Bay Area System Plan for a Regional Express Bus Service

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Overview of Study

- Caltrans-funded – concern over congestion management, efficient use of state facilities
- Partners - transit operators, county congestion management agencies, county transportation sales tax agencies, MTC (oversight committee)

Researchers – UC Berkeley

Objectives of Study

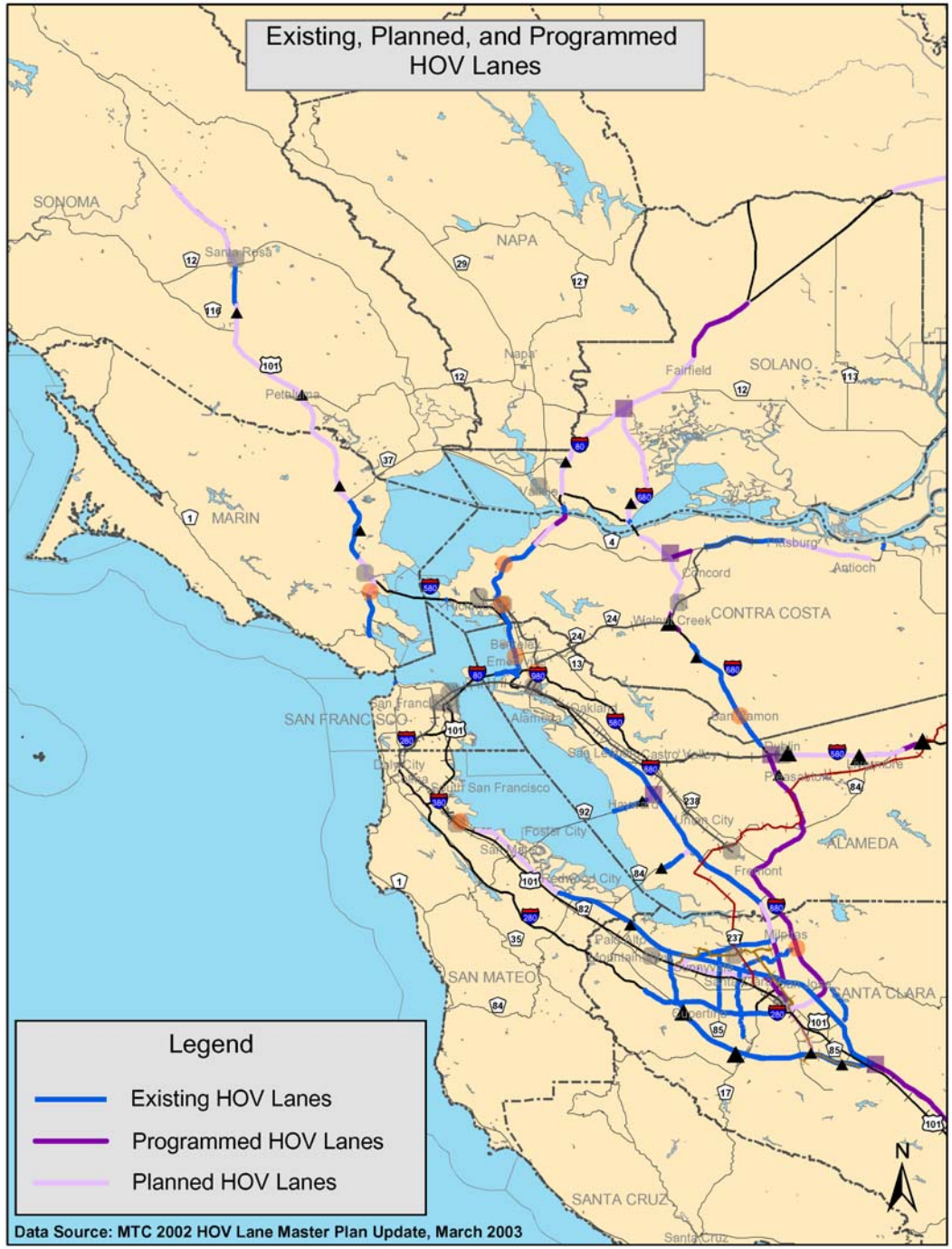
- Identify ways to increase effectiveness and use of express bus system
- Build upon previous work on HOV lane use
- Develop a plan to address likely demand, improve facilities, services, secure financing – short term and 20-25 yrs.
- Recommend further studies as needed

Research Approach

- Develop agreement on a policy framework
- Build upon, complement previous work focusing on freeway HOV lanes
- Work with operators, users, stakeholders to identify key issues – iterative approach
- Conduct analyses on ways to improve performance; reach agreement on priorities
- Recommend short and longer term improvements to services and facilities

Policy Framework: Key Express Bus System Design Elements
(Consensus List)

- Plan for door to door service, not just line haul speed – poor access, wait times, transfers can offset major capital investment benefits
- Address capital and operations needs on arterials as well as on freeways - most express buses operate on arterials part of the time
- Address user needs for safety, security, comfort, predictability as well as operator needs for priority treatment


Existing, Planned, and Programmed HOV Lanes
SONOMA
NAPA
SOLANO
MARIN
CONTRA COSTA
SAN FRANCISCO
ALAMEDA
SAN MATEO
SANTA CLARA
SANTA CRUZ
Santa Rosa
Petaluma
Napa
Fairfield
Vallejo
Pittsburg
Antioch
Concord
Walnut Creek
Berkeley
Emeryville
San Francisco
Oakland
Alameda
San Ramon
Dublin
Pleasanton
Livermore
San Leandro
Castro Valley
Daly City
Colma
South San Francisco
Hayward
Union City
Foster City
San Mateo
Redwood City
Fremont
Milpitas
Palo Alto
Mountain View
Sunnyvale
Santa Clara
San Jose
Cupertino
Santa Cruz
Legend
Existing HOV Lanes
Programmed HOV Lanes
Planned HOV Lanes
N
Data Source: MTC 2002 HOV Lane Master Plan Update, March 2003

Key Issues

- User concerns about services
- Crowded park and ride lots
- Feeder service needs and costs
- Delays on arterials
- Gaps in HOV lane network on freeways

Research Tasks

- On board surveys and observations
- Park and ride surveys and observations
- Focus groups – express bus users, park and ride users, car drivers in transit corridors
- Study of first and last mile shuttles
- Simulation of signal timing options, queue jumpers etc. on arterials
- HOV lane “gap analysis” and simulation of freeway HOV lane additions

Findings - Express Bus Users

- Many affluent workers, but low income in some corridors, midday (no “typical” user)
- Users’ key concerns: wait times, waiting conditions, transfer times, security and safety – in-vehicle time less in need of improvement
- Cuts in feeder buses increasing problem– need to investigate first and last mile options such as shuttles
- Lower income users are least likely to have employer commute benefits – social equity consideration

Findings – Park & Ride

- Problems include space availability, security, cleanliness, comfort –some users would pay for improvements ($1-3/day)
- Underutilized lots are poorly located (“wrong side” of the freeway or off main routes, would take hard sell to increase use
- Cost of park and ride space is considerable – $2 - $8 day not including land cost
- Land for expansion may not be available; costly
- Freeway stations feasible in some locations, but high cost, require attention to noise, vibration, emissions exposures.

Findings: First / Last Mile Services

- Transit operators have been cutting bus feeder services due to high costs, modest ridership
- Alternatives are park and ride or ???
- In some areas, shuttles - operated privately and as public-private partnerships offer a cost-effective choice
- Most are last-mile – of 800+ in Bay Area, only a handful operate from home end so far
- Could be an alternative to P&R expansion

