

Update and Discussion of Future Broadway Corridor High Capacity Transit Improvements

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Purpose of Presentation

To provide more information to the Broadway Citizens Task Force (CTF) for them to consider in determining how to accommodate HCT on Broadway during development of corridor concepts, including:

- Update the CTF on rough initial Bus Rapid Transit (BRT) modeling results
- Provide BRT design concept and best practices information for consideration during this Broadway segment's planning & design process



Presentation Outline

- Brief Review of Current Bus Transit Services
- Brief Review of PAG's High Capacity Transit Plan (HCTP) Recommendations
- Overview of Bus Rapid Transit (BRT) and BRT Elements
- Results from Initial BRT Conceptual Analysis
- Considerations for How to Preserve the Opportunity to Implement Future HCT on Broadway

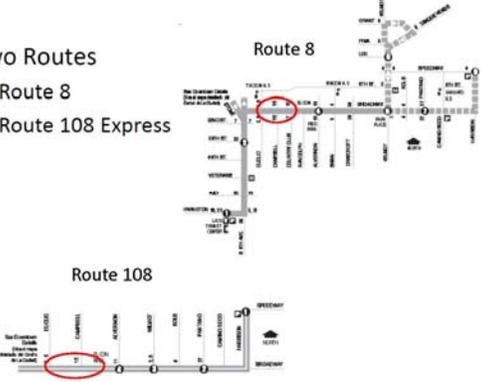


Brief Review of Current Bus Transit Service



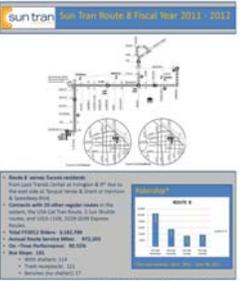
Current Transit on Broadway

- Two Routes
 - Route 8
 - Route 108 Express



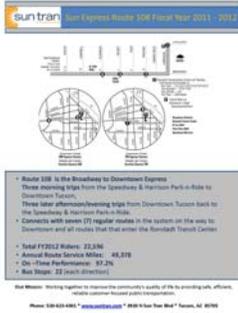
Current Transit on Broadway

- **Route 8**
 - Runs Broadway Blvd. & S. 6th Ave. every 15 mins.; Branches at Broadway & Wilmot, every 30 mins.
 - 161 Bus Stops
 - Highest ridership route in Sun Tran system
 - 3,182,789 million boardings, FY11-12
 - About 55% (1,733,666) boardings along Broadway Blvd.
 - About 9 % of total Sun Tran ridership



Current Transit on Broadway

- **Route 108 Express**
 - 3 trips in A.M.,
3 trips in P.M.
 - Limited stops, only
22 in each direction
 - 22,596 boardings, FY11-12
 - Performs at average of
Sun Express system
 - The only express route
with parallel Sun Tran
service along entire route



Brief Review of PAG's 2009 High Capacity Transit Plan Recommendations



2009 High Capacity Transit Plan Recommendations

- 2009 Plan completed by Pima Association of Governments
- Provides a financially unconstrained menu of options, to be implemented based on funding availability
 - High Capacity Transit (HCT)
 - High volume of passengers
 - Fast and convenient service
 - Types
 - Express Bus
 - Modern Streetcar
 - Bus Rapid Transit
 - Light Rail
 - Commuter Rail



2009 High Capacity Transit Plan Recommendations

- 2009 High Capacity Transit System Plan performed initial evaluations and identified priority corridors
 - Sixteen Initial Corridors Identified
 - Eight Selected Corridors for Evaluation:
 - Ridership
 - Right of Way Availability
 - Potential Capital and Operating Costs
 - Two Priority Corridors Identified:
 - Broadway Blvd.
 - 6th Avenue/Nogales Highway



2009 High Capacity Transit Plan Recommendations

- Identified Broadway Corridor for BRT
 - Favorable future ridership projections
 - 3,887 daily riders (~ 120,497 monthly ridership)
 - In 2011-2012 counts, this would be the 4th highest ridership route in the system
 - Existing bus lanes
 - Planned expansion
 - Relative low cost
 - Conducive to Transit-Oriented Development (TOD)
 - Serves transit-dependant populations



2009 High Capacity Transit Plan Recommendations

“There do not appear to be any constraints to implementing BRT service on Broadway Boulevard in the near term. In fact, the existing transit facilities within this corridor, including dedicated transit lanes and the upcoming transit priority signal timing upgrade, make implementation of BRT relatively straightforward.”

This statement is generally true of Broadway to the east of Alvernon, but within this Broadway: Euclid to Country Club project area, there are challenges.



