Optimizing Institutional Transit
Using GIS Tools

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Purpose

- VHB provides many of our institutional clients with transit-planning services as part of larger master planning efforts and stand-alone optimization studies. These studies fit into our company’s commitment to fulfilling a role in sustainable planning for urban areas.

- GIS software possess tools that best enable us to quickly map, analyze, and present the findings of our studies to relevant stakeholders.
Project Approach

Divider slides

There are divider slide color options available in most of our primary and accent colors from the corporate color palette. You can apply these by simply going to the "slide layout" menu and choosing the color you want.
What is “Institutional Transit”?

- Often only 1 constituent base
- Term can apply to universities or employers at a corporate campus
- May have funding combined with surrounding jurisdiction
- Multiple types of end users

- Used for a number of purposes –
  - TDM for either
    - Carbon Dioxide/ other GHG emissions offset
    - Limited parking capacity
  - ADA accessibility
  - Greater mobility for transportation-limited populations

- Like municipal transit - vocal champions and critics
Differences for Institutional Transit

- Different capital constraints/streams
- Hard to develop long-term riders
- Fundamentally different schedules for employees/staff and students
- Universities develop and change quickly, and transit service must be quick to adapt to those changes.
- Institutional transit routes may be altered frequently for special events
- Can get detailed data on riders/potential ridership, but may not be QUALITY data – no Farebox information
- Not in the GTFS – frequently closed to general public
How do we define “Optimizing” Transit?

• VHB has been contracted to optimize transit service for a number of colleges and universities as part of commitment to fulfilling a role in sustainable planning for urban areas.

• Optimization for us means:
  – The most cost-effective means of providing the highest level of service possible to the greatest number of constituents, given the established constraints of the institution.
  – May involve changing route geography, stop prioritization, scheduling, frequency, bus type (capacity), adding connections to other transit resources
  – All recommendations stem from analysis of verifiable data
Reasons Institutions seek optimization

- Need to view transit through stakeholder lenses –
  - This isn’t just redrawing routes to hit the greatest number of census blocks with sub-median household-income, 0-1 car households, at least 1 worker over the age of 16, within 3-15 miles of a popular destination, located within ¼ mile walking distance of an underserved corridor.

  - Riders and potential riders may want schedule shifts, frequency shifts, or route changes to better suit their needs

  - Administrators may want a cost reduction, which may mean route or schedule contraction, route combination, or increased fares

  - An operating agency may desire optimization in the form of better driver scheduling or fewer deadhead miles from a bus barn
The VHB Approach

- Optimize transit to support integrated master plans – adequate resources for
  - Parking
  - Pedestrians
  - Bicycles
  - Traditional Transit
VHB Approach

- Identify existing route structures
- Quantify existing demand
- Isolate origins and destinations of all system riders
- Determine reasons for demand
- Classify and analyze different types of rider
- Design routes, schedules, and headways that meet those needs
- Rank rider priorities for key decision makers
- Present menu of optimized routes that meet financial/political constraints
Case Studies

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Princeton University - TigerTransit

- Problem identification:
  - Shuttle system designed for multiple off-campus graduate housing complexes needed to respond to new locations
  - Geographic constraints had most on-campus employees and staff using shuttle system to get to their offices/meetings
  - Administration balancing transit costs, while also implementing a greenhouse gas reduction strategy for employee TDM
  - Lack of boarding and alighting data from transit provider.
  - Stakeholders acknowledge lack of a transit culture.
Princeton University - TigerTransit

- Solution:
  - In-depth on-board survey effort to find both boarding and alighting bus stops, as well as true trip origin/destination information, and perceptions of the service
  
  - Survey also identified three distinct rider types associated with campus affiliations – employees and staff, graduate students, and undergraduates
  
  - We eliminated significant route duplication, and designed routes for specific rider groups, with schedules and headways that fit their needs
  
  - Optimizing fleet structure for specific route ridership volumes helped decrease capital costs.
  
