

Desktop and Internet GIS Applications for Pace's Vanpool Incentive Program

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Paper Abstract

Pace Suburban Bus Service, along with two other agencies, provide public transportation to people in Metropolitan Chicago area. One of Pace's programs is Vanpool Incentive Program (VIP). Groups of 5 to 15 people who live and work near each other can share a van provided by Pace. This paper will present four GIS applications designed to promote VIP and facilitate the work of Pace VIP staff. The four applications include a MapObjects one that Pace Vanpool representatives use when meeting with client companies in identify potential vanpool groups, an ArcIMS application which helps individuals who want to join an existing vanpool with their decision making, a MapObjects application that helps Pace staff convert vanpool route information from paper to electronic version and store it in Oracle, and an ArcObjects program to back up four vanpool related ArcSDE featureclasses automatically.

Vanpool and the Benefits It Brings

Vanpool, in general, is a prearranged ridesharing program in which groups of people travel together on a regular basis in a van. My company, Pace Suburban Bus Service, is one of the three public transportation providers in Metropolitan Chicago area. Pace operates the second largest vanpool program in the United States. A group of riders who live and work close to each other use vans provided by Pace for transportation to and from their residences or other designated locations and their places of employments.

In 1998, Congress approved legislation that allows employees of corporations to pay for parking and transit (including vanpool) with pre-tax dollars while employers enjoy lower overall payroll taxes. The regulations concerning transportation benefits were finalized on January 11, 2001.

Vanpooling brings benefits to individuals, employers, and the community.

For individuals, Vanpooling can significantly reduce commuting cost. Participants don't have to worry about gas price and insurance. They pay Pace a fixed monthly amount, based on occupancy and distance traveled, and will be able to take the van to and from work. Out of this payment Pace pays for the van, gas, maintenance, and insurance. What's more, as a tax benefit, employees participating in vanpool pay for commute benefit with the pre-tax income and save on income taxes, or each of them can receive up to \$100/month tax free from his/her employer.

For employers, having their employees participate in vanpooling reduces tardiness and keeps absenteeism down by providing a relaxing, affordable, and reliable way for employees to travel, reduces the number of cars at the worksite, freeing up valuable parking spaces, expands the labor pool by increasing access to the facility, and adds a benefit to offer your employees at no cost to them. What's more, employers can save on payroll tax (at least 7.65% savings) because employees use pre-tax income to pay for vanpooling. An alternative is that employers can give their employees up to \$100/month to commute via vanpool and get a tax deduction, thus save over providing same value in gross income.

Vanpooling is good for the community. By eliminating number of vehicles on the road, it cuts down emissions, improves air quality, alleviates peak hour traffic, and reduces demands on energy resources.

GIS Applications for Pace's VIP Program

We in Pace's GIS Programming section are very supportive of the VIP program. Various custom applications were developed to assist the promotion and marketing of VIP and to facilitate the internal management of the vanpools.

This paper will cover four custom GIS applications developed for VIP programs. Depending on the user requirements, different technologies were used.

The four applications are as follows.

- GeoVan
 - Objective: promotes vanpool participation in employers' sites by matching their employees' home addresses on the map on the fly and visualizing potential vanpool routes.
 - Users: Pace's VIP representatives
 - Technologies: MapObjects, Visual Basic

- VIP Route Maker
 - Objective: facilitates the creation, modification and deletion of geodatabase records for vanpool origins, pickup locations, and destinations, and enables vanpool representatives to maintain accurate route narratives for all VIP routes.
 - Users: Pace's Vanpool administration staff and GIS services staff
 - Technologies: MapObjects, Visual Basic

- WebVan
 - Objective: promotes vanpool participation from individual users by helping them search for existing vanpools that they can join.
 - Users: the public
 - Technologies: ArcIMS, ASP, VBScript, JavaScript, HTML

- VIP Data Backup Tool
 - Objective: enables quick and easy backups of VIP route data
 - Users: GIS services staff
 - Technologies: ArcGIS, ArcObjects, VB