Major Activity Centers Along Broadway





Broadway HCT Options

- Bus Rapid Transit in Near Term, 0-10 years



- Streetcar between Downtown and El Con Mall in Mid Term, 10 to 20 Years



- Light Rail in Long Term > 20 years



Overview of Bus Rapid Transit (BRT) and BRT Elements

BRT Spectrum & Related Capital Costs

BRT – “Lite” Swift BRT - Everett	“Hybrid” BRT Eugene EmX	Full BRT Orange Line - LA
\$2-5 million per mile*	\$5-10 million per mile*	\$10-30 million per mile*

Image credit: Viggiano and Gonsalves, Parsons Brinckerhoff

* Likely overestimates Broadway’s full cost, since much of the Right-of-Way on the corridor is already available.

BRT Spectrum

BRT Attribute	“Lite” Basic Implementation	“Hybrid” Intermediate Implementation	Full Full-Featured Implementation
Right-of-Way	Mixed Traffic	Designated/HOV/Barrier-Separated Lanes	Exclusive/Grade Separation
Stations	Improved Passenger Amenities	Enhanced Passenger Information & Fare Collection	Enhanced Loading
Service	Improved Service Frequency	Skip Stop & Express Service Options High Frequency & Reliability	Convenient Transfers
Route Structure	Single Route with Transfers, Color Coding	Multiple Route Operations with Transfer Facilities Integration with Regional Transit	One Seat Rides Transfer Reduction
Intelligent Transportation System	Signal Priority	Automated Passenger Information	Vehicle Location and System Surveillance

Bus Rapid Transit

“Bus Rapid Transit can best be described as a combination of facility, systems, and vehicle investments that **convert conventional bus services into a fixed-facility transit service**, greatly increasing their efficiency and effectiveness to the end user.”

Federal Transit Administration, Bus Rapid Transit Demonstration Program, December 2002.



BRT Benefits to Passengers

User Experience	Broad Benefits
<ul style="list-style-type: none"> • Reduced transit travel time • Increased trip reliability • Improved transit connections and more direct service • Decreased station stop dwell times and waiting times • Enhanced system identity • Increased travel comfort • Enhanced safety and security 	<ul style="list-style-type: none"> • Capital Cost Effectiveness • Operating Cost Efficiency • Transit-supportive land development • Environmental Quality

BRT Systems

- Started in Curitiba, Brazil in 1974
- Applied world wide in major urban areas
- 20 systems in U.S., 1 systems rated as silver and 4 bronze by Institute of Transportation and Development Policy *Bus Rapid Transit Around the World*



BRT Elements

- Running ways
- Stations
- Vehicles
- Fare Collection
- Intelligent Transportation Systems (ITS)
- Service Structure & Relationship to Existing Bus Transit
- Branding

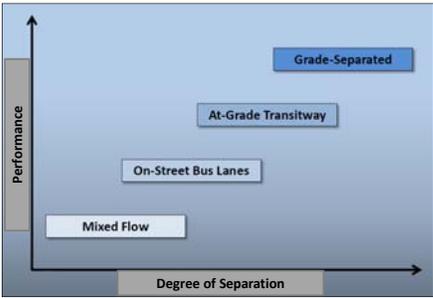


Running Way

- Defines BRT travel parameters
- Most critical component in determining system performance
- Important to public perception and identity
- Characteristics of running ways
 - Running way type
 - Running way markings
 - Running way guidance



Running Way Types



Running Way – Mixed Flow



Mixed Flow



Running Way – On Street Bus Lane



On-Street Bus Lanes



Running Way – At Grade Separated



Running Way – Grade Separated

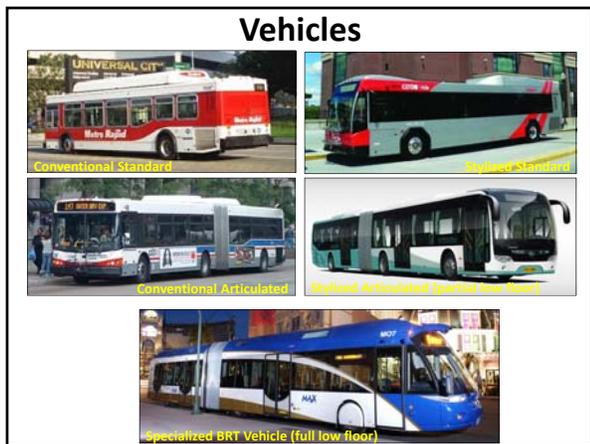


Stations

- Level boarding
- Real-time information
 - Arrival time
 - Route maps
 - Schedule
- Enhanced amenities
 - Increased comfort: shade, fare vending, other vending
 - Enhanced safety: lighting, emergency telephones, video cameras



