



Better Methods. Better Outcomes.

## TMIP Webinar Series

### Agency Experience using Activity-Based Models

**Session 2:**

**SF-CHAMP: How we use it**

**Date:**

**November 15, 2012**

**Speakers:**

**Elizabeth Sall (SFCTA)**



**U.S. Department of Transportation  
Federal Highway Administration**

## **Disclaimer**

*The views and opinions expressed during this webinar are those of the presenters and do not represent the official policy or position of FHWA and do not constitute an endorsement, recommendation or specification by FHWA. The webinar is based solely on the opinions and experience of the presenters and is made available for knowledge and experience sharing purposes only.*



# WHY DO WE HAVE A MODEL AT SFCTA?

Because people have questions that it can help inform



SF-CHAMP Model Basics

# **TODAY'S TOPICS**

**History / Overview**

**Specific Examples of Use and Development**

**Day-to-Day**



**SF-CHAMP Model Basics**

## Quick SF-CHAMP History Overview

- **Ongoing enhancements to support subsequent policy/project analyses**
  - **Key enhancements**
    - **Expand zonal detail in SF: 190 → 981**
    - **Expand geography**
      - SF → nine-county bay area
      - 7+ million persons
      - 30+ million daily trips
    - **Improved behavioral sensitivity (eg. distributed values-of-time, expanded modes, improved bike and ped models, transit crowding, trip time-of-day)**
- Re-estimation using 2000 HH survey**



## So what do we use it for?

### Long Range Planning:

San Francisco Transportation Plan

Fleet Plan

### Policy Questions:

Fare Policy/Free Muni

Congestion Pricing Feasibility

Climate Action Strategies

Fee Nexus

### Specific Projects :

Feasibility, Alternatives Analysis

Environmental Phase (EIS/EIR)

Public Health Analysis

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6



## Who are our “clients”?

### Other SFCTA Departments

### Other Public Agencies



“Interested  
Public”



SF-CHAMP Model Basics

7

# EXAMPLE 1

Cordon-Based Congestion Pricing Feasibility Study

Focus: Results from Model



SF-CHAMP Model Basics

# Cordon Based Congestion Pricing Feasibility

## Questions:

- What is the most effective shape and size for a cordon?
- What price point is feasible (if any)?
- What are the impacts?
  - Traffic diversions
  - Transit crowding
  - Equity Concerns



## Cordon Based Congestion Pricing Feasibility

- **Enhancements required to ensure that model:**
  - Is appropriately sensitive to the proposed scenarios
  - Can generate metrics to support evaluation of scenarios
- **Initial model lacked key capabilities**
  - Limited geographic extent (non-SF demand “fixed”)
  - Little pricing representation and sensitivity (distributed VOT, toll/notoll mode choices, pricing alternatives)
  - Simplistic accessibility measures and feedback loops
  - No peak spreading
  - Coarse regional calibration/validation



# Cordon Based Congestion Pricing Feasibility

- **Consultant-led model enhancement project**
  - In parallel with planning efforts
  - Deployable tools of increasing utility
  - 6 months, \$200,000
- **Enhancements**
  - Expanded geography
  - Explicit toll choice model, and VOT (from SP data collection)
  - Feedback and accessibility (mode choice logsums)
  - Time-of-day choice (peak-spreading)
  - Improved highway and transit

Charge type (area vs. cordon) and discount logic

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11



## Cordon Based Congestion Pricing Feasibility

Figure 2-1. Evaluation Framework – Categories and Metrics	
CATEGORY	METRIC
i. Transportation Network Conditions	1. Vehicle Miles Traveled (VMT) 2. Vehicle Hours of Delay (VHD) 3. Roadway Volumes 4. Peak-Period Travel Times 5. Transit System Performance/Loads
ii. Trip-Making and Mode Share	6. Daily Person Trips 7. Peak Period Mode Share 8. Trips by Mode by Income Group
iii. Environmental and Economic Effects	9. Greenhouse Gas Emissions 10. Criteria Pollutant Emissions 11. Collisions 12. Economic Effects
iv. Financial Performance	13. Program Capital Costs 14. Program Operating Costs 15. Annual Net Revenues 16. Daily Ttolled Vehicles

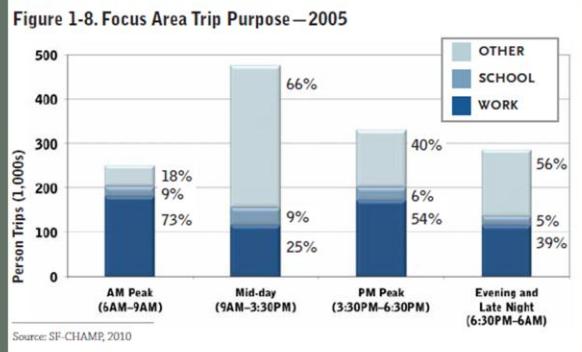
● - Used SF-CHAMP outputs

12

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

## Cordon Based Congestion Pricing Feasibility



“Peak-period travel in the Focus Area is dominated by work and school trips”



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13

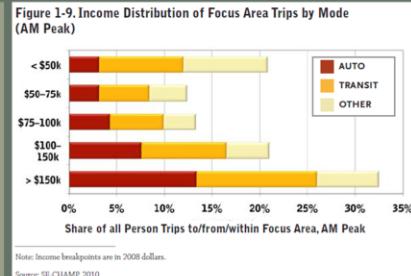
Source:

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# Cordon Based Congestion Pricing Feasibility

## Q: Who is driving in downtown San Francisco?

**"The majority of motorists in the peak period are travelers from households with incomes greater than \$100,000 per year. Fewer than five percent of travelers in the peak period are motorists from households with incomes less than \$50,000 per year."**



SF-CHAMP Model Basics

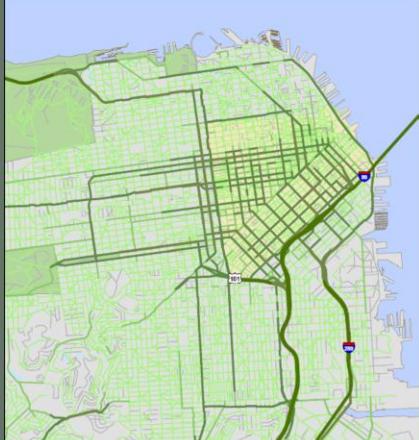
14

Source:

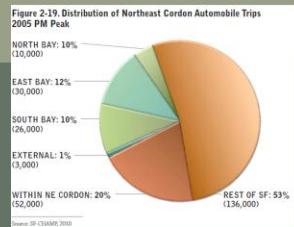
[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