Findings – New Investments

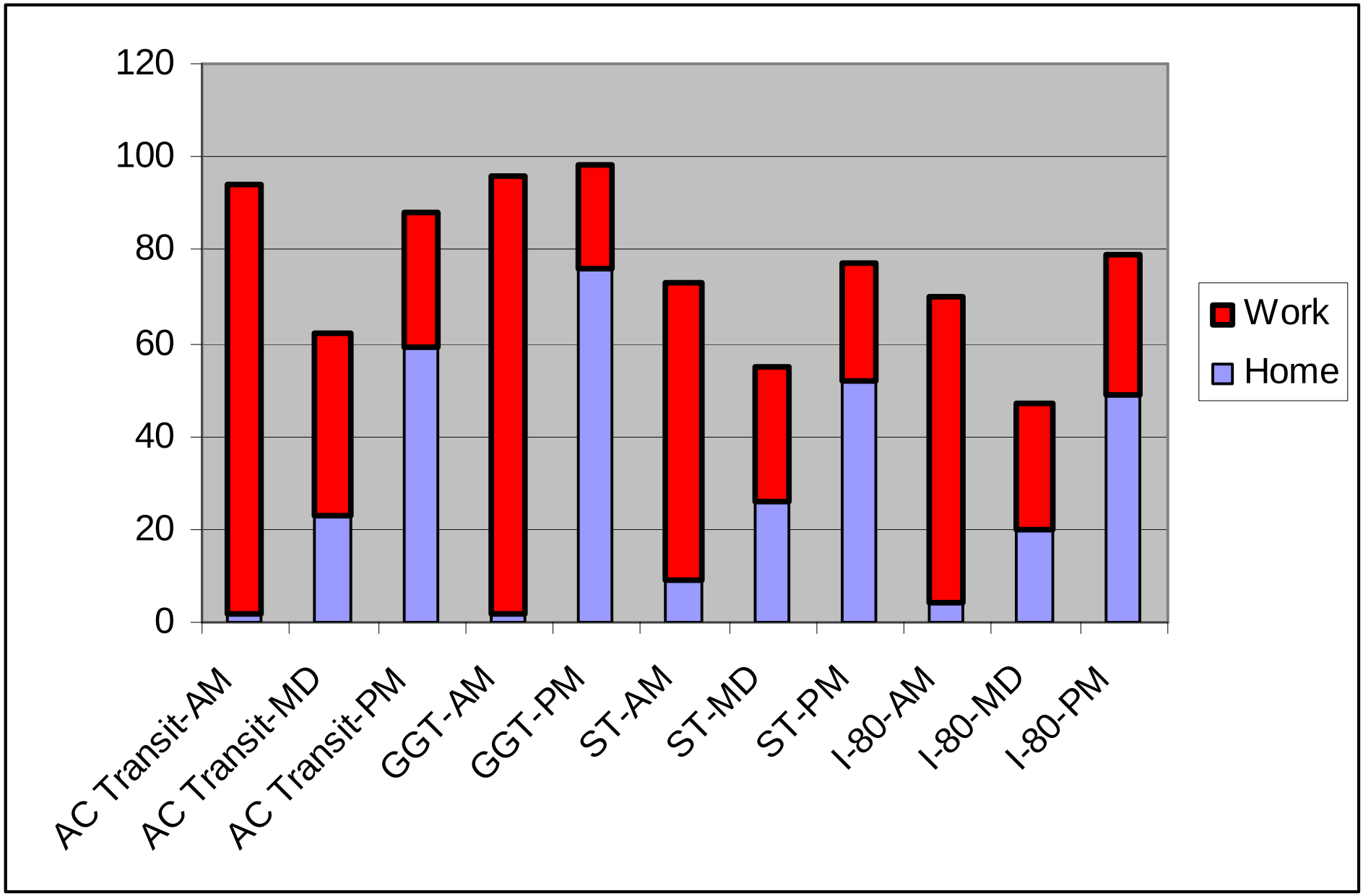
- Limited ability to add lanes, stations in medians– region already used this space for widening
- Will need to consider shoulder lanes in some locations
- Arterial improvements are equally important for express bus performance (1 min. delay at signals wipes out 1 mi. of HOV lane investment at $10M/mi.)
- Options are site-specific; simulation of arterial and freeway strategies can be used to determine best available options

On-Board Survey: Findings

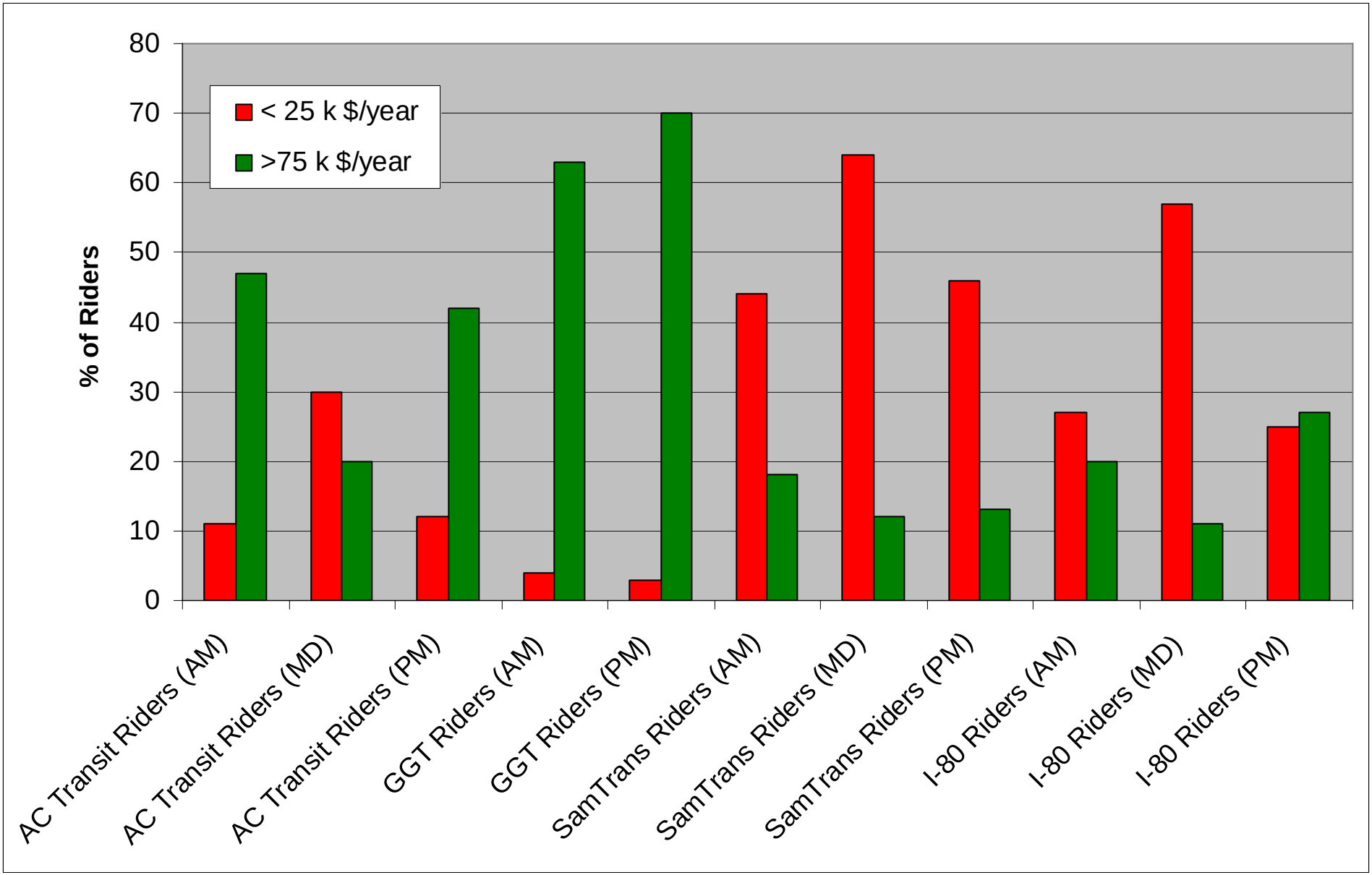
Survey Design

- Surveyed 28 express routes – 40% of total
- Surveyed about half the runs on survey day
- 3354 Responses
- Overall Response Rate: 37%

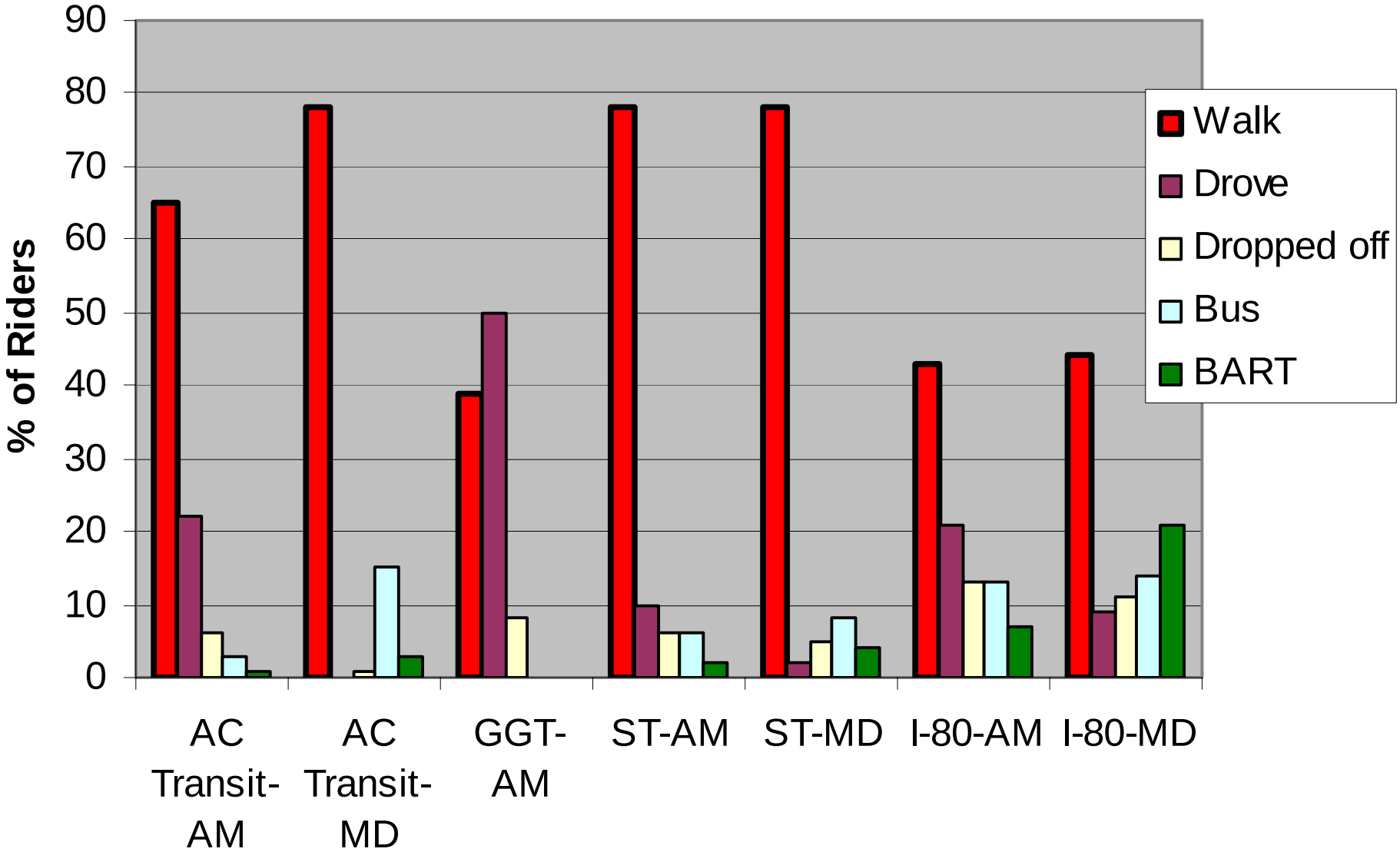
Peak hour trips were almost all for work, mid-day trips were more varied



