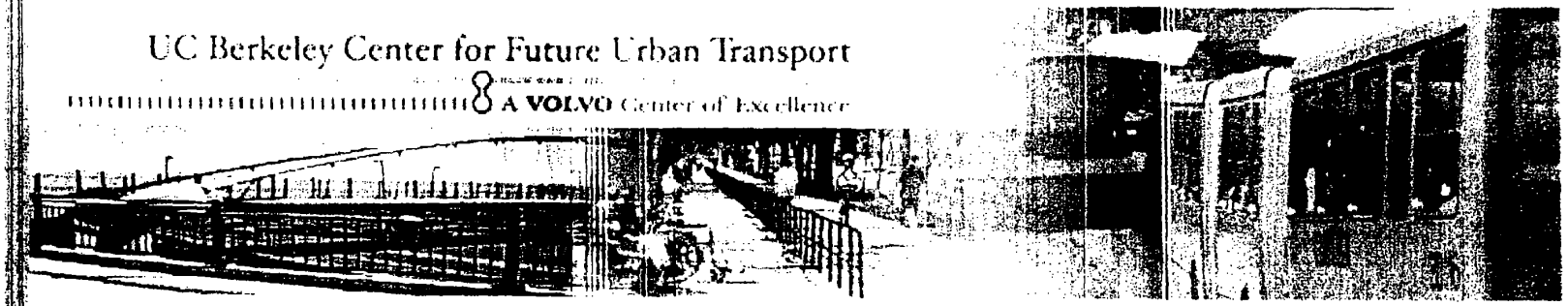
UC Berkeley Center for Future Urban Transport

A VOLVO Center of Excellence



Current projects include:

- Balancing mobility and accessibility in Chinese cities
- Bus lanes with intermittent priority
- Improving urban mobility through gridlock control
- Green city logistics
- Adaptive signal control for urban arterials
- Wireless infrastructure for urban traffic control

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California Center for Innovative Transportation

- Established in 2001 in collaboration with Caltrans to facilitate the development, commercialization and deployment of promising transportation technologies and systems

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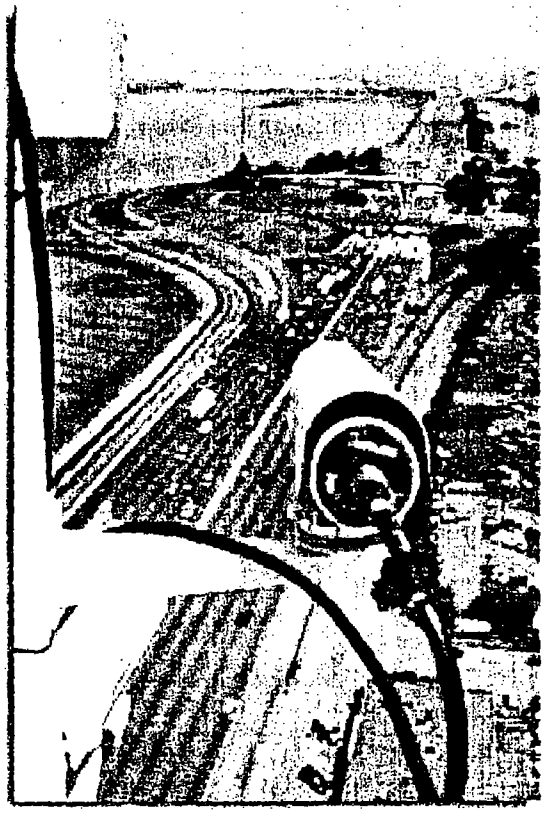
California Center for Innovative Transportation



Berkeley Highway Lab is a roadway detection research and development site on a 2.7 mile segment of I-80 just north of Oakland. It includes 8 paired loop detectors and an automated video surveillance system mounted on the 30-story Emeryville tower, enabling automated vehicle tracking over an extremely congested area.

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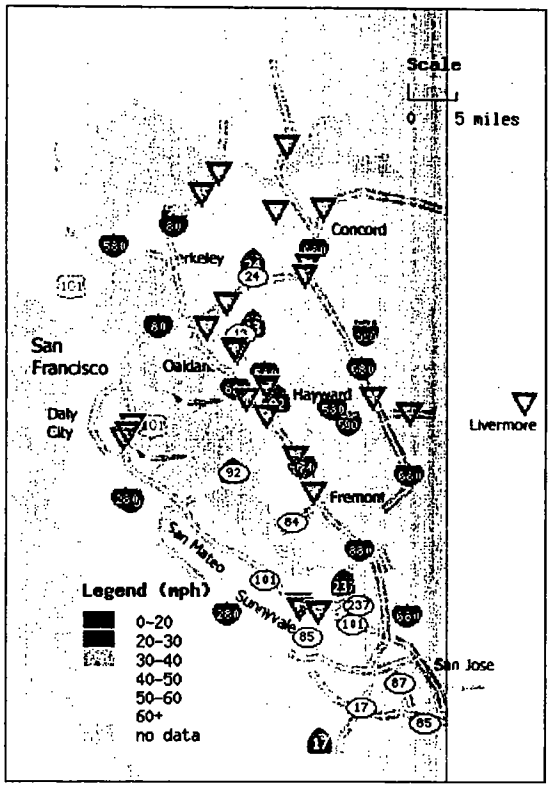
California Center for Innovative Transportation



PeMS, a joint effort between ITS researchers and Caltrans, collects real-time flow and occupancy data from loop detectors embedded in the state's freeways and makes it available to transportation managers, researchers and the private sector, for reducing congestion, improving trip reliability, enhancing customer safety and more fully utilizing existing system capacity.

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PAVEMENT RESEARCH CENTER

Pavement Research Center

PRC conducts research in partnership with other academic institutions, private industry and government to research questions pertaining to the design, construction, rehabilitation and maintenance of the highway infrastructure

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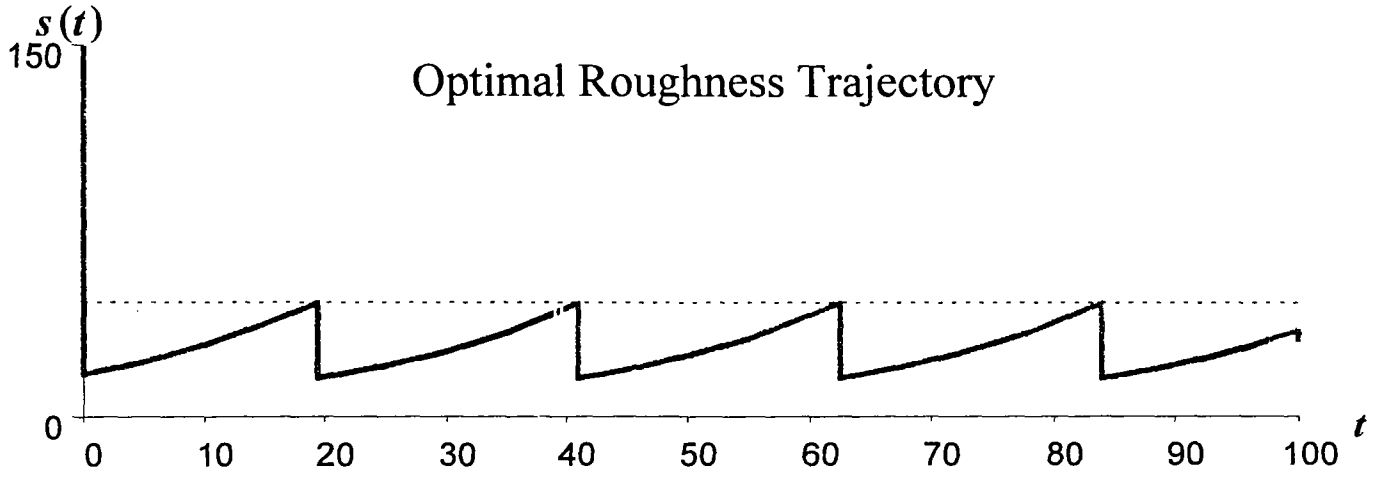
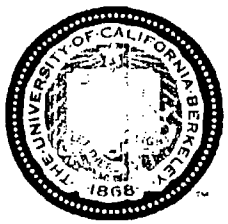
PAVEMENT RESEARCH CENTER

Pavement Research Center



Research has extended beyond pavement design to problems of optimization of maintenance of highway pavements



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PAVEMENT RESEARCH CENTER

Pavement Research Center

The CA4PRS project integrates design, materials, construction and traffic analyses for freeway rehabilitation and reconstruction projects in order to lengthen pavement life, speed construction and minimize traffic disruptions

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Traffic Safety Center

- Started in 2001 as a joint venture between ITS and the School of Public Health
- The mission of the TSC is to reduce traffic fatalities and injuries through multi-disciplinary collaboration in education, research, and outreach.

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ITS

Traffic Safety Center

Some current areas of TSC research:

Child Passenger Safety

Older Drivers

Intersection Crashes

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The University of California Transportation Center (UCTC)

- Funds fellowships for transportation students.
- Holds an annual competition for research project funding.
- Publishes *ACCESS* magazine.
- Sponsors an annual student transportation research conference.
- Not a part of the Institute of Transportation Studies, but important vehicle for policy research.

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Joint Center for Transportation Sustainability Research

- Collaboration of ITS, ERG, UCEI, UCTC, GMS & BIE
- Launch date: May 2006
- Initial projects include:
  - LCCA of ethanol as a fuel for the transportation industry
  - Field-test of hydrogen fuel cell vehicles as part of "Controlled Hydrogen Fleet & Infrastructure Demonstration & Validation Project," in collaboration with DCX & BP

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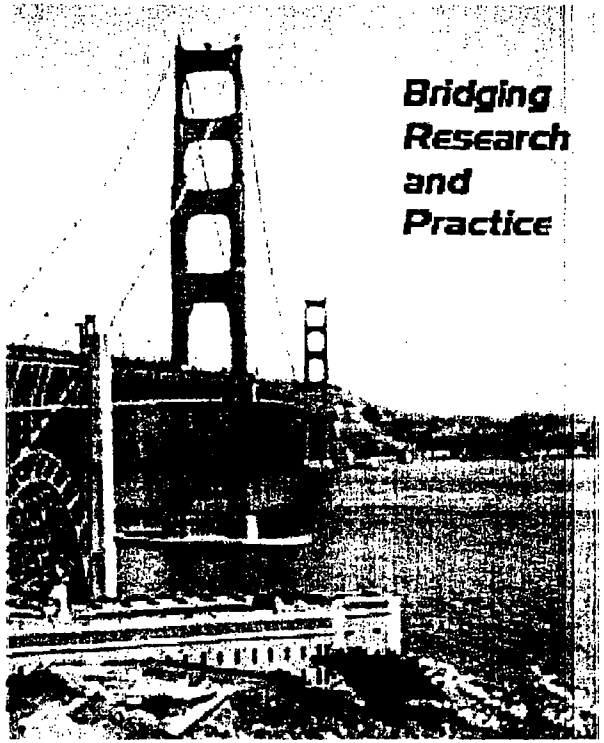
TECH TRANSFER

Technology Transfer Program



- A sponsored project providing California's public transportation agencies and transportation professionals with
  - Easy access to information and research
  - Low cost, high quality training at locations throughout California
  - One-on-one technical assistance
- Serving 4000+ professionals annually

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Technology Transfer Program

150 days of subsidized technical training annually in:

- Pavement maintenance & construction,
- Transportation planning & policy
- Traffic engineering
- Safety & project development

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What's coming down the road?

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Air Traffic Management Institute

- A collaboration between ITS Berkeley, NASA and UCSC.
- Mission is to conduct research and development that leads to new technologies and algorithms for assessing and improving the performance of the nation's air transportation system, and promote knowledge exchange among industry, government, and academic collaborators
- Expected launch date: July 2006

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iTS

For More Information…

Check out the ITS Web Site at:

http://www.its.berkeley.edu

… or contact Samer Madanat
Director
(510) 642-3585
madanat@ce.berkeley.edu

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Accelerated Pavement Testing: The Caltrans Partnered Pavement Research Program; A Twelve-Year Perspective

Danish Government Delegation

Richmond Field Station
University of California, Berkeley
August 30, 2006

Pavement Research Center Program

- Materials Evaluation
- Pavement design and rehabilitation
- Pavement construction
- Pavement maintenance
- Pavement management
- Technology Transfer

Partnered Pavement Research Program

- Relation to Caltrans Programs
  - Materials: asphalt concrete, cement concrete, soils and granular materials
  - Design: new and rehabilitated pavements
  - Construction: constructability, compaction, smoothness, QC/QA
  - Maintenance: PMS, maintenance treatments
  - Traffic: traffic simulation – urban freeway rehabilitation, WIM data analysis

PRC Program Background

- Pre-CAL/APT program 1993
- California Accelerated Pavement Testing Program (CAL/APT) July 1, 1994 - June 30, 2000
- Partnered Pavement Research Center (PPRC) July 1, 2000 - June 30, 2004

Program Background (cont.)

- Research partners
  - Caltrans
  - UC Berkeley, UC Davis
  - Dynatest / CSIR, South Africa
- Caltrans – separate purchase of 2 HVS's from CSIR (1994); operated by PRC
- Collaboration with others; e.g., 5-States Program

Technical Developments

- Pavement design and rehabilitation
  - Performance of drained and undrained pavements
  - Performance of overlays on AC pavements
    - ·D GAC versus RAC-G
    - ·MB Test Road
  - Performance of long-life concrete pavements
  - Design of long-life asphalt concrete and cement concrete pavements
  - HVS validation

HVS Test Program

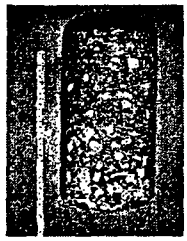
- **Test sections complete d: 80+ (5/30/06)**
  - 44 at RFS
  - 38 at four field sites
    - SR 14, Palmdale
    - US 101, Ukiah
    - SR 89, Calpine (near Truckee)
    - I 215 Interchange area (near Fontana)
- **Total H VS repetitions – $60x10^6$+**
- **Total E SALs – approx. $3x10^9$**

Richmond Field Station – Drained and Undrained Test Program

Results – Drained and Undrained Pavements

- **Improved compaction** – longer fatigue lives for AC layers
- **Use of tack coats** – increase of pavement service life because of improved bond between layers
- **Asphalt treated permeable base (ATPB)**
  - Eliminate use of ATPB directly under AC layer by improving AC compaction;
    or
  - Improve mix design (more binder, modified binder)
  - Use filter between aggregate base (AB) and ATPB
- **Use of rich bottom layer in thicker AC pavements**

ATPB Stripping – Undrained HVS Test

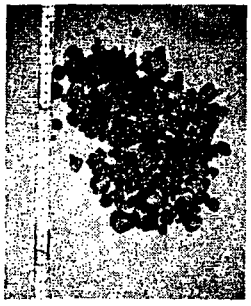


ATPB stri
from bot

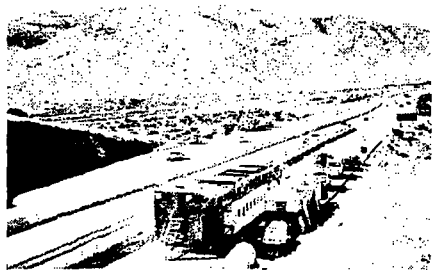
Outside trafficked area

Inside trafficked area

ATPB Stripping – Undrained HVS Test



Palmdale, State Route 14



Results – Long-Life Rigid Pavement Rehabilitation (LLPR) Studies

- Fast setting hydraulic cement concrete (FSHCC) not required for construction during 55 hour closures. (I-10 Study)
- FSHCC only cost effective for slab replacement during 8 to 10 hour closures
- Durability of FSHCC should be carefully evaluated:
  - Sulphate resistance
  - Alkali silicate reaction

Results – Long-Life Rigid Pavement Rehabilitation (LLPR) Studies

- Importance of dowels (large diameter)
- Dowel bar retrofit
- Combining traffic load and environmentally induced stresses
- Control of slab lengths
- Use of widened slabs under some conditions
- Use of AC base rather than LC base depending on environment

Results- Environmental Impacts on Concrete Pavement Performance

- Importance of concrete shrinkage and curling effects on performance in desert and central valley (California)
- Longitudinal cracking – identification of causes
- Establishment of environmental regions for concrete pavement design purposes

Ukiah Project, US 101

Dowel Bar Test Program

- **Retrofit – HVS testing**
  - Ukiah, CA
  - Palmdale, CA
- **Laboratory test programs**
  - Corrosion studies (includes section of 11-year old concrete pavement supplied by WSDOT)
  - Mechanical properties of fiber reinforced polymer (FRP) dowels

Ukiah Project

Concrete Maturity

- **Laboratory test program (curing temperature, time)**
  - Flexural modulus, modulus of rupture, shrinkage, coef. of thermal expansion, activation energy
- **Field test program (4 sites, high desert area, CA)**
  - Thermocouples, strain meters, JDMDs, weather station installed at each site
  - *Continuous monitoring from time of concrete placement*

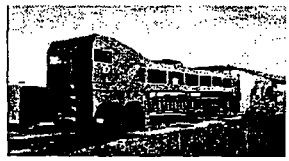
Results – Construction Productivity, Urban Freeway Rehabilitation

- **Construction Productivity (CA4PRS Software)**
  - I-10, Pomona, CA
  - I-710, Long Beach, CA
  - I-15, Devore,CA
- **Construction productivity combined with traffic simulation**
  - I-710
  - I-15
- **Four-States program support**
- **Training of District Personnel**
  - D8, D7, D4

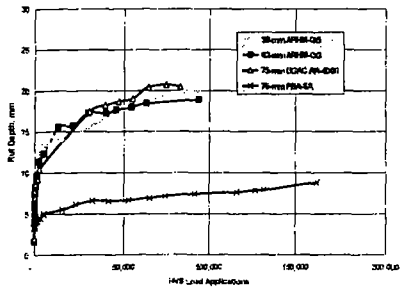
Contributions to I-710 Program

- **Mix designs**
- **Structural pavement section designs**
- **Contractor's mix evaluations**
- **Constructability – both contractor and Caltrans District 7 construction staff**
- **Traffic operations – District 7 traffic staff**
- **Follow-up program**

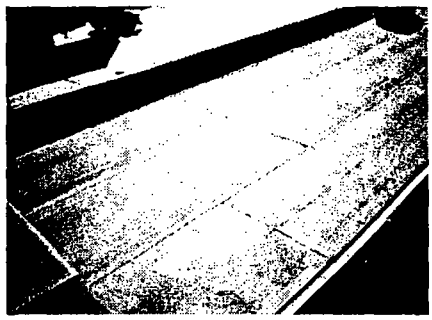
Partnering Example – HVS Validation Rutting Resistance of I-710 AC Mix



CAL/APT Evaluation

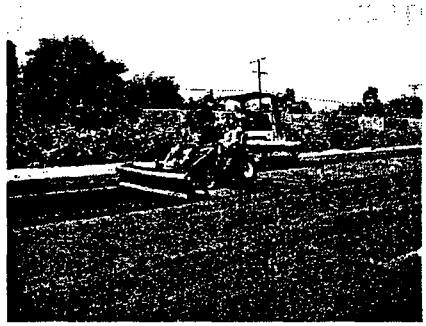


Existing Concrete Pavement



Placement of Leveling Course

Installation of Pavement Fabric



Placement of PBA-6A Mix

Digout and Placement of Aggregate Base – Working Platform

Rich Bottom Layer Construction

Contributions to I-15 Devore Project

- **Structural pavement section design**
- **Use of AC base rather than LCB**
- **Use of widened lane next to shoulder**
- **Slab length**
- **Selection on construction alternative (CA4PRS)**

Comparison: Construction Schedule, Traffic Delay, and Agency Cost

Closure Scenario	Schedule Comparison		Cost Comparison ($M)			Max. Peak Delay (Min.)
	Closure Number	Closure Hours	User Delay	Agency Cost	Total Cost	
72/96-Hour Weekday Continuous	6	464	9.5	16.4	25.9	90
55-Hour Weekend Continuous	10	510	19.0	20.5	39.5	195
1 Roadbed Continuous	2	360	11.0	14.0	25.0	195
10-Hour Night-time Closures	197	1,970	5.8	20.4	26.2	35

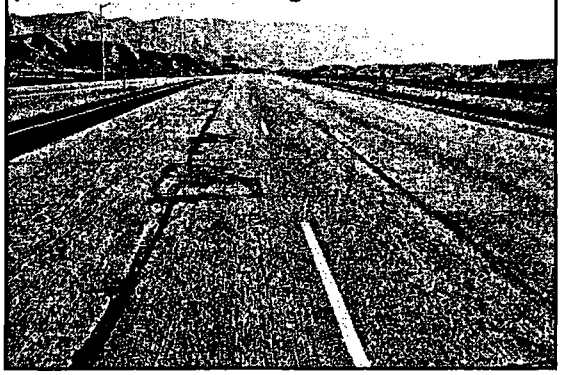
72-hour Weekday Closures were Selected as the Most Economical Closure Strategy

I-15 Devore Selected the Most Economical Scenario: Schedule, Traffic Delay, Total Costs

Construction Scenario	Schedule Comparison		Cost Comparison ($M)			Max. Peak Delay (Min)
	Total Closures	Closure Hours	User Delay	Agency Cost	Total Cost	
1 Roadbed Continuous	2	400	5.0	15.0	20.0	80
72-Hour Weekday Continuous	8	512	5.0	16.0	21.0	50
55-Hour Weekend Continuous	10	550	10.0	17.0	27.0	90
10-Hour Night-time Closures	220	2,200	7.0	21.0	28.0	30

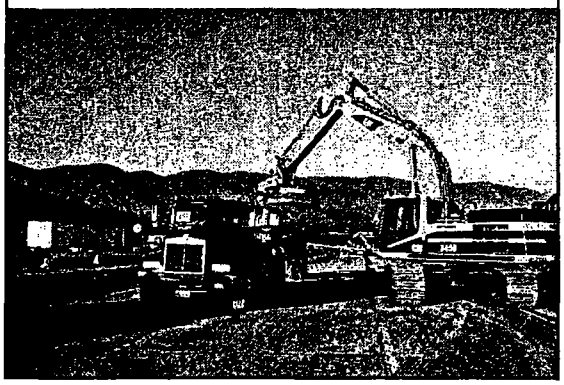
Public reactions changed 72-hour closures to one-roadbed continuous closures

