JCS1

ANYTHING BUT TRAINS?

A comparative analysis of alternatives proposed for the Sonoma-Marin Area Rail Transit Project (SMART)

Jack C. Swearengen, Ph.D. and Friends of SMART

Slide 1

JCS1

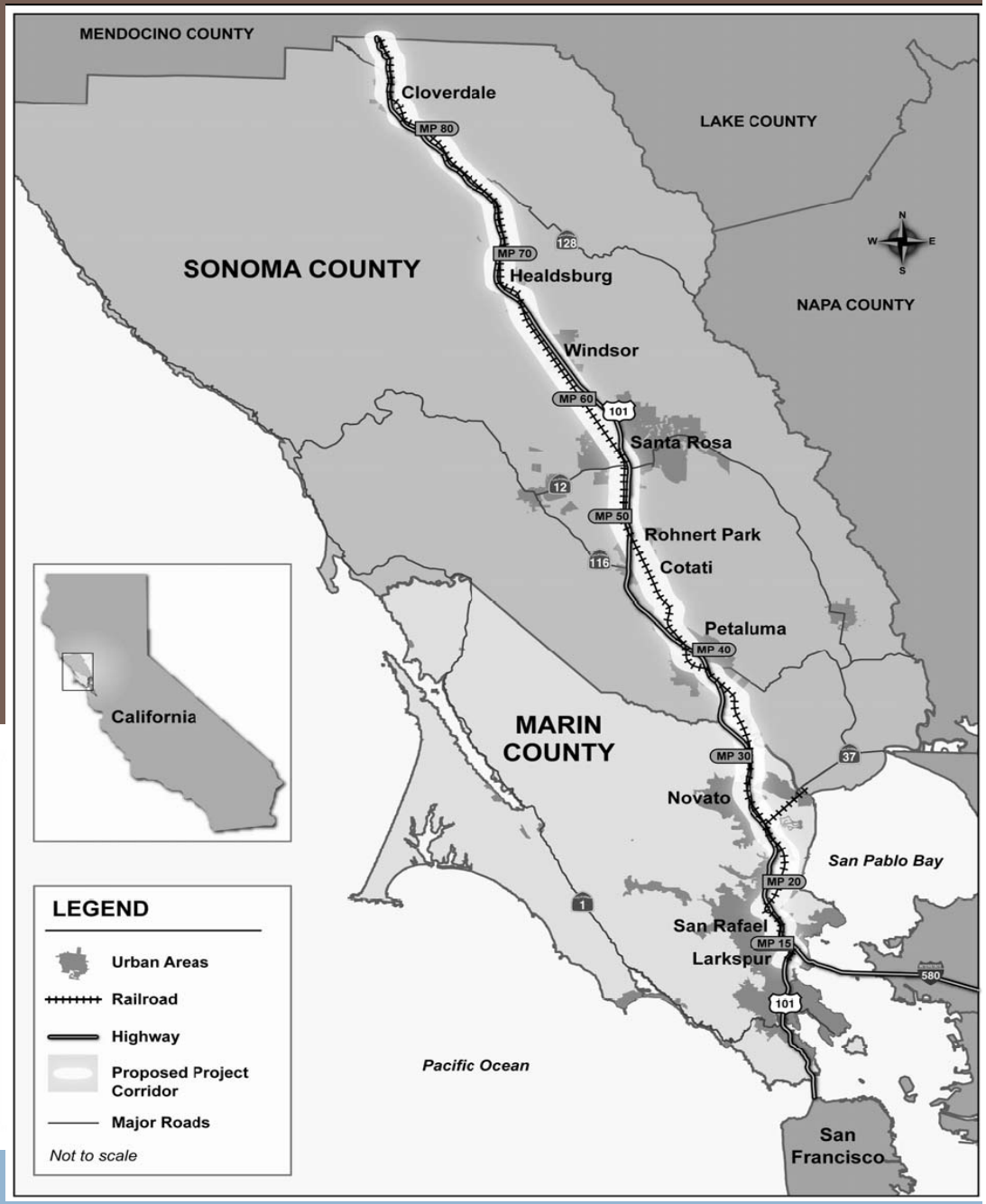
It is proving difficult to get US citizens out of their autos.
Even $4 gasoline having little impact.

Drivers and public officials alike are hoping for tech solution, e.g. ethanol, hydrogen highway.
And public officials are asked to weigh tech alternatives.

Needed: A tool to evaluate alternatives on a consistent basis. A biblical tool will be holistic, reflecting shalom.