**Q: Where is downtown congestions coming from?**



**“Well over half of peak-period automobile travel in the northeast cordon area is fully internal to San Francisco.”**



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15

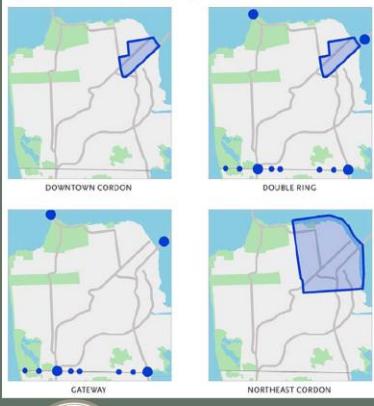
Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

## Q: What shape?

Figure 2-4. Initial Program Design Options



**Northeast Cordon seems best.**

**“Downtown cordon too small to avoid major diversionary impacts and does not generate sufficient revenue to be financially feasible”**

**“A gateway charge alone is not effective at reducing peak period traffic in the city’s most congestion areas”**

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16

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

## Cordon Based Congestion Pricing Feasibility

### Q: What price?

“\$3.00 across both weekday peak periods”

“...provides substantial congestion reduction benefits”

“...presents net revenues to reinvest in travel enhancements to those affected by charge”

“...modest enough not to affect overall trip making to area”



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17

Source:

[http://www.sfccta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfccta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

## Q: What boundaries?

Figure 2-6.  
Geographic Design  
Refinement Options  
Analyzed



**"The refined Northeast Cordon program provides the greatest congestion reduction in the city's most congested areas, while also delivering substantial additional benefits for transit performance, environmental quality, and sustainable growth."**



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18

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

## Q: How is overall accessibility changing with the fee?

Figure 2-12. Trip-Making and Mode Share Metrics

METRIC	2015 BASELINE	NE CORDON (AM/PM)	MODIFIED NE CORDON (PM OUTBOUND)	SOUTHERN GATEWAY (AM/PM)
AM Peak Transit Mode Share to/from Focus Area	42%	45%	43%	43%
PM Peak Transit Mode Share to/from Focus Area	33%	35%	35%	34%
Percentage Change by Scenario				
Daily Person Trips to/from Focus Area	1.63 million	+0.4%	+0.6%	+0.9%
Daily Person Trips to/from NE Cordon	2.53 million	-0.4%	-0.2%	+0.1%
Daily Person Trips to/from SF	4.49 million	-0.4%	-0.4%	-0.7%
Daily Non-Motorized Trips to/from NE Cordon	705,000	+4.4%	+4.0%	+4.0%
Daily Transit Trips to/from NE Cordon	644,000	+4.2%	+3.4%	+2.5%

Source: SF-CHAMP, 2010.



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19

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

## Q: Which scenario works best for reducing peak auto trips?

Figure 2-10. Vehicle Travel Metrics

METRIC	2015 BASELINE	NE CORDON (AM/PM)	MODIFIED NE CORDON (PM OUTBOUND)	SOUTHERN GATEWAY (AM/PM)
Percentage Change by Scenario				
AM Peak Vehicle Trips to/from NE Cordon	142,000	-13%	-5%	-5%
PM Peak Vehicle Trips to/from NE Cordon	229,000	-12%	-13%	-5%
AM Peak Vehicle Trips to/from S Corridor	95,000	-3%	-2%	-20%
PM Peak Vehicle Trips to/from S Corridor	122,000	-6%	-6%	-23%
AM Peak Vehicle Trips to/from SF	308,000	-7%	-4%	-6%
PM Peak Vehicle Trips to/from SF	475,000	-7%	-7%	-6%
Daily San Francisco VMT	9.8 million	-5%	-3%	-4%

Source: SF-CHAMP, 2010



SF-CHAMP Model Basics

20

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

## Q: Where are vehicle trip reductions coming from?

Figure 2-14. PM Peak Vehicle Trip Reduction—Share by Travel Market

NORTHEAST CORDON AREA	NE CORDON (AM/PM)	MODIFIED NE CORDON (PM OUTBOUND)	SOUTHERN GATEWAY (AM/PM)
Change in PM Pk. Vehicle Trips	-28,000	-29,000	-10,000
to/from SF	81%	76%	56%
to/from S.Bay	13%	13%	40%
to/from E.Bay	3%	7%	3%
to/from N.Bay	3%	3%	1%



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21

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

## Q: Who would benefit?

Figure 2-18. Distribution of Travel Time Benefits (\$ millions)

	NE CORDON (AM/PM)	SOUTHERN GATEWAY
San Francisco Residents	+\$110	+\$70
Other Bay Area Residents	+\$260	+\$180
Motorists	+\$300	+\$195
Transit Riders	+\$70	+\$55

Notes: Figures are in 2008 \$ millions for a typical mature year of operation. All figures rounded to the nearest \$5 million. Trip change disbenefit has been imputed into the above figures. Mode refers to user mode in baseline scenario.

Source: SFCTA, 2010.



“Significant travel time savings accrue for both local and regional travelers, particularly for regional motorists. This is due in part to the longer average travel distance for automobile trips and for regional trips, as well because of network effects – reductions in congestion ripple through the regional network, allowing travelers who do not directly travel in a priced area to enjoy improvements in travel time.”

SF-CHAMP Model Basics

22

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

# Cordon Based Congestion Pricing Feasibility

## Q: How much revenue would this program generate?

Figure 4-1. Financial Characteristics of the Highest-Performing Scenarios

	NE CORDON (AM/PM)	NE CORDON (PM OUTBOUND)	SOUTHERN GATEWAY (AM/PM)
Annual Revenue (before discounts)	\$185M	\$145M	\$125M
Discounts	\$40M	\$30M	\$20M
Annual Revenue (after discounts)	\$145M	\$115M	\$105M
Operations and Maintenance	\$45M	\$25M	\$30M
Amortized Capital Cost	\$20M	\$20M	\$15M
Net Operating Revenue	\$80M	\$70M	\$60M

Source: PBS&J and Transportation Analytics

**“The program would provide \$60 to 80 million in annual net revenue, which would be reinvested in the transportation system with special emphasis on enhancements to transit service”**



SF-CHAMP Model Basics

23

Source:

[http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS\\_study\\_final\\_lo\\_res.pdf](http://www.sfcta.org/images/stories/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf)

## Cordon Based Congestion Pricing Feasibility

Model was great for the congestion pricing study, but we also developed a “wish list” for future development:



SF-CHAMP Model Basics

No Parking Image: Flickr [H4NUM4N](#)