Distress in Existing PCC Pavement



Counter-flow Traffic During Construction

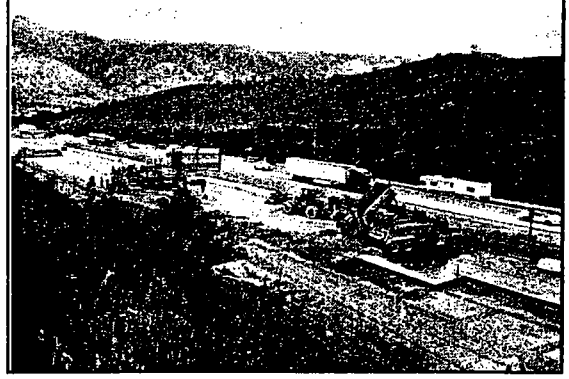
Slab Removal (Bucket-out)



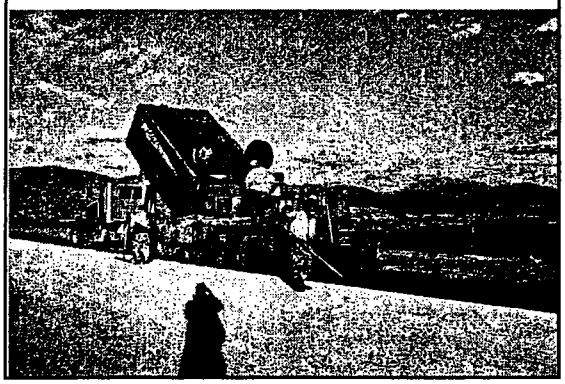
Excavation (10" Milling) of Cement Treated Base and Aggregate Base

AC Base Paving

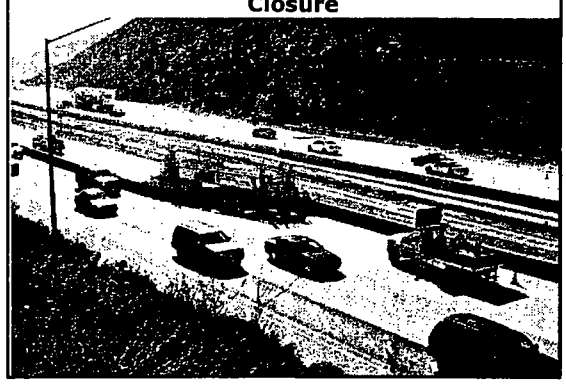
PCC Paving: Outer & Inner Truck Lanes



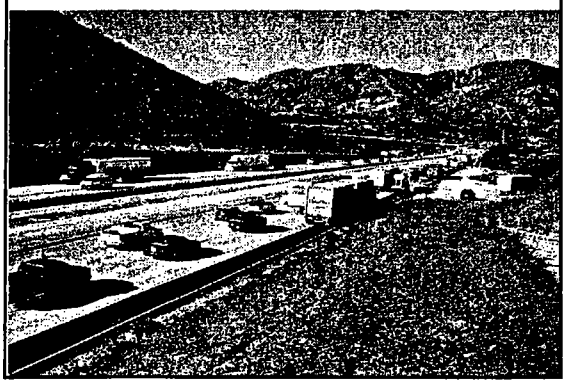
AC Shoulder Overlay



Shifting QCMB to the Median After the Closure



Traffic After Constructi on



New Technologies for Caltrans – Introduction, Development and Validation

- **Introduction of South African technologies,** e.g.
  - DCP, foamed asphalt
- **Mechanistic-empirical design,** AC and concrete pavements
- **Long-life pavement design**
  - rich bottom AC
  - Improved AC mix design
- **Validation of Caltrans thickness design for ARHM-GG in overlays**

DCP

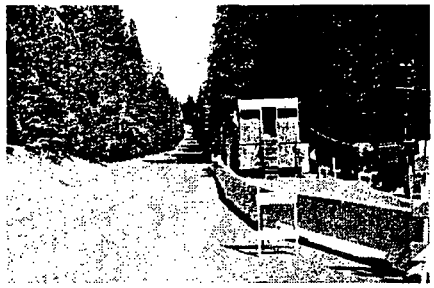
Dynamic Cone Penetrometer is used to determine in-situ strength of base and sub-base or native material

DCP verifies test pit, and provides an indication of continuity of structural section.

Deep In-Situ Recycling (DISR)

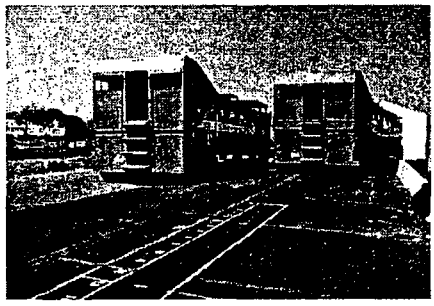
- **Caltrans implementation**
  - Four projects; foamed asphalt
- **PRC joint effort with Transportek**
  - HVS test program, State Route 89 (Truckee, CA)
  - Laboratory and field studies with mixes containing:
    - Foamed asphalt
    - Asphalt emulsion

Calpine (near Truckee) State Route 89



Calpine (January 2004)

Richmond Field Station – MB Test Road



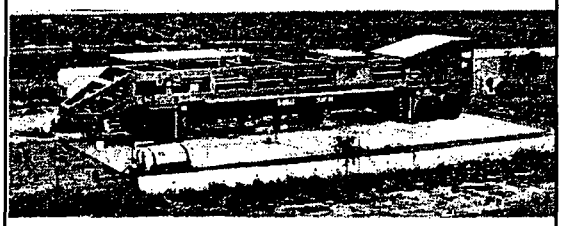
Modified Binder (MB) Test Road

- **Rehabilitation designs and materials evaluation for reflection cracking**
- **HVS test program**
  - "new" pavement (6 test sections)
  - Overlays on cracked "new' pavement sections

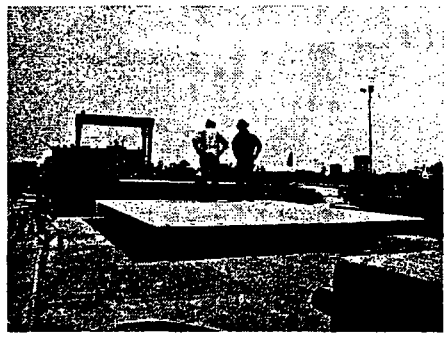
Modified Binder (MB) Test Road

- **Overlay materials (6 sections)**
  - MB-4 and MB-15 (modified) binders (3 sections)
  - MAC binder (1 section)
  - AR-4000 (conventional asphalt) binder (1 section)
  - AR-G (asphalt rubber) binder (1 section)
- **Thicknesses**
  - 80-90 mm (AR-4000, MB-4)
  - 40-50 mm (MB-4, MB-15, AR-G, MAC)

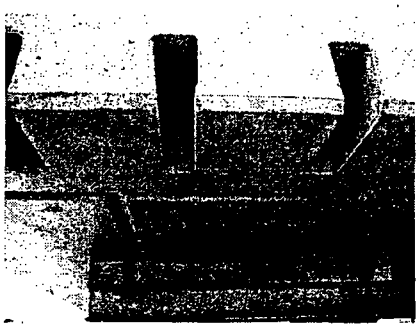
HVS Test, Precast Panels-District 8 (I 215 Interchange Area, Near Fontana)



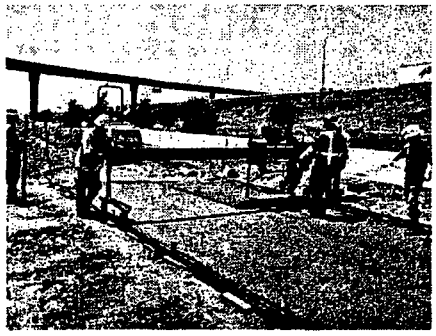
Precast Panels – District 8



Precast Panels – District 8



Precast Panels – District 8



Precast Panels – District 8

Mechanistic-Empirical New and Rehabilitated Pavement Design

- Flexible pavement design procedure
- Software version 1.0 developed for flexible design procedure
- Much of procedure being calibrated with HVS data
- Workshops for key Caltrans Staff

Mechanistic-Empirical New and Rehabilitated Pavement Design

- Rigid pavement design procedure
- Evaluation of recently released AASHTO 2002 Design Procedure underway
- Procedure to be augmented with additional design checks for longitudinal and corner cracking being developed at U. of Illinois, based on Palmdale HVS data

Mechanistic-Empirical New and Rehabilitated Pavement Design

- Overlay pavement design
- Developing simple routines for AC on PCC overlays; will require extensive HVS calibration (HVS data from Goal 6 Program being used to define mechanisms)
- May be applicable to AC on AC overlays
- Calibrating empirical-mechanistic models using Arizona and Washington State DOT PMS databases for use in design procedure as well

Economic Implications

- **Benefits from;**
  - Constructability (CA4PRS + traffic simulation)
  - Improved AC and PCC pavement design and rehabilitation (e.g., I-710 and I-15)
  - DISR, 4 Projects completed by Caltrans

Economic Implications

- **Implementation of recommendations for:**
  - Improved compaction and use of tack coat and rich bottom AC
  - Result –longer pavement lives, less maintenance and rehabilitation
  - Estimated net present value of savings (excluding user and safety costs):
    - Life extension 1.5 years – $50+ million
    - Life extension 5 years – $160+ million
  - With user and safety costs –sav ings even greater!

Implementation

- **Direct interaction with Caltrans and Industry**
  - e .g., long-life pavement task group for I-710 freeway rehabilitation
- **Working directly with Caltrans on items such as:**
  - I nteraction in test plan development
  - Me etings as new reports are completed
  - D CP
  - C oncrete maturity
  - Pav ement constructability

Implementation

- **Information Dissemination**
  - reports to Caltrans (also posted on web site)
    - (including 1- to 2-page summaries)
  - technology transfer, UCB/ITS publications
  - short courses and seminars (e.g., Materials Academy
  - special seminars throughout California (e.g.,13 PG Training Sessions Fall, Winter 20005- 06)
  - papers in technical journals
    - TRB, AAPT, ISAP, CAPSA

APT Program Keys

- **Strategic plan**
  - developed by program management
  - input from:
    - c ustomers
    - o peration staff
    - a nalyses staff
    - r esource providers
  - amenable to modification as project progresses

(Prepared by Tom Hoover)

APT Program Keys

- **Partnering**
  - *purpose - maximize results*
  - build on work of others
  - share results
  - will enhance progress

APT Program Keys

- **Adequate funding commitments for:**
  - long term operations
  - data analysis and presentation of results of investigations

APT Program Keys

- **Long term goals**
  - don't limit to product and pass/fail testing
  - must have at least 2 or 3 long term goals underway

Agency Overview

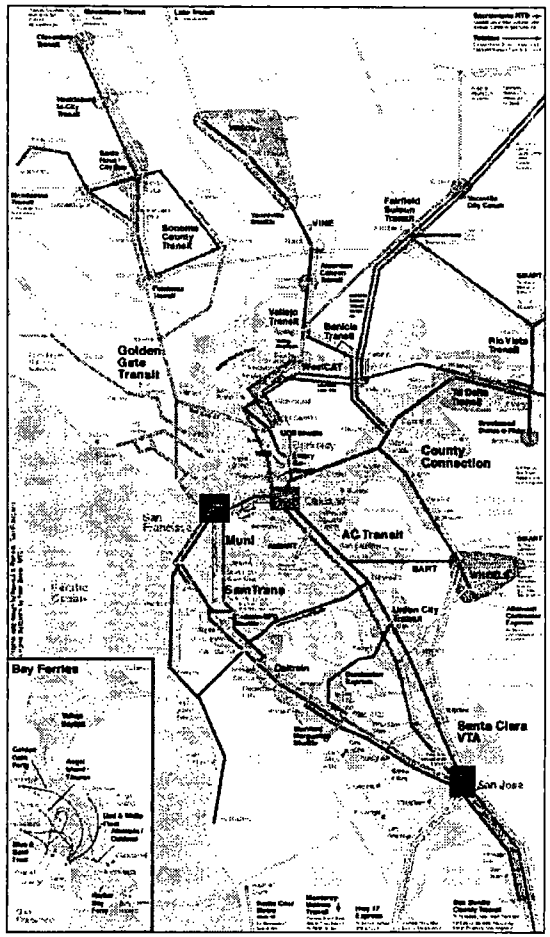
08 | 30 | 2006 | SAN FRANCISCO, CALIFORNIA

The MUNICIPAL TRANSPORTATION AGENCY (MTA)

- MTA is San Francisco's transit and streets management agency
- MTA was created in July 2002 as a result of a voter initiative (Proposition E) to improve and consolidate traffic/transit management
- MTA is a department of the City and County of San Francisco

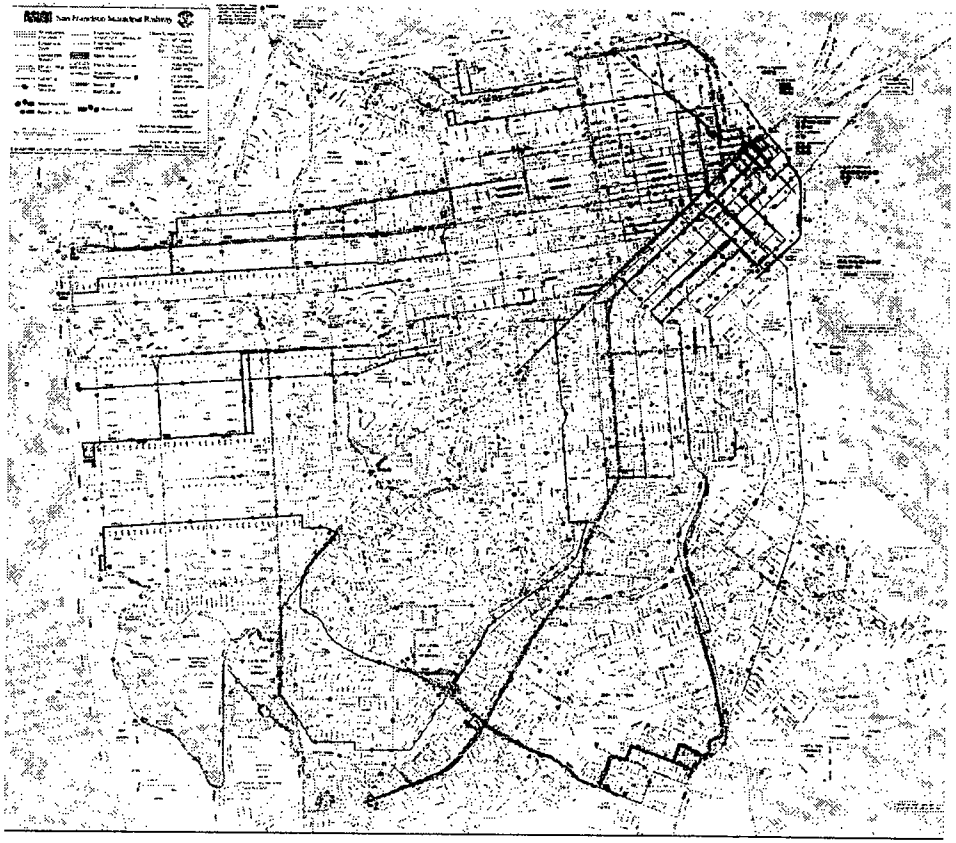
SF TRANSPORTATION FACTS

- San Francisco 1 of 9 counties in Bay Area (over 6 million residents)
- MTA is largest of 26 Bay Area transit agencies (rail, bus, ferry)
- Daytime SF population increase is over 100,000
- Daytime vehicle population increase is 35,000 vehicles
- About 450,000 Vehicles registered in SF
- 49% of all commute trips to downtown SF are on transit (Muni, BART, etc.).
- 9% SF workers walk to work, 2% bike
- 1,088 Miles of roads, 7,200 Intersections



MUNI: TRANSIT RIDERSHIP

- Seventh largest transit system in country, by ridership
- Service Area: 47.4 square miles
- Service Area Population: 799,203 residents
- Muni weekday boardings: 684,500
- Annual boardings: 217 million
- 95% of residents are within 2 blocks of a Muni stop



MTA MISSION & VISION

MISSION

- We enhance the quality of life in San Francisco by safely and efficiently moving people and goods.

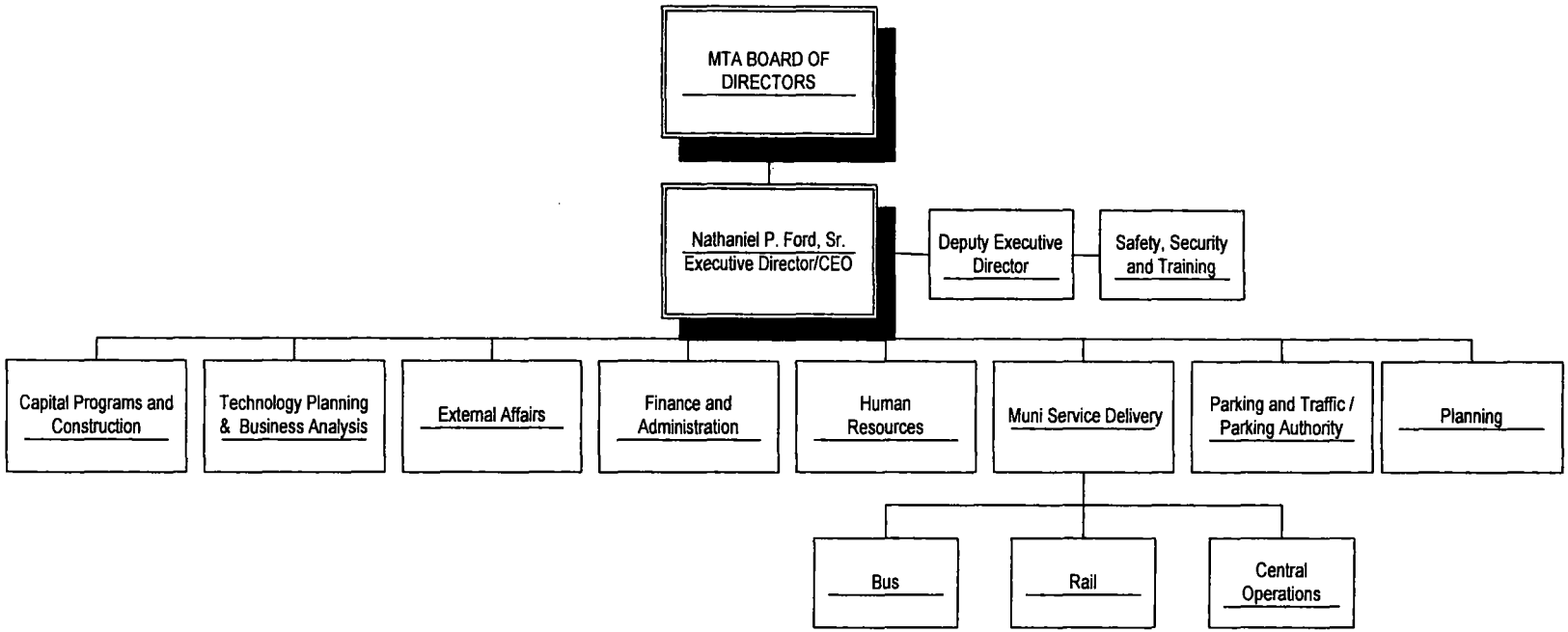
VISION

- We strive to be leaders in creating and maintaining a world class, comprehensive transportation system that is safe, attractive and financially and environmentally sustainable.