Jack Swearengen, 5/13/2008

transportation alternatives



Transportation Goals for Sonoma- Marin

Provide an alternative to driving

- **for those who choose not to drive**
- **for those who can't drive**

Reduce Vehicle Miles Traveled

- **reduce greenhouse gas emissions**
- **reduce congestion on highway and city streets**

Provide interconnectivity through multimodal transportation system

Use the most energy-efficient solution

Stay within projected cost levels ($5.5 million/mile)

Stated Objections

- Costs too much
- Not enough people will ride it
- Trains are noisy and polluting
- Will promote growth and sprawl
- Doesn’t cross the Bay
- Safety hazard at grade crossings
- Traffic delays at grade crossings
- Rail is nineteenth century technology

Other nineteenth century technologies

- Telephone and telegraph
- Chemical fertilizer
- Radio
- Paper
- Printing press
- X rays
- Gunpowder
- Rifled cannon
- Compass
- Optical Lenses
- Microscope and telescope
- Batteries
- Incandescent lamps
- Diode
- Milking machine
- Photography
- Computer
- Clock
- Electric motor
- Cast iron plow
- Seed drill
- Threshing machine
- Mechanical reaper and binder

Why is this a Christian Issue?

Because God intends His people to

- be *transformed.* Sanctified
- mature in discipleship
- live distinctly
  - *in* the world but not *of* it
- be *instruments of righteousness*
  - promote justice and *shalom* in a fallen world
  - demonstrate that the kingdom of God is at hand

4-fold alienation → 4 dimensions to heal

JCS3

Social & Cultural

"There are technological solutions to these problems"

Technological solutions introduce new problems

"The price of progress"

Spiritual

"The market is our best guide"

Environmental

"Environmentalism is new age"

Slide 8

JCS3 For secular audience:

Social -> social
Environmental -> environmental
Psychological -> aesthetic
Spiritual -> economic
Jack Swearengen, 7/29/2008

A Look at the Options

This presentation will look at the pros and cons of various options proposed for the SMART Right of Way including:

- AutoTram
- Personal Rapid Transit
- Automated Transit
- Monorail
- MagLev
- BART
- Electric light rail
- Dual Mode Vehicle
- Bus Rapid Transit
- Diesel Multiple Units (DMUs)
- Keep driving

Multimodal Transit in The Netherlands

FRA Regulations

for joint freight & passenger operations

Temporal separation:

Light Rail at Sandy, Utah

Separate tracks:

Caltrain Common Corridor, Mountain View, CA

Less realistic options

- AutoTram
- Personal Rapid Transit
- Automated Direct Transit
- Monorail
- MagLev
- BART Extension

AUTOTRAM

What is it?

- Large articulated bus which uses rubber tires and a hybrid engine
- Intended for city streets
- One or two cars, bi-directional

Why?

- Hybrid engine will be energy-efficient when it becomes available

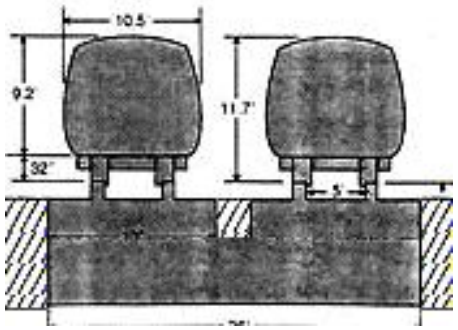
Why not?

- Would have to pave ROW, making freight and connecting rail service impossible
- Lower top speeds
- More drivers required

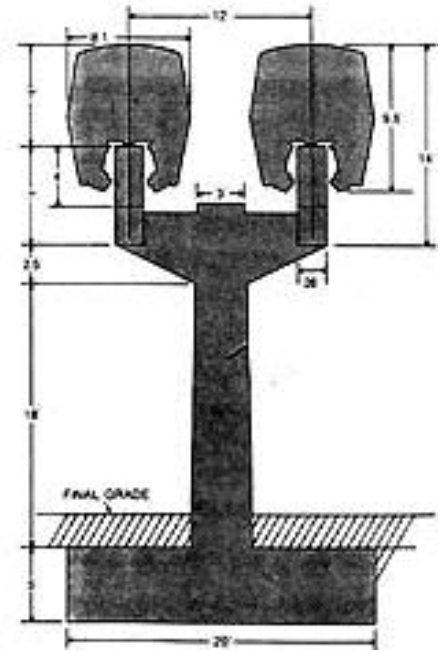
PERSONAL RAPID TRANSIT (PRT)

What is it?