State Garage Image: Flickr ThomasHawk

Parking Meter Image: Flickr jareed

## EXAMPLE 2

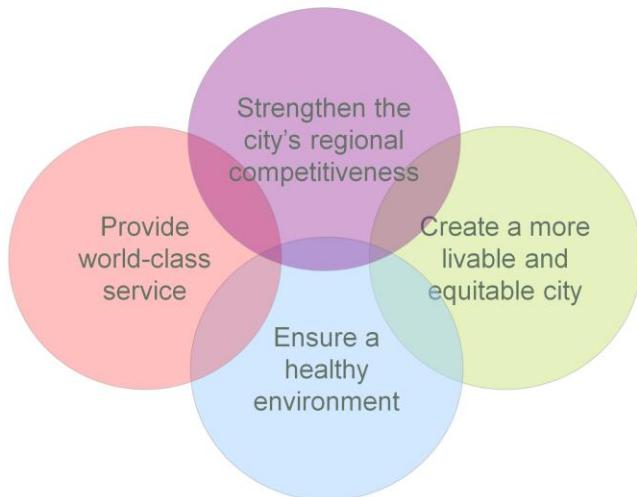
San Francisco Transportation Plan

Focus: Model Development



SF-CHAMP Model Basics

## Example 2 – San Francisco Transportation Plan (SFTP)

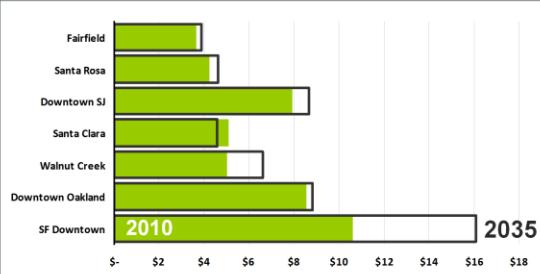


**SF-CHAMP Model Basics**

# San Francisco Transportation Plan (SFTP)

Q: How can we reach our economic viability goal?

Travel time + cost of AM Commutes by car



Q: How are SF's commutes compared to other markets by car?



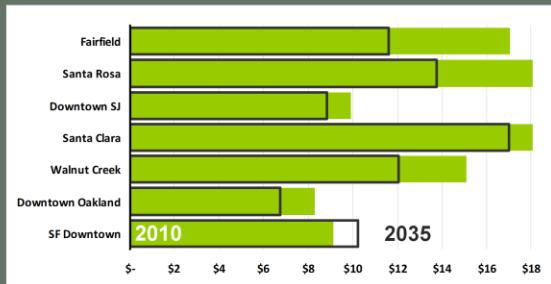
SF-CHAMP Model Basics

27

## San Francisco Transportation Plan (SFTP)

### Q: How can we reach our economic viability goal?

Travel time + cost of AM Commutes by *transit*



Q: How are SF's commutes compared to other markets by transit?



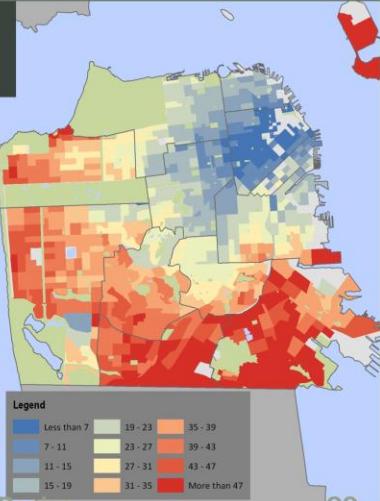
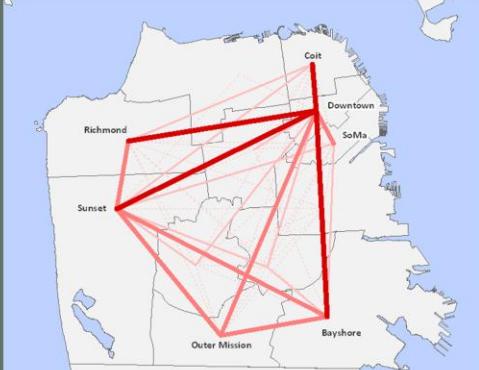
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28

# San Francisco Transportation Plan (SFTP)

Q: How can we reach our environmental goal?

Q: Who is producing GHG in the future?



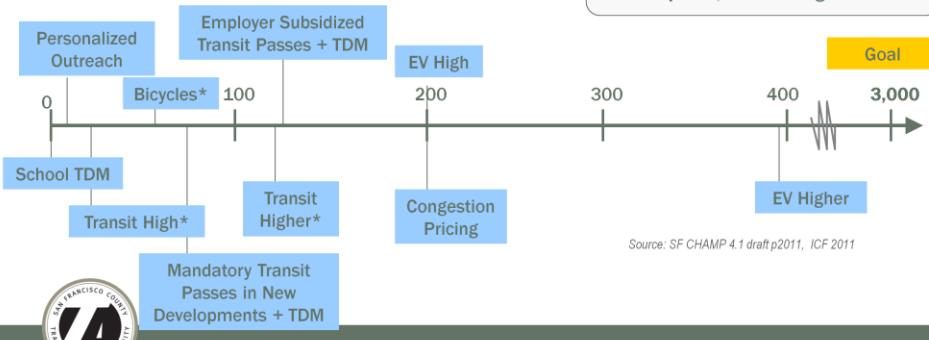
29

# San Francisco Transportation Plan (SFTP)

## Q: Can we reach our environmental goal?

- We need about a **3,000 metric ton/day** reduction to achieve our goal by 2035.
- At best, any individual strategy achieves <15% of goal

GHG reduction potential (in metric tons/day)



But does not consider costs, impacts, and other goals...



SF-CHAMP Model Basics

## San Francisco Transportation Plan (SFTP)

Q: How can we reach our transit capacity/SOGR goal?



Q: Where are there capacity issues in the transit system?

Q: If we mitigate capacity issues, is there latent demand that just fills it?