MTA GOALS

- Improve the movement of people and goods throughout San Francisco
- Promote the use of environmentally-friendly modes of travel
- Cultivate security awareness and preparedness
- Maintain a proactive approach to safety
- Provide exceptional customer service
- Recognize and value all employees
- Improve long-term financial stability

MTA ORGANIZATION



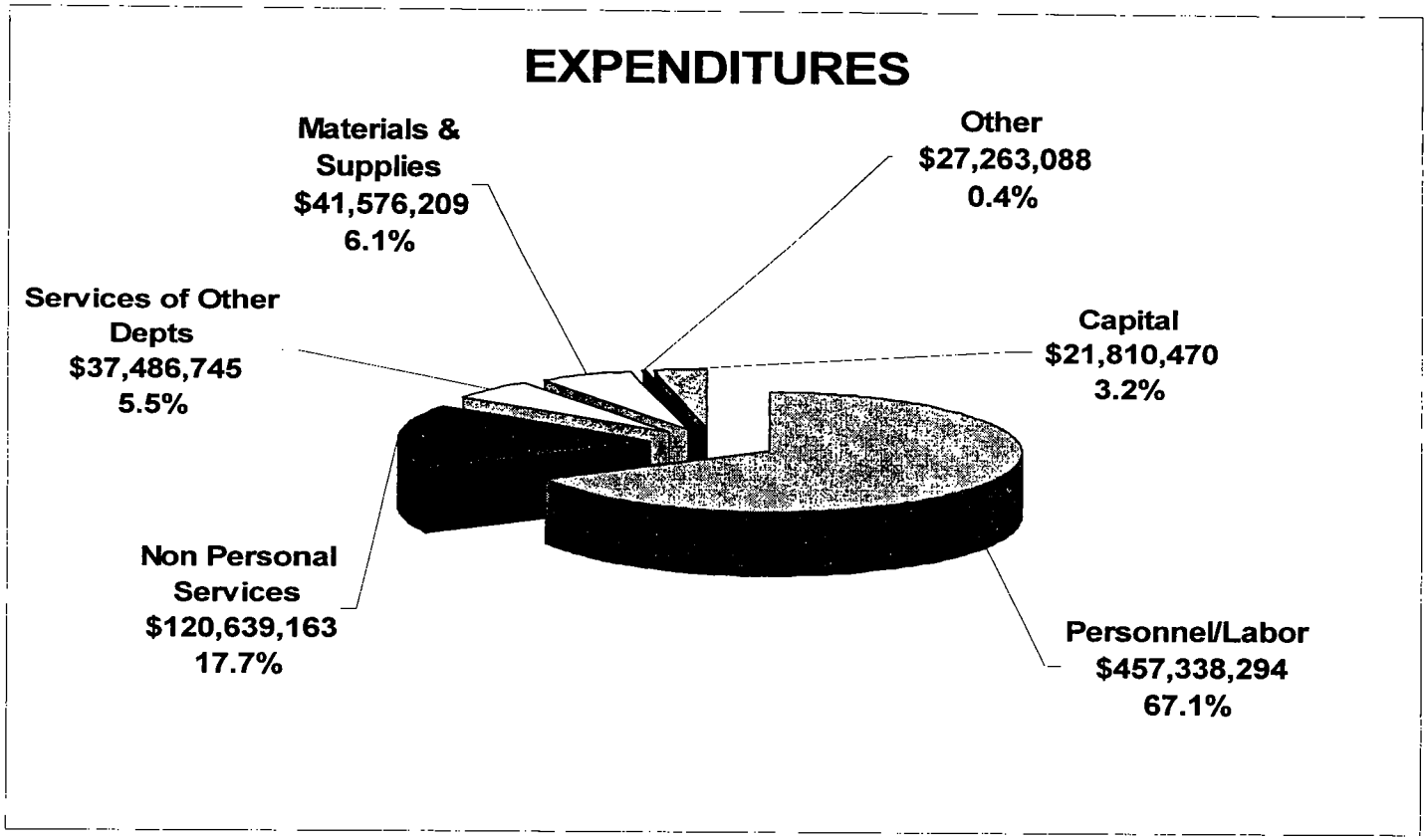
MTA EMPLOYEES

- 4,800 Employees
- Represented by 17 Labor Unions
- Largest groups:
  - 2,200 transit operators
  - 1,200 maintenance staff
  - 325 parking enforcement staff

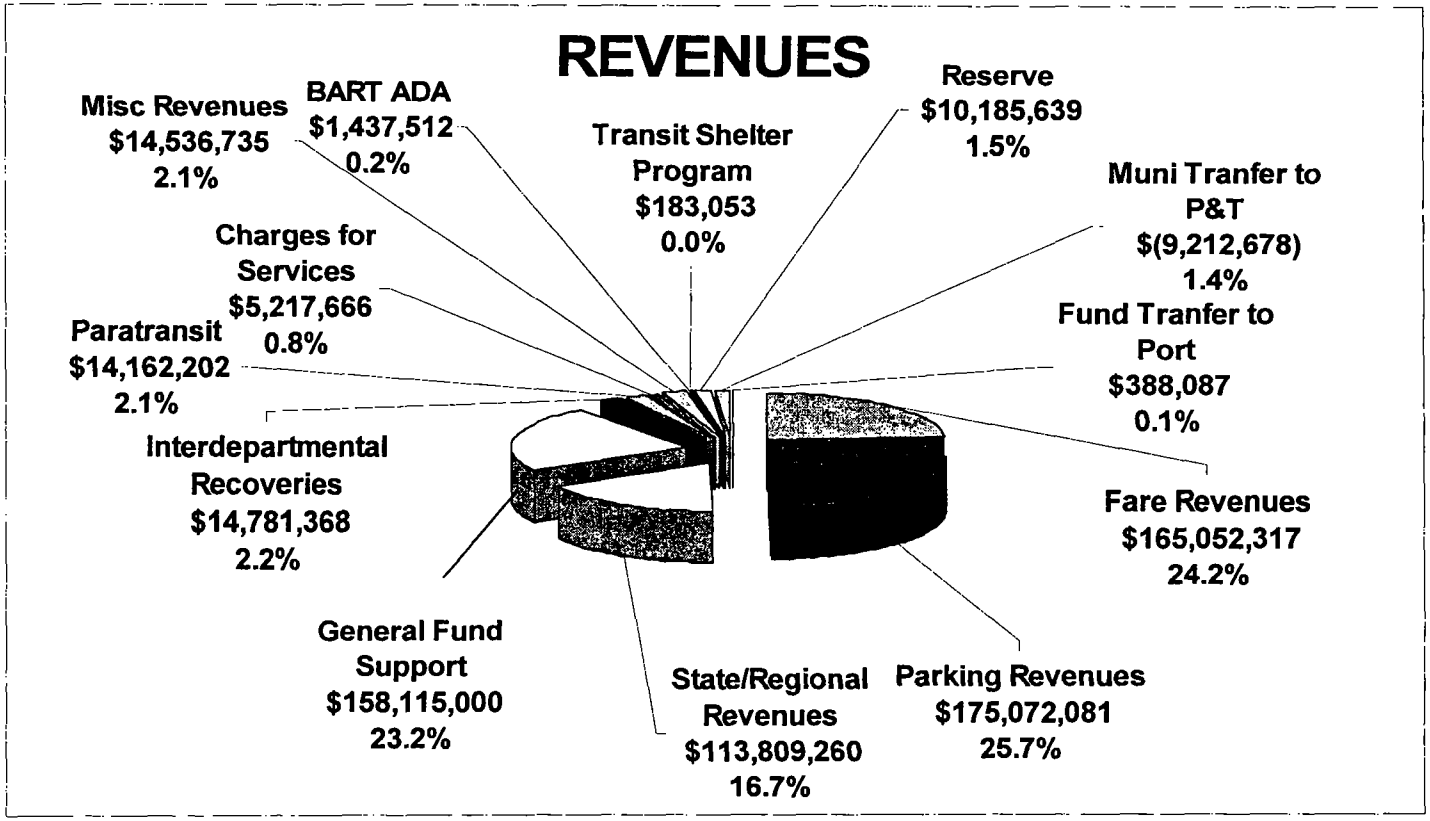
MTA FINANCES

- Operating budget: $681 million in FY07
- Capital program: $6 billion

FY 2006-2007 Operating Budget
Expenditures Summary



FY 2006-2007 Operating Budget Revenues Summary



MTA's ECONOMIC BENEFITS: A Multi-Modal City

MTA makes San Francisco a "Multi-Modal" City for Pedestrian, Bicycle, Transit and Traffic

- Ensures access to jobs, services, recreation for all
- Focus on Clean Air strengthens local economy
- Pedestrian, Bicycle programs part of why San Francisco is one of nation's "Most Physically Fit" cities
- Bicycle, Pedestrian focus supports compact development
- High transit ridership = High pedestrian traffic volumes
- Managed Parking ensures turnover to support businesses

MTA INITIATIVES

- Improving safety for pedestrians, cyclists, passengers, and drivers
- Initiating the Transit Effectiveness Project, Muni's first citywide evaluation of its network in over 20 years
- Third Street Light Rail project
- Improving technology systems: NextMuni, SFgo, Translink
- Developing a fuel-efficient fleet

MTA CHALLENGES

- Service Reliability and Systems Performance
- Improving our Financial Capacity
- Security and Safety

San Francisco Bay Area Rapid Transit District

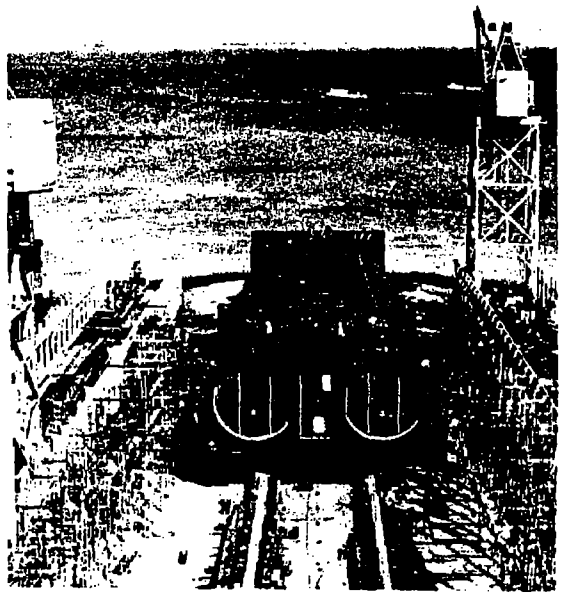
Overview of the BART Org

August 30, 2006

BART

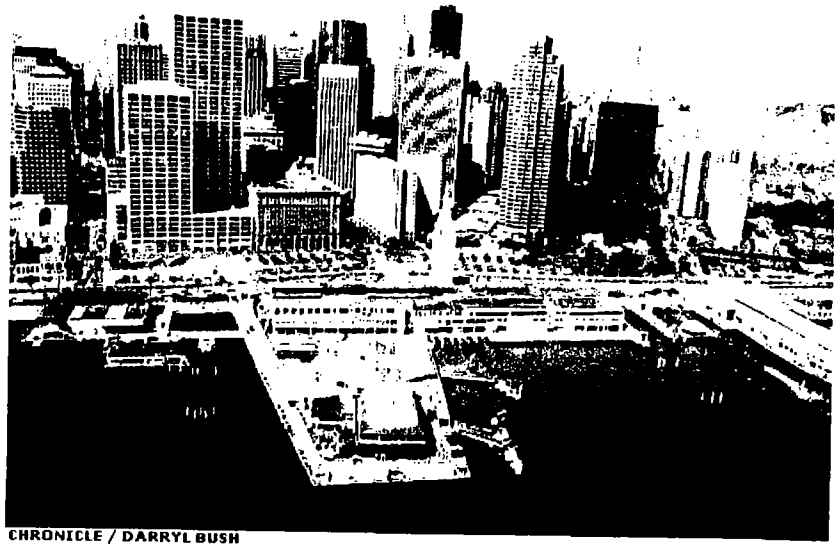
Historical Perspective

- Opened September 1972
- First new rapid rail system in the United States in almost 60 years
- Considered unique engineering achievement:
  - ✓ Significant aerospace influence
  - ✓ Full computer control of trains
  - ✓ Electronic technology and computers
  - ✓ Light weight cars
  - ✓ High performance design
- Today reliability is on par or slightly better than similar subway / commuter rail operations 93 - 95% on time



The Bay Area Economy

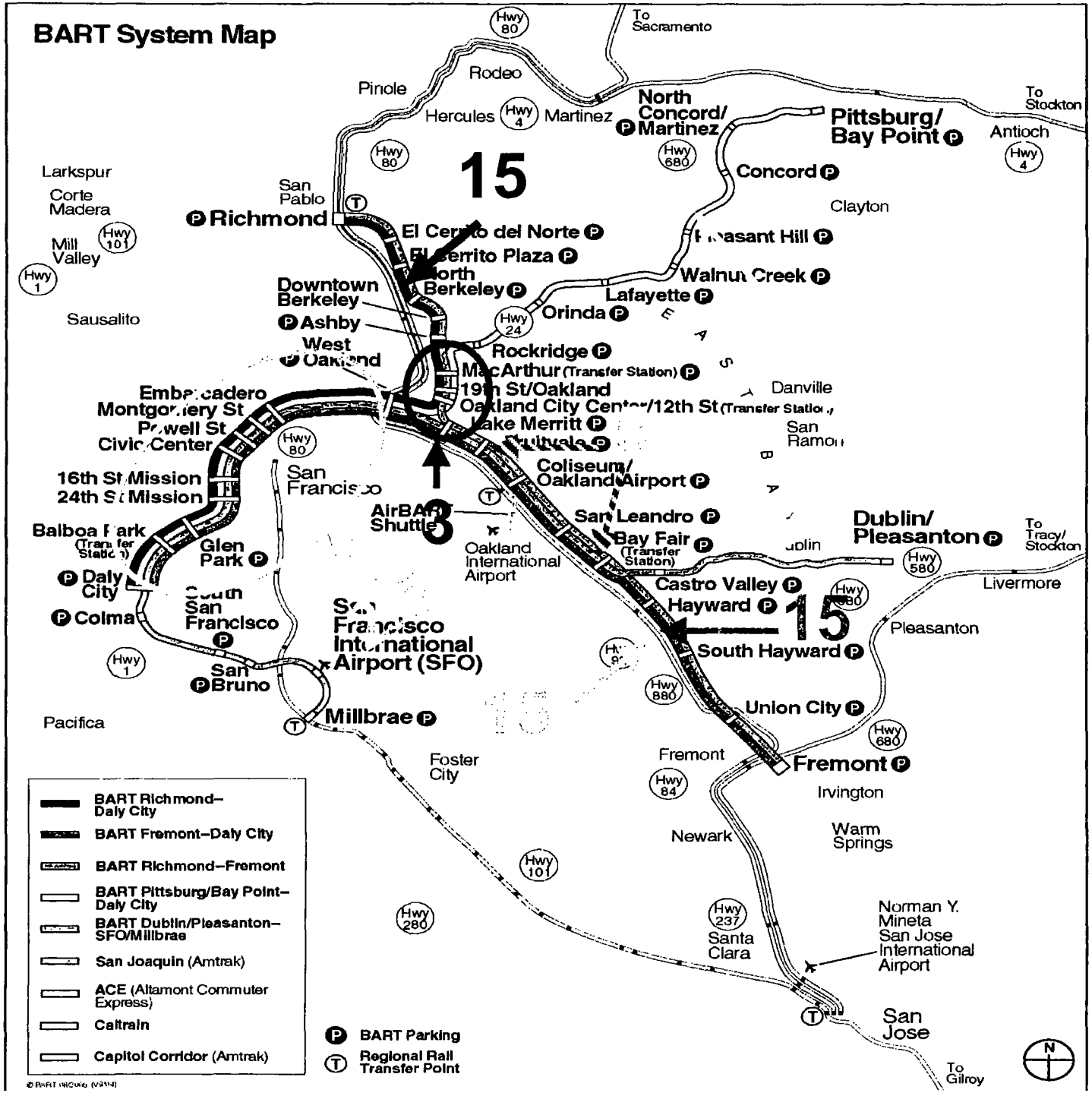
- Bay Area economy would be the world's 24th largest (2004 GRP - $300 Billion)
- Most productive metropolitan region in the United States, economic output/capita 84% higher than US average
- Second to New York City in Fortune 500 Companies.
- In 2004, 32% of the total U.S. venture capital invested was in the Bay Area



CHRONICLE / DARRYL BUSH

BART's Role in the Bay Area Economy

- 67% of BART's 322,965 daily trips either originate or end in the four Downtown San Francisco Stations
- BART riders spend approximately $400 million per year on retail in San Francisco
- Since 1963, 70% of the 56 million square feet of new office space in SF has been built within one quarter mile of the 4 downtown BART stations
- Annually 3.9 million tourists visiting San Francisco used BART (before SFO extension)
- 49% of Downtown Oakland employees commute via BART


BART System Map
To Sacramento
Hwy 80
Rodeo
Pinole
Hercules
Hwy 4
Martinez
North Concord/ Martinez
Pittsburg/ Bay Point
To Stockton
Antioch
Hwy 680
Concord
Clayton
Larkspur
Corte Madera
Mill Valley
Hwy 101
Hwy 1
Sausalito
San Pablo
Richmond
15
El Cerrito del Norte
El Cerrito Plaza
North Berkeley
Pleasant Hill
Walnut Creek
Lafayette
Orinda
Hwy 24
Downtown Berkeley
Ashby
West Oakland
Rockridge
MacArthur (Transfer Station)
19th St/Oakland
Oakland City Center/12th St (Transfer Station)
Lake Merritt
Fruitvale
Danville
San Ramon
Embarcadero
Montgomery St
Powell St
Civic Center
16th St Mission
24th St Mission
Balboa Park (Transfer Station)
Daly City
Colma
Glen Park
San Francisco
Coliseum/ Oakland Airport
AirBART Shuttle
3
Oakland International Airport
San Leandro
Bay Fair (Transfer Station)
Dublin/ Pleasanton
To Tracy/ Stockton
Castro Valley
Hayward
15
Livermore
Pleasanton
South San Francisco
San Francisco International Airport (SFO)
South Hayward
San Bruno
Millbrae
Union City
Pacifica
Foster City
Fremont
Irvington
Newark
Warm Springs
Hwy 880
Hwy 84
Hwy 280
Hwy 237
Santa Clara
Norman Y. Mineta San Jose International Airport
San Jose
To Gilroy
BART Richmond–Daly City
BART Fremont–Daly City
BART Richmond–Fremont
BART Pittsburg/Bay Point–Daly City
BART Dublin/Pleasanton–SFO/Millbrae
San Joaquin (Amtrak)
ACE (Altamont Commuter Express)
Caltrain
Capitol Corridor (Amtrak)
BART Parking
Regional Rail Transfer Point
N

Service Plan: Route Headways

Line	Early AM (4 - 5 am)	Peak Period (5 - 9 pm)	Midday (9 am - 3 pm)	Peak Period (3 pm - 7 pm)
Green		15	15	15
Orange	15	15	15	15
Yellow	15	15/10/5	15	15/10/5
Red		15	15	15
Blue	15	15	15	15

Line	Evening (7 pm-12 am)	Saturday (6 am - 6 pm)	Sat. Evening and Sunday (8 am - 12 am)
Green		20 (9:00 am start)	
Orange	20	20	20
Yellow	20	20	20
Red		20 (9:00am start)	
Blue	20	20	20

Service Plan: Hours of Service

Line	Route	Weekday	Saturday	Sunday
Green	Fremont/ Daly City	5:00 am to 6:30 pm	9:00 am to 6:00 pm	
Orange	Richmond/ Fremont	4:00 am to 12:00 am	6:00 am to 12:00 am	8:00 am to 12:00 am
Yellow	Bay Point/ Daly City	4:00 am to 12:00 am	6:00 am to 12:00 am	8:00 am to 12:00 am
Red	Richmond/ Daly City / Colma (Peak)	5:00 am to 6:40 pm	9:00 am to 6:00 pm	
Blue	Dublin/ SFO / Millbrae	4:00 am to 12:00 am	6:00 am to 12:00 am	8:00 am to 12:00 am

Service Plan: Equipment

Line	Route	Trains Required	Peak Cars per Train	Total Cars
Green	Fremont/Daly City	9	8/9/10	81
Orange	Richmond/Fremont	10	6/8	64
Yellow	Bay Point/Daly City	11	9/10	103
Yellow	Peak Hours Only	9	8/9/10	80
Red	Rich/Daly City/Colma	9	8/9/10	77
Blue	Dublin/SFO/Millbrae	12	9	108
	Logistic	2	2/4	6
	Ready Reserve	4	8/9/10	40
TOTALS		**66**		**559**

66 trains on-line with 513 vehicles during weekday peak periods

BART Equipment and Maintenance

- 669 Rail Cars
- 43 Stations
- 105 Route Miles
- 224 Track Miles
- 487 Mainline Switches
- 107 Elevators
- 11 Parking Structures (11,110 spaces)
- 32 Parking Lots (35,282 spaces)
- 46,392 Parking Spaces
- 928 Bicycles Lockers
- 2,733 Bicycle Racks
- 427 Connecting Bus Routes
- 572 Fare Gates
- 299 Ticket Vendor Machines
- 162 Add Fare Machines
- 360 Train Destination Signs
- 516 Non-Revenue Vehicles
- 74 Miles of ROW Fences
- 171 Escalators
- 80+ Train Control Computers
- 75 Traction Power Substations
- 74 Sumps/Pumps
- 12 Switching Stations
- 234 Miles of 34.5 kV Cable
- 98 Vents/Fans
- 107 Trunk Radio Transmitters

The People Who Make BART Run

- Station Agents (312)
- Train Operators (403)
- Communication Specialists (8)
- Train Controllers (19)
- Utility Workers (92)
- Police Officers (191)
- Mainline Technicians (20)
- Vehicle Mechanics (225)
- System Service Workers (134)
- Electronic Technicians (195)
- Computer Technicians (14)
- Engineers (90)
- Systems Analyst (1)
- Purchasing Agents (9)
- Auditors (9)
- CAD Operators (9)
- Marketing Representatives (7.5)
- Graphic Artists (1)

