

**To:** San Francisco Board of Supervisors

**From:** Eduardo Blount, Sandy Chan and Michael Cornwell

**Subject:** Policy Analysis of Solutions to Traffic Congestion in Downtown San Francisco

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The accompanying policy analysis examines the public problem of traffic congestion in downtown San Francisco. As the hub of the city's busiest activity, downtown San Francisco is host to over one million trips in and out of the area on a typical weekday. Travelers get through downtown using a variety of transportation modes, which include driving, riding transit and bicycling. Unfortunately, due to the concentrated activity, many parts of the area average between five to ten miles per hour during peak hour traffic, making travel time too long for commuters and visitors. Despite being a Transit First city, most trips made to and within San Francisco are by private automobile. In peak hour traffic, the congestion causes transit to be late, drivers to grow frustrated and the air to become polluted.

As the city's population is projected to grow to over 900,000 by 2030, it is imperative that decision makers take action to relieve traffic congestion in downtown San Francisco in order to maintain the city's economy and quality of life. This policy analysis offers three alternatives for consideration and concludes with our recommendation.

## **Executive Summary:**

After evaluating three potential methods of alleviating traffic congestion in downtown San Francisco, we recommend the adoption of Congestion Pricing (Alternative 2). In addition to being the only alternative to maintain a positive net present value at all levels of the sensitivity analysis, congestion pricing is amenable to the city's "transit first" policy. This demand-side market solution is accomplished through the establishment of fee zones, with the intention of reducing the number of single-occupancy vehicles during peak hours. Conversely, if this does not create a sufficient deterrent, the city is able to shift a percentage of the maintenance costs incurred to individual motorists. At a 5% discount rate, the net present value of congestion pricing is \$6.56 billion.

Costs and benefits require some clarification. It is important to note that all criteria were evaluated solely with respect to their impact on the City and County of San Francisco. The derived costs and benefits used to calculate net present values (NPVs) do not factor in those pertaining to individual motorists, nor are they viewed within a greater societal context. As such, this analysis contains no discussion of environmental concerns or equity, save for their relevance as preferences, with respect to the political feasibility of the alternatives examined. Although the Texas Transportation Institute (TTI) employs a derived average income to assign a monetary value to time lost due to congestion, we feel that this does not adequately capture the real essence of the problem. Similar formulas to assign monetary values to environmental externalities were eschewed.

## **Problem Identification**

Downtown San Francisco, which encompasses the northeastern quadrant of the city, is the hub of the city's busiest activity. Comprised of the Financial District, South of Market (SoMa), Union Square, Civic Center and Fisherman's Wharf, this area is the center of tourism and commerce. On a typical weekday, there are over one million trips going in and out of downtown. Private automobiles account for almost half of these trips. Because of this concentrated activity, many parts of downtown average between five to ten miles per hour during peak-hour traffic, which spans from 6:00-9:00 A.M. and 4:00-7:00 P.M. In essence, travelers spend too much time getting through downtown San Francisco. The congestion frustrates drivers, hinders reliable transit service and creates unnecessary pollution from idling vehicles.

According to the 2007 Texas Transportation Institute Urban Mobility Report, motorists in the San Francisco-Oakland area endure the second longest traffic delays of any metropolitan area, resulting in 60 hours wasted per traveler per year. As San Francisco's population is projected to increase from 744,041 residents to 940,000 with an increase in job growth of forty three percent by the year 2030, the city's leaders are looking for ways to accommodate this growth in light of the congestion problem (San Francisco County Transportation Authority [SFCTA] Overview, 2007).

## **Criteria of Evaluation**

- *Effectiveness* – Will the alternative reduce the amount of time that commuters and other motorists spend getting through downtown San Francisco? Vehicle miles traveled (VMT) and level of service (LOS) track changes in mobility.

- *Political Feasibility* – Will stakeholders support the alternative? Is it amenable to San Francisco’s transit-first policy? Surveys, focus groups, and City Hall/Board of Supervisors meetings, and ultimately, the ballot are effective measures.
- *Cost of Implementation* – Is the alternative a worthwhile use of the city’s financial resources? Net Present Value (NPV) calculations will be made for this criterion, along with a sensitivity analysis.