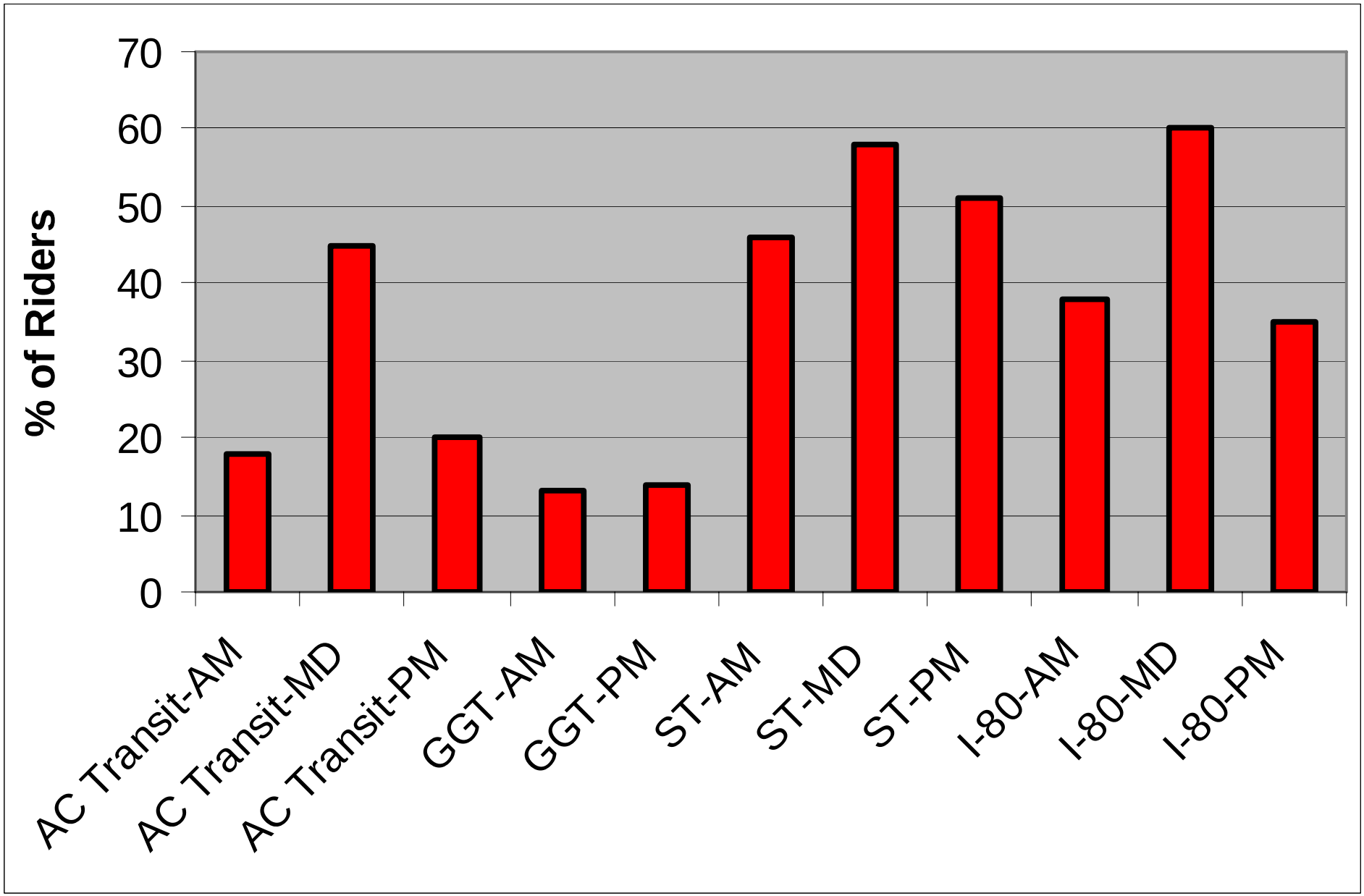
No “typical” express bus user: Household incomes vary greatly



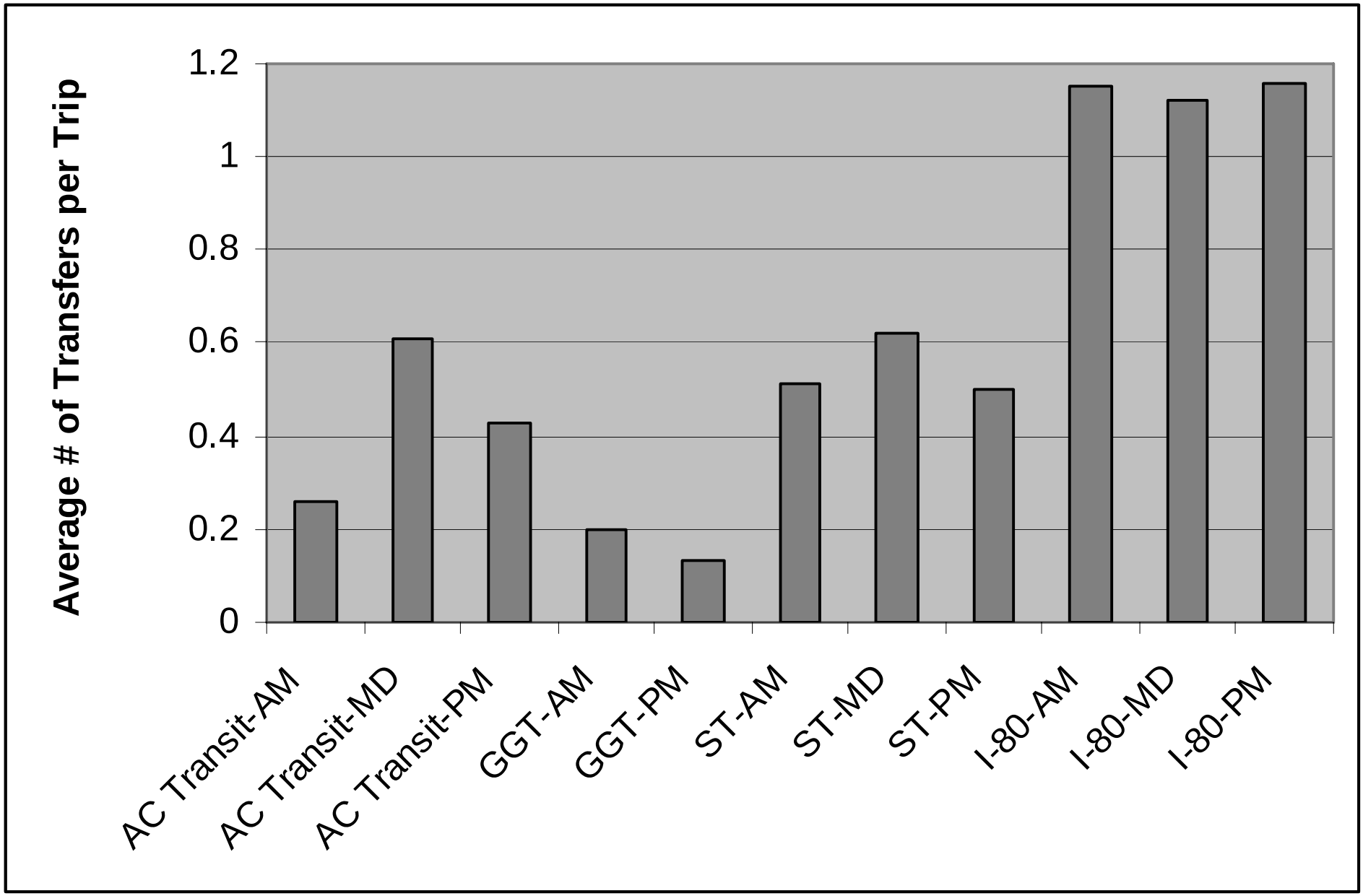
Walk access was much more common than expected – even to P&R lots