Basics

31

## San Francisco Transportation Plan (SFTP)

**Q: How can we reach our livability goal (<50% car trips)?**



**Q: How much demand can we attract to biking if we build lots of bike infrastructure?**



32

**Q: Do road diets and pedestrian connectivity projects increase walking?**

Bike lane: Flickr by sfbike

Road Diet: SF Planning

## San Francisco Transportation Plan (SFTP) - Model Development

Things we needed sensitivity in SF-CHAMP to:

- Bike infrastructure
- Walk connectivity and quality
- Transit crowding



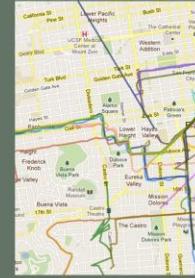
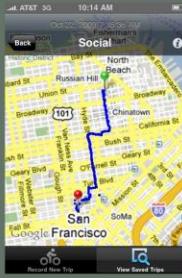
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33

# San Francisco Transportation Plan (SFTP) - Model Development: Bike Infrastructure

## Problem: Represent effect of bike infrastructure

- Needed bike route choice data on a budget
- Developed CycleTracks smartphone app



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34

[www.sfcta.org/cycletracks](http://www.sfcta.org/cycletracks)

## San Francisco Transportation Plan (SFTP) - Model Development: Bike Infrastructure

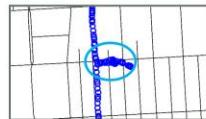


**Jeff adapted procedures from MATSIM**

5,178 traces  
497 users

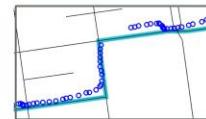
$$\exp -\frac{(t - t_j)^2}{2\sigma^2}$$

Gaussian  
smoothing



Activity & mode  
detection

3,034 bike  
stages  
366 users



Map  
matching

(Schuessler & Axhausen 2009)



**SF-CHAMP Model Basics**

Schuessler, Nadine and Kay W. Axhausen. "Processing Raw Data from Global Positioning Systems Without Additional Information," *Transportation Research Record : Journal of the Transportation Research Board*, No 2105. Washington D.C., 2009, pp. 28-35. <http://trb.metapress.com/content/tv306m812140p330/>

[www.sfcta.org/cycletracks](http://www.sfcta.org/cycletracks)

## San Francisco Transportation Plan (SFTP) - Model Development: Bike Infrastructure

- Jeff developed a choice set generation algorithm



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36

Hood et al "A GPS-based bicycle route choice model for San Francisco, California." *Transportation Letters*, 3(1), January 2011.

[www.sfcta.org/cycletracks](http://www.sfcta.org/cycletracks)

## San Francisco Transportation Plan (SFTP) - Model Development: Bike Infrastructure

- Jeff estimated a path size logit model and coded the model into Python



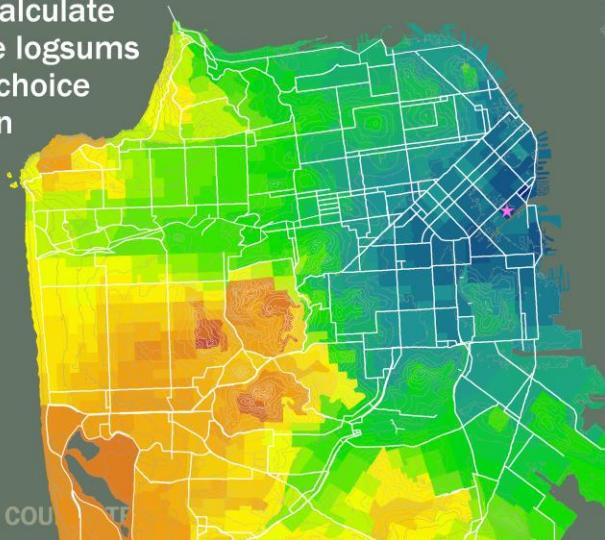
Attribute	Coef.	SE	t-stat.	p-val
Length (mi)	-1.05	0.09	-11.80	0.00
Turns per mile	-0.21	0.02	-12.15	0.00
Prop. wrong way	-13.30	0.67	-19.87	0.00
Prop. bike paths	1.89	0.31	6.17	0.00
Prop. bike lanes	2.15	0.12	17.69	0.00
<i>Cycling freq. &lt; several per wk.</i>	1.85	0.04	44.94	0.00
Prop. bike routes	0.35	0.11	3.14	0.00
Avg. up-slope (ft/100ft)	-0.50	0.08	-6.35	0.00
<i>Female</i>	-0.96	0.22	-4.34	0.00
<i>Commute</i>	-0.90	0.11	-8.21	0.00
Log(path size)	1.07	0.04	26.38	0.00

Hood et al "A GPS-based bicycle route choice model for San Francisco, California." *Transportation Letters*, 3(1), January 2011.

[www.sfcta.org/cycletracks](http://www.sfcta.org/cycletracks)

## San Francisco Transportation Plan (SFTP) - Model Development: Bike Infrastructure

- **Lisa added to Jeff's Python code to calculate bike route choice logsums to use for mode choice model estimation**



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## San Francisco Transportation Plan (SFTP) - Model Development: Walk Environment

### Problem: How do we represent different walk qualities?

- Lisa wrote a walk path generation algorithm (also used for transit access and egress)
- Follows generalized cost
- Skims slope, density, street capacity
- Measures indirectness



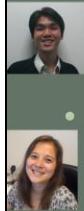
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## San Francisco Transportation Plan (SFTP) - Model Development: Transit Crowding

### Problem:

- Ridership forecasts unrealistically high;
- poor line validation for congested corridors;
- no relationship between capacity and ridership.
- Dan W. estimated dwell times:
  - $f(\text{boards, exit, veh. type})$
  - APC Data
- Developed Iterative, capacity-informed transit assignment (which Lisa then made even more awesome)



SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

40

Zorn Lisa, Elizabeth Sall, and Daniel Wu. "Incorporating crowding into the San Francisco activity-based travel model." *Transportation*, 2012, vol. 39, issue 4, pages 755-771.

(also presented at TRB Annual Meeting Washington DC 2012)

## San Francisco Transportation Plan (SFTP) - Model Development

### Problem:

- Put it all together into a new model version
- Matt estimated new mode choice models with:
  - Congested transit skims
  - Walk path variables
  - Bike route choice log-sums
- Matt and Lisa both had pleasure of model calibration
- Dan T. developed up-to-date calibration and validation targets



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41

## San Francisco Transportation Plan (SFTP) - Model Development

### Trip Difference - Bike Projects

Daily Tours	v4.1 Harold		v4.3 Fury	
Bike	500	0.1%	3,000	0.8%
Walk	1,100	0.0%	-500	-0.0%
Transit	850	0.0%	-600	-0.0%
Auto	-2,400	-0.0%	-1,300	-0.0%
Total	0	0.0%	600	0.0%