Due to the highly participatory nature of San Franciscan politics, Political Feasibility appears to be the most significant criterion in evaluating the viability of prospective alternatives. In order for congestion pricing to be legal, California state law must be amended to permit the city to charge motorists. Despite this major caveat, the criteria are not weighted differently, as political acceptance at the local level is the first hurdle.

### **Alternative 1: Status Quo**

San Francisco is ostensibly committed to a transit-first policy that seeks to diminish congestion and promote use of mass transit. Five major public transportation systems operate within the downtown area, but in recent years, San Francisco has witnessed a decrease in transit usage and a rise in private auto transportation. Although public transit only accounts for 17 percent of the daily trips in San Francisco, it is responsible for 42 percent of trips into downtown San Francisco during peak commute hours.

### **Effectiveness:**

How well does the transportation infrastructure manage congestion in downtown San Francisco? While bicycle and pedestrian traffic are definitely of consequence, the focus of this analysis is automobile traffic. Driving is the most utilized form of transportation in San Francisco. In 2000, the SF County Transportation Authority (SFCTA) estimated 62% of regional and internal trips were made by automobile. Drivers who face congestion on the downtown streets of San Francisco encounter significant trouble during the peak morning and evening commute hours. SFCTA states that on more than half of the downtown surface streets, the average speed is less than ten miles per hour during peak periods. The slow pace of travel affects both private autos and the surface public transit routes that share the road with them.

The methodology to used monitor congestion is called level of service (LOS). This system illustrates the operating conditions on a roadway, using a scale from “A” to “F” to rank mobility, with “A” meaning free flow of traffic, and “F” meaning bumper-to-bumper. The San Francisco County Transportation Agency states, “LOS is the main indicator of congestion and as the uniform yardstick for measurement of improvement in transportation service, as well as to gauge the congestion relief potential of proposed transportation solutions”. A table can be found in the appendix showing sample traffic flows downtown during peak hours.

According to the San Francisco County Transportation Agency, transit carries 36% of the 98,700 San Francisco based trips to downtown each morning. This figure grows to 42% when regional trips are included. Thus, public transit plays a significant role in transportation in the downtown area. The largest public transit operator in San Francisco and the downtown area is Muni, whose transit network is a modified grid

focusing on the city's central business district. The system carries 680,000 passengers each weekday, making it the seventh largest in the United States. It is designed to get people to any point in the city with no more than one transfer (SFMTA, 2006).

To better understand the effectiveness of Muni, the San Francisco Municipal Transit Agency funded the Transit Effectiveness Project (TEP). This project evaluated the status quo and provided many different measures of the system's effectiveness. One major discovery it made was that, although number of trips in San Francisco has increased since 1985, Muni's ridership has fallen or stayed flat. Several factors contributed to this trend, such as San Franciscans' commuting outside the city, an increase in "telecommuting" and a shift to BART for intra-city trips. Muni surface speeds in the downtown area are limited to 7.5 miles per hours, but these slow speeds are attributable, in part, to traffic congestion (SFMTA, 2007). In short, Muni does not sufficiently address the city's transportation needs.

### **Political Feasibility:**

The San Francisco County Transportation Agency (2004) stated in its countywide transportation plan that the Transit First Policy has been critical to maintaining accessibility in the city and its downtown area. Article XVI of the San Francisco Charter outlines at length how the city will promote the use of transit. The main elements of the transit first policy are: (1) encouraging multi-modality; (2) finding alternatives to single occupancy vehicles; and (3) giving priority to the maintenance and expansion of the local transit system (SFMTA, 2006).

Many San Franciscans are tired of congestion downtown and elsewhere, and they

demand accountability. In this context, the status quo does not appear politically feasible. The November 2007 General Election featured two ballot measures with diametrically opposite ways of addressing the city's congestion problem. Prop A called for an increase in spending on public transportation, while Prop H was concerned with creating additional parking spaces as a potential solution. The passage of either one or both of these propositions would be a rebuke of the status quo. It is important to note that if both pass, Prop A would trump Prop H, due to the city's transit-first imperative.