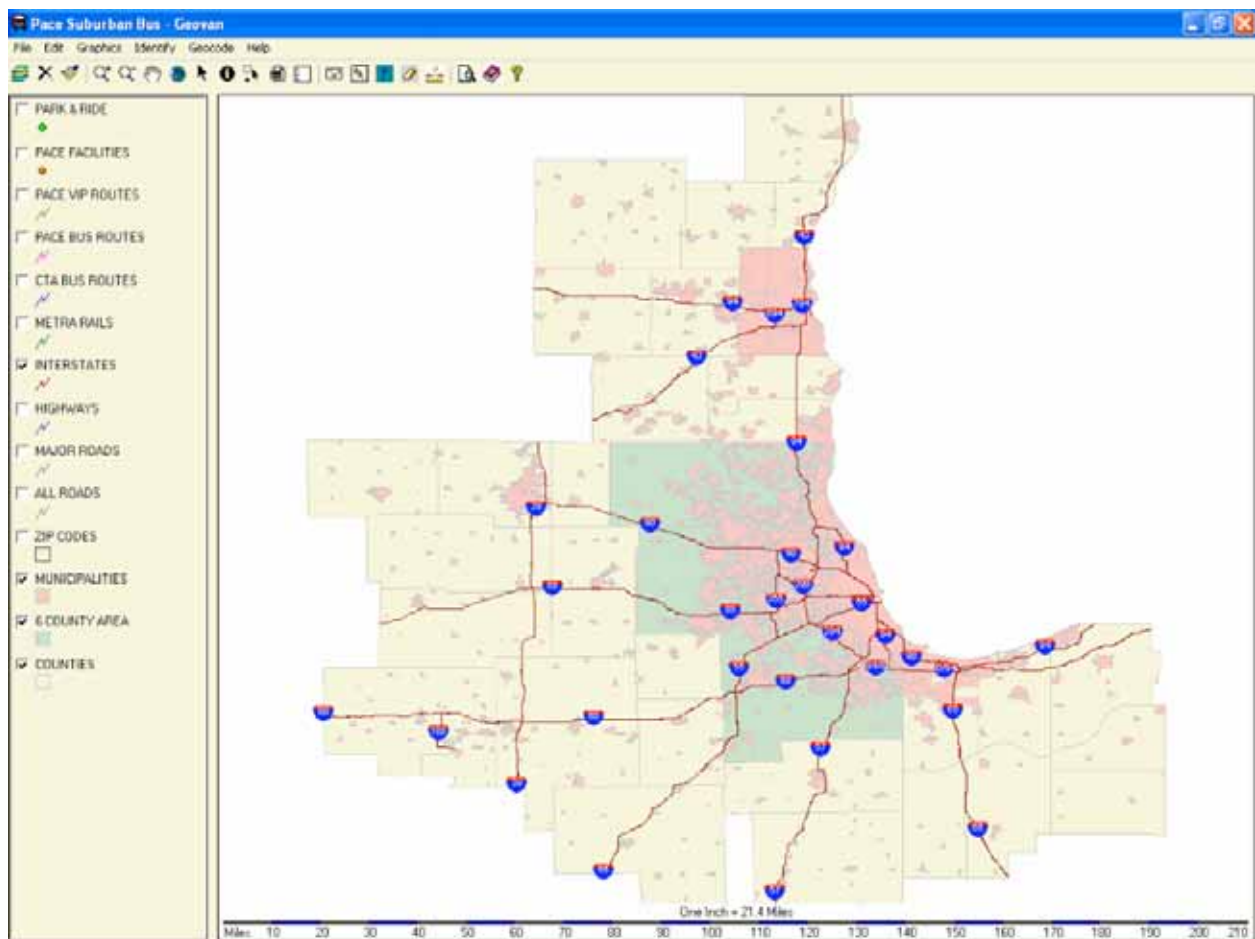
The rest of the paper will cover the four applications in details.

Application 1: GeoVan

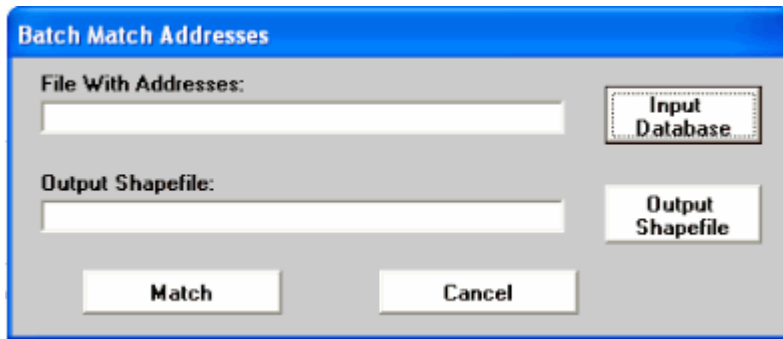
Introducing Pace's VIP program to employers can be seen as the first step in getting people into vanpools. Initially, Pace's VIP representatives meet with the target company's Human Resource, and later their employees, to introduce our vanpool program. GeoVan is developed to help this process.

By using GeoVan, Pace Vanpool representatives will be able to locate target company's employees' home addresses on the fly, visualize them on the map, and identify potential vanpool groups.