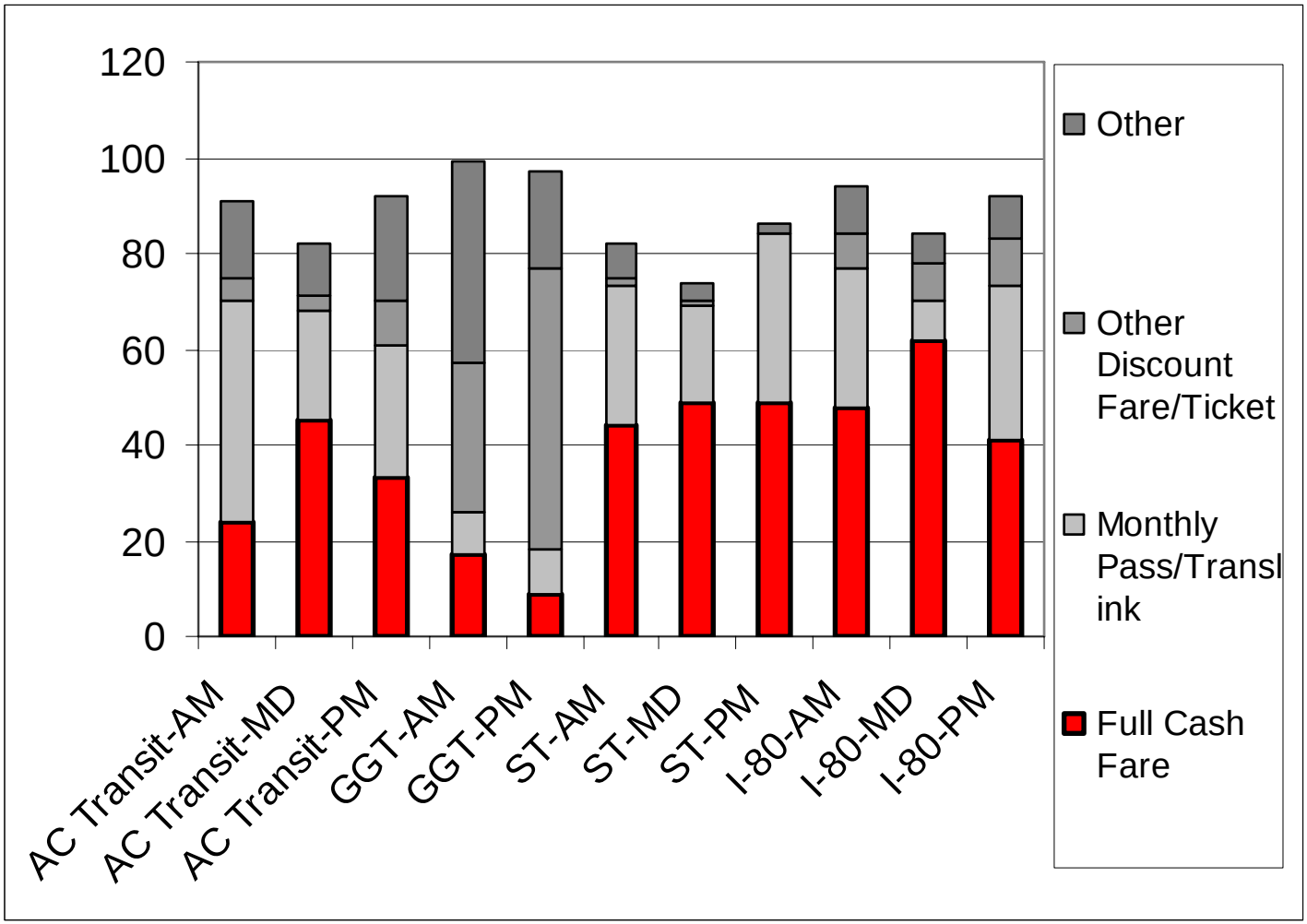
Share of Transit-Dependent Riders

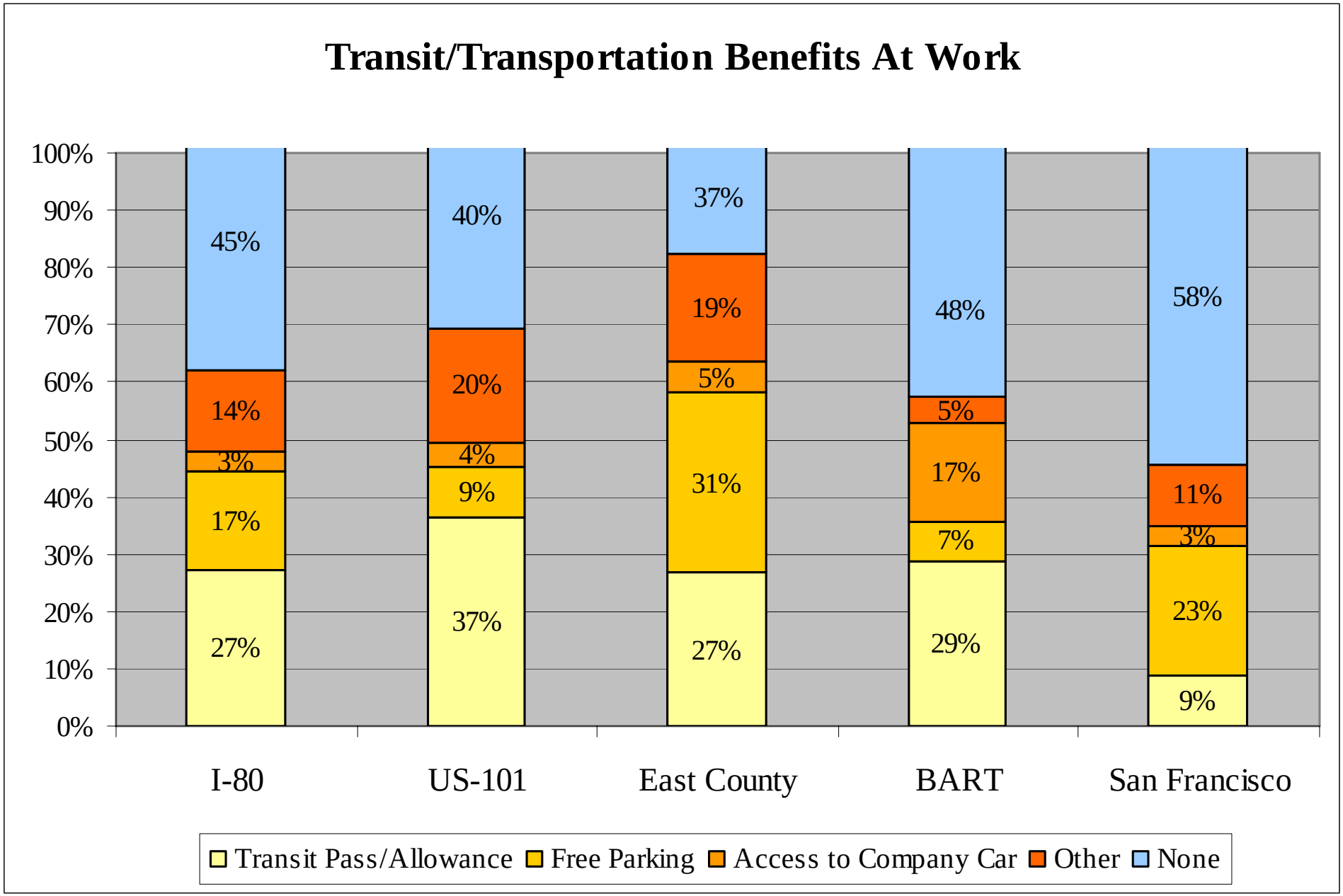


Transfers: a Low-Income Issue



Full Cash Fare: Another Low-Income Issue




Transit/Transportation Benefits At Work
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
45%
14%
3%
17%
27%
40%
20%
4%
9%
37%
37%
19%
5%
31%
27%
48%
5%
17%
7%
29%
58%
11%
3%
23%
9%
I-80
US-101
East County
BART
San Francisco
Transit Pass/Allowance
Free Parking
Access to Company Car
Other
None

Rider Concerns (from comments)