**Cost:**

The projected operating budget and revenues reflect those of Muni and the Department of Parking and Traffic. The MTA projected operating costs for FY2007/2008 are \$595,000,000, while projected revenues are \$595,000,000 (MTA, 2007). Solvency is a goal of the transit-first approach. The projected Average Annual Cost (FY2007) of street resurfacing is \$38,044,000 (DPW, 2004). Using a discount rate of 5% the costs of the alternatives outweigh the benefits. The continued operations of managing congestion in downtown San Francisco will have a NPV of \$165,000,000. Results of the sensitivity analysis at the 3% discount rate demonstrated a negative NPV; however, at the 8% and 10% discount rates the NPV is positive. The fact that 8 and 10% are positive tells us that the internal rate of return is between 8 and 10 percent.

**Alternative 2: Congestion Pricing**

Congestion pricing is a transportation demand management strategy that involves the imposition of a fee on motorists who use congested roads. Because downtown roads are free to use, there is little incentive for drivers not to overuse them. To affect the

behavior of drivers, economic theory would suggest putting a price on the usage of the road in order to bridge the gap between supply and demand. In London, where congestion pricing was implemented in February 2003 in its 8.5 square-mile central business district, drivers are charged a little over \$16 per day to enter the fee zone on weekdays between 7am and 6pm. Payment can be made online, by phone, mail or text message, and at kiosks, stores or gas stations. Enforcement is done with cameras set up along the roads that record license plate numbers of vehicles and match them with those on a list of paid vehicles. It is crucial to increase public transit simultaneously with the implementation of congestion pricing in order to accommodate commuters who decide to switch from driving to riding transit.

**Effectiveness:**

Congestion pricing in the form of fee zones has not been implemented in the United States. However, since London adopted congestion pricing, traffic congestion has dropped thirty percent in the target area, and bus service has attracted 18% more riders. Revenues from congestion pricing, which totaled about \$437 million in 2006, have been used to improve transportation infrastructure in London. If adopted in San Francisco, revenues from the fee zones can be used to improve Muni's reliability and increase the arrival frequency of transit vehicles. This coincides with the city's transit-first approach.

Other cities that have used congestion pricing have experienced traffic congestion along the perimeter of the pay zones, as motorists tended to drive just close enough to the zone to avoid having to pay the fee. It would be self-defeating if traffic congestion is only

displaced rather than reduced. A fee zone that covers the entire northeastern quadrant of the city would be effective in preventing this behavior.

### **Political Feasibility and Stakeholder Analysis:**

Several stakeholder groups would be expected to weigh in on this issue. A more simplified stakeholder analysis for this alternative can be found in the appendix.

#### *Business Interests*

Given the importance of downtown commerce to San Francisco's economy, business interests exercise considerable leverage over policy outcomes. However, their reaction to congestion pricing may not be united. Some willingly accept that downtown traffic and parking conditions are so unaccommodating to automobiles that mass transit is the best way to travel, while others may be vehemently opposed. Parcel and freight companies may improve their productivity, while retailers may lose potential customers. Seventy percent of business owners in London said the scheme had no discernible effect on their bottom line (SFCTA Briefing Book, 2007). As such, congestion pricing may not have as negative an effect as some merchants think.

#### *Downtown Drivers*

Whatever their reason, some people do not use mass transit. Commuters and other motorists who drive downtown will most likely be opposed to an additional fee. This echoes merchants' concerns.

### *Environmentalist Groups*

True to San Francisco's history of activism, environmentalist groups have long called for congestion management to alleviate pollution, and they serve as a watchdog on the city's operations as they affect the environment. In 1989, for example, the Sierra Club Legal Defense Fund and the Citizens for a Better Environment filed lawsuits in the Federal District Court of Northern California, claiming that the State of California and the Metropolitan Commission of San Francisco had violated provisions of the Clean Air Act Amendments of 1977 by not doing enough to meet the clean air standards (Weiner, 1997). Because congestion in downtown causes unnecessary pollution, it is likely that environmental groups will support congestion pricing.