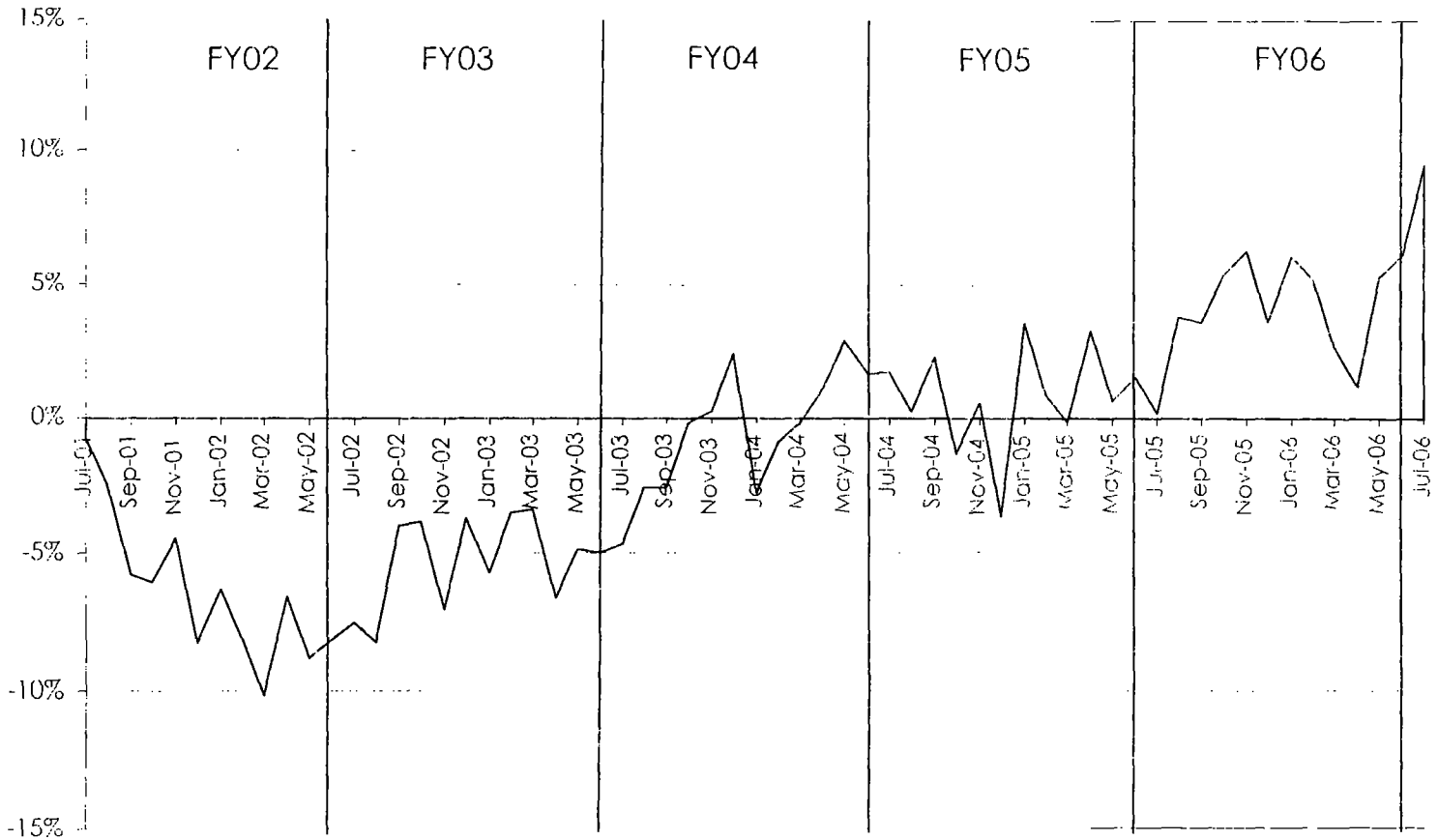
Ridership Basics

Day	FY06	FY01 High Water Quarter	FY99 Quarter Before "Ramp Up" Started	FY95	FY88
Weekday	322,965 (294,498)	332,632	275,126	248,300	195,921

Weekday Peak/Offpeak: 56%/44%
Weekday Transbay: 47%
Weekday Westbay: 28%
Weekday Eastbay: 25%

Core Average Weekday Trips

Year-to-Year Percent Change

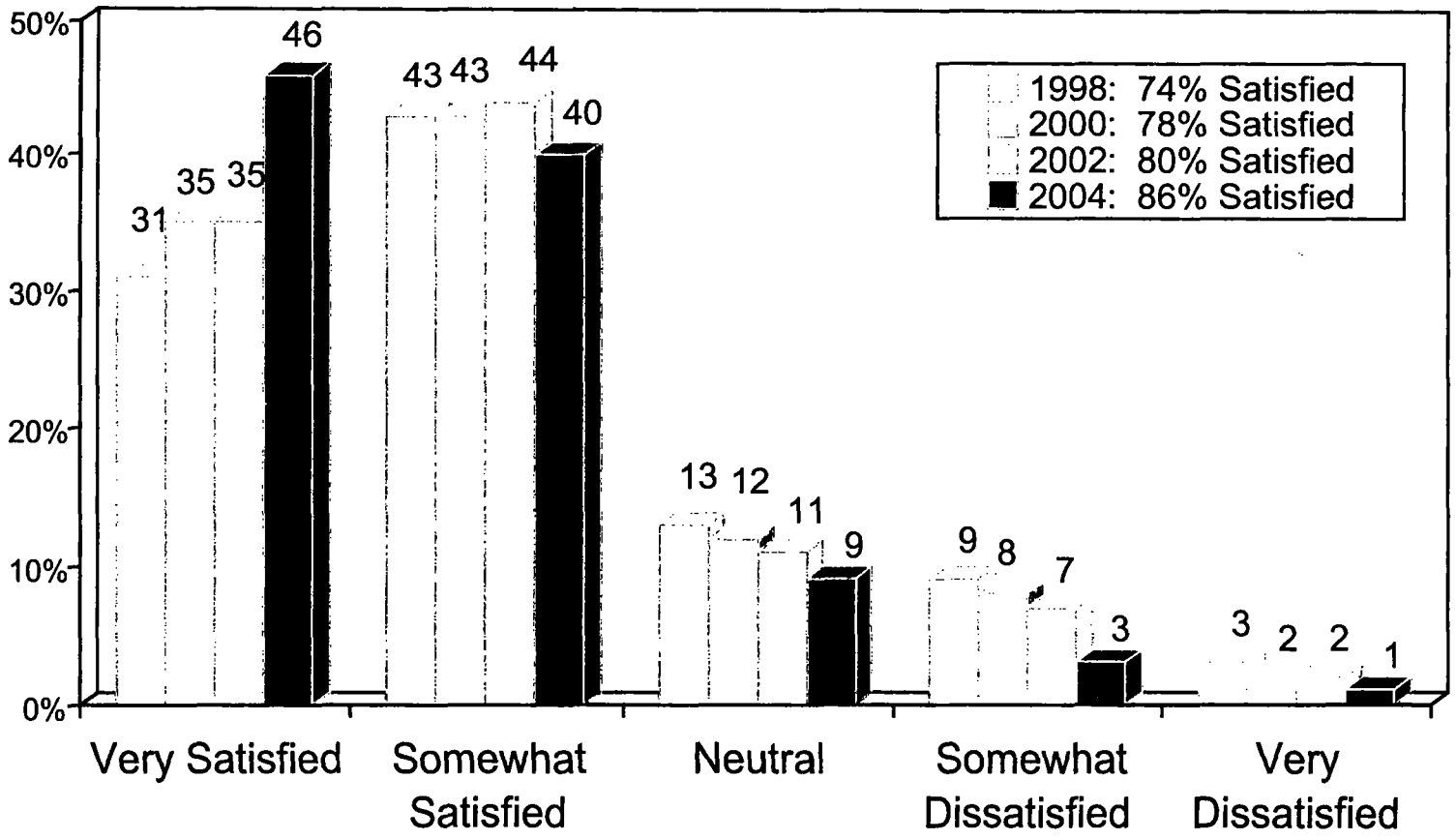


Performance Monitoring

- Customer Satisfaction Survey (every 2 years)
- Quarterly Performance Report (to Board of Directors)
- Passenger Environment Survey (PES Quarterly)
- "How Are We Doing" Monthly Charts (posted in District facilities)
- Weekly Consumer Comments Reports (reviewed at Operations staff meeting)

Satisfaction

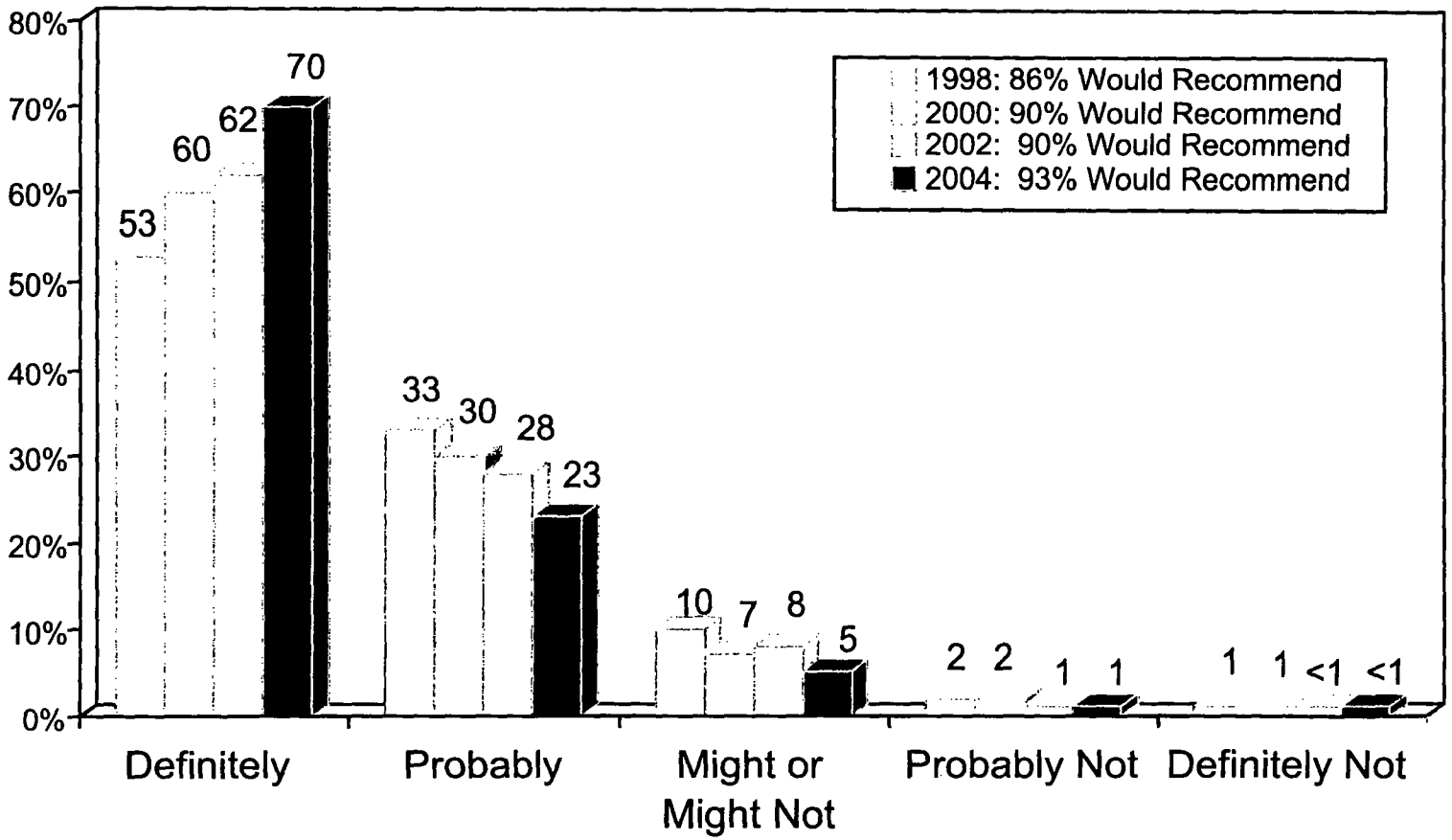
Overall, how satisfied are you with the services provided by BART?



Percents may not total due to rounding and non-response

Pride in BART

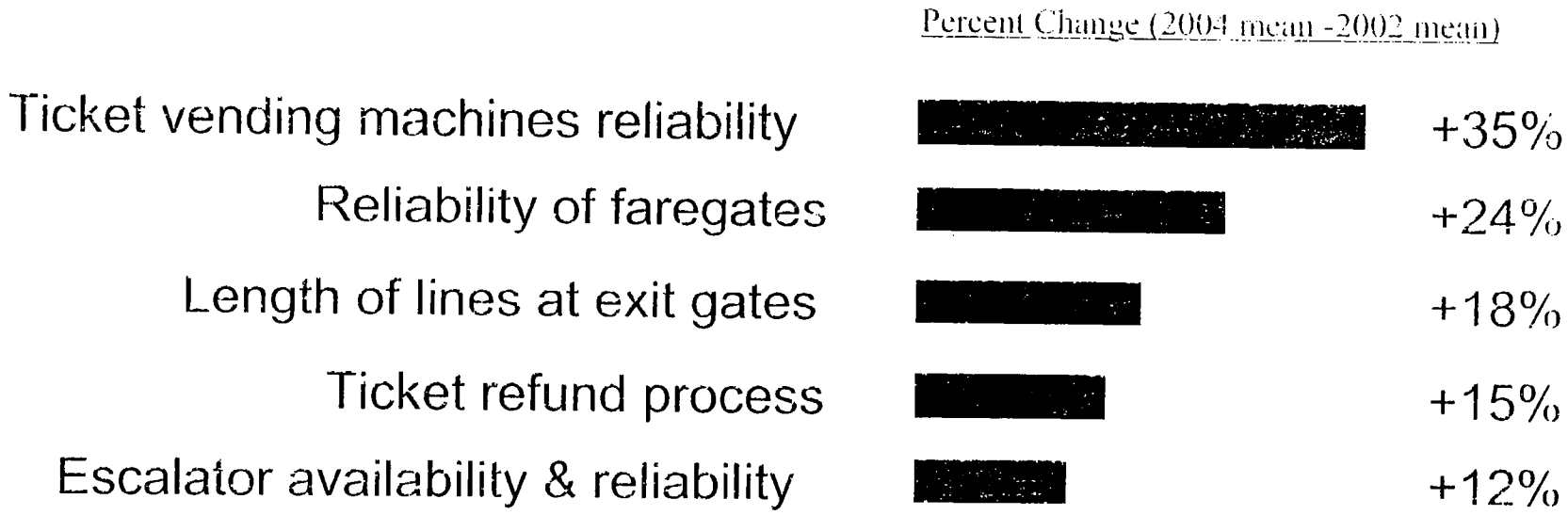
Would you recommend BART to a friend or out of town guest?