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42

## San Francisco Transportation Plan (SFTP) - Model Development

### Trip Difference – Livability Projects

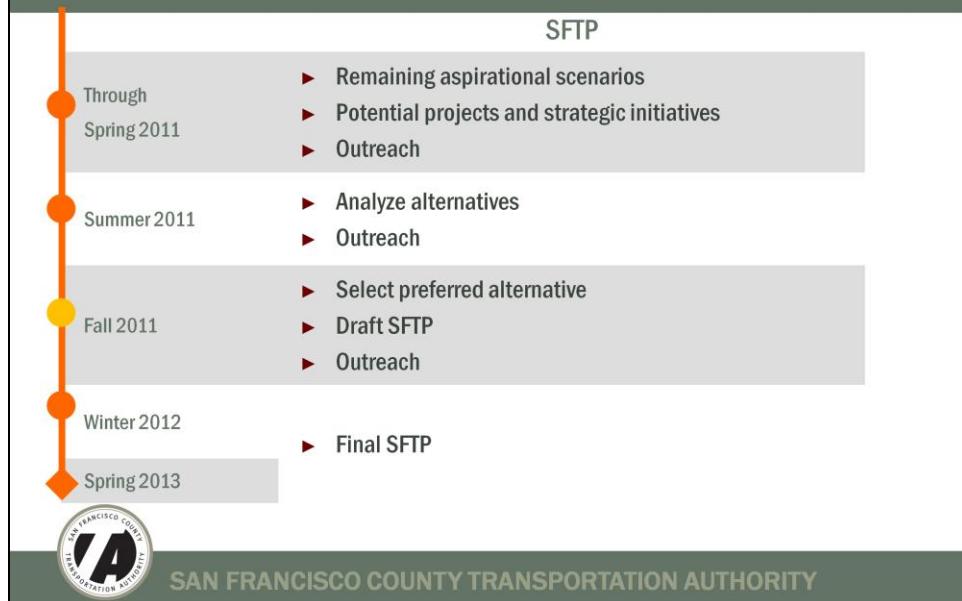
Daily Trips	v4.1 Harold		v4.3 Fury	
Walk	2,100	0.1%	7,800	0.3%
Bike	200	0.0%	1,500	0.5%
Transit	6,100	0.7%	3,500	0.3%
Auto	-10,000	-0.0%	-15,700	-0.1%
Total	-1,700	-0.0%	-2,800	-0.0%



SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

43

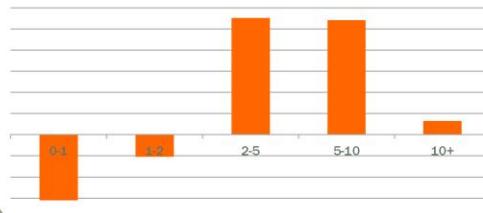
# San Francisco Transportation Plan (SFTP)



## Interesting Results from Other Studies with *Fury*



Transit by Distance



SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

# San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**How is school travel handled by a family?**

**What about school choice?**



46

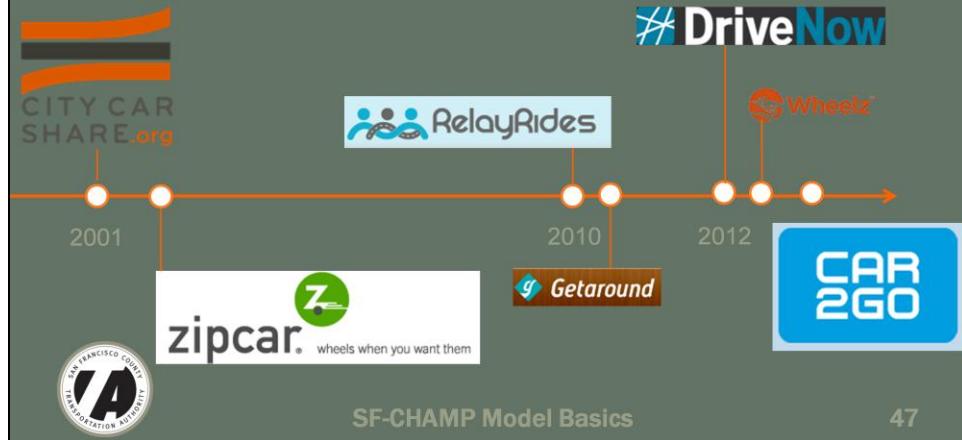
~ 50 percent of kid's mode share to school is "family car".

Each school has a target mode share to achieve.

## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**Does providing more access to car sharing reduce VMT or give more people access to driving?**



CityCarShare – 213 locations, many with multiple vehicles. 15,000 active members in bay area.

Relay Rides: 200 vehicles

Wheelz: 68 vehicles

DriveNow: 22 in SF, 21 in East Bay, 5 in San Mateo

## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**Required transit pass purchases for new mega developments.**

**Parking cash-out.**



**SF-CHAMP Model Basics**

**48**

## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**Sharing of other modes of transport, not just cars**



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49

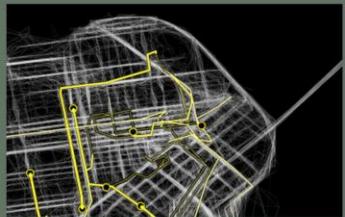
## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**There are a bunch more ways to “get a ride”  
these days...**



Everyone's Private Driver



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50

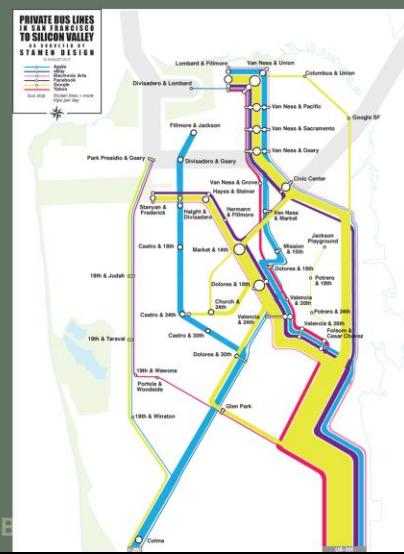
## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

## Private transportation options have become an employer benefit.

Transportation systems that are dynamic based on demand.

**Not only changes transportation  
...but land use too!**



Intracity shuttles ~ 29k boardings per day

Regional shuttles ~ 7k boardings per day, 50% of which would have driven if the shuttle hadn't been there.

## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**If personalized transit didn't exist, would people even make a trip to work?**



Jessica Brandi Lifland for The New York Times



Chronicle / Mike Kepka



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52

Ritual Coffee Roasters in the mission was actually the home of FLICKR before it was bought by Yahoo

Why pay Rent?

Current modeling practices don't account for Ritual Coffee Roasters on Valencia Street to be the "go to" workplace.

## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**The people aren't the only flexible part...the attractions  
are increasingly flexible as well.**



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53

“pop ups”

## San Francisco Transportation Plan (SFTP)

What we discovered we wanted to know more about

**And its not all about math of supply and demand. There are 'it' factors and peer effects.**



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54

<http://www.flickr.com/photos/birdinthehand/3397727526/sizes/z/in/photostream/>

BIRD IN THE HAND on FLICKR

Biking saw a huge increase in SF when we weren't even building any biking infrastructure.