### *Residents*

San Francisco residents also have a history of activism. Following the damage to the Embarcadero Freeway caused by 1989's Loma Prieta Earthquake, residents chose to demolish the freeway altogether, preferring the construction of street-level boulevards instead. Residents will want wider sidewalks and spaces to congregate, and continue the history of resident activism by supporting congestion pricing in downtown to discourage traffic congestion close to them.

### *City Hall – Board of Supervisors*

As the legislative body of San Francisco, the Board of Supervisors must consider resolutions for the city's problems that will ensure the vitality of the city in the long run. A key to achieving this is through effective public transit. City Hall knows that its performance will be judged, in part, on the success of the transit system, so it would

prefer to be able to adopt a congestion pricing scheme that will generate revenues for transit and reduce traffic congestion that hinders transit reliability.

### *San Francisco Muni (SFMTA)*

Transit currently carries the bulk of trips downtown, but it must be able to carry more if downtown growth is to succeed. The better the transit system, the more likely people will get out of their cars, which means less traffic congestion and air pollution. While Muni provides almost 700,000 trips a day and operates 80 routes throughout the city, it suffers from staffing and funding shortages and labor issues which have ultimately hampered its ability to give prompt service (SFMTA, 2007). Congestion pricing would divert revenues to Muni as well as improve timeliness. Because Muni is central to the transportation needs of the city's residents, it will be difficult to ignore its preferences.

### **Cost:**

If San Francisco adopts a plan similar to London's but with electronic toll collection transponders, it will spend about \$665 million in start-up costs, which include sensor equipment and personnel expenses, enforcement, customer service centers and a website. Ongoing operating costs will be about \$50 million. If the city uses FasTrak transponders, additional costs can be offset by integrating FasTrak into the fee zone scheme.

On the revenue side, it is not known what fee the city would charge for entry into the fee zone or what fee structure will be used, but in London's case, its congestion pricing program brought in about \$437 million last year, charging \$16 per weekday. In downtown San Francisco, with over half a million trips per day (to and from) being made

by vehicle and about a 30% reduction in vehicular traffic as a result of congestion pricing at \$8 per day, we arrive at \$391,751,360 per year in additional revenue. This is the only alternative that maintains positive net present values at all discount rates in the sensitivity analysis, and is the overwhelming favorite using this criterion.

### **Alternative 3: Expanding Road-Carrying Capacity**

The idea of widening existing lanes, or creating more roads to alleviate congestion in heavily traveled corridors is nothing new. This approach has been applied extensively in the Southwest, where rapid suburban development engendered long commutes on roads that were insufficient to keep pace with demand (Nozzi, 2003). By increasing road-carrying capacity in downtown San Francisco, traffic mobility will be improved by approximately 15%, and motorists will presumably spend less time stuck in traffic. If we consider population growth as the key determinant of traffic congestion, expanding road-carrying capacity is merely one way of accommodating inevitable future growth.

### **Evaluation of Increasing Road-Carrying Capacity Against the Criteria**

#### ***Effectiveness:***

A major concern with this alternative is that the creation or expansion of roads may simply attract drivers who previously used different modes of transportation, employed other routes, or scheduled trips during non-peak hours to avoid congestion. This phenomenon is known as induced travel. Since our criterion is whether this alternative will increase mobility, induced demand is a major concern.

In their analysis of congestion, Cervero and Hansen (2000) noted that the D.C. metro area experienced an increase in mobility of 15% after widening roads in the downtown area. The authors concede that induced demand does offset some of the positive benefits of increasing road-carrying capacity, but it is only in rapidly growing metropolitan areas that these gains are fully negated. Research by Fulton, et al, (2000) shows that in very dense metropolitan areas with adequate mass transit systems, the correlation between increasing road-carrying capacity and induced demand is significantly lower. San Francisco may therefore be able to minimize the inherent risk of induced travel, resulting in gains similar to those in D.C. Vehicle miles traveled (VMT) or LOS would be appropriate measures of increased mobility for this alternative.