Percents may not total due to rounding and non-response

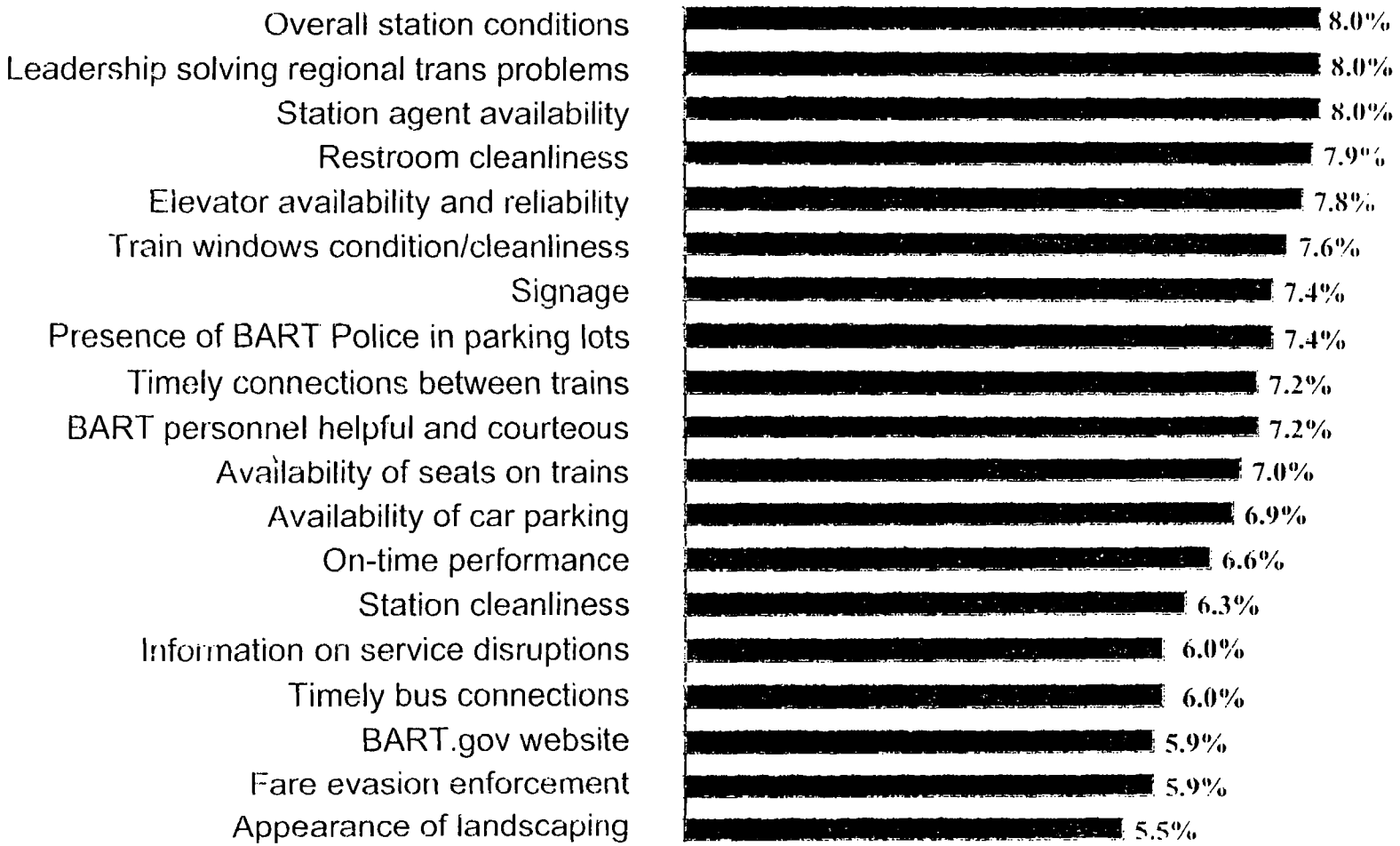
Major Service Rating Gains

Percent change in Average Ratings



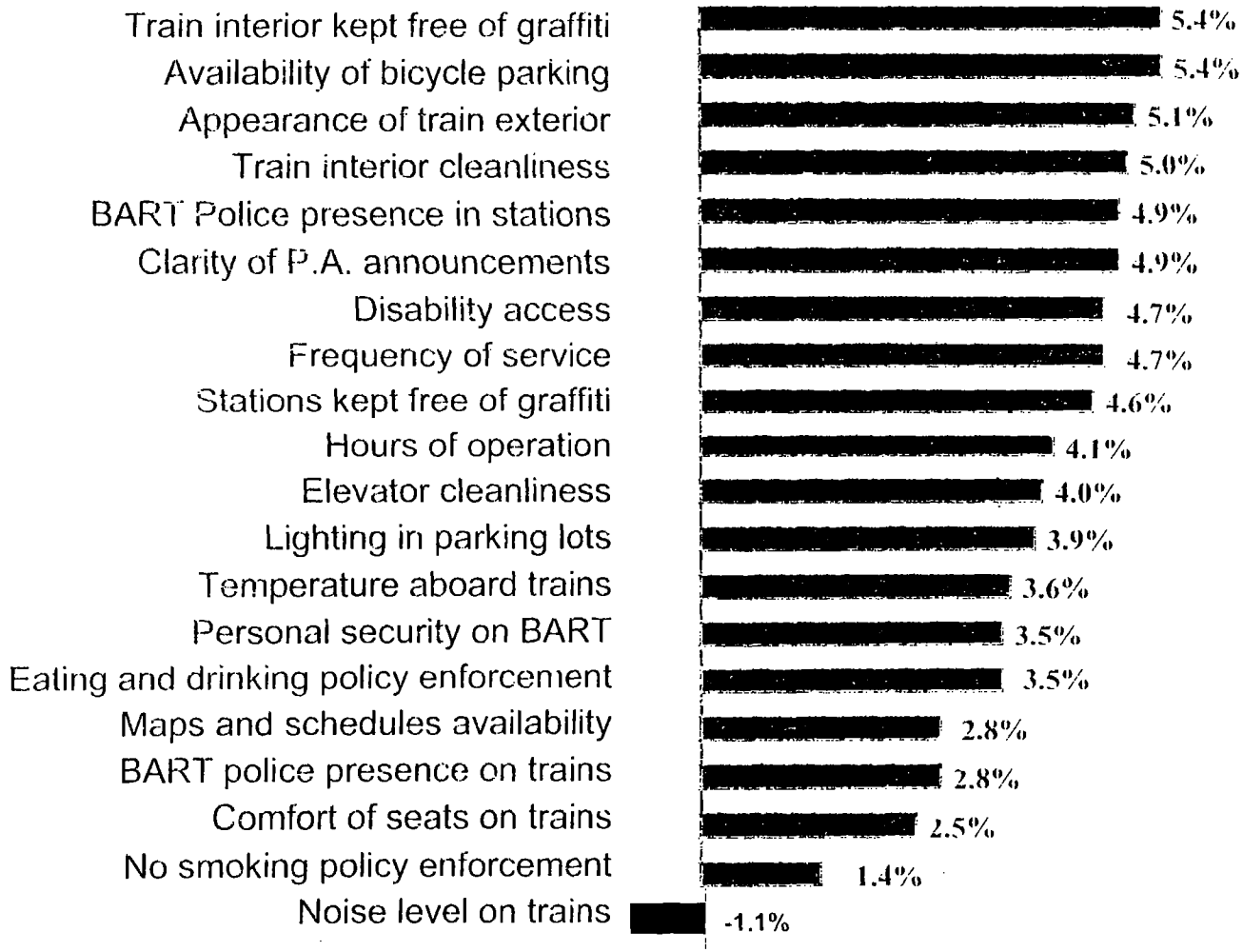
Other Service Rating Gains

Percent improvement in Average Ratings

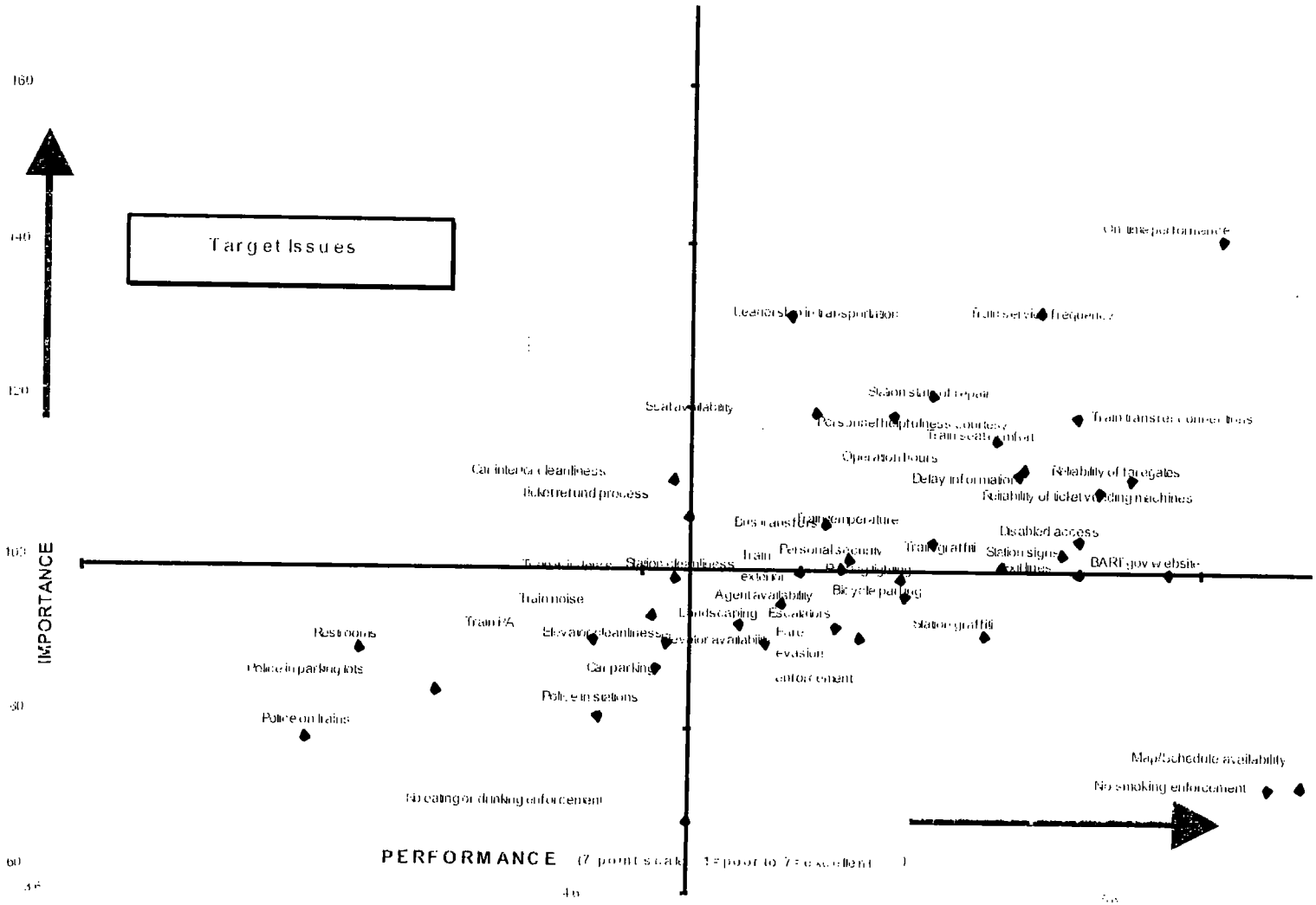


Other Service Rating Changes

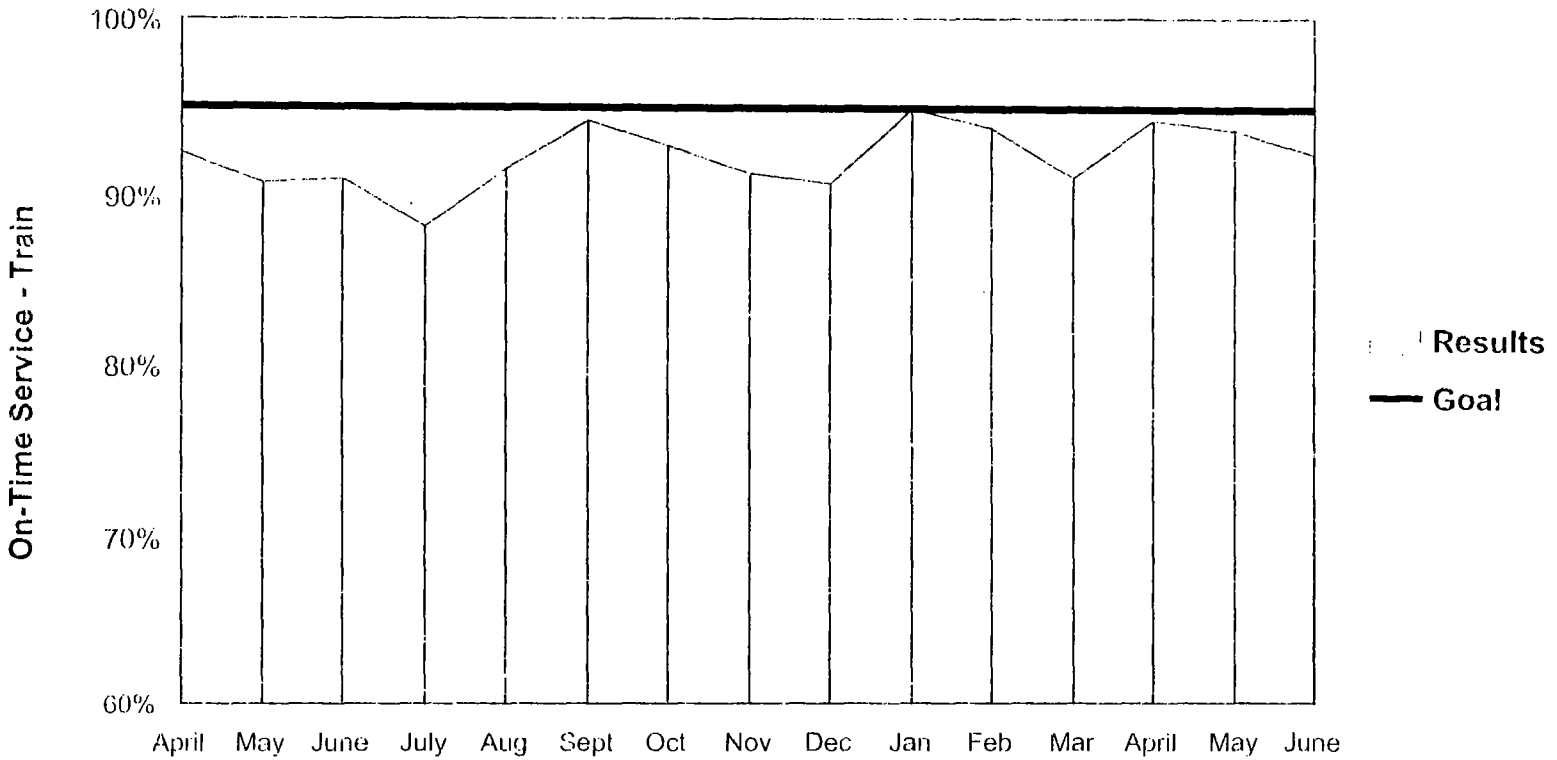
Percent change in average ratings over 2002



Quadrant Chart 2004

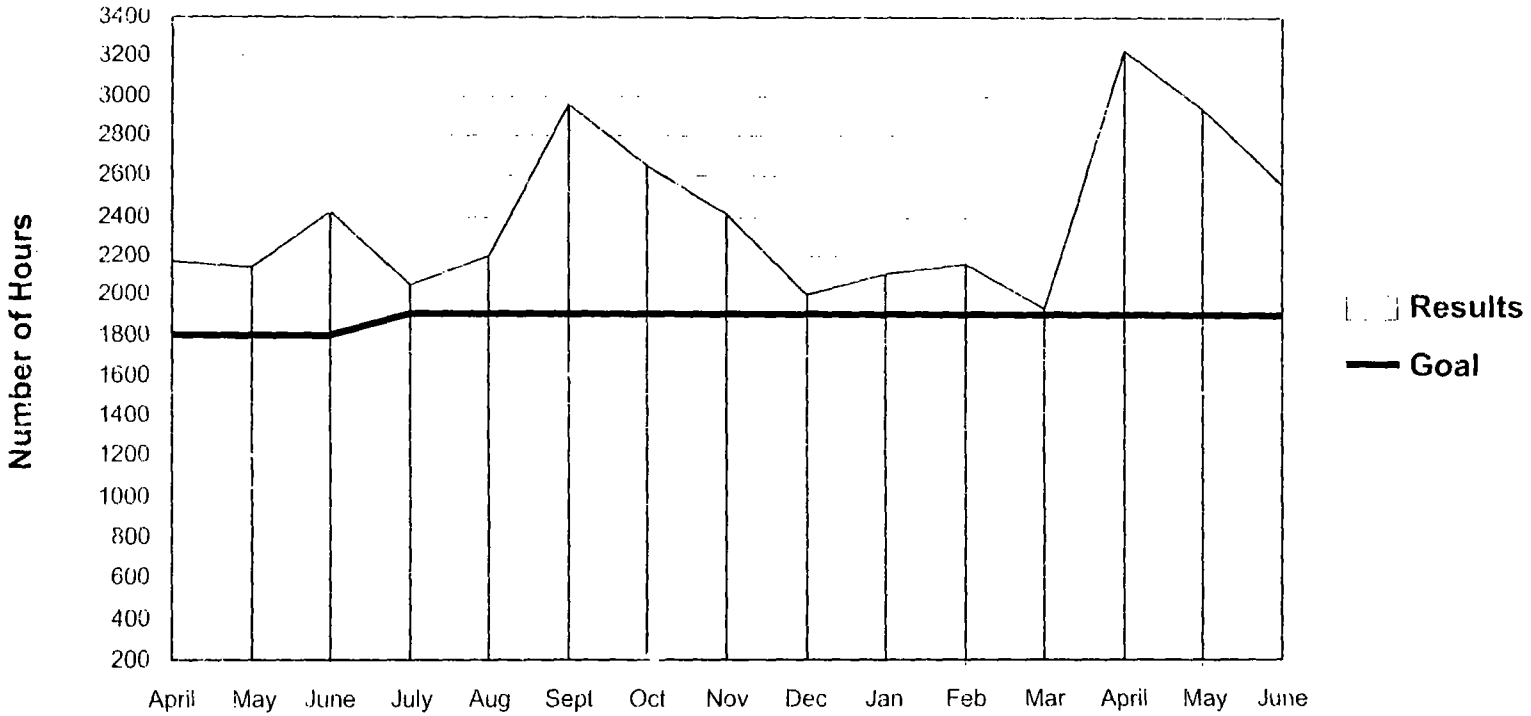


On-Time Service - Train



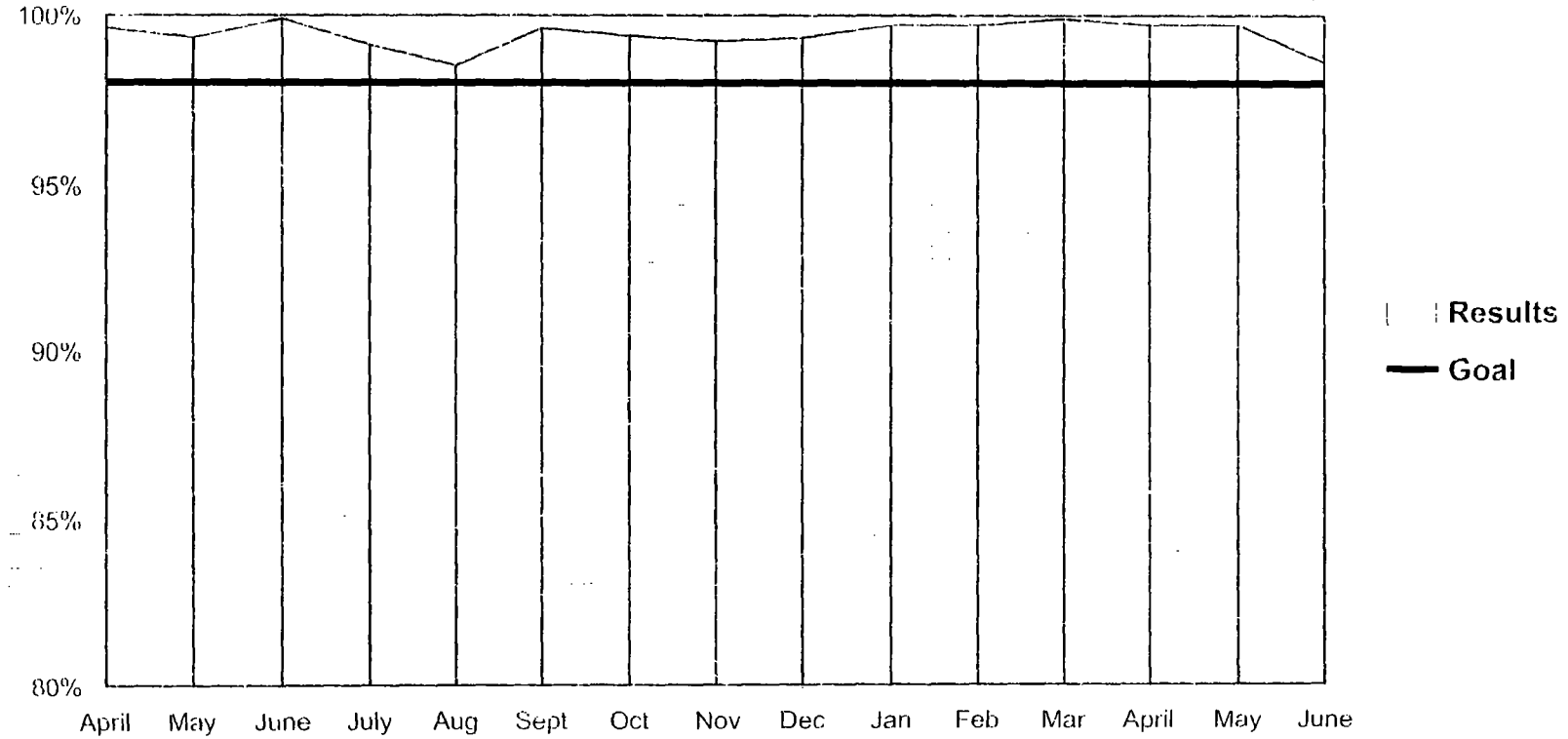
- ✓ Performance below goal, but slight improvement over last quarter and same quarter last year
- ✓ April much improved after March computer/network problems
- ✓ Largest disruption in service occurred on May 22nd when 129 trains were delayed by broken track pads and a false occupancy problem near Glen Park

Car Equipment - Reliability



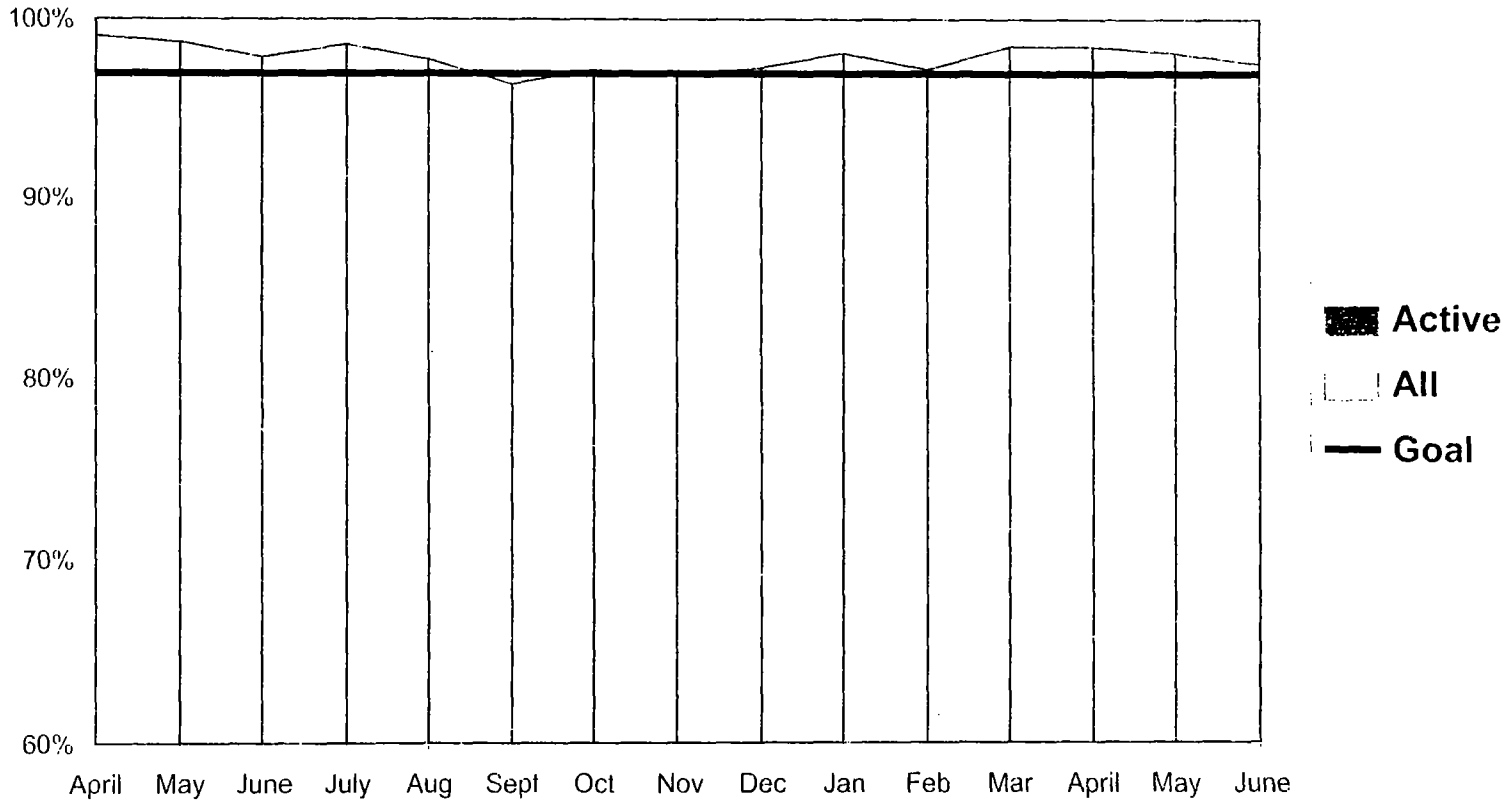
- ✓ Performance remains above goal
- ✓ Large improvement, aided by benign weather

Elevator Availability - Stations



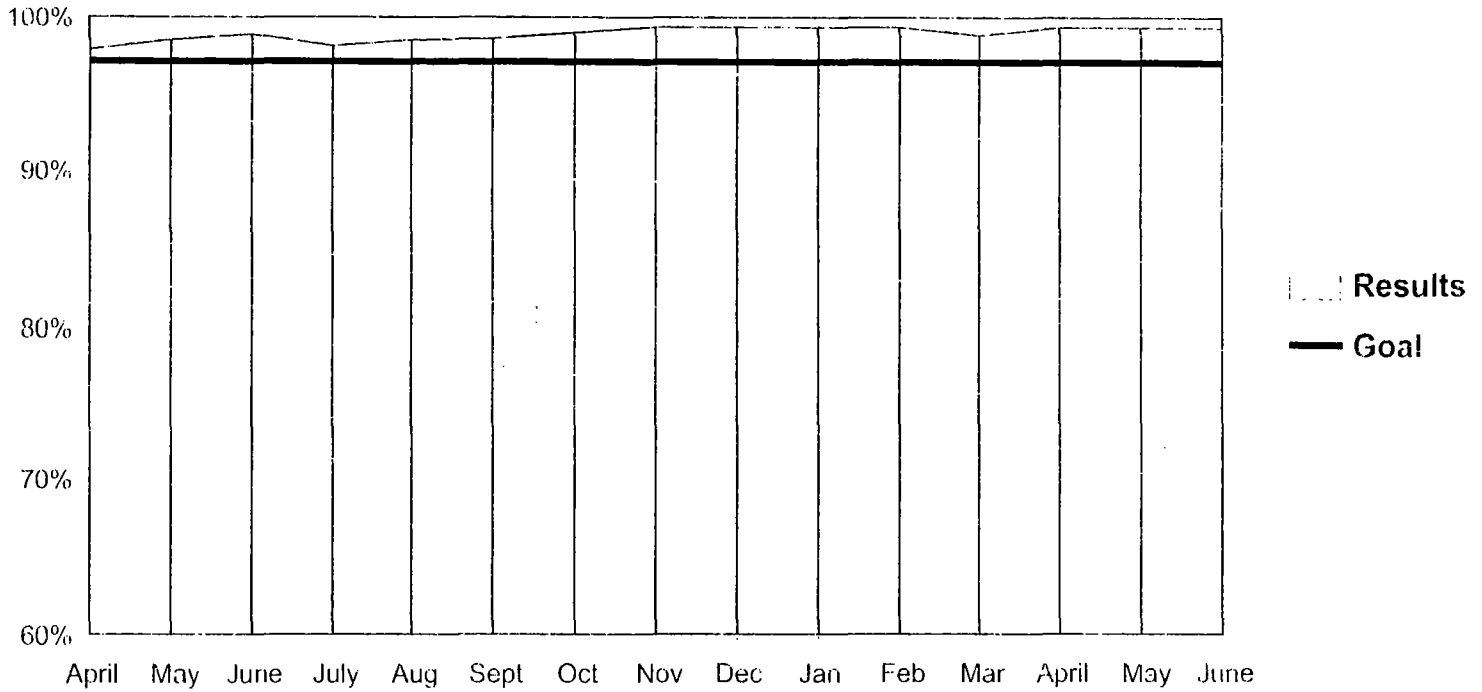
- ✓ Exceeded goal
- ✓ Replacement of elevator emergency and white courtesy phones with hands free phones to begin on A-Line in August