The illustration below shows the interface of GeoVan

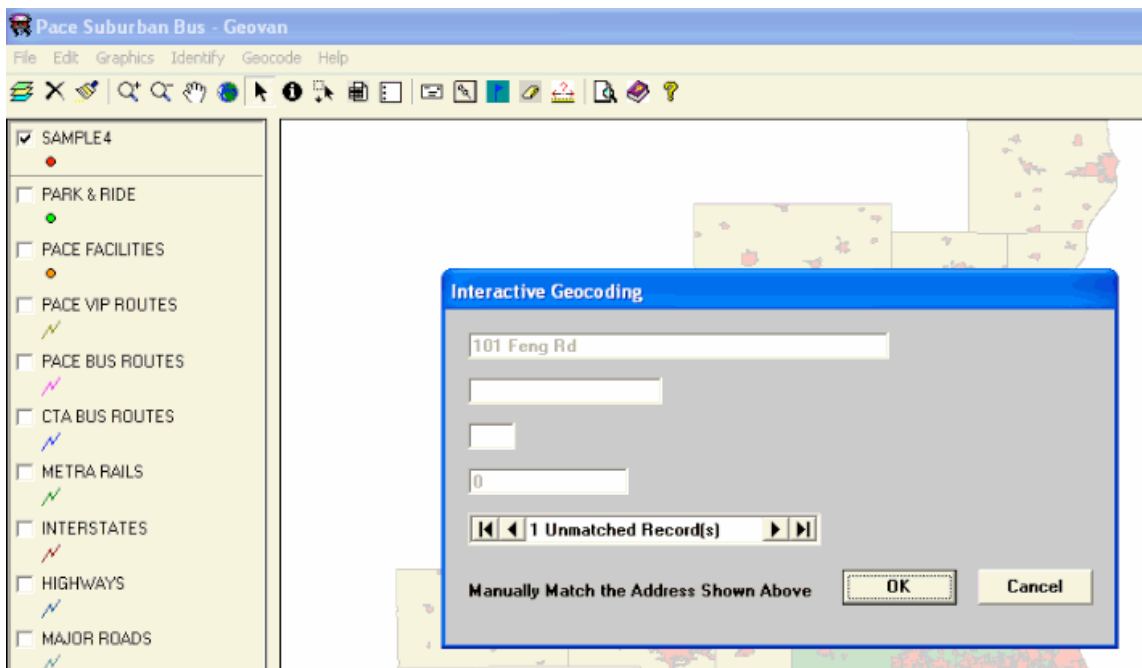


The illustration below shows GeoVan's Batch Match Addresses window.

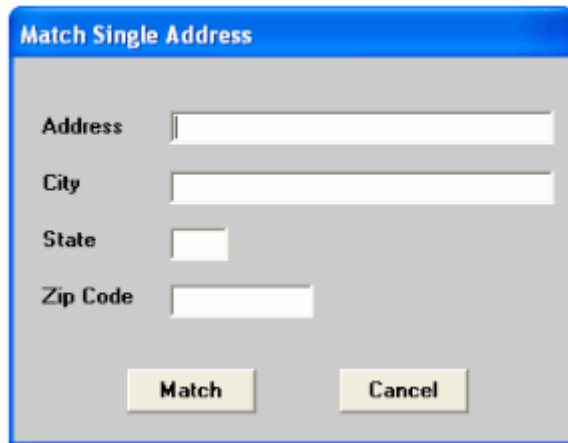


It takes an input file containing the employees' addresses – the file can be Microsoft Access table, Excel spreadsheet, Lotus spreadsheet, or dbf file – and outputs a Shapefile with points as the addresses.

If some addresses can not be found, an interactive geocoding tool can be used to manually click on the map to generate point features. The illustration below shows the Interactive Geocoding Tool.



GeoVan also provides Match Single Address tool, as shown below.

A screenshot of a software dialog box titled "Match Single Address". The dialog has a blue title bar and a light gray background. It contains four text input fields: "Address", "City", "State", and "Zip Code". The "Address" field is the largest, followed by "City", "Zip Code", and "State" is the smallest. At the bottom of the dialog, there are two buttons: "Match" and "Cancel".

Other functionality of GeoVan includes adding layers, removing the active layer, changing a layer's appearance, zooming in, zooming out, panning, zooming to full extent, identifying, box selection, showing selected records, clearing selection, measuring, and plotting layout.

GeoVan was developed in MapObjects and Visual Basic. We had several concerns when we choose the technologies: the users of GeoVan have no GIS knowledge and experience and they have limited time for application training; the goal of the application is straightforward – locate addresses, and it doesn't need advanced map generating functions; and since it is deployed to users' laptops, it should be as lightweight as possible. All those concerns led to the selection of MapObjects, a collection of embeddable GIS components used to build specialized solutions.

Application 2: VIP Route Maker

After a vanpool group is created, the primary van driver of the group will fill out a Vanpool Route Information Sheet. The sheet contains the start and end locations and times of the vanpool route, pickup locations, and other information. The sheet is kept on file in Vanpool Department.

VIP Route Maker is developed to convert the paper record to digital format. Pace's vanpool administration staff first uses this tool to enter the information into an Oracle database; our GIS services staff then creates the route shape based on the description.

The final product from VIP Route Maker is a VIP Route featureclass stored in our enterprise GIS database server, an ArcSDE database for Oracle relational database management system.

VIP Route Maker is also developed in MapObjects and Visual Basic because its goals are very specific and functions are focused.

The illustration below is a sample of Vanpool Route Information Sheet.

Vanpool Route Information Sheet

Van Number 9999 Vanpool Number 999 Work Start Time 6:30
Driver Name John Smith Work End Time 4:00
Origin City Guenee Company Smith & Associates
Destination City Deerfield Destination County Cook

Miles from driver's home to first pick-up point (Deadhead Miles one way): 5 miles
(If deadhead miles exceeds 10 miles one way, mileage in excess of 10 miles one way will be added to the daily rider round trip miles to determine monthly riders fares.)