### ***Political Feasibility and Stakeholder Analysis:***

#### *Business Interests*

Faced with potential relocation through eminent domain or loss of revenue during construction, merchants in the downtown area might be vehemently opposed to widening streets, while freight and delivery businesses would welcome such changes, as they would increase the potential number of deliveries made per day.

#### *Commuters and Other Motorists*

A secondary goal of this policy is to reduce commute times. In addition to commuters and downtown drivers, emergency and public safety vehicles may benefit from increased capacity. As such, a wide array of motorists would be favorably disposed toward this alternative.

#### *Environmental and Activist Groups*

With mobility as its primary focus, this alternative does little to assuage the fears of environmental groups, who would likely perceive it as irresponsibly increasing carbon emissions. Other activist groups would be expected to weigh in against this alternative, in the form of protests and grassroots lobbying efforts.

#### *San Francisco Muni*

SF Muni would voice strong opposition to this alternative, because it diverts funds from public transit, and induced demand may offset gains in mobility.

#### *Residents*

While this is a huge, catch-all category of stakeholders, the political climate of San Francisco does not favor the construction of more roads to “build” San Francisco out of its congestion problem. Those that carpool or rideshare may see this alternative as a step backward, while others may simply see it as fiscally irresponsible.

#### *City Hall – Board of Supervisors*

Competing political ideologies notwithstanding, re-election is the main concern for these officials. Muni funding remains popular, and this alternative is not amenable to the city’s transit-first policy. As such, the Mayor and Board of Supervisors would be opposed.

#### **Cost:**

Using projected costs from the Metropolitan Transportation Commission (2005) for new and upgraded local streets and roads, we arrive at \$63 million in construction costs for the widening of roads in the downtown area. Eminent domain will most likely be invoked in order to complete certain segments of construction. Using Vancouver as a guideline, our estimate is that this will incur an additional one-time cost of \$2 million if

used sparingly (65% probability) or \$8 million if there are many hold outs that resist the new project (35% probability). Finally, annual maintenance costs would be slightly higher than those projected in the Transportation 2030 plan. By averaging these costs we derive an additional \$20,000 to maintain the expanded areas each year. No additional revenue is generated by this alternative to offset costs, and it has negative net present values at all discount rates used in the sensitivity analysis.

**Alternatives Rejected without Evaluation:**

***Increased gasoline taxes and/or parking fees***

Both of these alternatives shift the costs of congestion back to the individual driver, and contain demand-side incentives similar to those found in congestion pricing. Furthermore, increasing gasoline taxes is usually done at the state or federal level.

***Travel allowance or elimination of guaranteed employer-provided parking.***

These alternatives are predicated upon employers possessing guaranteed parking for their employees. This is highly uncertain in San Francisco, where parking is at a premium.

***Creation of additional parking capacity.***

Proposition H appeared on the ballot in the 2007 General Election, but the outcome is not clear at this time. If successful, this initiative will become part of the status quo alternative, but faces the same potential for induced demand present in expanding roads.

***Increased funding for mass transit.***

In direct contrast to the creation of additional parking, Prop A also appeared on the ballot for public consideration.

***Creation of High-Occupancy Vehicle Lanes.***

Similar in scope to Alternative 3, this alternative focuses on increasing mobility through the creation of lanes specifically designated for carpooling or buses. This is an expansion of the Mobility 2030 plan for San Francisco, and will gradually figure more prominently in the status quo.

**Comparison of Alternatives and Recommendation:**

With its transit-first emphasis, the status quo provides a benchmark for other alternatives. As such, increases in mobility can be compared against this alternative as if it were static. While it currently enjoys political support, this may change, depending on the results of the 2007 General Election. Despite negative NPV's at lower discount rates, the status quo is a compromise solution with an internal rate of return between 8 and 10%, potentially making it more attractive than an ambitious congestion pricing scheme that may not yield immediate results during an elected official's tenure in office. A time-sensitive analysis was not conducted, as we believe that the city is committed to a transit-first policy for the foreseeable future.