Escalator Availability - Platform



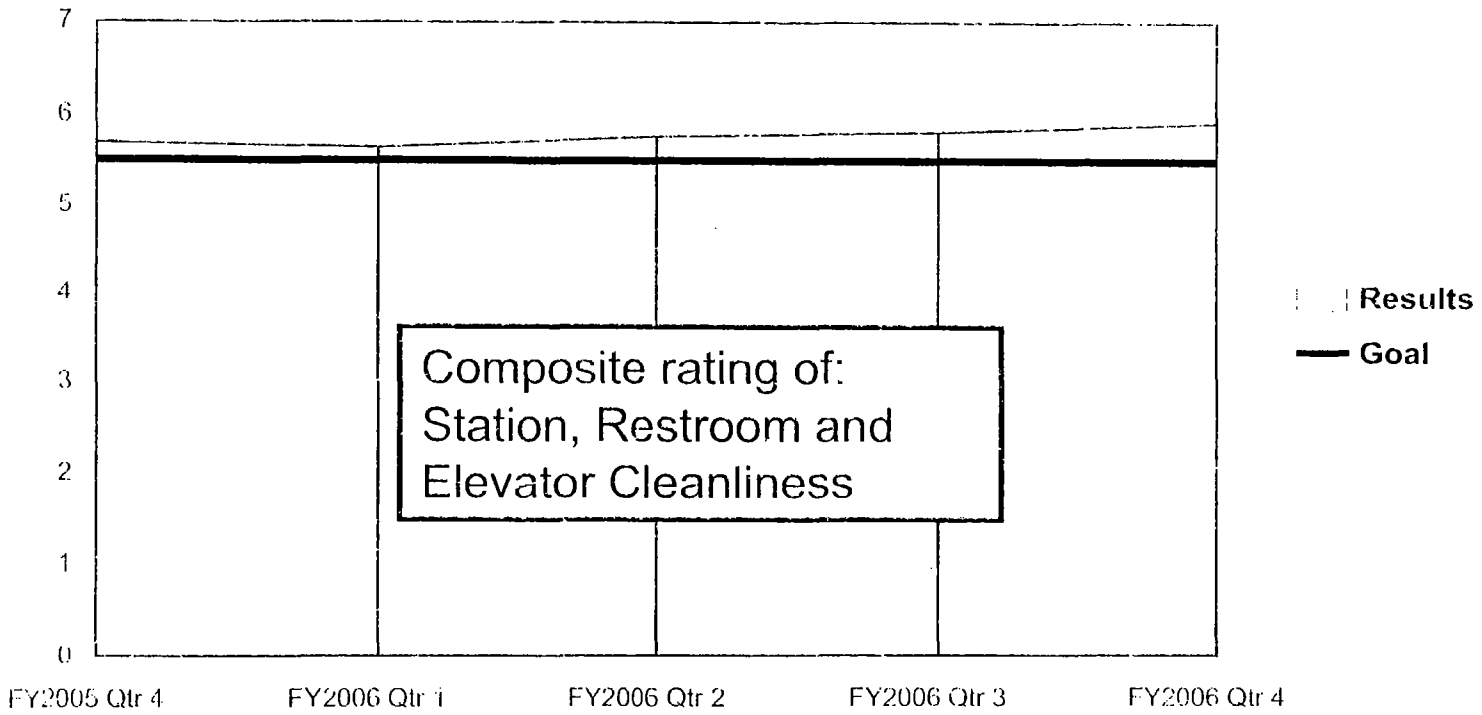
✓ Above goal performance

AFC Gate Availability



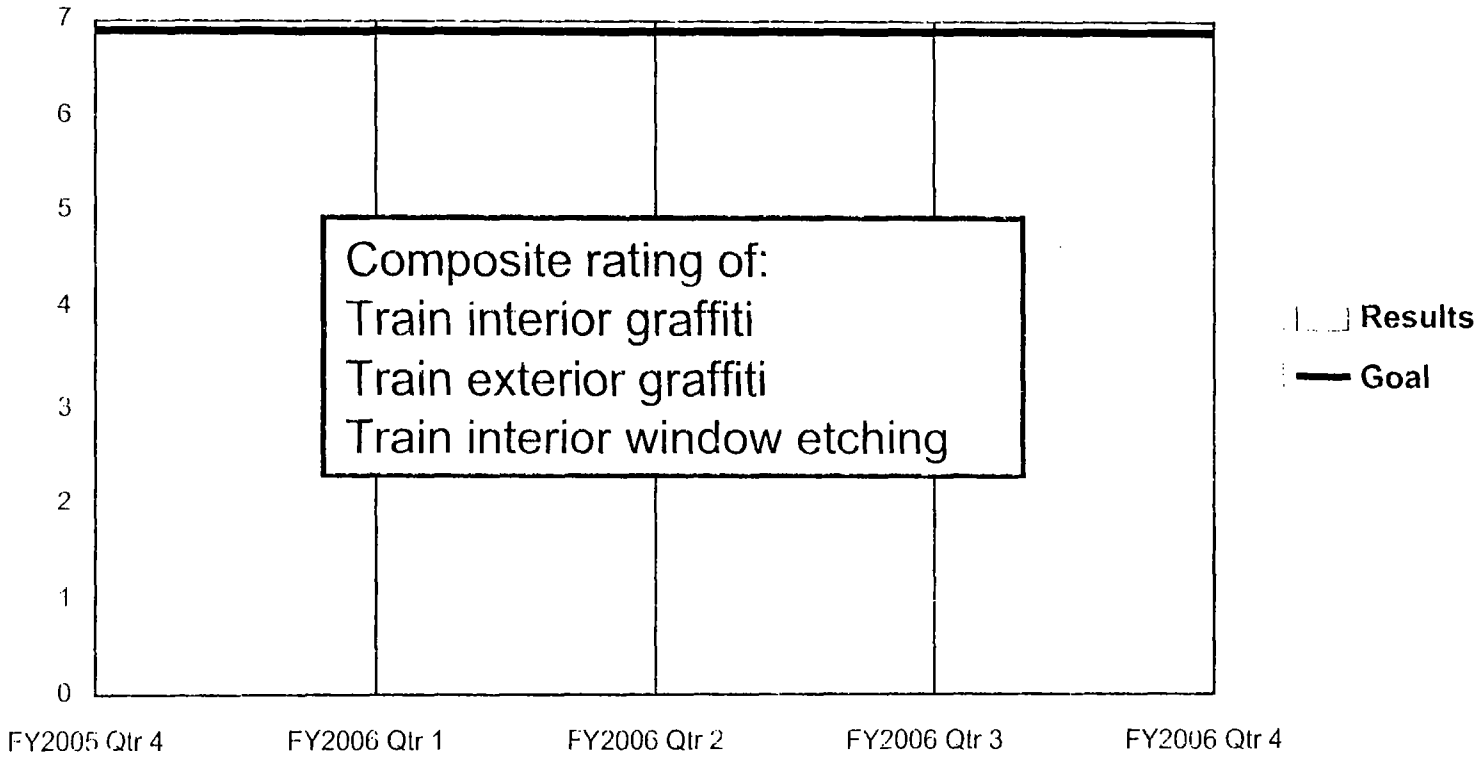
- ✓ Continued availability above 99%
- ✓ Lower incident rate than last quarter
- ✓ New software for accessible fare gate ticket jam problem is being tested at Y10

Environment - Inside Station



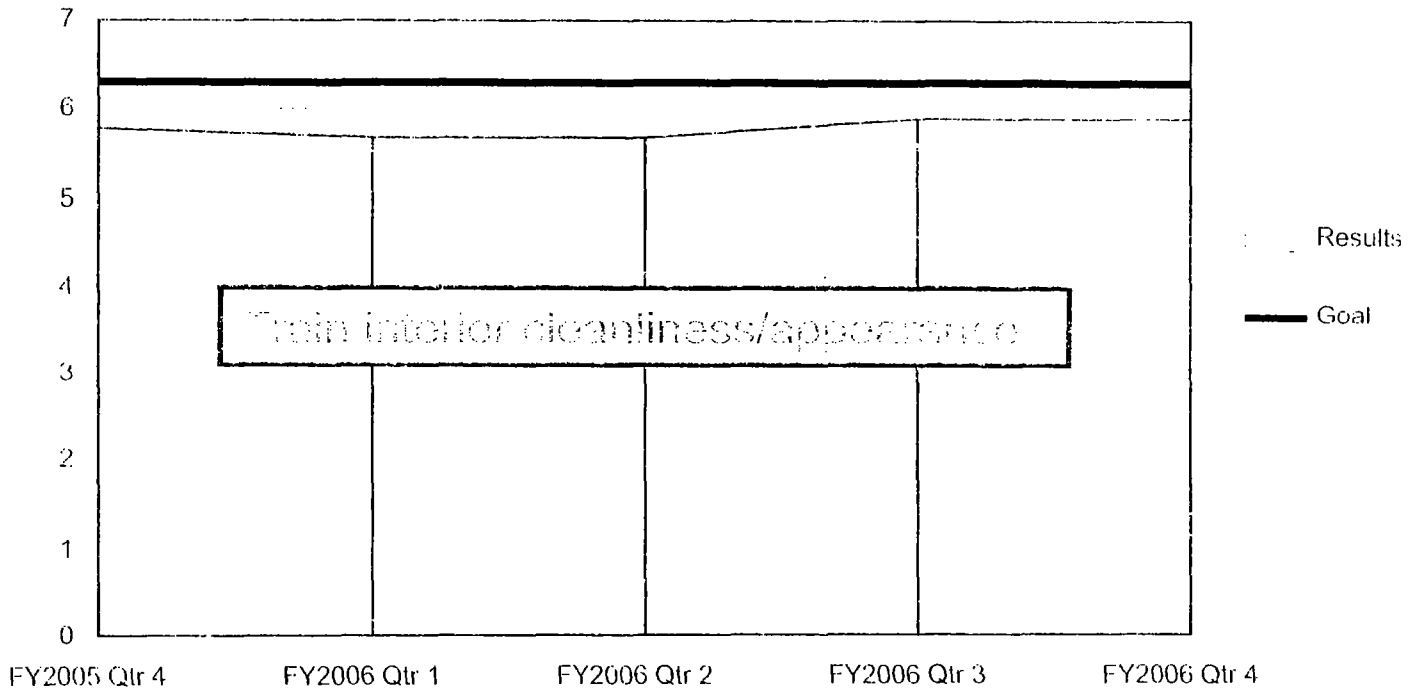
- ✓ Goal met with slight improvement over last quarter in each category
- ✓ Ten additional positions contributed to upward trend for last two quarters

Train Vandalism



✓Goal met, all measures continued at 7.0

Train Cleanliness



- ✓ Rating unchanged from last quarter, results still unsatisfactory
- ✓ Sight improvement in Daly City & Richmond fleets
- ✓ Different end of line cleaner deployment strategies are being tested
- ✓ Floor replacement underway on C2 cars
- ✓ New seat proto-types due in early fall

Weekly Consumer Comments Report

Tuesday through Monday - 2006

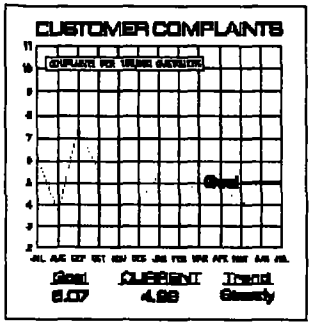
	June 20 June 26	June 27 July 3	July 4 July 10	July 11 July 17	July 18 July 24	July 25 July 31	August 1 August 7	August 8 August 14	August 15 August 21
SERVICE	28	13	14	22	13	24	7	8	13
POLICE SERVICES (8/8/96)	7	0	3	2	2	3	2	2	2
ANNOUNCEMENTS	7	2	10	6	2	7	4	1	5
PERSONNEL	7	5	6	6	15	10	10	12	5
STATION Cleanliness	4	6	6	2	1	4	7	2	5
TRAINS	2	4	0	1	8	6	2	0	1
MAINT. & EQUIPMENT	25	13	13	7	7	12	7	10	15
PASSENGER INFORMATION	4	6	8	1	0	2	2	3	1
AFC PROBLEMS	3	4	3	1	2	5	5	1	0
BUS SERVICE	0	0	0	0	2	0	1	0	0
PARKING PROBLEMS	19	15	14	5	15	12	7	8	8
POLICIES	38	13	22	12	28	38	19	11	8
TRAIN CLEANLINESS (7-7-95)	3	2	2	2	3	2	3	3	4
NEW BIKE PROGRAM (10-3-96)	2	5	1	2	3	5	5	1	2
TOTAL FOR WEEK	149	88	102	69	101	130	81	62	69
COMPLIMENTS	11	10	24	5	14	17	8	3	8
REQ FOR INFORMATION	126	72	77	52	98	45	83	58	65

BART

SERVICE

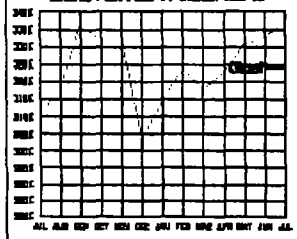
How are we doing ?

CUSTOMER COMPLAINTS



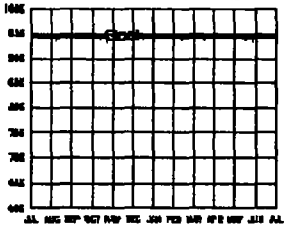
Goal	CURRENT	Trend
6.07	4.99	Steady

CUSTOMER RIDERSHIP



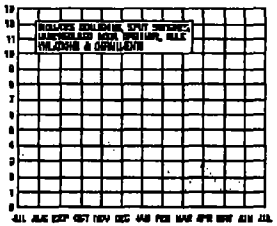
Goal	CURRENT	Trend
5E4K	5E7K	Up

ON-TIME SERVICE



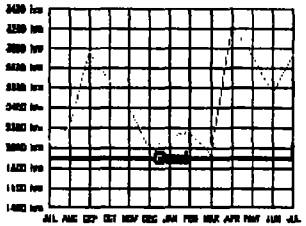
Goal	CURRENT	Trend
94.5%	91.73%	Steady

SAFETY INCIDENTS



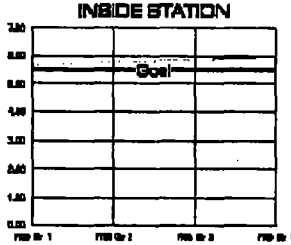
CURRENT	Trend
2	Steady

CAR EQUIPMENT - RELIABILITY



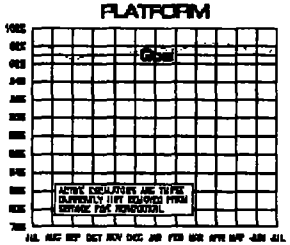
Goal	CURRENT	Trend
8160 Hrs	8946 Hrs	Up

ENVIRONMENT INSIDE STATION



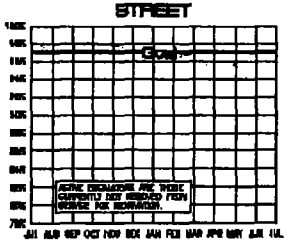
Goal	3rd Quarter	Trend
8.53	8.94	Steady

ESCALATOR AVAILABILITY PLATFORM



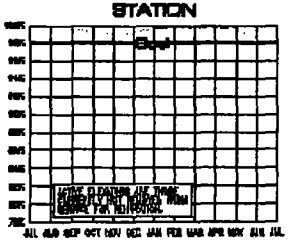
Goal	ACTIVE	ALL	Trend
97%	97.7%	97.7%	Steady

ESCALATOR AVAILABILITY STREET



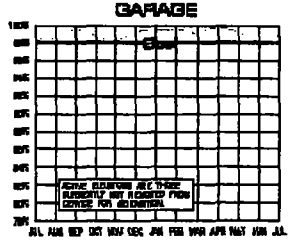
Goal	ACTIVE	ALL	Trend
97%	99.5%	99.5%	Down

ELEVATOR AVAILABILITY STATION



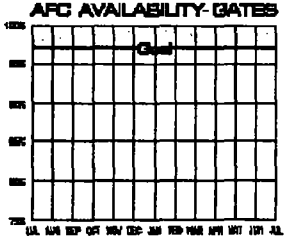
Goal	ACTIVE	ALL	Trend
99%	100.1%	99.1%	Steady

ELEVATOR AVAILABILITY GARAGE



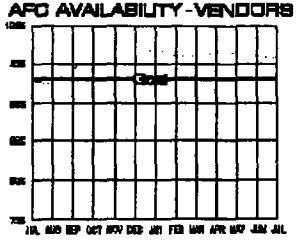
Goal	ACTIVE	ALL	Trend
99%	99.5%	99.0%	Steady

AFC AVAILABILITY - GATES



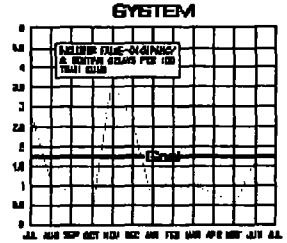
Goal	CURRENT	Trend
97%	99%	Steady

AFC AVAILABILITY - VENDORS



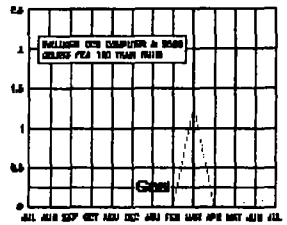
Goal	CURRENT	Trend
93%	96.9%	Steady

WAYSIDE TRAIN CONTROL SYSTEM



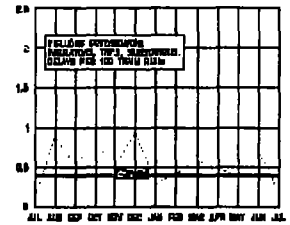
Goal	CURRENT	Trend
1.75	0.88	Steady

COMPUTER CONTROL SYSTEM



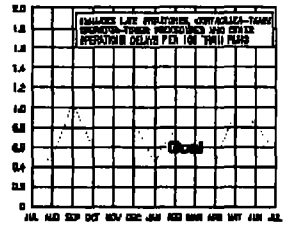
Goal	CURRENT	Trend
0.25	0.06	Steady

TRACTION POWER



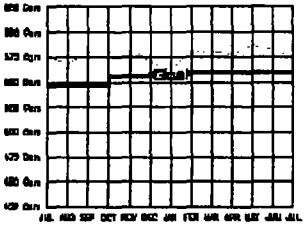
Goal	CURRENT	Trend
0.4	0.18	Steady

TRANSPORTATION



Goal	CURRENT	Trend
0.80	0.62	Steady

CAR EQUIPMENT - AVAILABILITY



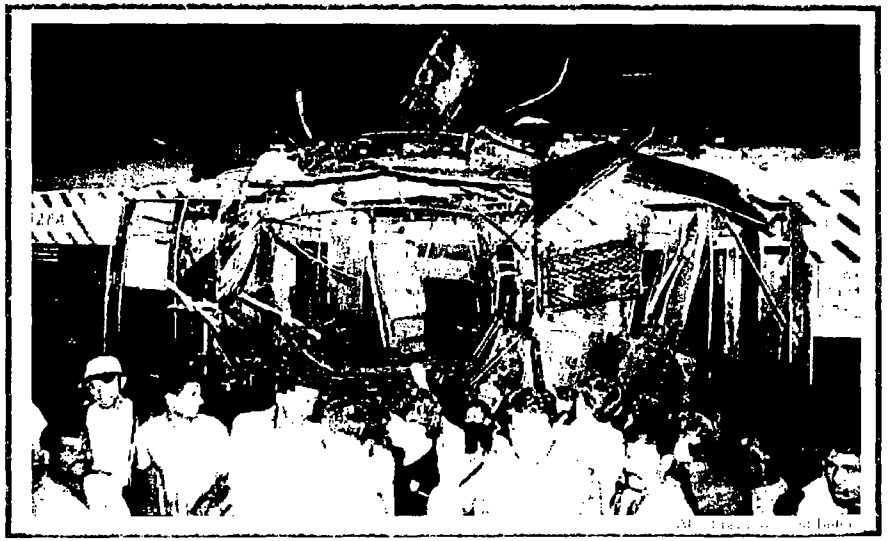
Goal	CURRENT	Trend
668	672	Steady

Principles and Basics

- Terrorism is a serious, realistic threat to BART.
- Public transit, by its nature, is a vulnerable target.
- Don't reinvent the wheel, partner with other agencies, R&D and technology.
- Ingrain security in the culture of the organization.
  - Avoid the priority of the month (year) syndrome
- Because the consequences are so potentially catastrophic, focus is on prevention.
  - Behind the scenes target hardening
  - Very public, very visible displays of law enforcement / employee presence and other public actions
    - ✓ Rationale not always obvious or disclosable to our riders
- Protocols are very situational.
  - Striving for unpredictability

Why Are We Concerned?

- Transit is still a prime target for terrorists.
  - Historically, 33 to 40% of terrorist attacks occur on transit.
  - Bombay, India is just the most recent example. In the past transit agencies in Spain, Russia, France, Great Britain, Singapore and Israel have been targeted.

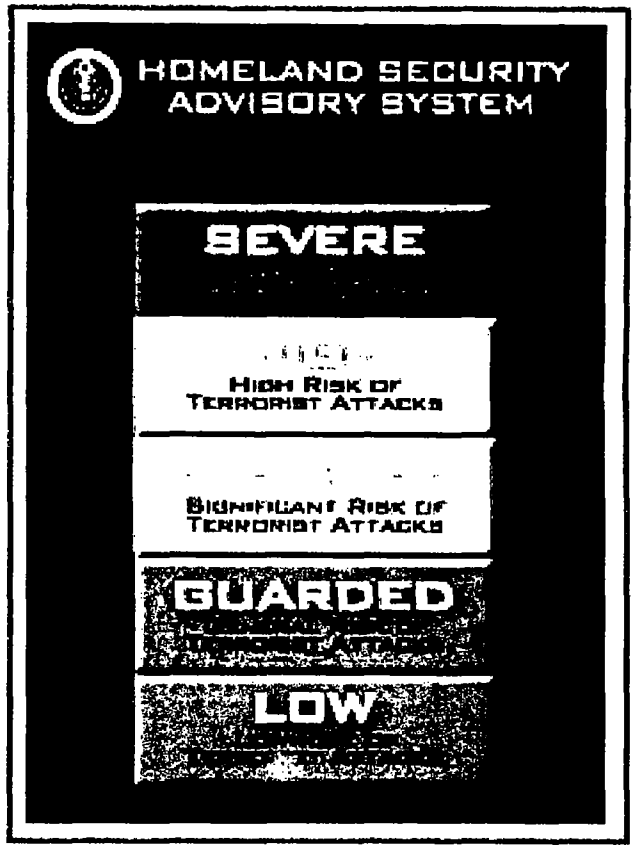


Making BART Safer

- Post 9/11
  - We have conducted several security related assessments to assess our vulnerabilities
  - Target Hardening
    - ✓ Since 9/11, we have hardened our critical infrastructure by installing entry and intrusion alarms, cameras and bollards (barricades) at critical points of the system such as the LMA Administration Building, the Transbay Tube transition structure, portals, and cross-passage doors.
    - ✓ We have also removed or reduced hiding places for people or packages. We regularly inspect stations, restrooms and storage areas not in regular use.