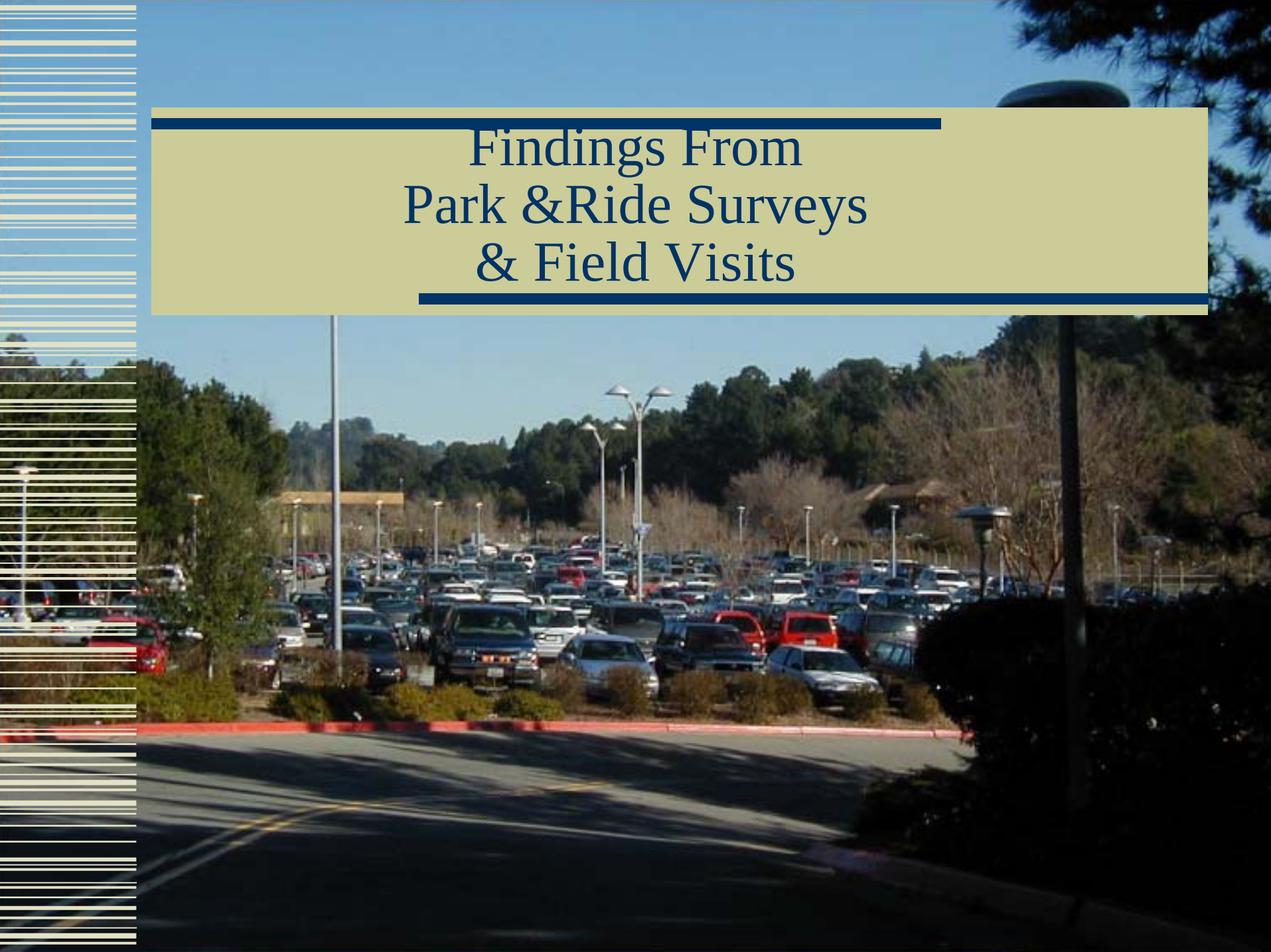
- Lack of security, comfort at stops
- Buses running behind schedule / poor information
- Missed transfers
- Delays at major intersections due to traffic, poor signal timing, no priority to buses

NOT a big problem: on-board comfort, on-board speeds

Conclusions

- Express buses are serving both affluent and the less-so
- Access is a growing problem – need feeders, park and ride
- Equity issues uncovered – fares, number of transfers, lack of employee benefits for lowest earners

Findings From Park &Ride Surveys & Field Visits



Methodology

- Mail back surveys distributed to
  - all cars parked at 38 P&R lots (37% response)
  - 3 BART parking lots (Modified survey – 32% response)
  - 3 San Francisco commuter lots (Modified survey – 10% response)
- Objectives: Determine OD patterns, trip purposes, user characteristics, use of alt. lots, access modes; for BART – why drive rather than take bus? for SF lots – Why drive to the City?

Findings

- 97-99% of P&R patrons are going to work
- 90% use lot 4+ days/wk
- 90% park in same lot each day
- Over 80% live within 15 minutes of P&R that they use
- BART riders use different lot if primary lot full; others park in neighborhoods or drive to work

Park and Ride Customer Wish List

- Patrols
- Lighting
- Bathrooms
- Cleaning – trash, pigeons, etc.
- News stand/boxes
- Food vendors / beverage machine
- More parking!

Conditions At Park& Ride Lots

Bike Parking

Counts as a parking space

Recommendations

- Restripe existing lots to smaller spaces, separate SUVs & big trucks from cars
- Legalize use of driveway shoulder and organize spaces
- Rethink cuts in feeder buses since new P&R is as expensive on a daily basis
- Make more use of public private partnerships for first and last mile (800 programs already in region)

Findings : Shuttles for the First and Last Mile

- Over 800 shuttles in the Bay Area
- Three models:
  - Single employer shuttle
  - Multi-employer/shopper/hotel shuttle/circulator
  - Community shuttle
- First two mostly started as traffic management requirements (developer exactions), now seen as employee benefits / business support
- Third often grew out of 2d model

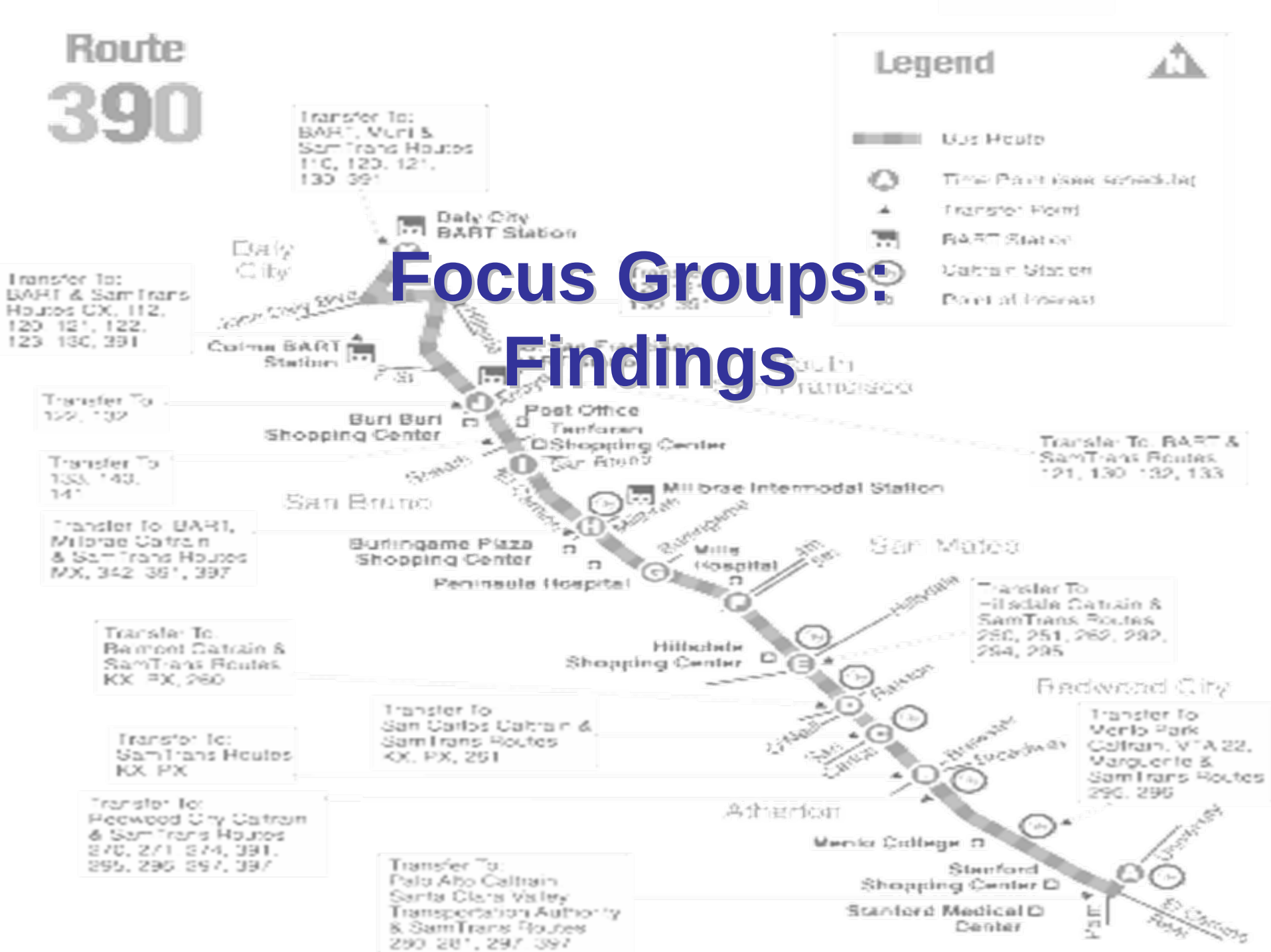
Shuttle Advantages

- Use a variety of vehicles matched to market – from used buses to vans
- Costs run $50-60/hr – about same as least expensive conventional bus provider in region, less than half the higher cost providers' rates
- Drivers are unionized but work rules are flexible
- Services are "agile" – flexible, respond to market
- Relations with conventional transit often are positive

Recommendations

- Consider shuttles as environmentally friendly alternative to park and ride
- Evaluate shuttles as substitute for marginal feeder bus services
- Engage employers, local businesses, cities in funding shuttles

Focus Groups: Findings



Approach

- 13 focus groups: 7 with Transit Users, 2 with Carpoolers, 4 with Solo Commuters
- 140 participants
- Recruited on board, at park and ride, and from FastTrak (toll tag) data
- Objectives: understand reasons for people’s travel choices and views on possible improvements

Themes

- “I’m trying to do the right thing by taking transit. But they don’t make it easy to do the right thing.” *(East Bay commuter to UCSF)*
- “I’ve tried it all.” *(Hercules Casual Carpooler)*
- Considerable frustration, desire for improvements, willingness to pay for them
- Resentment against rising fares with diminishing services.