Please note the name of the pick-up locations (i.e., Wal-Mart, Woodfield Mall, St. Joseph's Church):

Location of 1st pick-up point: Guenee Mills Parking lot Guenee
City

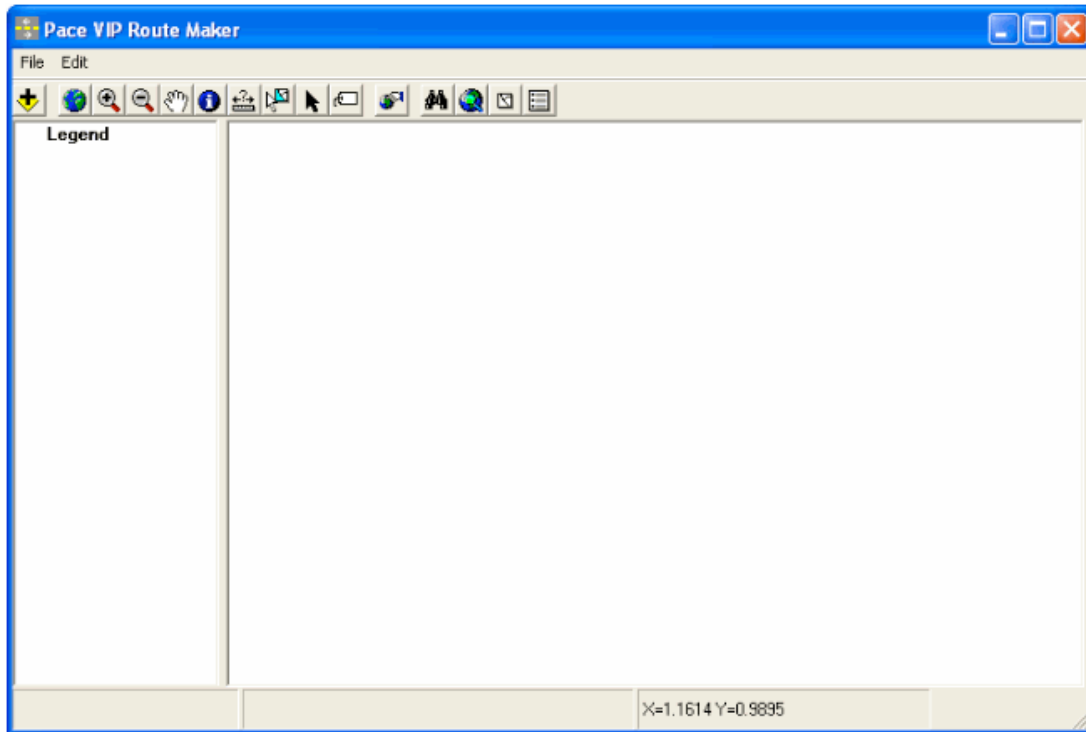
Location of 2nd pick-up point: _____
City

Location of 3rd pick-up point: _____
City

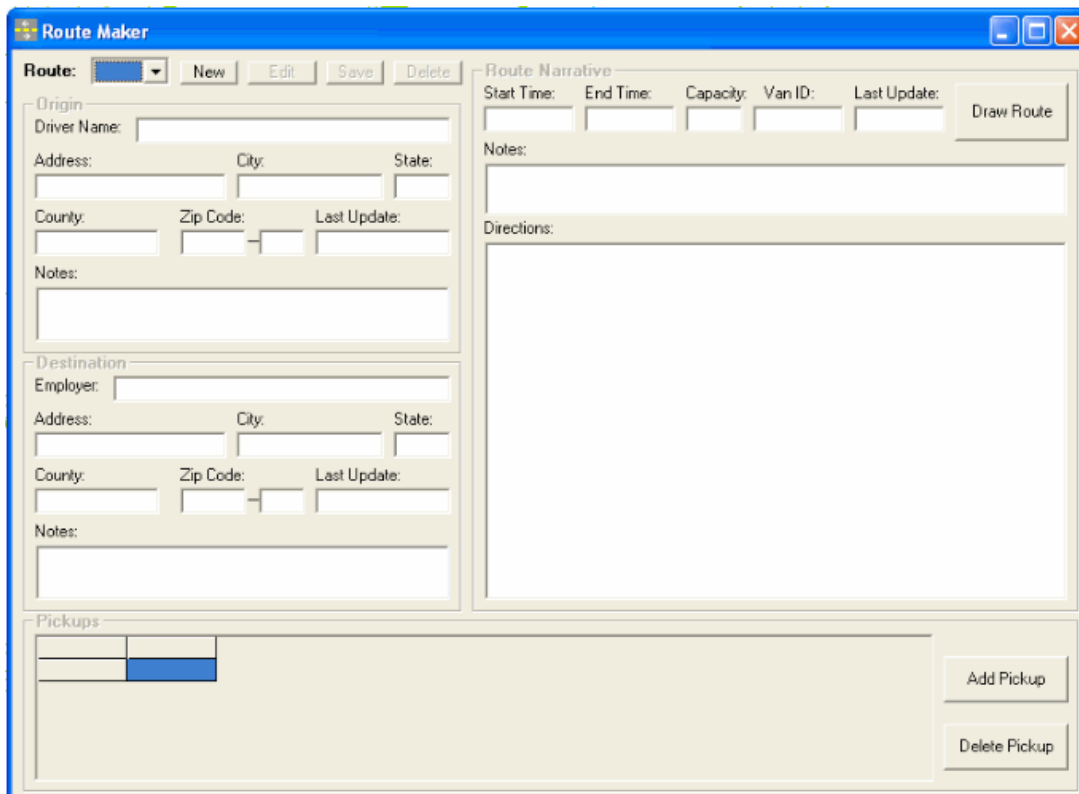
Proposed vanpool route (Please be specific): We depart from Guenee Mills and get on the tollway 94 south and ~~get on the tollway~~ get off at Lake Cook Rd. at drop off 1 person at ~~then we take which is across the street from Besta.~~ Because there isn't a Northbound ramp on Lake Cook Rd. to get on 94 North when we are going home. I take Saunders to Reinwoods road then go on Halfday Rd (RT. 22) to get on the tollway 94 North then we get off at Grand Ave West (RT. 132) to Guenee Mills Parking lot.