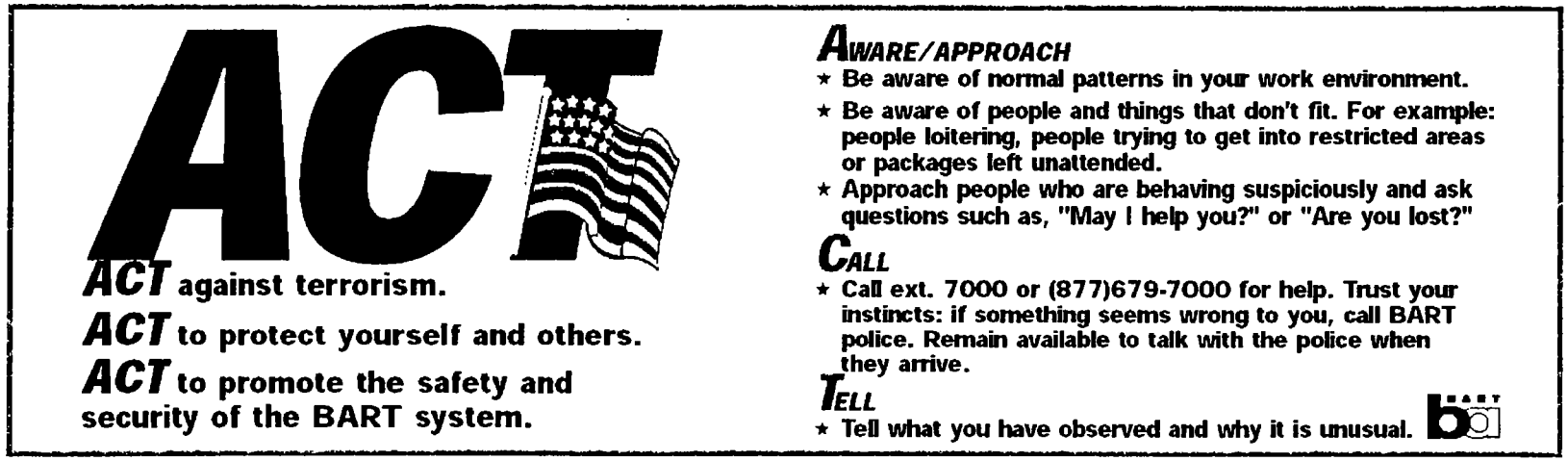
Making BART Safer

- BART has tied response protocols for potential terrorist threats and events to the Homeland Security Advisory System.



Making BART Safer

- Employee Awareness and Training Programs
  - ✓ The ACT Program was developed to promote employee awareness of their work environment and encourage them to approach individuals displaying suspicious behavior. They are asked to call BART Police or a manager if their suspicions are not relieved.
  - ✓ Frontline employees have received updated Anti-Terrorism training, updated NBC (Nuclear, Biological and Chemical) training, and more recently Terrorist Activity Recognition and Reaction training Security Awareness Training from NTI .



Making BART Safer

- BART has developed and distributed several security related training videos for employees: *Secret Weapon*, *Spotting Suspicious Packages*, and *H.O.T.*
- Employees have been trained on the HOT principal developed by the London Underground - Hidden, Obviously Suspicious, and not Typical—reminds employees of identifiers of a suspicious package.

Making BART Safer

- Communicating to Our Passengers
  - ✓ BART's eyes and ears awareness campaign encourages passengers to help keep BART safe by reporting any suspicious or unattended packages or suspicious activity to BART personnel. The latest campaign "Bomb Detectors" was rolled out in August 2005.

PORT OF SAN FRANCISCO

Welcomes . . .

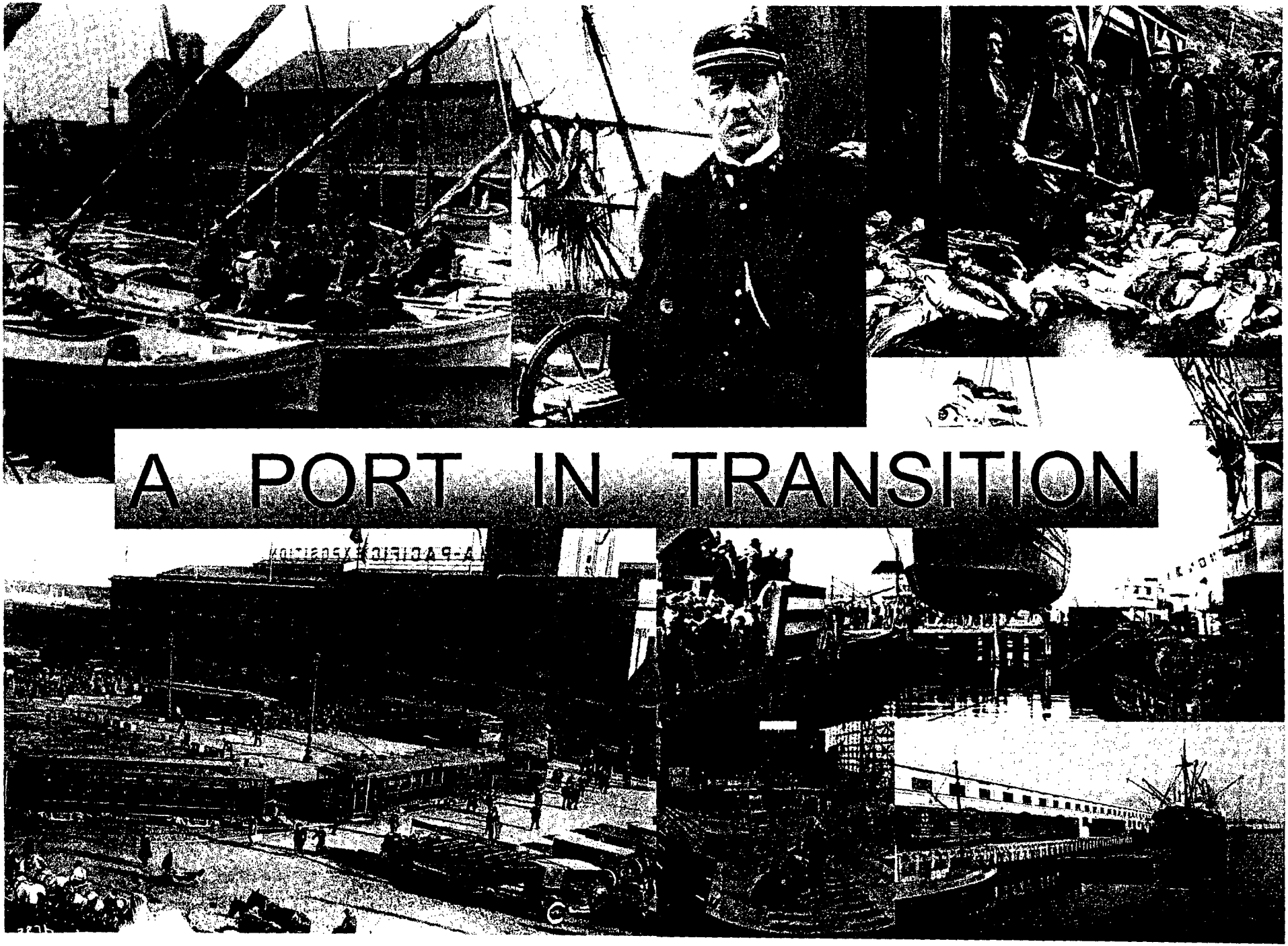
Danish Parliament

Committee on Transportation

August 30, 2006

Flemming Damgaard Larsen, Chairman

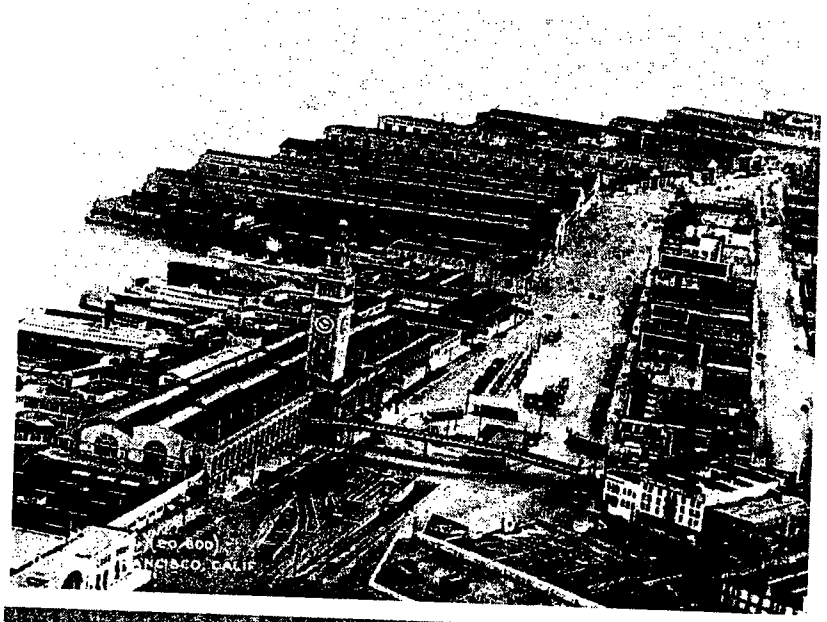
Poul	Andersen	Susanne	Isaksen
Morten	Bæk Sørensen	Jacob	Jensen
Gitte Lillelund	Bech	Anne Mette	[illegible]
Walter	Christophersen	Martin	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

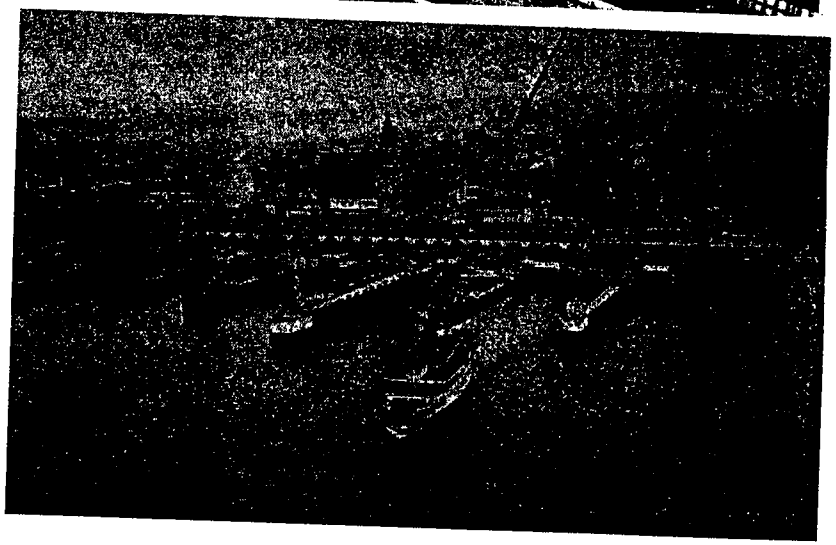

A PORT IN TRANSITION

PORT OF SAN FRANCISCO

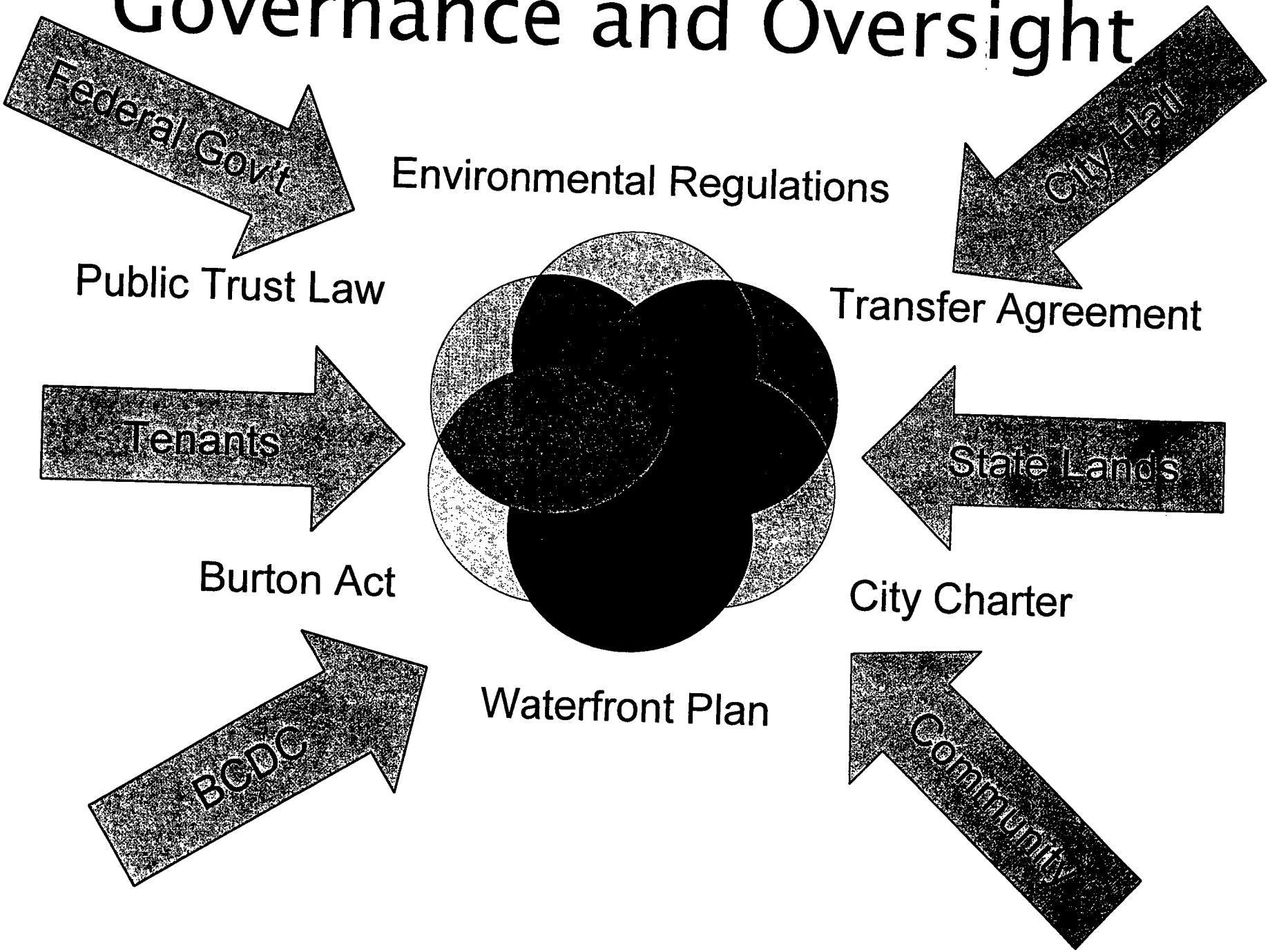
Our History

- Founded in California's Gold Rush
- Established in 1863 as California Harbor Commission
- Transferred to the City by Burton Act (1968)





Governance and Oversight



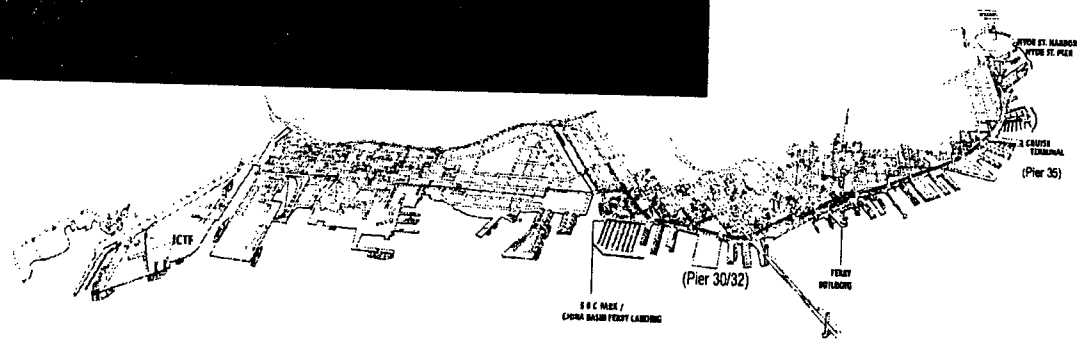
7½ Miles of Waterfront

PORT OF SAN FRANCISCO

56% of San Francisco's Shoreline

455 Acres

6.5 Million sq.ft.



Economic Impact to San Francisco

Port Operations

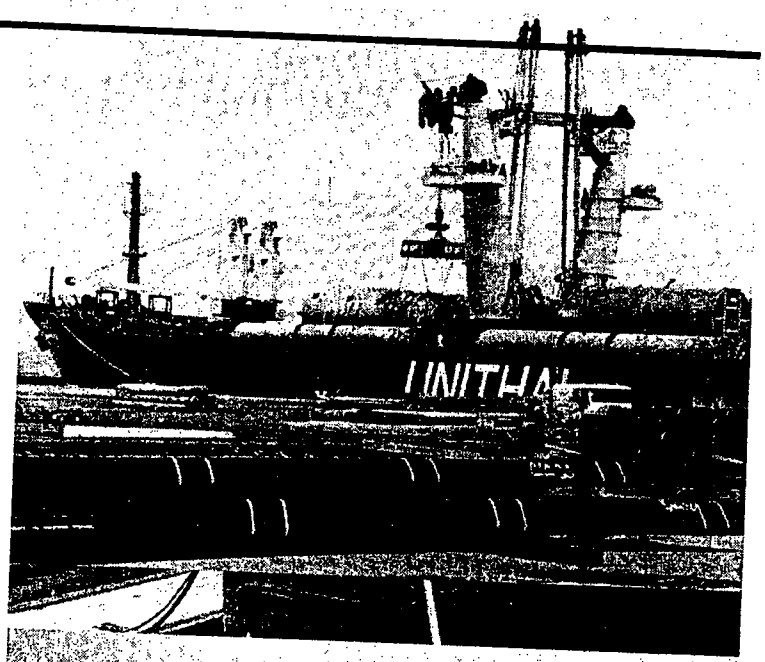
- ✓ produced 29,531 jobs
- ✓ generated $1.6 billion in revenues
- ✓ resulted in $120 million of state & local taxes

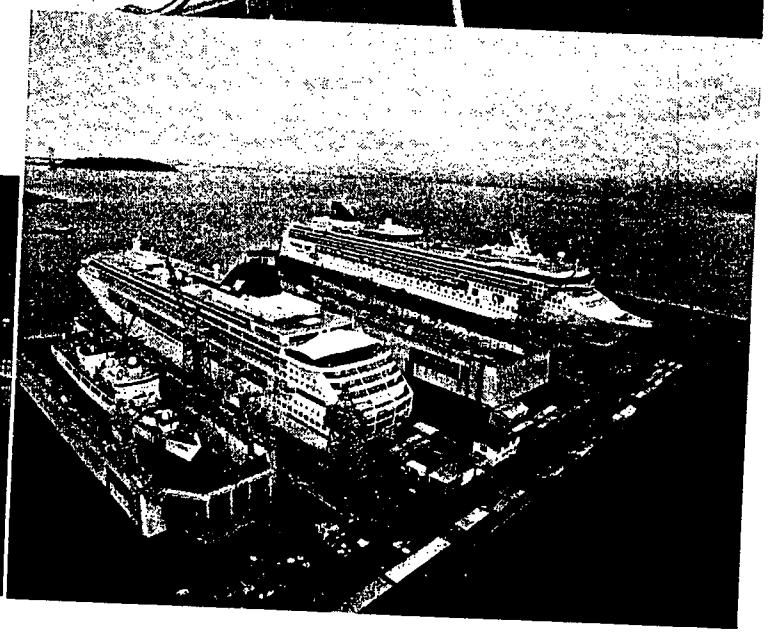
(Source: Economic Impact Report, Martin Associates, 2000)


Napa
Valley
Sonoma
Valley
to Reno,
Sacramento
& Lake Tahoe
Port of Benicia
Port of Richmond
Berkeley
Port of
Oakland
Port of
San Francisco
Mount
Diablo
Oakland
Airport
SF Intl.
Airport
Port of
Redwood City
Silicon
Valley
to Carmel and
Monterey
San Jose
to LA
101
80
680
780
580
280
880
5
1
12
29
121
116
37
13
92
84
85
237
17