Findings

- Transit riders concerned about wait times, waiting conditions, missed transfers, safety, cleanliness.
- Lower priority: on-board travel time and bus characteristics (other than seat comfort).
- Findings are consistent with travel behavior research, but surprised Caltrans and MTC, who have been focusing on “missing link” capital projects

Findings (continued)

- Many carpoolers were former transit users who gave up in frustration.
- Carpoolers also liked no-cost travel – many would take bus if free pass were available.
- Both transit users and carpoolers would pay one to three dollars per day for park and ride lot policing, cleaning, toilets, lighting, and shelters.

Findings (cont.)

- Middle-income commuters drive to San Francisco for three primary reasons:
  - Avoid multi-transfer transit trips
  - Avoid high out-of-pocket costs for transit
  - Have car available when working extra hours
- Most avoid high SF parking charges by moving car around residential zones, parking in parks, etc. (go to great lengths)

Specific areas needing improvement (all groups)

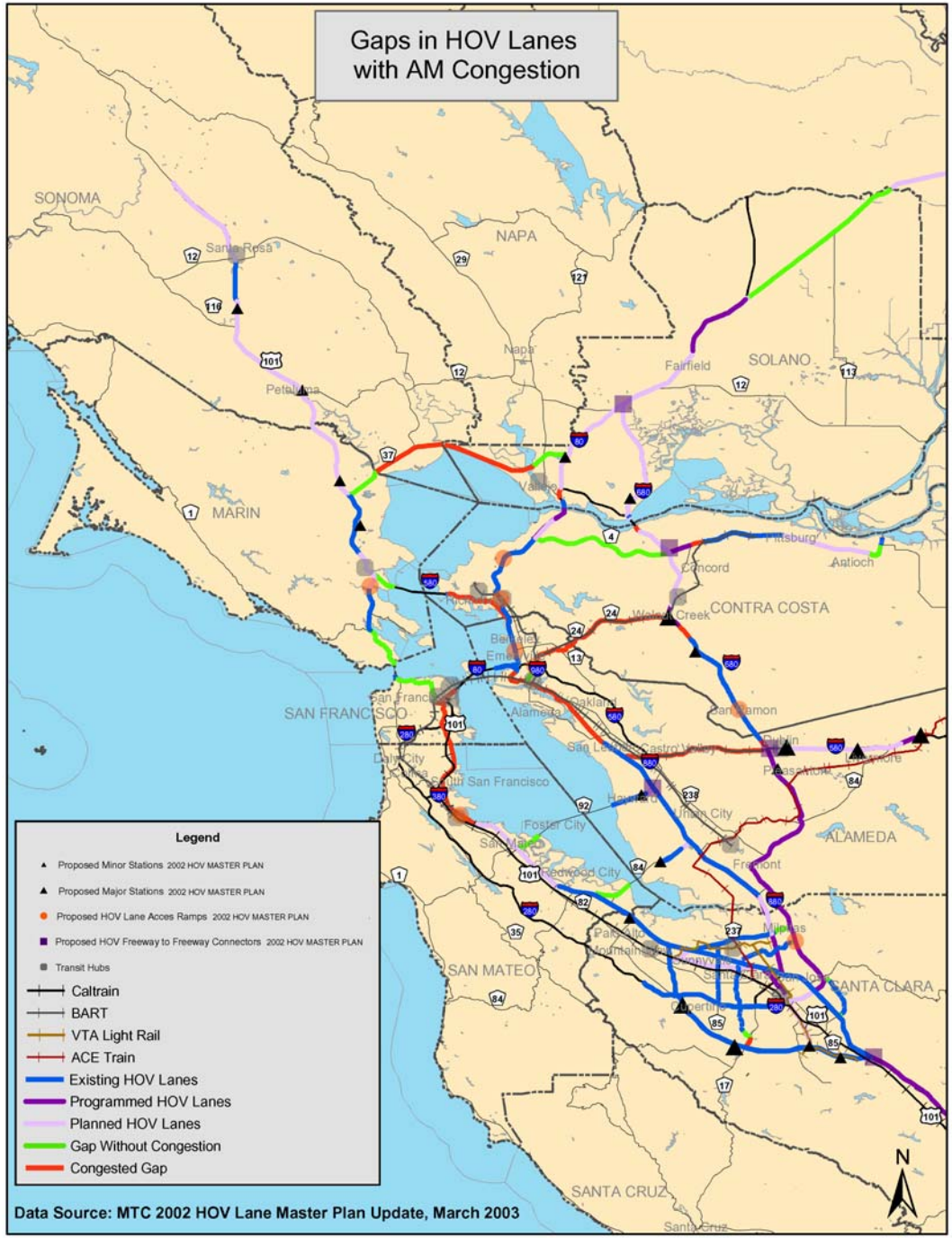
- Local access to express bus
- Park & Ride capacity
- Park & Ride security
- Intermodal transfers (bus to BART in particular)
- Cleanliness
- Communication with transit agencies (customer service)
- Rider Information

Capital Investments and HOV Gaps

HOV Lane Gap Identification

- HOV lanes and other priority treatments found throughout the Bay Area BUT
- Gaps persist, and some cause substantial delay, frustrations for HOVs
- Legislators have taken notice, have asked why network is not continuous

- Red indicates congested gap sections
- Green indicates uncongested gap sections



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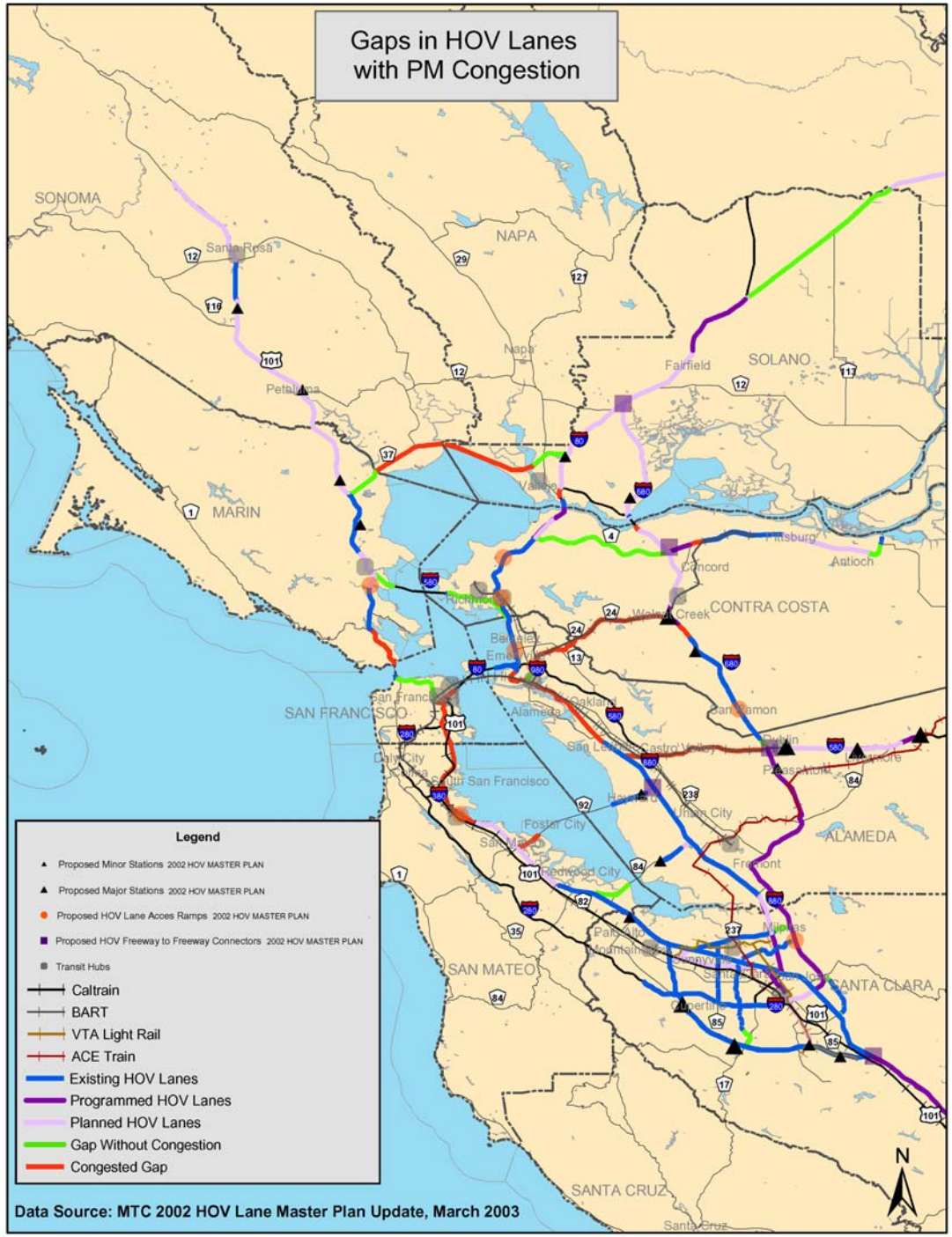


