transportation network model.
- **Transportation Network Components:** The FGDC has completed the documentation of a partial transportation network standard (<http://www.transportationresearch.gov/TFTN/default.aspx>) that the County is adopting and extending. The FGDC standard uses the concept of RoadPoints, RoadSegs, and RoadPaths, but does not define how roads are to be segmented,

leaving that decision up to the end users. DuPage County has adopted the following standard for the segmentation and spatial orientation of road segments:

- Roads network records in the geodatabase are to be segmented at:
  - Intersections with other roads.
  - At changes of road names and/or road route designations.
- Road segment orientation will follow the Federal Interstate rules for route numbering, that is roads will be represented in the geodatabase as running from either west to east or south to north.
- **Software:** The County contracted with two Illinois based GIS software development firms for the creation of tools and data models to supplement the capabilities of our core GIS software, Esri's ArcGIS:
  - **Transportation Network Database Management tools:**
    - Transfer adjacent point address data to create new, more accurate road centerline address data ranges. Includes verification of the road names of the address points against the road centerline name.
    - Change direction of road segments to Federal Interstate standard.
    - Allow for the storage of overlapping / multi-directional address ranges for a single road segment.
    - Input and retrieval of road segment attributes using dynamic segmentation.
  - **Standard County and Custom Map production tools:**
    - Standard placement of road name annotation using a rule base system.
    - Generation of road names and route symbols for custom maps using 1/9 of a township tile increments.

**GIS Data Coordination:** Many attempts have been made in the past two decades at Illinois statewide GIS coordination, and unfortunately none have succeeded.

In 1995, the Illinois State Legislature approved a bill establishing the Illinois Geographic Information Council (ILGIC). Due to a lack of support by the principal agencies of the Council, state agencies, ILGIC became non-functional by 2003. The following is a roster of the original ILGIC membership:

<http://appointments.illinois.gov/appointmentsDetail.cfm?id=106>

Staff at the Illinois Department of Natural Resources spearheaded an effort in 2007 named the Illinois Statewide GIS Initiative to resurrect coordination efforts. A significant number of public hearings and surveys were conducted as part of the project. Despite a large amount of grass roots participation in the development of this plan, it too became dormant due to the lack of support by any state agency.

In 2009, the State of Illinois appointed a GIS Coordinator to improve the efficiencies of State GIS operations, and to ultimately extend these coordination efforts to the local level. Due to the current fiscal situation in the State, it is highly unlikely that this GIS Coordinator will have the resources to achieve any coordination efforts beyond the State agency level.

In 2010, the State GIS Coordinator met with the Board of Directors of the Illinois GIS Association (ILGISA), a private, non-profit agency, to request their assistance in working on statewide coordination efforts. The Board of Directors of ILGISA responded by directing their Membership and Standards committees to investigate what efforts would be needed for ILGISA to effectively organize and sustain Illinois GIS coordination work.

By February of 2011, the Membership Committee was considering the use of the following procedures and tools to develop a State of Illinois GIS Coordination System:

- Use of the National States Geographic Information Council (NSGIC) GIS Inventory Internet web system (<http://www.gisinventory.net/>) as a means to inventory all of the GIS personnel, systems, and data within Illinois.
- The inventory work tasks performed by ILGISA volunteers will be segmented into nine areas coincidental with the Illinois Department of Transportation Districts (<http://www.dot.state.il.us/idotmap.html>).
- There are a number of significant regional GIS coordination efforts underway, primarily in the more populated areas of the State. ILGISA will contact these regional coordinating bodies in an attempt to enlist their aid in our inventory efforts, and in the development of State GIS standards:
  - <http://gis2.co.lake.il.us/ilgisa/>
  - <http://mcgis.org/>
  - <http://www.peoriacounty.org/GIS/>
  - <http://www.bacog.org/barringtonareagis.html>
  - <http://www.ccrpc.org/gis/index.php>
  - <http://ims.wingis.org/Default.aspx>
  - <http://www.ilarconline.org/news/6-1.php>
  - <http://www.gisconsortium.org/public/>

**GIS Data Distribution:** During the course of conducting this project, three areas were identified that need to be improved to support the efficient distribution of GIS data between agencies in the State:

**GIS Data Documentation:** In February of 2010, the DuPage County GIS Division in cooperation with USGS conducted a multi-day FGDC compliant metadata training class for County personnel and representatives from all of the counties in the Chicago area. As a result of this training, DuPage was able to prepare FGDC metadata for all of its major GIS data distribution sets. As the counties of the NEIL consortium prepare their data for sharing with each other, maintenance of FGDC metadata will become an absolute necessity.