A Diverse Portfolio of Maritime Businesses

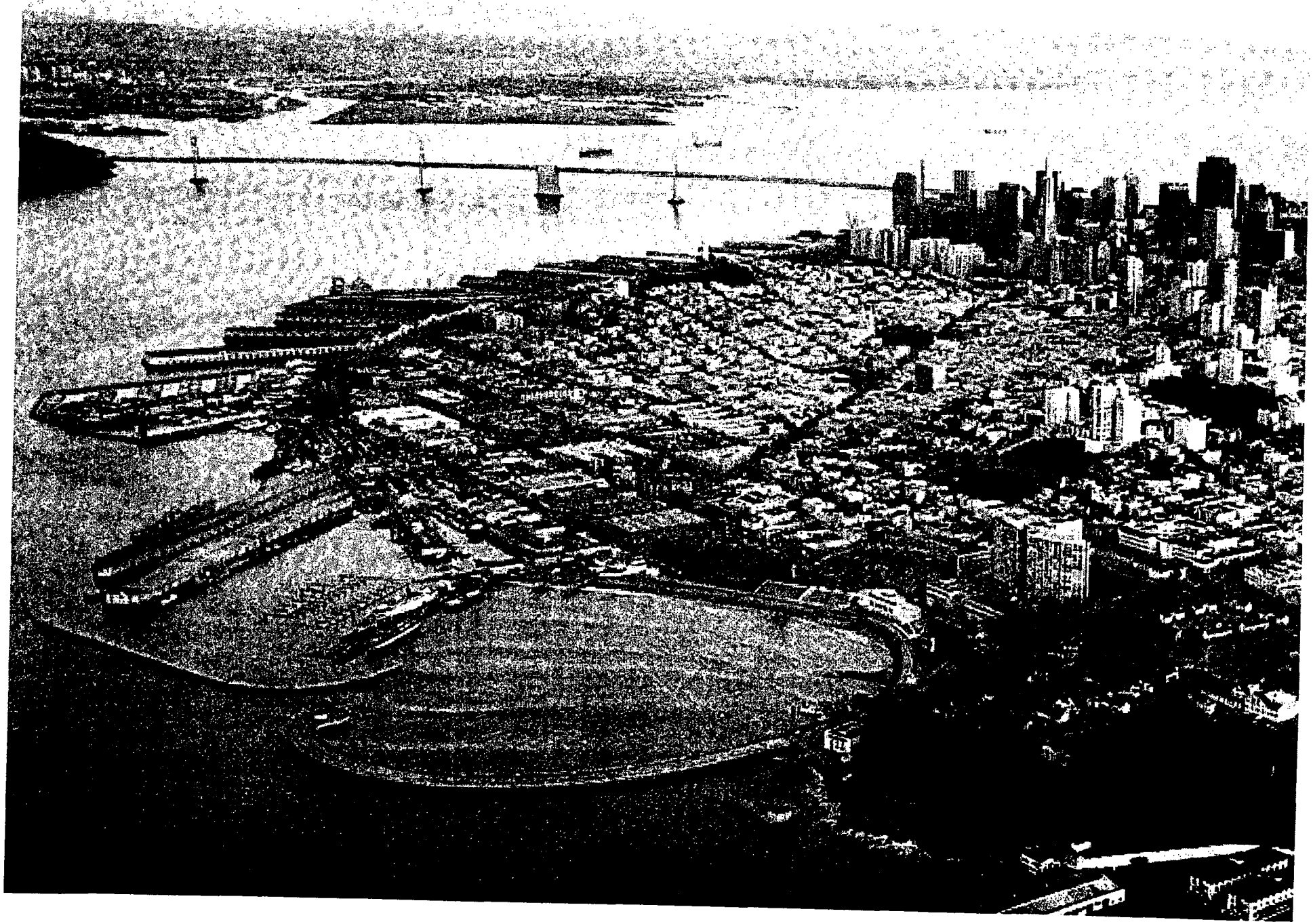
- ✓ Cargo Shipping
- ✓ Foreign Trade Zone
- ✓ Commercial Fishing
- ✓ Sport Fishing · Recreational Marinas · Public Launches
- ✓ Excursions
- ✓ Ferries
- ✓ Harbor Services / Lay Be
- ✓ Ceremonial / Historic Shi
- ✓ Passenger Cruise
- ✓ Ship Repair

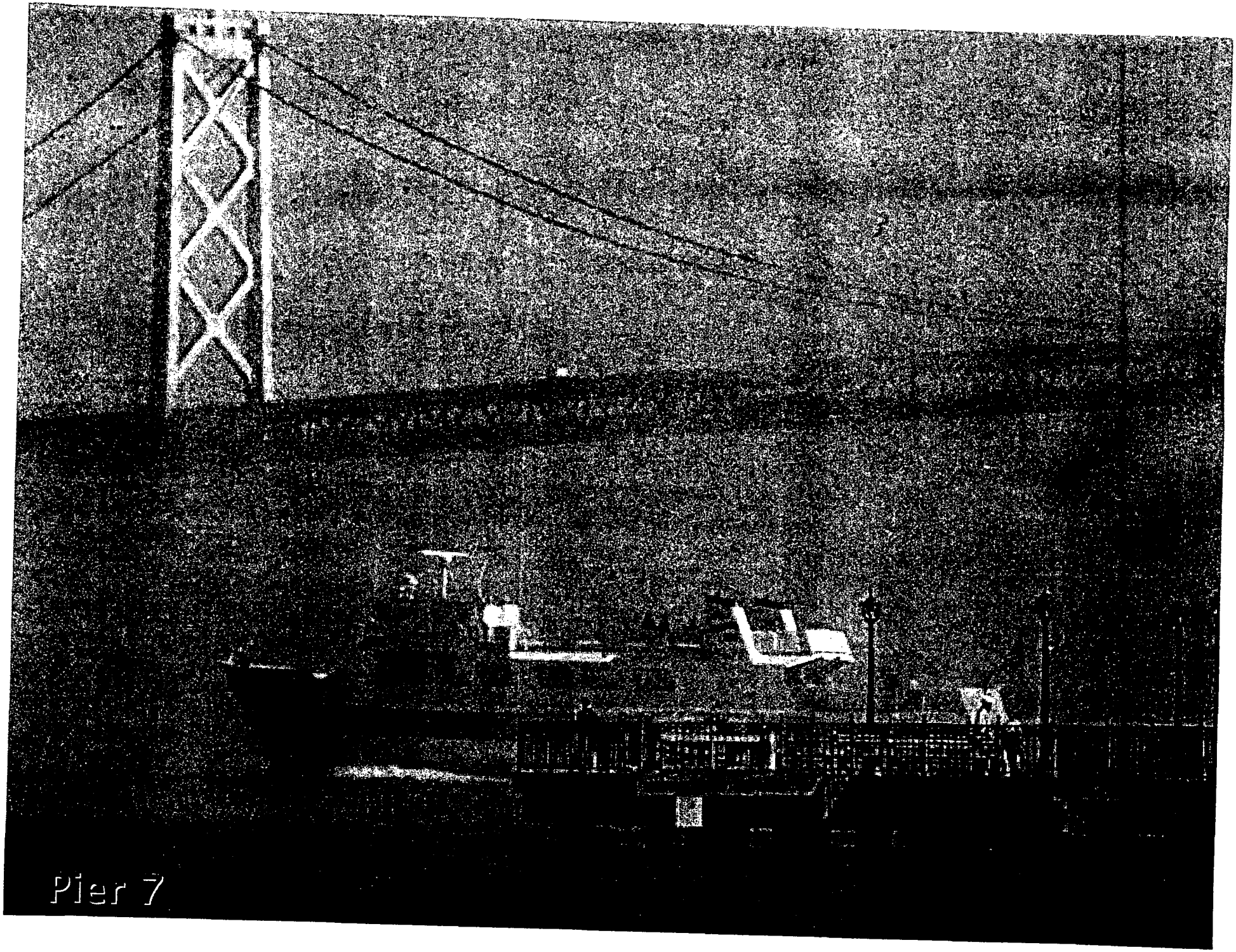


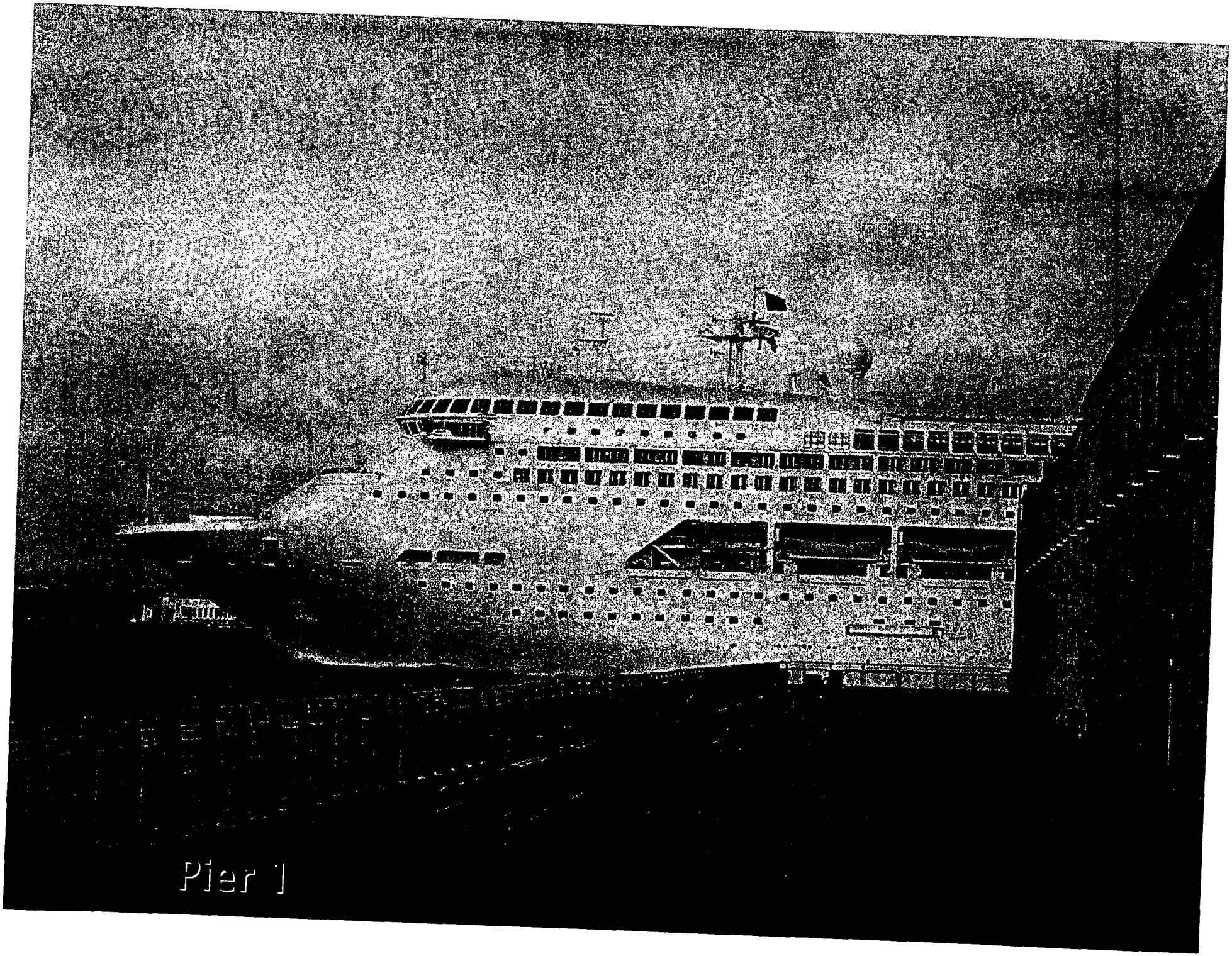


New Challenges

- Operating Efficiencies
- Homeland Security
- Environmental




Pier 7


Pier 1


Farmers Market Information

The Making of a Public Waterfront

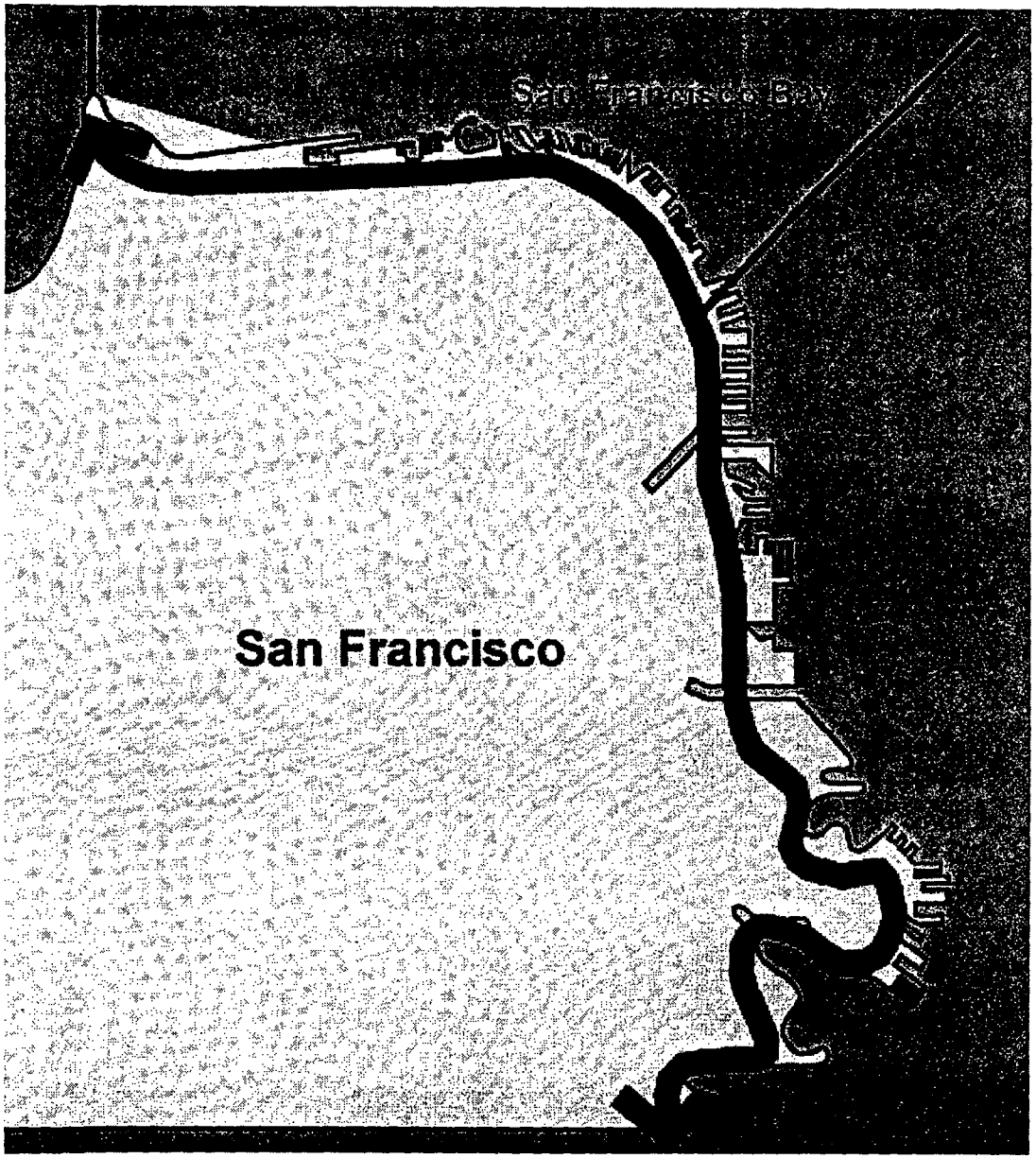
- A Complete Vision
- Authentic Maritime
- Facilities That Attract People


Public Space &
Development Opportunities

Open Space Policies

- Continuity
- Sequence
- Variety

Continuity

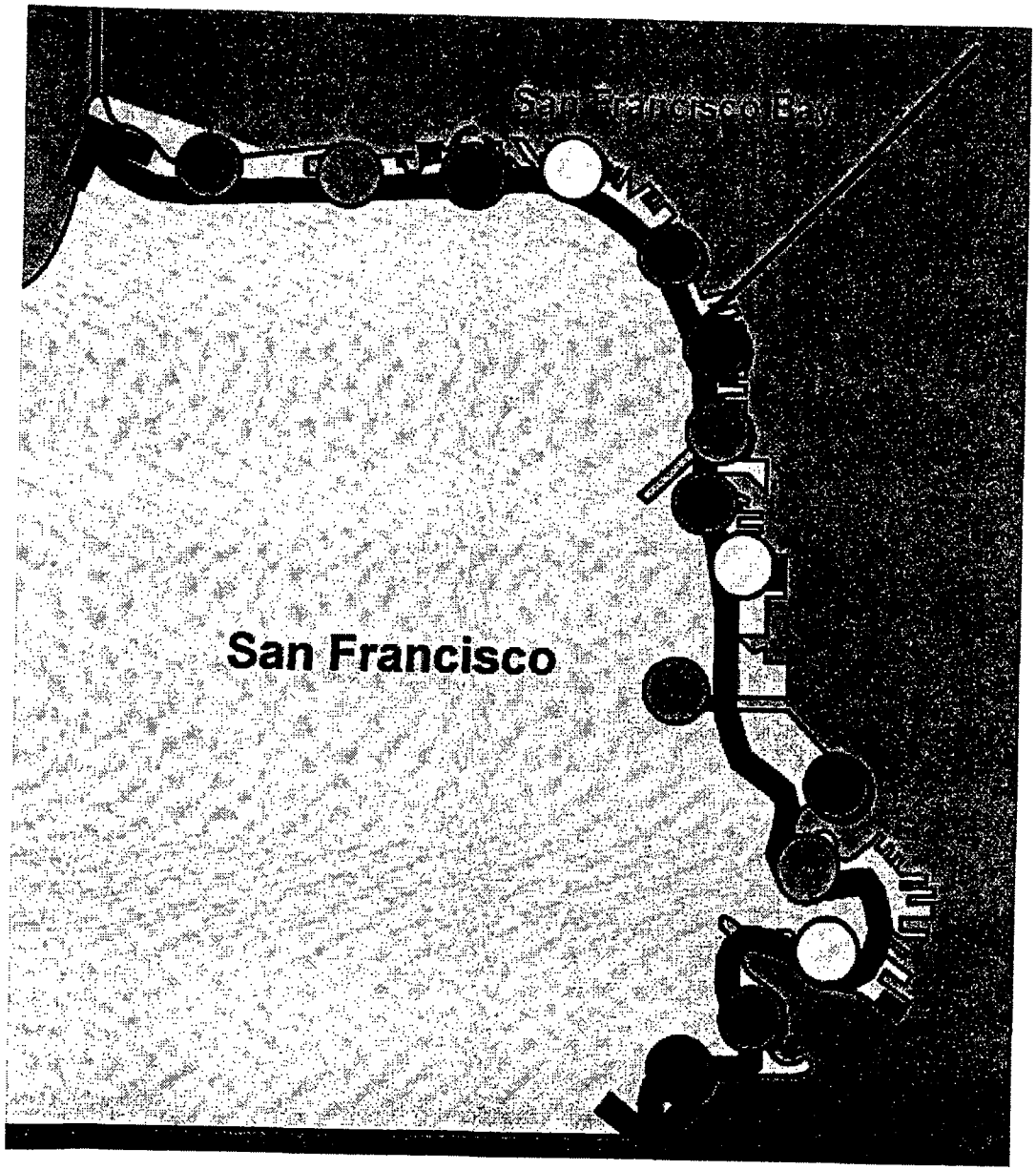


- A Continuous Waterfront Walkway

Sequence

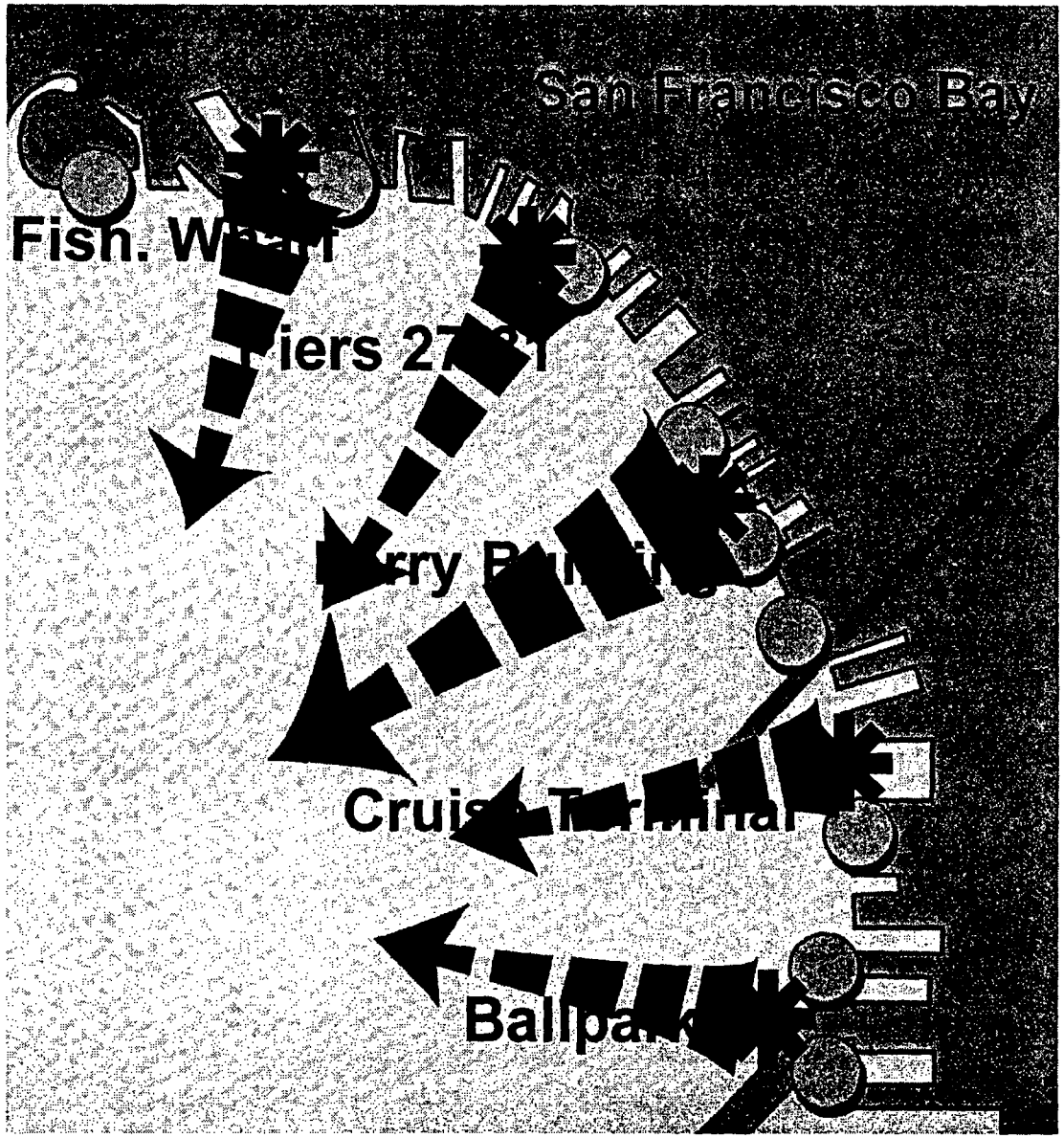
- Sequence of Major Open Spaces at
  5 to 7 Minute Walking Intervals.

Variety



- Variety of Public Open Spaces That Offer Many Recreation Opportunities.

Major Development Opportunities



- Existing and Planned Public Open Spaces
- Major Developments

Ferry Building Area