Most Common Reason for Gaps: No Right of Way, High Costs

- Previous capacity expansions used freeway shoulders and medians - little room left for HOV lanes (14 gap sections – 120 route miles)
- Cost of new ROW high, funds not identified

Options for High-Cost Gaps

- Re-striping to create an additional lane in existing, paved right-of-way or shoulder lane operation – both would require engineering studies, policy changes
- Seek alternative routes for specific gap sections
- Reconsider conventional wisdom that taking a lane for HOVs is unacceptable
- HOT lanes where high costs are the problem

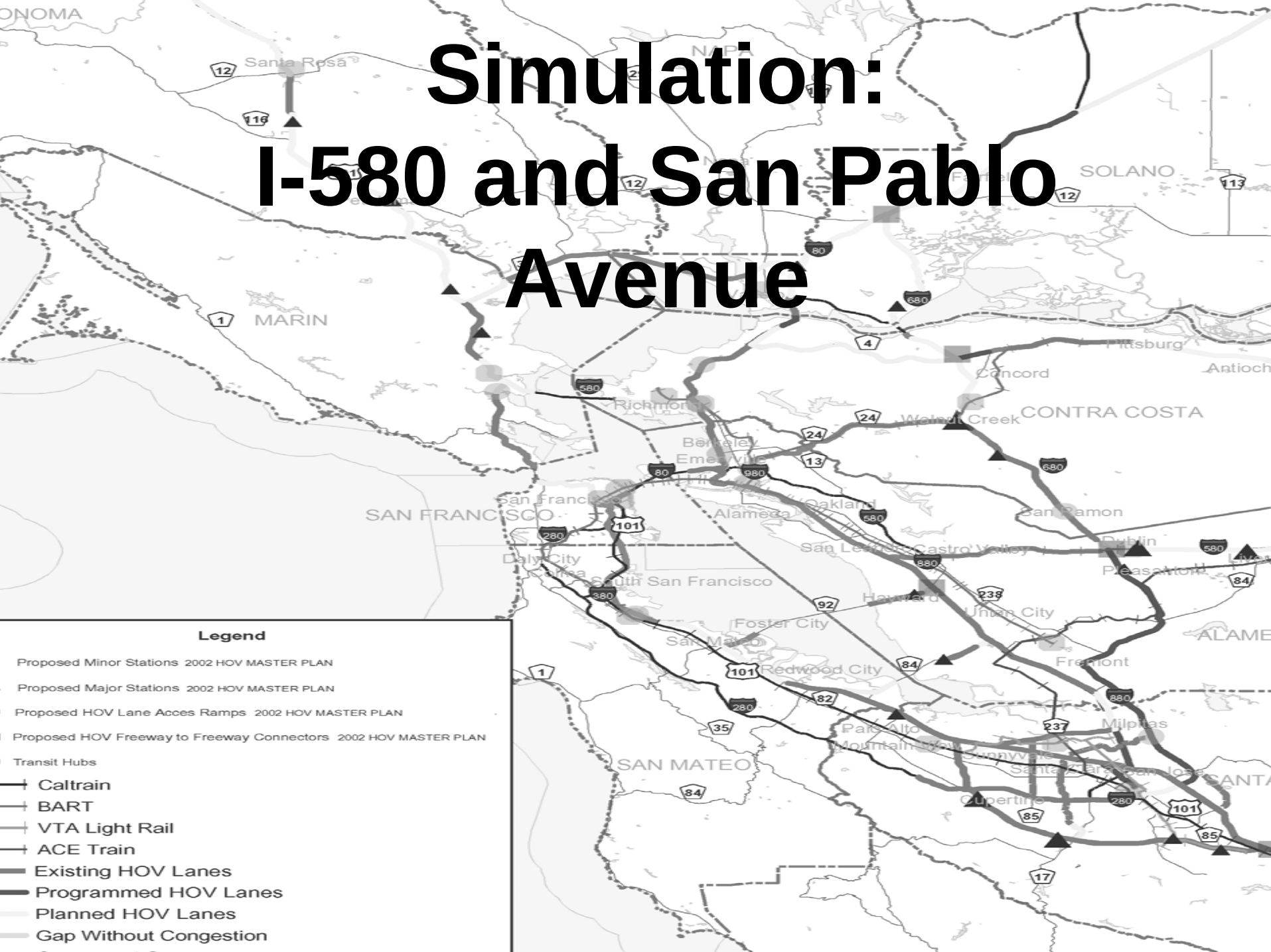
Second Most Common Reason for Gaps: Section Isn’t Congested (Yet)

- 13 gap sections, 110 route miles of freeway aren’t congested yet – HOV lanes wouldn’t provide any benefit
- Need to monitor these sections as growth patterns evolve
- Retain ROW for future needs

Remaining Gaps: Upstream or Downstream Bottlenecks

- 5 gap sections, 23 route miles
- Bottlenecks would have to be fixed before priority lanes would offer a significant advantage
- Few cost-effective options to fix these
- Possible future study: ITS alternatives?

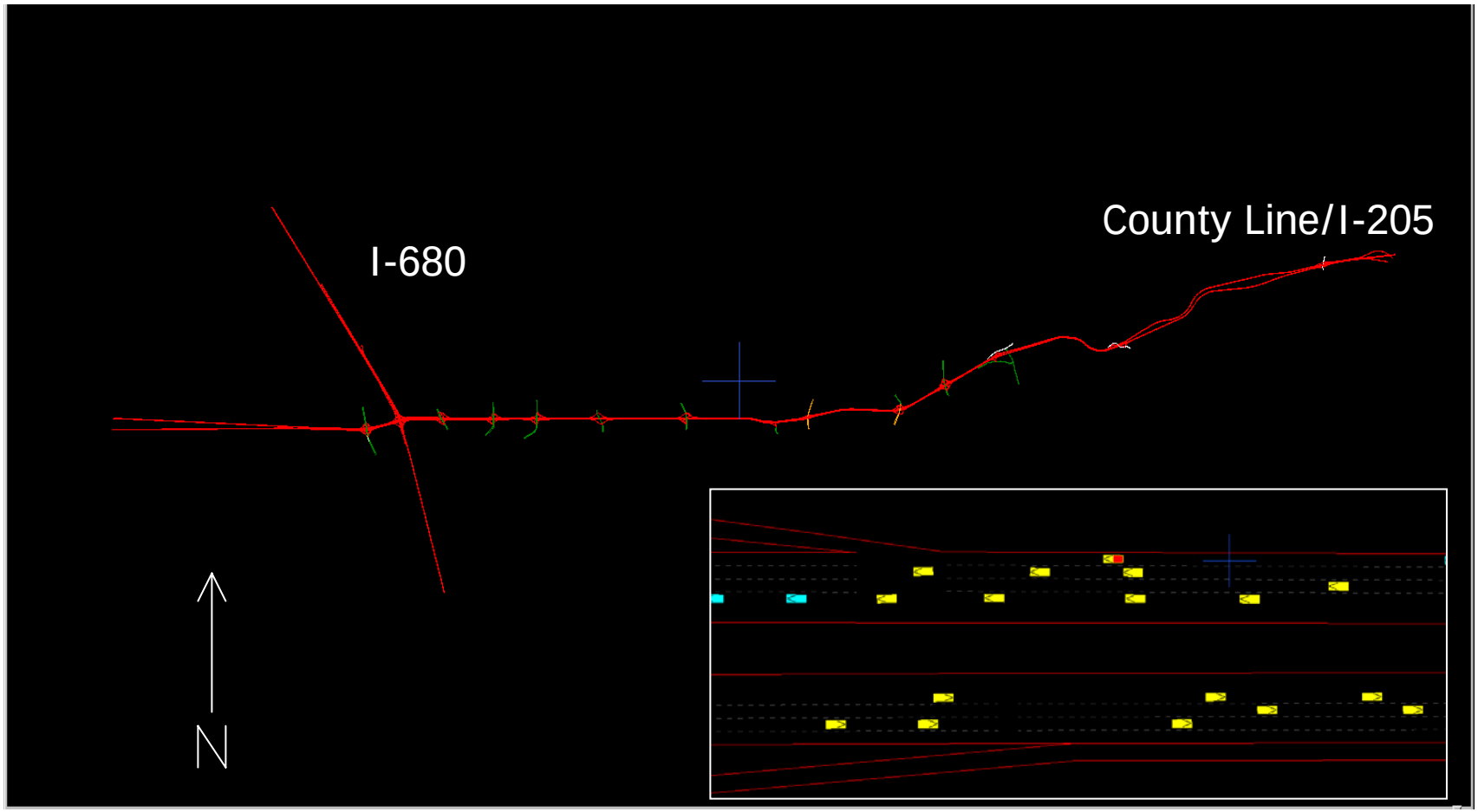
Simulation: I-580 and San Pablo Avenue



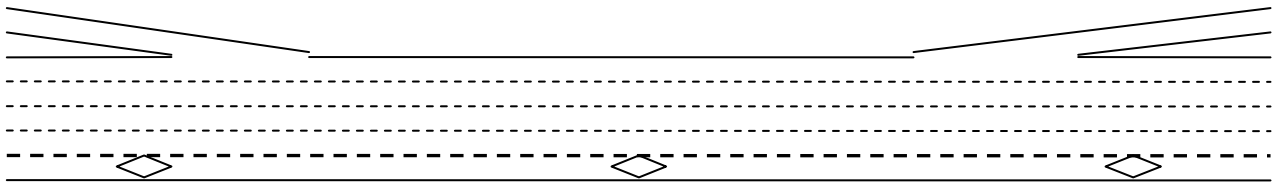
Objectives

- Consider two important issues: fitting HOV lane into existing right of way, and improving priority treatment on arterials carrying express buses
- Show through case studies how various strategies could improve performance