Heavy congestion, road repairs or weather conditions may require occasional deviations from the above route. Notify the Vanpool Office if the route deviations occur for an extended period of time.

The screenshot below shows the main interface of VIP Route Maker.



From File, choose Edit VIP Route, the main interface for editing will show as illustrated below.



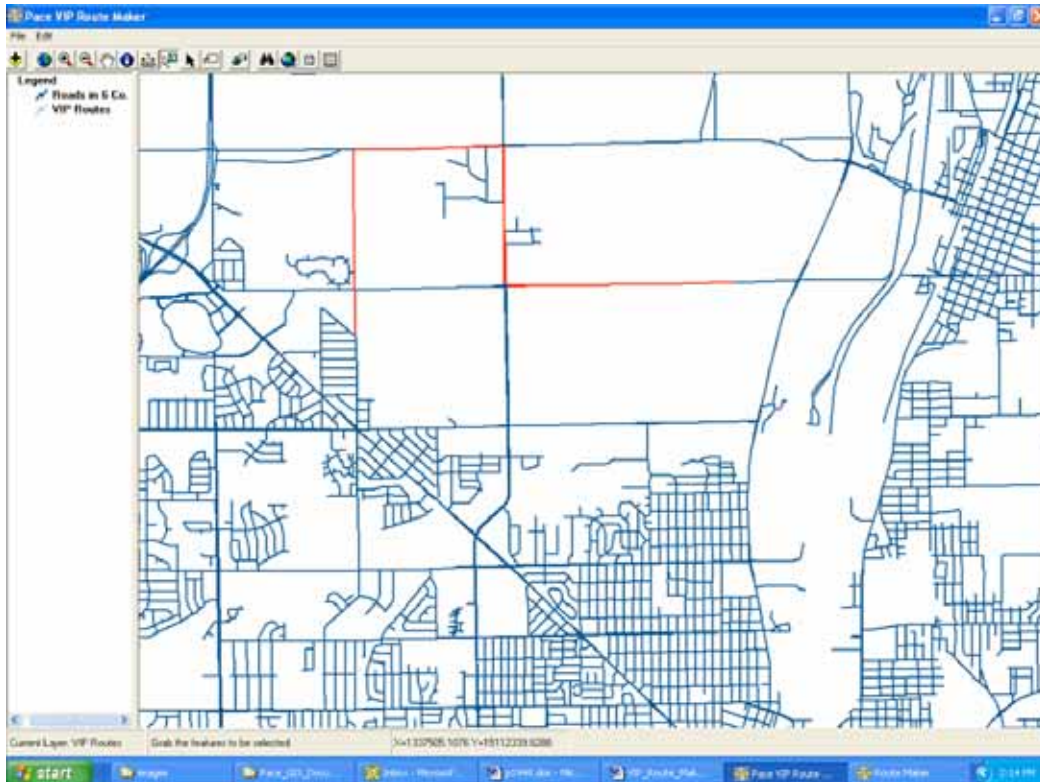
To use VIP Route Maker, vanpool administration staff, who has no GIS experience and training, will complete the data entry for each Vanpool Route Information Sheet.

The following screenshot is the data entry for the sample Vanpool Route Information Sheet shown earlier.