**GIS Data Access Laws:** Conflicting interpretation of state law and incompatible data distribution policies are a major impediment to statewide GIS data sharing. In January of 2010, a new Freedom of Information Act (FOIA) took effect in the State that was meant to vastly improve access to most government data. In many ways this new law has had the opposite effect. Various county State's Attorneys have provided their respective county boards with differing opinions on how to implement the law. A number of counties provide all

of their GIS data for free, including to private companies, while many continue to charge varying costs for data access.

**Recommendations:** The 2010 FOIA law is very explicit regarding the requirement of providing most government data to other units of government, the general public, and to non-profit agencies. It is usually only the distribution policies for the release of GIS data to private entities that governmental units in Illinois do not agree on. Most GIS data provided to private companies is used for the benefit of the general public. GPS based navigation systems, online mapping programs, and vehicle routing systems are all used extensively by the general public, and would all be improved by free access to more up to date government GIS data. No government agency in the United States has ever shown any significant amount of revenue generated by the sale of GIS data. Conversely, it can easily be proven that countless resources are wasted each year by the lack of free access to timely GIS data. DuPage County's many years of experience in operating a GIS have shown that free and easy access to GIS data allows everyone to work more efficiently and improves the quality of that data by an increased level of scrutiny.

**GIS Data Distribution:** There is no statewide system available for the storage and distribution of the highly detailed GIS datasets maintained by the various local units of government in the State.

One of the major goals of this grant program was to develop a prototype of a GIS data distribution system that could be used by any local unit of government to cost effectively provide its information to end users. Ideally this test data distribution system would be built on an existing state government facility and not have to incur the cost developing a new system.

Since 1997, the Illinois GIS Clearinghouse at the University of Illinois has been serving up many terabytes of statewide imagery and Illinois GIS Base Data such as PLSS, township, and county boundaries. The Clearinghouse is the only existing government GIS data distribution facility in Illinois that could be considered to conduct this test.

As a part of this grant program, DuPage County contracted with the Clearinghouse for a period of one year to study the viability of using its facilities for local government GIS data dissemination. The staffs of the County GIS Division and the Clearinghouse determined that they would design and implement a test GIS data distribution system that would meet the following goals:

- All County GIS data stored and distributed via the Clearinghouse would include FGDC compliant metadata.
- Data would be made available to users via two means:
  - Direct download of full County GIS theme datasets via FTP server access.

- An ArcGIS Server GIS web site that included viewing and “clip and ship” capabilities allowing the user to select a subset of the data and obtain a downloadable file.

In July 2010, the Clearinghouse completed the setup of the FTP and ArcGIS servers and began the test of serving up the DuPage County GIS data.

**Recommendations:** The Illinois GIS Clearinghouse has a proven track record of being able to successfully manage the dissemination of large statewide GIS datasets, and would be the best means of providing access to local GIS data. The DuPage test performed under this grant proved that the Clearinghouse could successfully serve large amounts of local data to a diverse group of end users.

It is recommended that the GIS managers of the nine counties in the NEIL GIS Consortium actively pursue the long term use of the Clearinghouse as the primary means of providing their GIS data to each other, all other governmental agencies, and the general public. The Clearinghouse would be an excellent means of supporting the shared emergency management and homeland security operations between the counties, which may ultimately provide the best means of funding a common data distribution source. Successful use of the Clearinghouse by the NEIL GIS Consortium could then be replicated by other groups around the State.

**Conclusions:** The completion of this grant program has produced a documented reasonable solution to how the Illinois GIS community can address the problems of the lack of statewide GIS data coordination and standards.

While the current economic climate in the State precludes the creation of any new large scale programs to support GIS coordination, there is an alternative that can be build upon utilizing the many existing resources we do have available. These include the large number of highly skilled GIS professionals throughout the State, existing Federal GIS standards that can be adopted and extended, an existing State GIS Clearinghouse for sharing data, and a professional organization that is willing to take on much of the coordination work on a volunteer basis.