Despite being the runaway favorite in terms of both political feasibility and cost criteria, the figures for congestion pricing are only estimates. Aside from London and Singapore, there is very little empirical data regarding this alternative, making it difficult to ascertain to what degree mobility is increased. One large potential trade-off is that this policy may inadvertently create induced demand on lesser-traveled roads encircling the

downtown area, as motorists continue to choose single-occupancy vehicles over mass transit.

Of the three alternatives examined, only increasing road-carrying capacity results in an immediate and easily appreciable increase in mobility. Initial costs and maintenance expenses are also significantly lower than those of congestion pricing. This is tempered, however, by the fact that it generates no additional revenue for the City of San Francisco, and would be fiercely opposed by several relevant stakeholder groups. At all discount rates in the sensitivity analysis, this alternative was the only one with negative NPVs. That this alternative continues to be adopted in major metropolitan areas is a testament to these cities' growth and the widely held political preference of expediency. This confirms the adage in urban administration that cities cannot build their way out of congestion (Downs, 2004).

When all three alternatives are compared to the criteria, Alternative 2 – Congestion Pricing, emerges as both the most politically acceptable and cost-effective. The results of the 2007 General Election may play an important role in providing momentum for this solution, especially if the City of San Francisco invests in a citywide WiFi network. The ambiguity inherent in gauging the effectiveness of congestion pricing is a slight deterrent, but there is a distinct possibility that the existing FasTrak infrastructure will accommodate this alternative, further diminishing initial costs. For these reasons, we recommend congestion pricing as the preferable alternative to reducing traffic congestion in downtown San Francisco.

**Appendix: Exhibits and Calculations:**

The Congestion Management Program 2008/07 report contains the following data regarding LOS monitoring in the downtown area. The speeds for both auto and transit in each of the examples equate to an LOS of “F”, which is analogous to bumper-to-bumper traffic.

<b>Congested Downtown Roadways P.M. Peak Period (2006 vs. 2007)</b>					
Name	Direction	2006 Auto Average Speed	2006 Muni Average Speed	2007 Auto Average Speed	2007 Muni Average Speed
Market	Van Ness to Drumm	9.3	7.0	12.0	6.8
Columbus	North Point to Greenwich	15.9	8.5	12.5	7.0
4 <sup>th</sup> Street	Market to Harrison	11.3	6.2	9.4	5.1
Van Ness S.Van Ness	Golden Gate to 13 <sup>th</sup> Street	12.7	6.5	11.8	6.4
Mission	3 <sup>rd</sup> Street to Embarcadero	11.8	5.5	10.2	5.2

<b>Congested Downtown Roadways P.M. Peak Period (2006 vs. 2007)</b>					
Name	Direction	2006 Auto Average Speed	2006 Muni Average Speed	2007 Auto Average Speed	2007 Muni Average Speed
Market	Drumm to Van Ness	9.9	6.2	11.5	5.7
Columbus	Greenwich to North Point	13.1	8.1	16.8	6.7
4 <sup>th</sup> Street	Harrison to Market	8.9	5.1	9.1	4.2
Van Ness S.Van Ness	13 <sup>th</sup> Street to Golden Gate	9.1	4.1	12.7	5.7
Mission	Embarcadero to 3 <sup>rd</sup> Street	13.4	7.0	11.3	5.4

*Political Analysis of Congestion Pricing*

	<b>Business Interests Pro</b>	<b>Business Interests Against</b>	<b>Downtown Drivers</b>	<b>Environmental Groups</b>	<b>Residents</b>	<b>City Hall</b>	<b>SF Muni</b>
<b>Role</b>	Interest group	Interest group	Policy target	Interest group	Citizens	Decision maker	Interest group
<b>Position</b>	Supports	Opposes	Opposes	Supports	Supports	Supports	Supports
<b>Power</b>	Money, media attention, city's vitality hinges on commerce	Money, media attention, city's vitality hinges on commerce	None by themselves	Media attention, membership size, protesting & going public	Voting, litigation	Formal decision making	Media attention, city's vitality hinges on effective transit
<b>Values</b>	Unhindered road travel for operations and customers	Free road travel for operations and customers	Free road travel	Protection of environment	Mobility, Livability, Access	Transit first mentality, sustainability	Transit service
<b>Motivations</b>	Profit	Profit	Arriving to destination timely	Public interest, environmental protection	Comfortable living	Public interest, re-election	Public interest, sound budget

