UNIVERSITY of WASHINGTON

Explore : An Attraction Search Tool for Transit Trip Planning

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ABSTRACT

Publishing information about transit stops, routes, schedules, and status in a variety of formats is essential to improving accessibility and satisfaction of a system's riders.

A key staple of transit info systems is the trip planner, which is useful if both origin and destination are known. However, sometimes accessibility of a location via transit is more important than the actual destination.

We developed an Attractions Search Tool that uses an underlying trip planner to search online databases of local restaurants, shopping, parks and other amenities based on transit accessibility from the user's origin.

The ability to perform such a search by attraction type rather than specific destination can be a powerful aid to a traveler with a need or desire to use public transportation.

Explore allows riders to choose their destinations based on transit accessibility, which can encourage transit use.

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BACKGROUND

•Trip planner is a staple of transit traveler information
•Use origin address , destination address & desired time frame to give possible trips

2002
30 web-based trip planners in US

2005-2006
Google Transit

Today
Almost every major US city has an online trip planner

TRANSIT AGENCY TRIP PLANNERS TODAY

•Most pre-trip info comes from internet

•Of 50 transit agencies with the highest unlinked passenger trips in US, trip planners NOW on all but one website as
  •Own version
  •Link to larger agency
  •Link to Google

•Current info still considered poor to average

•Some types of searches are not possible

Table 1 – Trip Planner capabilities for the 50 largest transit agencies in the US.

	Transit Agency	City	State	Trip Planner on Website	Google Transit
1	MTA New York City Transit	New York	NY	Yes	Yes
2	Chicago Transit Authority	Chicago	IL	Link to Google	Yes
3	Los Angeles Co. MTA	Los Angeles	CA	Yes	Yes*
4	Washington MATA	Washington	DC	Yes	No
5	Massachusetts Bay TA	Boston	MA	Yes	Yes
6	Southeastern Pennsylvania TA	Philadelphia	PA	Yes	Yes*
7	New Jersey Transit Corp.	Newark	NJ	Yes	Yes
8	San Francisco Municipal Rail	San Francisco	CA	Yes	Yes
9	Metro. Atlanta Rapid TA	Atlanta	GA	Yes	Yes
10	King County Metro	Seattle	WA	Yes	Yes
11	Miami-Dade Transit	Miami	FL	Link to Google	Yes
12	MTA Bus Company	New York	NY	MTA NYC	Yes
13	San Francisco Bay Area RTD	Oakland	CA	Yes	Yes
14	Maryland Transit Admin.	Baltimore	MD	Link to Google	Yes
15	MTA Long Island Rail Road	Jamaica	NY	MTA NYC	Yes
16	MTA of Harris County	Houston	TX	Yes	Yes
17	Tri-County MTD	Portland	OR	Yes	Yes
18	Denver RTD	Denver	CO	Yes	Yes
19	Port Authority Trans-Hudson	Jersey City	NJ	NJ Transit	Yes
20	San Diego MTS	San Diego	CA	Yes	Yes
21	MTA Metro-North Railroad	New York	NY	MTA NYC	Yes
22	Metro Transit	Minneapolis	MN	Yes	Yes
23	METRA	Chicago	IL	Link to Google	Yes
24	Dallas Area Rapid Transit	Dallas	TX	Yes	Yes
25	City and Co. of Honolulu DOT	Honolulu	HI	Link to Google	Yes
26	Orange County TA	Orange	CA	Yes	Yes
27	Port Authority of Allegheny Co.	Pittsburgh	PA	Yes	Yes
28	Alameda-Contra Costa TD	Oakland	CA	511 SF Bay	Yes
29	RTC of Southern Nevada	Las Vegas	NV	Link to Google	Yes
30	The Greater Cleveland RTA	Cleveland	OH	Yes	Yes
31	Bi-State Development Agency	St. Louis	MO	Yes	Yes*
32	Valley Metro	Phoenix	AZ	Yes	No
33	Milwaukee County Transit	Milwaukee	WI	Link to Google	Yes
34	Santa Clara Valley TA	San Jose	CA	Link to Google	Yes
35	Broward County Office Trans	Pompano Beach	FL	Link to Google	Yes
36	VIA Metropolitan Transit	San Antonio	TX	Yes	Yes*
37	Utah Transit Authority	Salt Lake City	UT	Yes	Yes*
38	Pace - Suburban Bus Division	Arlington Hts	IL	Link to RTA	No
39	City of Detroit DOT	Detroit	MI	Link to Google	Yes
40	Capital MTA	Austin	TX	Yes	Yes
41	MTA Long Island Bus	Garden City	NY	MTA NYC	Yes
42	Sacramento RTD	Sacramento	CA	Yes	Yes
43	Westchester County Bee-Line	Mount Vernon	NY	Link Trips123	No
44	DOT and Public Works	San Juan	PR	No	No
45	City of Los Angeles DOT	Los Angeles	CA	On LA Metro	No
46	Ride-On Montgomery Co. Transit	Rockville	MD	On WMATA	Yes**
47	Long Beach Transit	Long Beach	CA	Link LA Metro	Yes**
48	Southwest Ohio RTA	Cincinnati	OH	Yes	No
49	Central Florida RTA	Orlando	FL	Yes	No
50	Niagara Frontier TA	Buffalo	NY	Yes	Yes

* = Added since research initially conducted in April 2009
** = Added since first version of TRB paper written in July 2009