# San Francisco Transportation Plan (SFTP)

## What we discovered we wanted to know more about



And even a terrible bus ride can be made “fun” and worth your while with the right game

SF-CHAMP Model Basics

55



# BEHIND THE SCENES

Day-to-day

People

Tools



SF-CHAMP Model Basics

## Day-to-Day

### APPS

600 since 2008

243 in 2010

Prefer one per week

### DEV/RSCH

~15 TRB Papers in 5 years

~5 Published Papers in 5 years

Meetings

Network Coding

Model Babysitting

Output Tools  
Development

Output Digestion  
and Presentation

Identifying Needs

Read Research

Develop Develop

Write a TRB Paper

Fix Fix

MAINT.

Paperwork

New Land Use

Update coding

Computer issues



57

Develop tools to make mundane and repeated, time consuming task tolerable and fast.

Allows us to spend more time “being planners” and “being researchers” and “coding”.

## Behind the Curtain - People

“The TA Modelers”



“The TA Inspiration”



“The TA Planners”

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58

## Behind the Curtain - People

But how it really works...



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59

Planners understand modeling and modelers understand planning. Interns, too!

## Behind the Curtain - Consultants



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60

There are people left off here – sorry! I couldn't find your picture!

## Behind the Curtain - People



Jennifer Ziebarth  
B.A. Mathematics, Carleton  
PhD Mathematics, minor  
Computer Science, Wisconsin



Daniel Tischler  
B.S. Urban and Regional Studies Cornell  
M.C.P. / M.S. Transportation Engineering  
Berkeley



Lisa Zorn  
B.S. Computer Science, Brown  
M.C.P. / M.S. Transportation  
Engineering Berkeley



Elizabeth Sall  
B.S. Civil Engineering, North Carolina State  
M.S. Civil Engineering, UT - Austin



All bring different skills to the table.

All have different professional development goals.

All excited about planning a more efficient transit-first city.

Interns critical part of our team.

## Behind the Curtain – People (Interns!)



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62

# Behind the Curtain – Network Coding

Network Wrangler Projects:

West Dublin BART Station

```
def desc():
    d = "BART - add West Dublin Station"
    return d

def applyEdits(net):
    WEST_DUBLIN = -16545
    pattern = re.compile("^100_BART_BLU")
    for l in net.line(pattern):
        try:
            l.setStop(WEST_DUBLIN, isStop=True)
            print "Making WestDublin a stop on %s" % (l.name)
        except:
            print "passing over line %s because doesn't have w. dublin" % (l.name)

def year():
    return 2011

def champVersion():
    return "4.3"
```



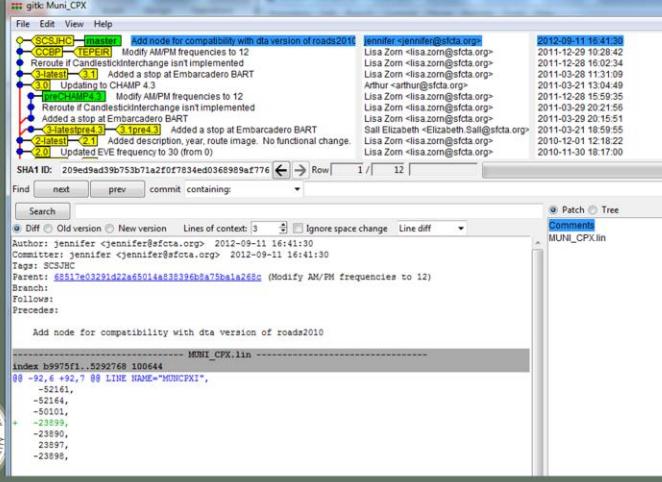
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63

<https://github.com/sfcta/TAutils/tree/master/wrangler>

# Behind the Curtain – Network Coding

- Projects version controlled using Git
- Can either grab “the latest” coding, or grab via a tag for intra-project consistency
- Can always go back to a previous version
- Model runs log which version they use so you can be consistent



gitk Muni\_CPX

File Edit View Help

SCSJBC - master Add node for compatibility with dtu version of roads2010 jennifer <jennifer@sfcta.org> 2012-09-11 16:41:30

CCBP - master Modify AM/FM frequencies to 12 Lisa Zorn <lisa.zorn@sfcta.org> 2011-12-29 10:28:42

Reroute if CandelstickInterchange isn't implemented Lisa Zorn <lisa.zorn@sfcta.org> 2011-12-28 16:02:34

CCBP - master Reroute if CandelstickInterchange isn't implemented at Embarcadero BART Lisa Zorn <lisa.zorn@sfcta.org> 2011-03-21 13:04:49

CCBP - master Upgrading to CHAMP 4.3 Arthur <arthur@sfcta.org> 2011-12-28 15:59:35

CCBP - master Modify AM/FM frequencies to 12 Lisa Zorn <lisa.zorn@sfcta.org> 2011-03-29 20:21:56

Reroute if CandelstickInterchange isn't implemented Lisa Zorn <lisa.zorn@sfcta.org> 2011-03-29 20:15:51

CCBP - master Added a stop at Embarcadero BART Sallie <sallie@sfcta.org> 2011-03-29 20:15:51

CCBP - master -2.0 Added description, year, route image. No functional change Lisa Zorn <lisa.zorn@sfcta.org> 2010-12-01 12:18:22

CCBP - master -2.0 Updated EVIC frequency to 30 (from 0) Lisa Zorn <lisa.zorn@sfcta.org> 2010-11-30 18:17:00

SHA1 ID: 209ed9ad39b753d71a2f07834ed0368989af776

Find next prev commit containing: Search

Diff Old version New version Lines of context: 3 Ignore space change Line diff

Author: jennifer <jennifer@sfcta.org> 2012-09-11 16:41:30  
Committer: jennifer <jennifer@sfcta.org> 2012-09-11 16:41:30  
Tags: SCSJBC  
Parents: 65517003291d27a65014a538396b75b1a2d8c (Modify AM/FM frequencies to 12)  
Branch:  
Follows:  
Precedes:

Add node for compatibility with dtu version of roads2010

----- MUNI\_CPX.lin -----

index b995f51..5292768 100644  
00 -92,4 +92,7 00 LINE NAME="MUNICPXI",  
-52164,  
-52164,  
-50101,  
-23890,  
-23890,  
-23898,

Commands MUNI\_CPX.lin

64

<https://github.com/sfcta/TAutils/tree/master/wrangler>



## Behind the Curtain – Network Coding

- Scenarios built by project and “tag”
- Limits errors from coding
- Very simple to run a ton of different scenarios

