Facilities Parking Project at the University of New Hampshire, Spring 2006

Abstract

In January of 2006 we began an internship project for the University of New Hampshire Facilities Information Technology (GIS Division) under the guidance of Peter Lisichenko (acting GIS administrator) and Tim Sullivan (GIS analyst). The purpose of this project was to develop a detailed surface management geodatabase that would include campus walkways, roadways, and parking lots. We were given the responsibility of data collection for the parking lot portion of the project. These responsibilities included: creating a parking lot geodatabase, collecting data points in the field, and post processing the data in ArcGIS 9.

Before any data was collected in the field it was necessary for us to build a geodatabase of parking lot features and their attributes within ArcCatalog (Figure 2). To determine which features we wanted to use in constructing our geodatabase we visited several parking lots and decided that the feature classes of lot area, curbs, line stripes, parking spaces, pavement markings, meters, and guard shacks should be included. In creating the geodatabase we determined what attributes would be collected for each feature, and whether features would be represented as points, lines, or polygons.

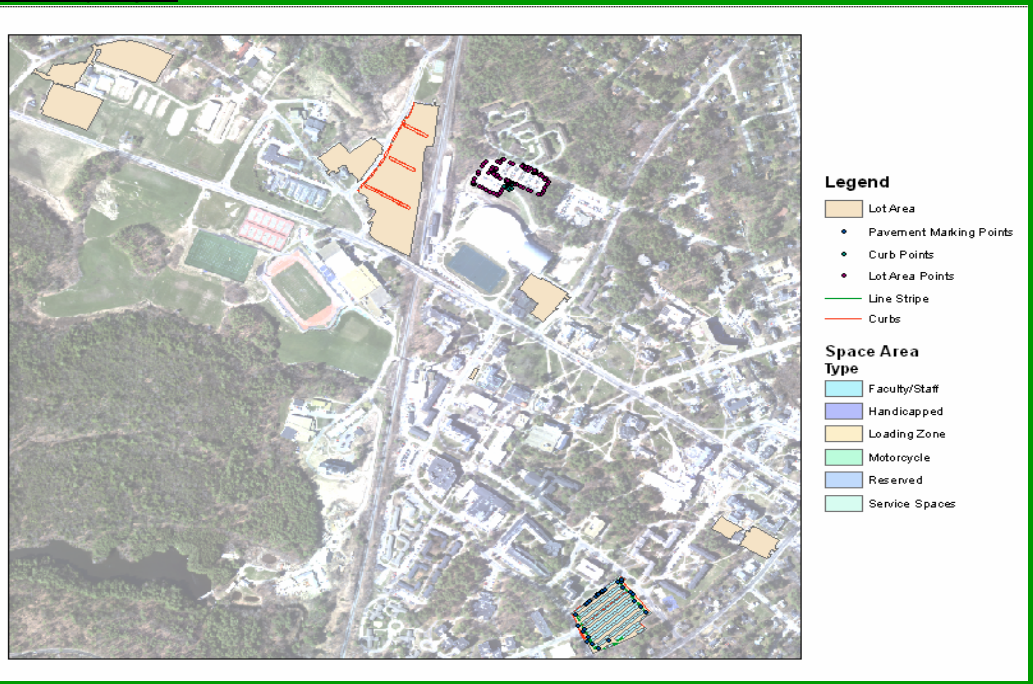
It was initially planned that we would be collecting data for all of the features within our geodatabase for every parking lot on campus. However, after further consideration and time spent in the field it was determined that collection of such a substantial amount of data, though needed in the future, would not be possible within the timeframe of our internship. As a result, we focused solely upon the collection of lot area and curb data for as many university parking lots as time permitted. Special exception was made for Parking Lot B where we collected data for all applicable features within our geodatabase to create a representative example of a parking lot with several feature shown.

In the field data was collected using a Trimble Real Time Kinematic (RTK) unit, Leica Pro 4a Laser Distance Meter, and Suunto Hand bearing compass. A data dictionary was created for the RTK unit prior to going into the field that provided us with a prompt to include all applicable attribute data with each data point collected. Using the RTK unit we collected globally positioned points with attributes for parking lot features (Figure 3). In order to accurately map the entire area of parking lots it was necessary to collect multiple data points around their perimeters. For mapping curbs, points were collected on both the inner and outer sides of a curb for the extent of every curb section. Points were more widely spaced when collections areas were straight lines and more densely collected when on curves and other misshaped features. Similar collection methods were used in the collection of data points for the parking spaces, line stripes, and pavement markings in Parking Lot B. When we were unable to physically collect data with the RTK unit due to high PDOP, poor satellite coverage, or obstructions that limited our ability to take points (i.e. a car on a line) it was necessary for us to take offset points (Figure 4). Offsets were collected using the Leica laser distance meter and compass to determine the distance and bearing of a position from a known point collected by the RTK unit.