RECENT ENHANCEMENTS TO TRIP PLANNERS

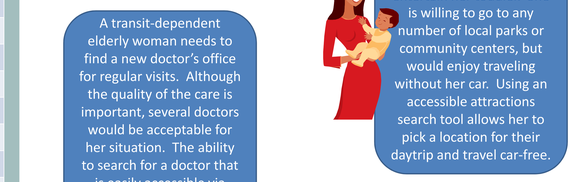
•Added input capabilities
  •Maximum walk distance, maximum number of transfers
  •ADA accessibility needs
  •Preferred mode of travel
  •Input by intersection, stop or station, or landmark.
  •Click on a map to add an address (SEPTA)
  •Develop a history of addresses or categories searched (UTA)
•Added output capabilities
  •Print, e-mail, download to a PDA
  •Return trip button
  •Text-message based trip planner (Dabnab)
  •Mobile trip planners (MTA NYC, BART)
  •Maps, station info, carbon saved, fare info, station advisories (BART)
•Mapping capabilities
  •Origin and destination address location (Cherry, Hickman, et al , Melbourne)
•Multi-agency and multi-modal integration
  •Feed from all agencies involved in the trip planner (Goroo - RTA Chicago)
  •Broker between agencies(Wisconsin)
  •Google transit, walk and car directions
  •Train, bus, drive and drive to bus with bike and parking availability to come (Goroo)
  •Cycling and walking (A-Train in Atlanta, London)
  •Coach, air and ferry services (Athens).

BEYOND THE SINGLE TRIP ORIGIN / DESTINATION PLANNER

•Personalized point to point schedules (MTA NYC, MUNI, KC Metro and Minneapolis)
•"Service in area" searches (routes in the area of a landmark or address)
  •Cannot provide information about potential destinations along the reachable routes
•"Search Nearby" tool (Google) – attractions near address
  •May still involve several searches to find transit accessible destination

ONE BUS AWAY EXPLORE TOOL

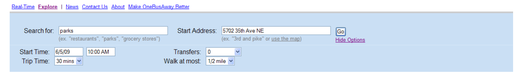
•Typical trip planners work if destination is known.
•Sometimes accessibility of location via transit more important than actual destination



These searches would require typing in multiple destinations into a trip planner or consulting multiple paper schedules

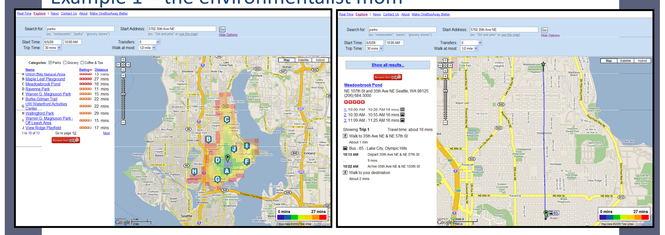
CURRENT VERSION OF EXPLORE

•Specifies starting point and category of destination
•Optional start time and date, max trip length, maxi transfers, maxi walk distance



Program executes by:
1. Computing total area reachable by transit given starting point and constraints
2. Local search within the reachable transit area for specified destination types

Example 1 – the environmentalist mom



1. FINDING THE AREA REACHABLE BY TRANSIT

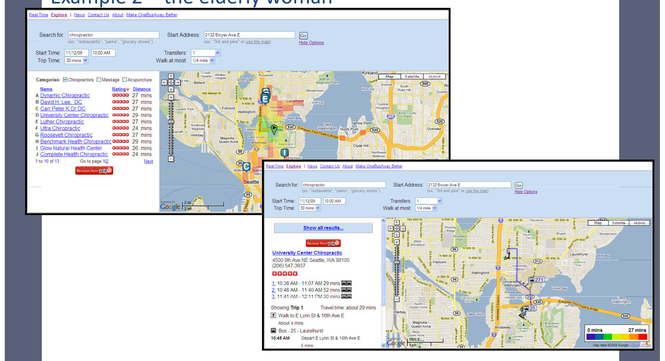
•Search for set of all transit stops reachable using constraints
  •Fundamentally different from typical trip planner
  •Explore has no fixed destination
  •Efficient paths to ALL potential stops and destinations
•Dijkstra's graph search algorithm on a memory-resident street/sidewalk and transit network graph
  •Simulate all potential trips taken by rider from starting location
  •Advance each trip in parallel through time
  •Note if trip was the first trip to reach the stop
    •If so, continue modeling the trip
    •If not, prune the trip
  •Stop searching when the longest trips reach user-specified time window
•Optimization, full set of potential transit transfer points pre-computed offline
•Compute reachable stops for 20 minute window in 200 ms

2. FINDING AMENITIES WITHIN REACHABLE AREA

•Discretize reachable area into half-mile grid
•Grid cell included if it contains a reachable stop
•Search for local businesses and amenities specified
  •Beta uses Yelp (http://yelp.com) online database
  •Possible to use Google Local or Yahoo Local
•Check results against street/sidewalk network to ensure path exists and within travel time
•Avoid search results separated by non-walkable barrier (highway, water)

Beta version at http://onebusaway.org/explore/onebusaway/ using King County Metro data.

Example 2 – the elderly woman



NEXT STEPS FOR EXPLORE

•Enhancements
  •Details about bus frequency and return trip frequency and exceptions
  •Details for new bus riders - side of the street to board, fare information
  •Support for Yahoo and Google Search
  •Features including print button, store a search
•Ability to connect a second trip to the first (dinner and a movie)
•Link to the real-time information one OneBusAway
•Additional OneBusAway tools coming

IMPLICATIONS AND FUTURE RESEARCH

•One of many possible online search tools to make transit more easily accessible
•Goal of One Bus Away project to implement tools to make transit easier to use
•One Bus Away is an open-source transit traveler information system
  •Transit agencies and developers can access the code and use it themselves
  •Only possible with aid of transit agencies that make their data available for free