### Net Build Specifications in `build_networks.py`

```
---set definitions
TAG = 'SCSJHC'
YEAR = 2040
{
  "2040_NoProject": [
    {'hwy': [r"bridgeTolls\2010",
            "TwoWayMcAllister",
            r"RoadDiets\Folsom",
            "MarketStreet_ForceRights",
            "Streetscape_CesarChavez",
            r"BikePlan\2014",
            "TwoWayHaight",
            "GenevaExtension",
            "CandlestickInterchange
    'rail':[ 'RegionalRail',
            'BART_wDublinStation',
            "BART_WarmSprings",...etc
```



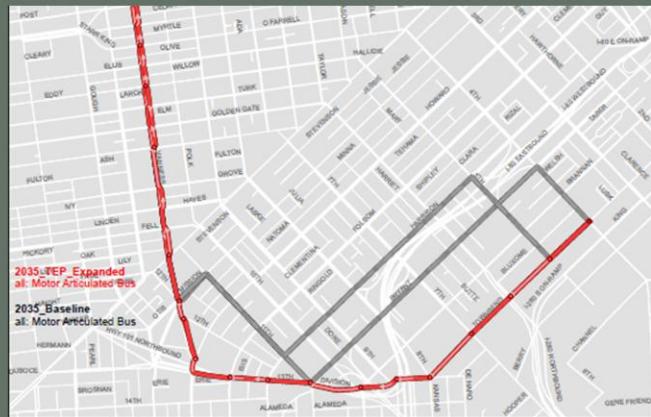
SF-CHAMP Model Basics

65

<https://github.com/sfcta/TAutils/tree/master/wrangler>

## Behind the Curtain – Network Coding

- Can export coding in planner-digestable formats
- Can review changes between scenarios so planners can sign off



SF-CHAMP Model Basics

66

<https://github.com/sfcta/TAutils/tree/master/wrangler>

# Model Versioning Using Git

SFCTA Git Browser / champ.git / summary

summary | about | log | commit | diff | tree | latest snapshot

description SF-CHAMP Code & Scripts  
owner administrator  
last change Tue, 18 Sep 2012 01:06:09 +0000  
url git://git.sfccta.org/champ.git

heads

3 weeks ago	<a href="#">master</a>	shuttle	1aa
12 months ago	<a href="#">4.0.1</a>	shuttle	1aa
2 years ago	<a href="#">4.0.0</a>	shuttle	1aa
3 years ago	<a href="#">4.0.0_1</a>	shuttle	1aa

shortlog

3 weeks ago	Liaa Zom	Fix CHAMPVERSION for release 4.0.0.1 (TIPERI) <a href="#">[diff]</a> <a href="#">[commit]</a>
3 weeks ago	Liaa Zom	Minor fix for CHAMPVERSION 4.0.0.1 official release. <a href="#">[diff]</a> <a href="#">[commit]</a>
3 weeks ago	Liaa Zom	Transit takes viscosity into account when summing ... <a href="#">[diff]</a> <a href="#">[commit]</a>
5 weeks ago	Liaa Zom	Convenience list TRANSITMODES. Also quiet down debugg ... <a href="#">[diff]</a> <a href="#">[commit]</a>
5 weeks ago	Liaa Zom	Wrangler: Default wrangler argc: suppressValidation=false <a href="#">[diff]</a> <a href="#">[commit]</a>
5 weeks ago	Liaa Zom	Bug fix: don't double count visitors <a href="#">[diff]</a> <a href="#">[commit]</a>
5 weeks ago	Liaa Zom	Fix for bug in BRT mode for TEP <a href="#">[diff]</a> <a href="#">[commit]</a>
5 weeks ago	Liaa Zom	Fix walkways multiplicity implementation; before other ... <a href="#">[diff]</a> <a href="#">[commit]</a>
6 months ago	Liaa Zom	Finally implemented Cubehelix to Shapfile (Pivotal Track ... <a href="#">[diff]</a> <a href="#">[commit]</a>
6 months ago	Liaa Zom	Error property if the extra delay mapping script isn't ... <a href="#">[diff]</a> <a href="#">[commit]</a>
6 months ago	Liaa Zom	More error checking: MTPPE-SF or MTC for bike network ... <a href="#">[diff]</a> <a href="#">[commit]</a>
6 months ago	Liaa Zom	Don't do any more mapping if the mapping file is empty ... <a href="#">[diff]</a> <a href="#">[commit]</a>
7 months ago	Liaa Zom	BRT bug fix: BRT in a location with no name <a href="#">[diff]</a> <a href="#">[commit]</a>
8 months ago	Liaa Zom	Dispatch network export rungs to taraval (where there ... <a href="#">[diff]</a> <a href="#">[commit]</a>
8 months ago	Liaa Zom	Implemented ExtraDelay functionality to enable some ... <a href="#">[diff]</a> <a href="#">[commit]</a>
8 months ago	Liaa Zom	Additional BRT changes: mode 20 (regional BRT) is local, ... <a href="#">[diff]</a> <a href="#">[commit]</a>

tags

5 weeks ago	<a href="#">4.0.1</a>	commit   about   log   [commit]
5 weeks ago	<a href="#">TIPERI</a>	commit   about   log   [commit]
8 months ago	<a href="#">4.0.0</a>	commit   about   log   [commit]
16 months ago	<a href="#">4.0.0_1</a>	commit   about   log   [commit]
16 months ago	<a href="#">4.0.0_1_beta</a>	commit   about   log   [commit]

File (FILE) Y → champ → releases →

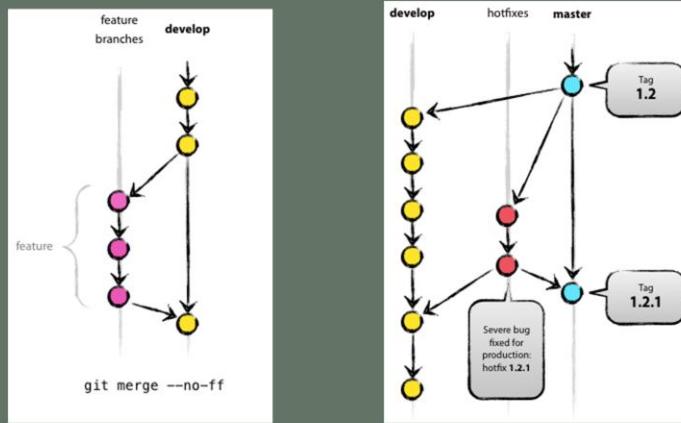
older

Name	Date modified
└── archive	6/2/2011 7:25 PM
└── 2.4.0	6/2/2011 7:27 PM
└── 4.1.0	6/2/2011 7:27 PM
└── 4.1.0.1	6/2/2011 7:27 PM
└── 4.1.0.2	7/1/2011 2:53 PM
└── 4.1.1	6/2/2011 7:26 PM
└── 4.3.0	3/26/2012 7:25 PM
└── 4.3.0.1	9/17/2012 5:43 PM
└── 4.3.0.2	9/20/2012 11:43 AM
└── RPMP_3.3.0	6/2/2011 7:26 PM
└── RPMP_3.3.1	6/2/2011 7:26 PM
└── RPMP_3.3.2b	6/2/2011 7:26 PM
└── RPMP_3.3.3	6/2/2011 7:26 PM