After collecting all of the field data for a given day the data was uploaded onto the computer and imported into Trimble Geomatic Office (TGO). TGO allowed us to transfer our field collected data into a GIS file for exporting to ArcGIS 9. The exported data could then be added to our post-processing file within ArcGIS. Once in ArcGIS we were able to take our field collected data, which appeared as multiple points (Figure 6), and use it to create construction shapefiles (Figure 7). The construction shapefiles acted as rough drafts for drawing the features during geo-processing. After creating satisfactory shapefiles we were then able to draw our geodatabase features by simply tracing over the construction shapefiles. When drawn within the geodatabase, lot areas and parking spaces were created as polygons, curbs and line stripes as lines, and pavement markings as points (Figures 8 & 9).

Throughout the course of our internship project we were able to collect lot area and curb data for parking lots A, B, C, H, M, Mast Road lots 1 and 2, the Visitor lot and the Woodsides lot (Figure 1). For Parking Lot B we were also able to collect parking space, line stripe, and pavement marking data. Geo-processing of lot areas and the majority of curbs was completed for all lots in which data was collected, excluding the Woodsides lot. The geo-processing of parking spaces, line stripes, and pavement markings for Parking Lot B was also completed. The data we were able to collect and the geo-processing in which we completed will serve as a foundation for further parking lot data collection and a complete University surface management geodatabase.

Figure 1: University Parking Areas



This map shows the extent of the data we collected and the post processing we completed for University parking lots. Data was collected for parking lots A,B,C,H,M, Visitor lot, Mast Road 1 and 2, and Woodsides. The majority of the lots show lot areas and curb data, while parking lot B also shows line stripes, pavement markings, and space areas.

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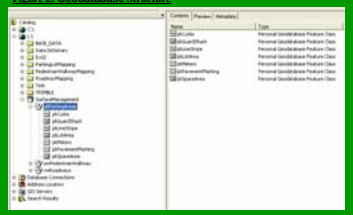
Figure 2: Geodatabase Structure



This is our geodatabase as it appears in ArcCatalog. It shows the parking lot features that are of importance to our project. Feature classes are represented as points, lines, and polygons.

Figure 3: Offsets

Offsets are necessary when points are unable to be physically colleted with the RTK unit because of high PDOP, poor satellite coverage, or obstructing objects. Offset points are taken by finding the distance and the bearing of a position from a known point that the RTK unit is able to collect. A Leica Pro 4a Laser Distance Meter was used for measuring distance and a Suunto Hand compass was used to determine bearing.

Figure 4: Collecting Points

While in the field we used a Real Time Kinematic (RTK) unit to collect globally positioned points with attributes. With the RTK unit we were capable of collecting points with sub-centimeter accuracy. Several points were collected along the extent of each feature to ensure an accurate representation of data.

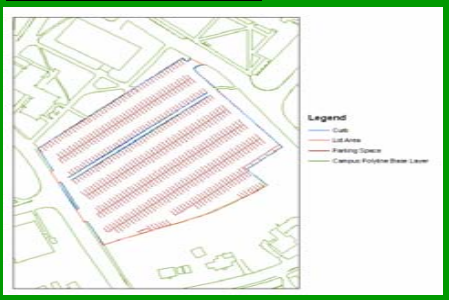
Figure 5: Line Stripe and Parking Spaces

This photo shows some of the common features that were collected including: line stripe, parking spaces, and pavement markings.

Figure 6: B-lot as collected data points

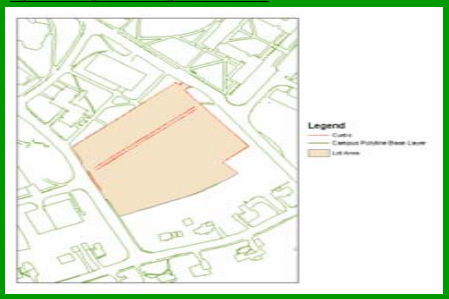
This map shows data collected by the RTK unit as it appears when first added to ArcGIS and before any post processing has occurred. Each dot is representative of a point collected in the field and contains attribute data relevant to the feature being collected.

Figure 7: Parking Lot B as construction shapefiles



This map is representative of the first step of post processing our data. It shows curb, lot area, and parking space data for parking lot B during the construction shapefile editing process. The construction shapefiles were used as a template for the creation of our features within the geodatabase.

Figure 8: Parking Lot B showing lot area and curbs



This map represents parking lot B following the completion of the next step in our post processing. It shows lot area and curbs after geo-processing. The geo-processing of lot area and curbs was completed for several other lots on campus.

Figure 9: Fully drawn geodatabase image of Parking Lot B

This map shows parking lot B following the completion of geo-processing using all of the data we collected to create a detailed map of features and attributes. It is a representative model of how all lots will appear after the completion of their post-processing.