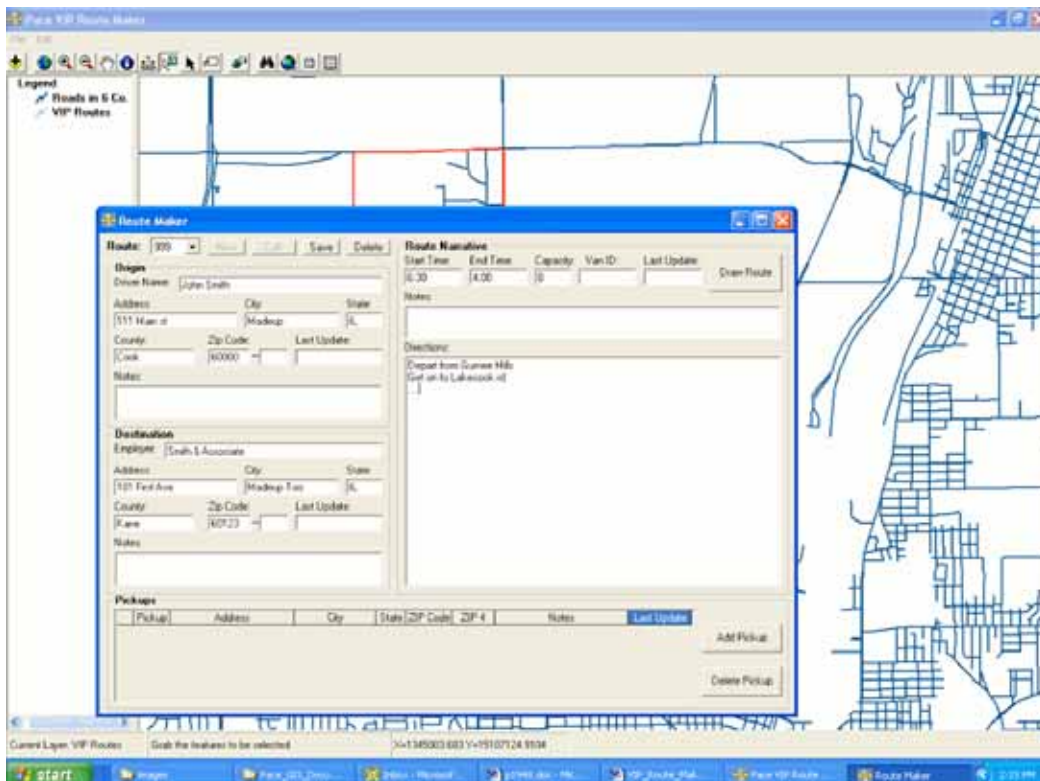
The screenshot shows the 'Route Maker' application window. The interface is divided into several sections:

- Route:** A dropdown menu showing '999' and buttons for 'New', 'Edit', 'Save', and 'Delete'.
- Origin:** Fields for Driver Name (John Smith), Address (111 Main st), City (Madeup), State (IL), County (Cook), and Zip Code (60000).
- Destination:** Fields for Employer (Smith & Associate), Address (101 First Ave), City (Madeup Too), State (IL), County (Kane), and Zip Code (60123).
- Route Narrative:** Fields for Start Time (6:30), End Time (4:00), Capacity (8), Van ID, and Last Update. A 'Draw Route' button is circled in red.
- Directions:** A text box containing the text: 'Depart from Gurnee Mills', 'Get on to Lakecook rd', and '...'. This box is outlined in red.
- Pickups:** A table with columns: Pickup, Address, City, State, ZIP Code, ZIP 4, Notes, and Last Update. Below the table are 'Add Pickup' and 'Delete Pickup' buttons.

After the data entry is done, GIS services staff will select road segments, as indicated in the Directions box, and hit the Draw Route button. This process is illustrated below.



1. Select road segments as written in the Directions box.



2. Hit Draw Route button, the application will take the selected road segments, merge them as the new Vanpool route, and save it to ArcSDE Oracle database.

Application 3: WebVan

WebVan is developed to provide potential individual vanpool participants with tools to search Pace's vanpool routes. A user can search for existing vanpool routes that go by his/her home and work places, or search routes going from his/her home city to work city, or simply view a map of all Pace's existing vanpool routes without searching.

WebVan is an Internet mapping application developed with ArcIMS with ActiveX connector, ASP, VBScript, JavaScript, and HTML.

The following screenshot is the entry page if WebVan with the three options.

The screenshot shows a web browser window titled "Vanpool Searching - Microsoft Internet Explorer". The address bar shows "http://www.pacebus.com/webvan/index.asp". The page header includes the Pace logo and navigation links: "Pace Store | Employment | Site Map | Customer Service | Transit Links". Below the header are tabs for "Schedules/Maps", "Programs", "News & Events", "About Pace", and "Business Opportunities".

The main content area has a breadcrumb trail: "Home » Vanpool » WebVan". It features three search options, each with a "CLICK HERE" link:

- Search for a vanpool based on addresses for origin and destination:**
 - Home:** Address or Intersection, City, State, Zip Code.
 - Work:** Address or Intersection, City, State, Zip Code.
 - Walking distance no more than miles.
- Search for a vanpool based on origin and destination municipalities:**
 - Home City:**
 - Work City:**
- Display a map with all vanpool routes. (Do not search for a specific route.)**

A blue "SUBMIT" button is located at the bottom left. At the bottom right, there is contact information: "You can also join an existing vanpool by emailing us at vp_rpd@pacebus.com. For more information or to form a new vanpool group email vp_astad@pacebus.com".