*Political Analysis of Increasing Road-Carrying Capacity*

	<b>Business Interests Pro</b>	<b>Business Interests Against</b>	<b>Commuters and Downtown Drivers</b>	<b>Environmental and Activist Groups</b>	<b>Residents</b>	<b>City Hall</b>	<b>SF Muni</b>
<b>Role</b>	Interest Group	Interest Group	Policy Target	Interest Groups	Citizens	Decision Maker	Interest Group
<b>Position</b>	Supports	Opposes	Supports	Opposes	Opposes	Opposes	Opposes
<b>Power</b>	Money, media attention, city's reliance on commerce	Money, media attention, city's reliance on commerce	Voting, litigation	Media attention, membership size, & protesting	Voting, litigation	Formal decision making	Media attention, city's reliance on effective transit
<b>Values</b>	Smoother travel for operations and customers	Minimal interference in operations	Free road travel	Protection of environment, freedom of speech	Mobility, Livability, Access	Accountability, sustainability	Public transit service
<b>Motivations</b>	Profit	Profit	Shorter commutes, less time in traffic	Public interest, environmental protection	Comfortable living	Public interest, re-election	Public interest, larger budget

**Net Present Value (NPV) Calculations (at 5% discount rate)**

Alternative 1 – Status Quo

**Costs**

- \$38 million in annual maintenance costs for existing roads in perpetuity.
- \$595 million annual operating budget for MTA/Muni in perpetuity.

**Benefits**

- \$595 million in revenue from MTA/Muni in perpetuity.

$NPV = -(\$633M/.05) + \$595M + (\$595M/.05) = \mathbf{-\$165 \text{ Million}}$

Alternative 2 – Congestion Pricing

**Costs**

- \$665 million in start-up costs (which include operating costs in Year 0)
- \$50 million in operating costs in perpetuity

**Benefits**

Based on 1,076,240 trips (to and from) in downtown SF made by 538,120 travelers. 50% of these travelers drive private automobiles => 269,060 drivers (SFCTA Briefing Book, 2007) A 30% reduction in traffic is desired. 70% of 269,260 gives us the number of travelers who continue to drive = 188,342

- 188,342 (after 30% reduction of 538,120 vehicles) x \$8/day 1,506,736 per day X 260 workdays/year = \$391,751,360 per year

$NPV = -665 \text{ million} - 50 \text{ million}/0.05 + 391,751,360 + 391,751,360 /0.05 = \mathbf{\$6,561,778,560}$

Alternative 3 – Increasing Road-Carrying Capacity

**Costs**

- \$63 million in construction costs in Year 0.
- \$20,000 annual maintenance costs in perpetuity.
- \$2 million (Pr = .65) or \$8 million (Pr = .35) one-time costs from eminent domain in Year 0.
- 

$EV = -\$63M - [(2M*.65) + (8M*.35)] = -\$67.1 \text{ Million}$

$NPV = -\$67.1M - (20,000/.05) = \mathbf{-\$67.5 \text{ Million}}$

**Sensitivity Analysis of Alternatives**

<i>Discount Rate</i>	<i>Alternative 1</i>	<i>Alternative 2</i>	<i>Alternative 3</i>
<b>3%</b>	-\$671,000,000	\$11,118,463,360	-\$67,766,667
<b>5%</b>	-\$165,000,000	\$6,561,778,560	-\$67,500,000
<b>8%</b>	\$120,000,000	\$3,998,643,360	-\$67,350,000
<b>10%</b>	\$215,000,000	\$3,144,264,960	-\$67,300,000

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