Vehicles



Fare Collection

- On-Board, Driver-Validated System
- On-Board, Conductor-Validated System
- Off-Board Barrier System
- Off-Board, Barrier-Free, or Proof-of- Payment (POP) System
- Fare Medium
 - Cash
 - Magnetic Card
 - Smartcard



BROADWAY BOULEVARD

Intelligent Transportation Systems (ITS)

- Transit Vehicle Prioritization
- Intelligent Vehicle Systems
- Operations Management Systems
- Passenger Information Systems
- Safety and Security Systems



BROADWAY BOULEVARD

Service Structure & Relationship to Existing Bus Transit

- Route Length
- Route Structure
- Service Span
- Service Frequency
- Station Spacing
- Methods of Schedule Control



BROADWAY BOULEVARD

Branding

- Provides system identity
- Creates impression of high quality
- Helps boost ridership



Results from Initial BRT Conceptual Analysis



PAG Initial BRT Alternatives Analysis

- "Sketch level" analysis provides very rough information; helps to guide focus of next level of analysis
- Coordinated by Pima Association of Governments (PAG) staff, in conjunction with the PAG Transit Working Group
- Performed as part of a partnership between PAG and University of Arizona
- To evaluate potential time savings of BRT and impact on existing traffic



BRT Study Area

11-mile corridor

BRT Initial Alternatives Analysis Modeling

- Model Inputs
 - Overall lane configuration:
 - Indirect left turns assumed at every intersection
 - Hybrid & Outside-running lane model:
 - Includes center-running lane in project area (Euclid-C. Club)
 - Reintegrate with outside-running traffic lanes from C. Club to Columbus
 - Diamond Lanes between Columbus and Camino Seco
 - Back to mixed traffic between Camino Seco and Houghton

BRT Initial Alternatives Analysis Modeling

- Model Inputs
 - 12 stops in each direction (approx. every 1 - 1½ miles)
 - 2 stops in project area: Euclid and Campbell; next stop El Con Mall
 - Interaction with other traffic
 - Center-running only interact with traffic at intersections (possible conflicts if traffic backs up in indirect cue lane as buses would need to wait until vehicles clear)
 - No bus pullouts
 - Bus operation frequency

PAG Initial BRT Alternatives Analysis Alternatives Reviewed

- 1: Center Running Dedicated Lanes
 - Buses given signal priority and vehicle left-turns limited to major intersections
- 2: Outside Lane Mixed Traffic
 - Vehicles operate in diamond lanes or mixed traffic
 - Some use of BRT elements
- 3: Hybrid Center Lane and Outside Lane/Mixed Traffic
 - Dedicated median running way along Broadway Euclid to Country Club expansion
 - After Country Club, reintegrate with traffic and travel in diamond lanes to Columbus, travel in diamond lanes from Columbus to Camino Seco, then back to mixed to Houghton



PAG Initial BRT Alternatives Analysis Alternative 1

Center Running Dedicated Lanes

Buses given signal priority and vehicle left-turns limited to major intersections



Image credit: San Francisco County Transportation Authority

PAG Initial BRT Alternatives Analysis Alternative 2

Outside Lane Mixed Traffic

Vehicles operate in diamond lanes or mixed traffic; Some use of BRT elements



Image credit: San Francisco County Transportation Authority

PAG Initial BRT Alternatives Analysis Alternative 3

Hybrid Center Lane and Outside Lane/Mixed Traffic

- Dedicated median running way along Broadway Euclid to Country Club expansion
- After Country Club, reintegrate with traffic and travel in diamond lanes to Columbus, travel in diamond lanes from Columbus to Camino Seco, then back to mixed to Houghton






PAG Initial BRT Alternatives Analysis BRT Alternatives Descriptions

BRT Element	Alternative 1 Dedicated Center	Alternative 2 Outside Busway	Alternative 3 Mixed Center/Outside
Running Way	Dedicated Center	On-street Bus/Shared Turning	Mix Alt 1/Alt 2
Stations	Level Boarding/Real Time Info	Unique Bus Shelter	Mix Alt 1/Alt 2
Vehicles	Specialized BRT	Specialized Articulated	Specialized BRT
Fare Collection	Off-Board, Smart Card	On-Board, Smart Card	Mix Alt 1/Alt 2
Intelligent Transportation System (ITS)	Transit Priority/Cue Jump	None	Transit Priority/Cue Jump
Branding	Unique Branding	Unique Branding	Unique Branding

PAG Initial BRT Alternatives Analysis Travel Time Comparison

- Modeling assumed one-way trips between Ronstadt TC and Harrison
- Estimated total travel time based on departure time
- Travel times compared between alternatives and against current Route 8
- Route 8 trip times represent Ronstadt to/from Harrison only, no S. 6th or Wilmot legs