The following illustration provides an example of the first option, search for a vanpool based on addresses for origin and destination.

CLICK HERE Search for a vanpool based on addresses for origin and destination

Home

Address or Intersection
Randall rd & Big Timber rd

City
Elgin

State Zip Code
IL

Work

Address or Intersection
550 W Algonquin rd

City
Arlington Heights

State Zip Code
IL 60005

Walking distance no more than miles

CLICK HERE Search for a vanpool based on origin and destination municipalities

Home City

Work City

CLICK HERE Display a map with all vanpool routes. (Do not search for a specific route.)

SUBMIT

You can also join an existing vanpool by emailing us at vip.rep@pacebus.com
For more information or to form a new vanpool group email vip.sales@pacebus.com

Check this option, enter home and work addresses, and a walking distance, and hit Submit



Microsoft Internet Explorer

Home | Search | Favorites | Media | ...

pace | Pace Store | Employment | Site Map | Customer Service | Transit Links

Schedules/Maps | Programs | News & Events | About Pace | Business Opportunities

Pace Home > Vanpool > View/View

Map Manipulation Tools: Zoom In, Zoom Out, Reposition, Reset Map

Layer Visibility Control: Vanpool Routes (checked), Highways, Major Roads, Pace Park-n-Ride Lots, Cities

Map showing vanpool routes highlighted in red across the Elgin and Arlington Heights area.

Query: Destination = Enter Show All

Highlight: Vanpool Number = Enter

VANPOOL #	ORIGIN CITY	DESTINATION CITY	CAPACITY	WORK BEGN	WORK END
309	Huntley	Des Plaines	6	0600	1530
419	Carpentersville	Des Plaines	6	0600	1630
696	Balundere	Des Plaines	10	0600	1630
978	Marengo	Elk Grove Village	14	0615	1445

Four existing vanpool routes were found. They are highlighted in red on the map; their records are displayed in the table below the map.

For the second option, search for a vanpool based on origin and destination cities, an example is provided below.

[CLICK HERE](#) Search for a vanpool based on addresses for origin and destination

Home

Address or Intersection

City

State Zip Code

Work

Address or Intersection

City

State Zip Code

Walking distance no more than miles

[CLICK HERE](#) Search for a vanpool based on origin and destination municipalities

Home City

Work City

[CLICK HERE](#) Display a map with all vanpool routes. (Do not search for a specific route.)



[Face Home](#) > [Vanpool](#) > [WebVans](#)
[Back to last page](#) || [Help](#)

Map Manipulation Tools

Zoom In Factor

Zoom Out

Reposition

Reset Map

Layer Visibility Control

Vanpool Routes

Vanpool Route

Highways

Interstate

US Highway

State Highway

Major Roads

Major Road

Pace Park-n-Ride Lots

Pace Park-n-Ride Lot

Cities

City

Refresh Map

Query Destination = **Enter** **Show All**

Highlight Vanpool Number = **Enter**

VANPOOL #	ORIGIN_CITY	DESTINATION_CITY	CAPACITY	WORK_BEGIN	WORK_END
896	Chicago	Arlington Heights	6	0830	1700

The third option, displays a map with all vanpool routes (Do not search for a specific route), is illustrated here:

[CLICK HERE](#) Search for a vanpool based on addresses for origin and destination

Home

Address or Intersection

City

State Zip Code

Work

Address or Intersection

City

State Zip Code

Walking distance no more than miles

[CLICK HERE](#) Search for a vanpool based on origin and destination municipalities

Home City

Work City

[CLICK HERE](#) Display a map with all vanpool routes. (Do not search for a specific route.)

SUBMIT



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Map Manipulation Tools

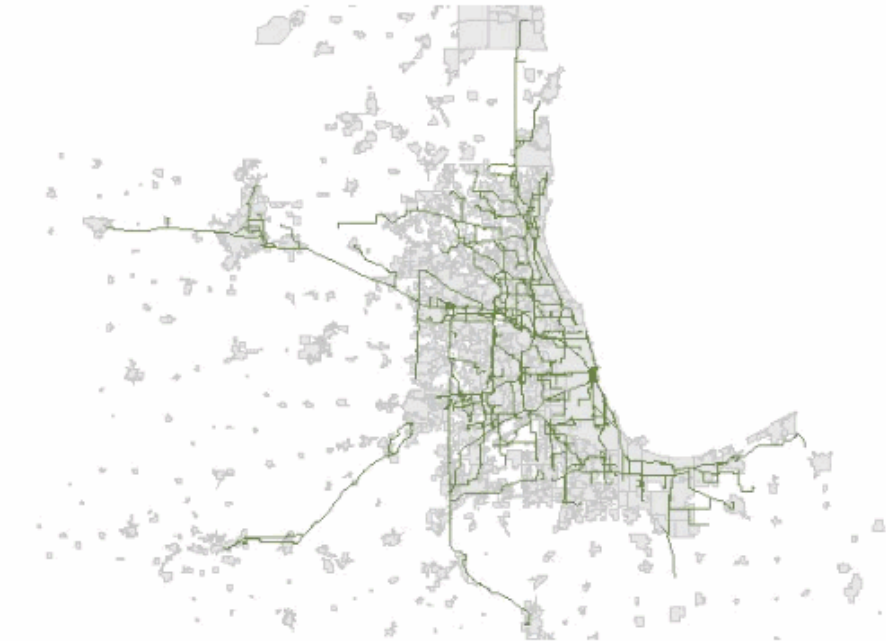
- Zoom In Factor
- Zoom Out
- Reposition