## SF-CHAMP Model Basics

# Model Versioning Using Git



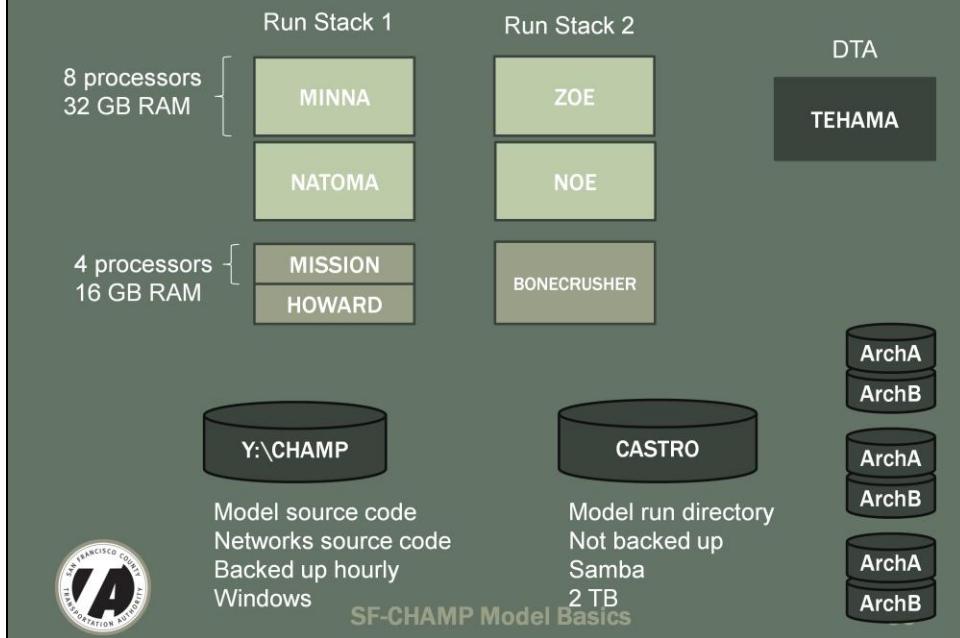
<http://nvie.com/posts/a-successful-git-branching-model/>



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68

## Behind the Curtain - Machines



# Behind the Curtain - Machines

TARAVAL

> runmodel.bat

Two main ways we Distribute jobs:

1 – dispatch (for exe)

distributes a job list to a set of  
machines (i.e. MINNA, NATOMA)

2 – python cluster (for cube scripts)

wraps a cube script list in a  
bigger cube script with  
cube distributeMultistep  
commands

MINNA

NATOMA

Run bulk of  
the code  
across their  
combined 32  
cores

MISSION

HOWARD

Helpers for highly  
parallel tasks: transit  
and highway  
assignment / skims



SF-CHAMP Model Basics

## Behind the Curtain – What Happens at “go”?

### Model Run Specifications in `runmodel.bat`

```
:: -----
set BASEDEMAND=Y:\champ\triptables\sf\p2009\CHAMP4.1\2035
set MTCDEMAND=Y:\champ\triptables\mtc\p2007_RTP2009\2035
set LANDUSE=Y:\champ\landuse\p2009\CHAMP4.Standard\2035\runInputs
set NETWORKS=.\Inputs\2035
set PROJECTION=p2009
SET MAXITERATIONS=3
set CHAMPVERSION=Y:\champ\releases\4.1.0

:: -----Dispatcher/Cluster setup
SET MACHINES=BONECRUSHER
SET COMMTPATH=Y:\COMMTPATH\BONECRUSHER
SET NODES=8
SET HWYDIST=BONECRUSHER
```



## What else?

- We just finished our citywide DTA model:
  - Every hill
  - Every signal
  - Every bus
  - All created programmatically from our static network on-the-fly



72

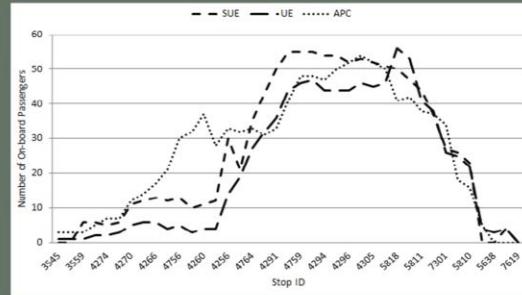
<http://dta.googlecode.com>



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## What else?

- Working with FAST-TriPs person-based dynamic transit assignment

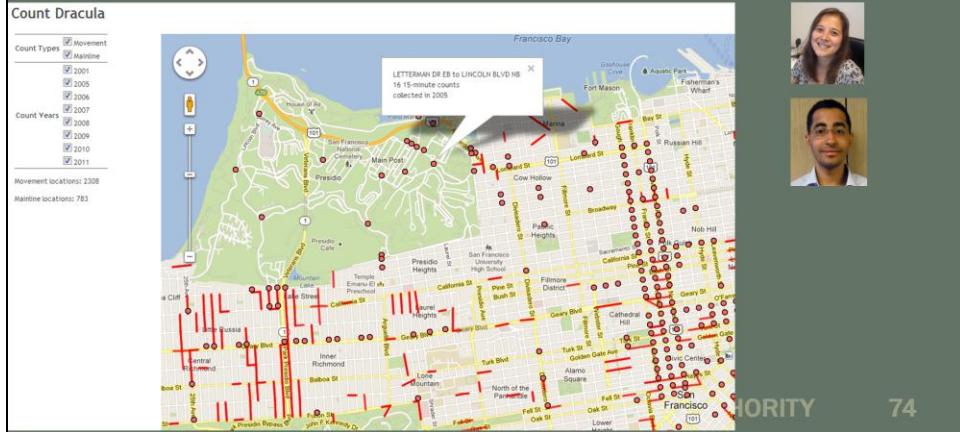


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73

## What else?

- Developed an open-source web-based data base for organizing traffic counts and interfacing with our DTA model



<http://github.com/sfcta>

That's it!

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[dan@sfcta.org](mailto:dan@sfcta.org)

[www.sfcta.org/modeling](http://www.sfcta.org/modeling)



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