  - Improve connections to NJ Transit rail and bus systems for commuting populations
Origin-Destination Pairings
Princeton Transit Survey
Ohio State University- CABS

- Problem Identification
  - Large, divided campus with East and West sections, major barriers in middle
  - Desire to make core of campus more pedestrian-friendly
  - Building large hospital addition to medical college, eliminating thousands of parking spaces adjacent to the hospital site
  - Want connection to existing local transit systems (COTA)
  - Expectation for high-frequency transit irrespective of time
  - Transit needs to have capacity to be modified for massive special events (football games)
  - Desire to accommodate the one-seat ride - avoid route duplication
  - Reduce conflict between cars and pedestrians/bicycles
  - Lack of a transit culture
Ohio State University - CABS

- Solutions:
  - Creation of multiple transit hubs at north and south end of East Campus.
  - Shorten route distances by offering routes targeted to certain populations – students v. employees v. medical staff
  - Integrated city transit into transit station concept
  - Designed routes so special events didn’t negatively impact the ability of medical staff to park and get to work
  - Recommendations to improve infrastructure – bus stop amenities, ITS boards
Existing CABS Board/Alight Volumes
COTA Connections Concept
George Mason University – Mason Shuttles

- Problem Identification:
  - Large commuter student body spread throughout region
  - Millennial mode-choice shifts result in fewer cars on campus and more demand for transit
  - Need to improve connections with other municipal (CUE), and regional (WMATA bus and rail, VRE) systems
  - Questions about duplication of services, perception of inefficiency
  - Equitable financial contribution/partnership relationship with municipal bus service
  - Concerns about effects of special events taxing service capacity
George Mason University – Mason Shuttles

- Solutions:
  - Online survey of students/employees and municipal populations for views on Mason/City transit
  - On-board survey of existing riding volumes on both university/municipal buses for preferences/riding patterns
  - Recommended limited changing of routes, marketing programs to target lack of rider system awareness
  - Developed formula to respond to equitable financial contribution of university to city question
Requested Destinations by Proximal Density

CUE Routes and George Mason Shuttle Routes

0 1 2 Miles

Density of Requested Destinations

GMU Boundary
City of Fairfax
Metrorail Orange
GMU Shuttle Routes
CUE Routes
Requested Destinations
Transit Opportunities – Bulk of Needs Met

Existing Transit Opportunities
WMATA and Fairfax Connector Routes
High Household Density Requested Destinations
Liberty University – Liberty Transit

- Problem Identification:
  - Massive growth in student enrollment over past 15 years
  - Challenging geography to create walkable campus – topography, campus design, and roadway network
  - Weekly large-scale special events (Convocation)
  - Satellite parking
  - Service provided through a combination of public transit and university.
Liberty University – Liberty Transit

- Solutions:
  - Work with campus architects to create more walkable, residential zones within the campus footprint
  - Sunsetting routes as off-campus residential structures come offline
  - Identifying underperforming routes
  - Identifying stop pairings that need more direct service
  - Fleet recommendations to accommodate demand
Liberty University – Liberty Transit

- GIS helped us:
  - Visualize Transit Load factors
  - Plot Origin/Destination Pairs
  - Visualize Parking Demand
  - Analyze Route Timings
  - Pursue Alternate Routings given limited and changing street network
Future Data Integration
Future Data Integration

- ITS data have gotten better to the point where the stop-level data is available through the providers, and the ridership can make better use of the systems.
- Long-term citywide trip surveys using wearable GPS technology are informing researchers about not just journey to work data, but all trip information, along with complex route/mode/temporal-choice modeling.
- BRT and personal light rail concepts are going to improve transit’s time advantages over SOV’s in urban areas.
- Integrated multi-modal networks need to become the new standard for transit planning as technology improves accessibility.
- GIS as a technology is positioned to assist in analyzing the data and visualizing the planning process associated with these developing technologies.