Summary of Results

- Broadway BRT ridership would be 4th highest in the region
- Separated/dedicated lanes provide the most significant time savings
- Hybrid model is an improvement over outside-running only lanes

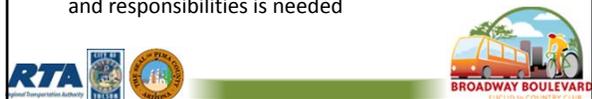


Considerations for How to Preserve the Opportunity to Implement Future HCT on Broadway



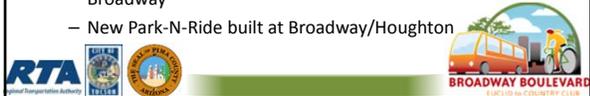
Realities of Implementing HCT on Broadway

- Additional planning and analysis required to select a preferred service system (costs money; takes time)
- Funding source(s) need to be identified and committed before HCT can be implemented
 - Federal funds require local match
 - Local funding requires finding funding streams
- Commitment to Operations and Maintenance Costs and responsibilities is needed



Realities of Implementing HCT on Broadway

- Schedule/timing of implementation is uncertain until key decisions made and funding identified
- Current activities are conducive to continued, accelerated BRT planning efforts:
 - Downtown development (and related construction, population, and jobs which has created congestion)
 - Convenient circulation once passengers are downtown, particularly once Streetcar is built
 - Additional population and jobs in other centers along Broadway
 - New Park-N-Ride built at Broadway/Houghton



Design Considerations for Broadway Planning & Design

- Broadway Roadway Project funding does not include money to implement BRT service, but can support facility construction that works today and could accommodate BRT in the future
 - Potential to use as cost match for Federal funding in the future
- RTA Plan includes funding for transit enhancements on Broadway, but not BRT
 - Supports incremental improvements of existing bus service, and potential future BRT



Design Considerations for Broadway Planning & Design

Bottom Line:
Allow enough Right-of-Way in improved roadway to accommodate future HCT (“preserve the opportunity”)



Design Considerations for Broadway Planning & Design

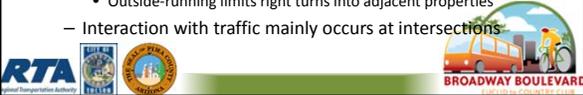
- **Relationship to Existing Local Bus Service**
 - BRT would operate at higher frequencies (for example, every 10-15 mins.)
 - Local bus could be reduced in frequency (for example, from every 10-15 mins. to every 30 mins.)
 - With pullouts for local bus service and reduced frequency of local bus service, vehicular flow can continue to move quickly



BROADWAY BOULEVARD

Design Considerations for Broadway Planning & Design

- **Dedicated lanes**
 - Center-running performed the best in the initial modeling (with 30% time-savings)
 - Center-running lanes assumed for project area for Hybrid model
 - Removal of traffic lanes in the future could be very challenging
 - Access to roadway's adjacent properties
 - Center-running limits left turns
 - Outside-running limits right turns into adjacent properties
 - Interaction with traffic mainly occurs at intersections



BROADWAY BOULEVARD

Design Considerations for Broadway Planning & Design

- **Intersection design**
 - Indirect left was assumed at all major intersections
 - Center-running lanes
 - No left turns permitted on any section
 - Transit stations built in center median, on far side of intersection



BROADWAY BOULEVARD

Design Considerations for Broadway Planning & Design

- **Station design**
 - Bus pullouts are better for vehicular flow, NOT transit
 - Relationship to existing bus transit stops
 - Platforms
 - Bike lanes



LA Metro Rapid: Incremental BRT

- Simple route layout: easy to find/use
- Frequent: 3-10 minutes during peak
- Fewer stops: ¼ mile apart
- Level boarding (LB buses speed-up dwell times)
- Enhanced stations: maps, lighting, canopies, "Next Bus" displays
- Same fare
- Minimal investment:
 - Signal priority
 - Passenger information
 - Strong branding (buses, stations etc.)



Results after demonstration:

- 23-29% reduction in travel times
- 38-42% increase in riders/weekday
- 1/3 of total choice riders, Same cost

*Cliff Henke, PB TR&S, Inc.

Next Steps for PAG and COT for Transit Improvements/Enhancements

- Utilize results from Comprehensive Operational Analysis currently underway to identify opportunities for existing enhancements and/or BRT system funding
 - Incremental system enhancements for bus transit overall
 - Potential local funding of incremental BRT implementation
- Pursue initiating an application for the Federal Small Starts Program funding program
 - Alternatives analysis (would look at BRT, Streetcar extension, and Light Rail Transit)
 - Efforts to commence sometime after SunLinks (Streetcar) is operational



Thank you

Questions?