Reset Map

Layer Visibility Control

- Vanpool Routes
- Vanpool Route
- Highways
- Interstate
- US Highway
- State Highway
- Major Roads
- Major Road
- Pace Park-n-Ride Lots
- Pace Park-n-Ride Lot
- Cities
- City

Refresh Map



Query Destination = **Enter**

Show All

Highlight Vanpool Number = **Enter**

No matter which option you choose, the following functionalities are always available:

1. Map Manipulation Tools

- Zoom In – Check the checkbox beside Zoom In, position the pointer over the map and left-click to decrease the scale and see a smaller area.
- Zoom Out – Check the checkbox beside Zoom Out, position the pointer over the map, and left-click to increase the scale and see a larger area.
- Reposition – Check the checkbox beside Reposition, left-click on the map and the map will center on the point you just click.

2. Layer Visibility Control

These controls allow you to add and remove different layers of information to and from the map.

Data which can be added/removed from the routes includes:

- Vanpool Routes
- Highways, including Interstates, U.S. Highways, State Highways, and ramps
- Major Roads
- Pace Park-n-Ride Lots
- Cities

Check and uncheck the boxes as desired, then click on the Refresh Map button to add or remove layer(s) of information. Greater levels of detail are more easily visible when the map is zoomed-in, displaying a relatively small area.

3. Query

Use this tool to see detailed information about all Vanpools in a certain destination or origin municipality, or information about one particular Vanpool. Select destination, origin, or vanpool number using the pull-down menu, enter the information, and then click Enter. The results of this query are shown in the table below the map.

4. Highlight

This tool makes it easy to see one particular Vanpool route on the map. To highlight a route, enter the Vanpool number and press Enter. The Vanpool route is highlighted on the map in yellow.

The illustration below shows an example of query and highlight functions.

Query = ← 1. Choose Destination, enter a city name, and hit enter

Highlight Vanpool Number =

Query: Destination = Arlington Heights

VANPOOL_#	WORK_BEGIN	WORK_END	ORIGIN_CITY	DESTINATION_CITY	CAPACITY
342	0800	1630	Barrington	Arlington Heights	6
463	0730	1600	Mundelein	Arlington Heights	6
834	0800	1630	Plainfield	Arlington Heights	6
895	0800	1630	South Holland	Arlington Heights	11

2. Scroll down to see the whole list of vanpool with Arlington Heights as destination city.

Highlight Vanpool Number = ← 3. If interested in one of them, enter the vanpool # in highlight box and hit Enter

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[Back to last page](#) || [Help](#)

Map Manipulation Tools

- Zoom In
- Zoom Out
- Reposition

Reset Map

Layer Visibility Control

- Vanpool Routes
 - Vanpool Route
- Highways
 - Interstate
 - US Highway
 - State Highway
- Major Roads
 - Major Road
- Pace Park-n-Ride Lots
 - Pace Park-n-Ride Lot
- Cities
 - City

Refresh Map

4. Vanpool Route with Vanpool # 342 is highlighted in yellow on the map

Query =

Highlight Vanpool Number =

5. Show All

Click on the Show All button, a table with all the existing Pace vanpool route information will show below the map, at the same place where the query results show.

WebVan has been modified multiple times since it was developed. One of the changes is the removal of all pop-up windows. For example, in an older version of WebVan, when Query function is used, after the user enters the query criteria and hits Enter, a new window will pop up with the query results. In the new version of WebVan, a scrolling list, as illustrated on the last page, will show below the map. The reason for this change is the increasing number of users with their pop-up blockers turned on.

Application 4: VIP Data Backup Tool

VIP Data Backup Tool is developed for Pace's GIS services staff to quickly and easily backup the VIP route featureclass and save the backup in a historical dataset inside the ArcSDE Oracle Geodatabase.

VIP Data Backup Tool is an ArcGIS extension (DLL) developed in ArcObjects and Visual Basic. The picture below shows its interface.



Conclusion

Custom GIS applications can be very focused and specific in achieving goals. The paper introduces Pace's Vanpool program and describes four custom GIS applications that are used to help vanpool marketing and management. The success of the four applications shows the increasing popularity in adopting GIS and computer programming technologies in public transportation industry. Our success and experiences will definitely opens a wider GIS application and brings more GIS programming challenges.

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