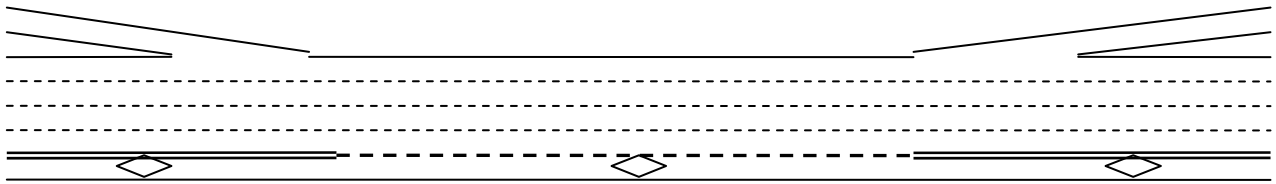
I-580 Simulation



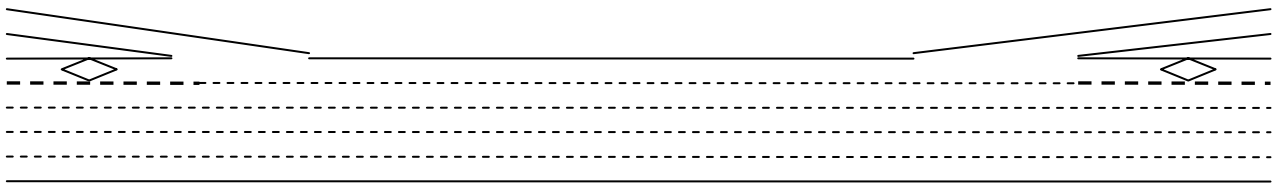
I-580 Simulation HOV Lanes



Median HOV Lane



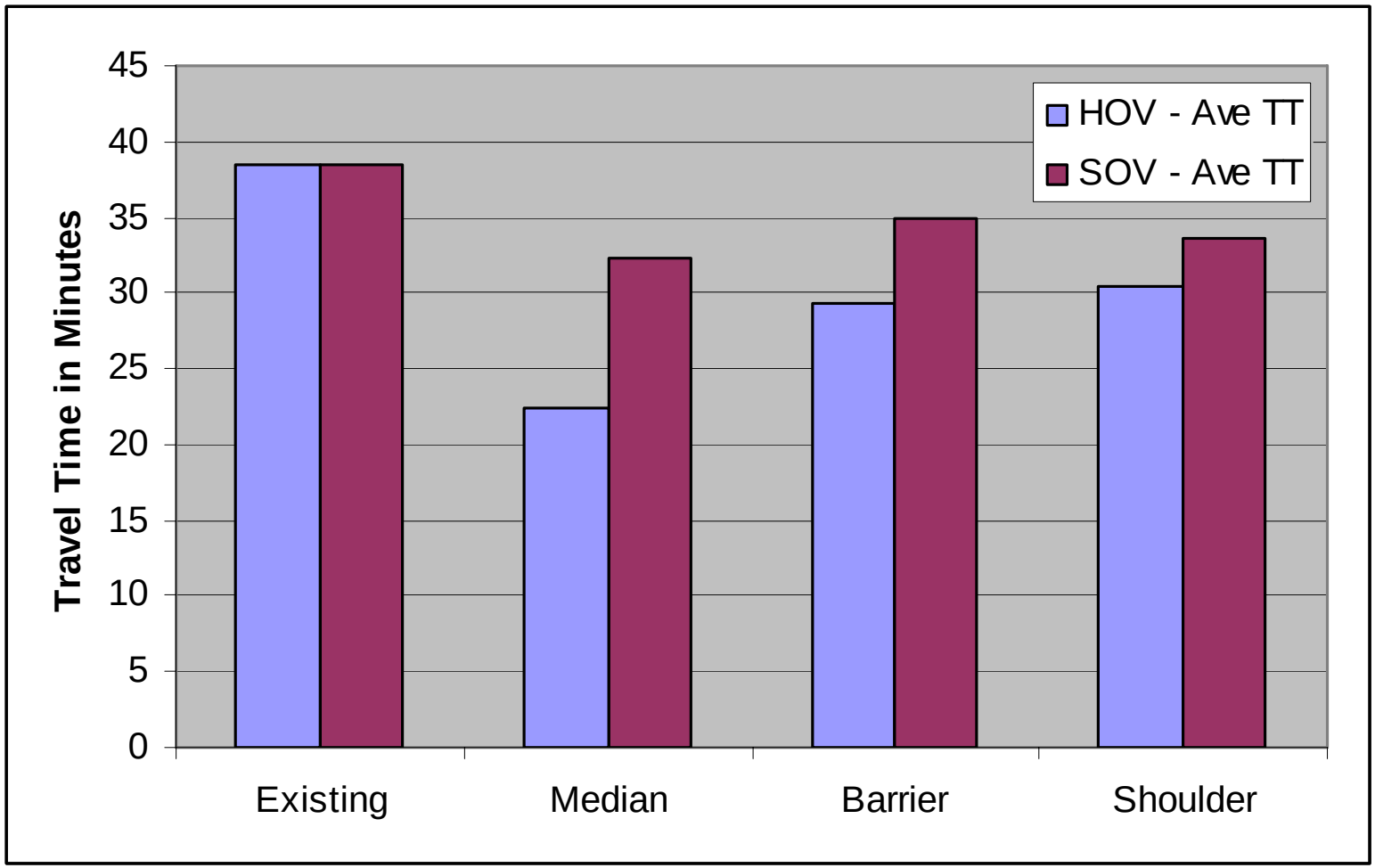
Barrier Separated Median HOV Lane



Shoulder HOV Lane

San Pablo Avenue Simulation

Travel Times for Alternative HOV Lane Designs



San Pablo Avenue Simulation

- Express Bus Improvement
  - Transyt-7F
    - Time signals for transit (person hours of delay)
    - Weight transit vehicle more than cars
  - Paramics
    - Add queue jumpers
    - Change intersection and bus stop geometry

Results (1)

- Transyt-7F - compare “ordinary” signal timing to bus-weighted timing

	Existing		Weighted	
	Bus	**Total**	**Bus**	**Total**
Delay (veh-hr/hr)	10	1364	8	1459
Total Stops (veh/hr)	6836	114885	3762	84514

Results (2)

- Paramics (signal priority and queue jumpers)
  - Significant improvements to travel time of express buses
  - More significant improvement to reliability (reduced variance)

Conclusion

- Simulation software provides opportunities to easily explore a multitude of alternatives
- Can quantify the effect of geometric and operational changes to REB performance
- Gives ability to simulate future scenarios and growth
- Allows us to evaluate new techniques for delay calculation considering buses

Short and Long Term Projects

Findings and Recommendations

Capital Projects Summary

Type of Improvement	Timeline	Number of Proposals
Traffic signals - New, adjust, priority	S	36
Metering lights - New, adjust	S	6
Research or study for solutions	S	4
Park & Ride lots and Transit Center Expansion	S/M	32
Pavement markings - crosswalks, turn lanes, etc.	S/M	32
Rolling stock purchase	M	22
Bus stops - New, refabricate	M	14
Queue jump lanes - New	M	9
New Park & Ride lots and Transit Centers	M/L	14
HOV lanes - New, extend, adjust	L	6
Ramps and connectors - New, realign	L	8

Project Evaluation Approach

- Transit operators provided lists of proposed projects
- We evaluated them based on cost per rider now and in the future (net present value)
- Costs based on Bay Area data (Caltrans worksheets)
- Ridership based on MTC forecasts

Conclusions

- Express buses serve both affluent and not-so-affluent commuters in the Bay Area
- Services could be greatly improved by more attention to user needs: better management of access, wait, transfer conditions
- In-vehicle travel time improvements are important, but are overwhelmed when access, wait, transfer conditions are poor

Conclusions (cont.)

- Operations improvements such as signal timing and small capital improvements such as queue-jumpers are highly cost-effective
- Some capital projects are not (too few buses would use them, too few hours of the day)
- Parking expansion likely to be major cost ($25K+/space) – feeder services cost-competitive
- “Color of money” problem – easier to get capital projects than operational improvements

Further Reading

- TRB papers are forthcoming on park and ride, Paramics simulation
- Additional publications will be forthcoming this summer