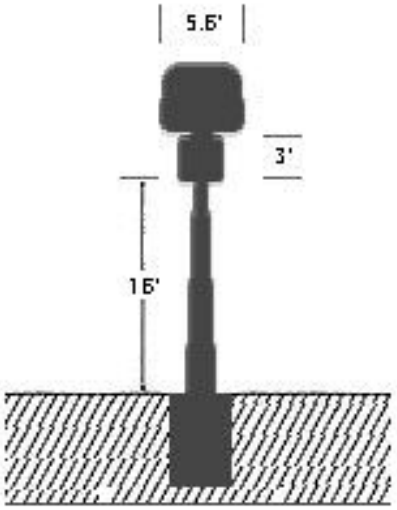
• A system of small vehicles under independent or semi-independent automatic control, running on fixed guideways in grids or networks



Standard Rail

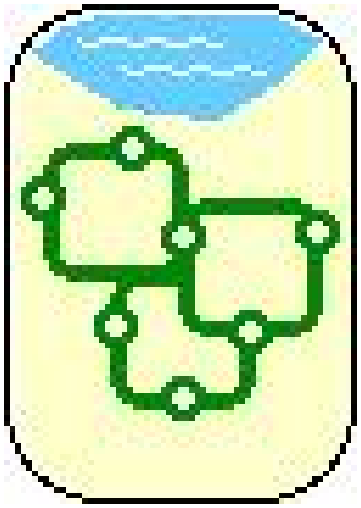


Monorail

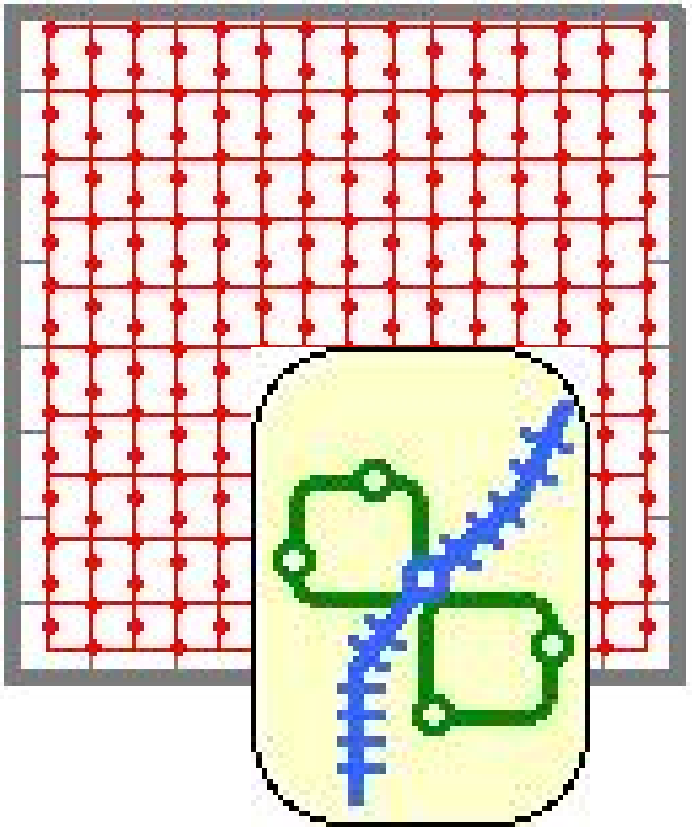


PRT

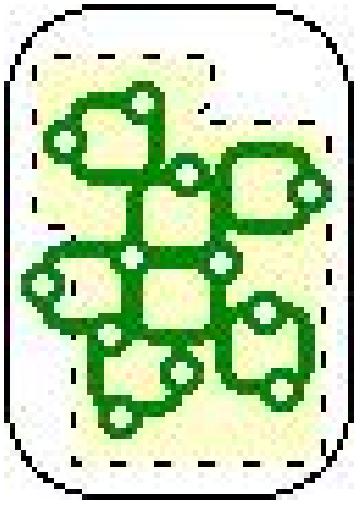
Grid/networks for PRT



Small [PRT] networks for local circulator transit, congestion relief, or in anticipation of future density



Transit service to and from rail stations



Circulators linked together, forming a citywide network

PERSONAL RAPID TRANSIT (PRT)

Why?

• Designed to provide the secu
found in larger more common

• Lightweight cars are inexper

Demonstration projects have cost $100 million per mile

Ineffective until regional grid established

Unknown public acceptance means high risk

No O&M data from operating system

Overhead guideways will be visually obtrusive

Projected congestion at stations / on lines

Small vehicles claustrophobic for longer trips

Emergency exit concerns

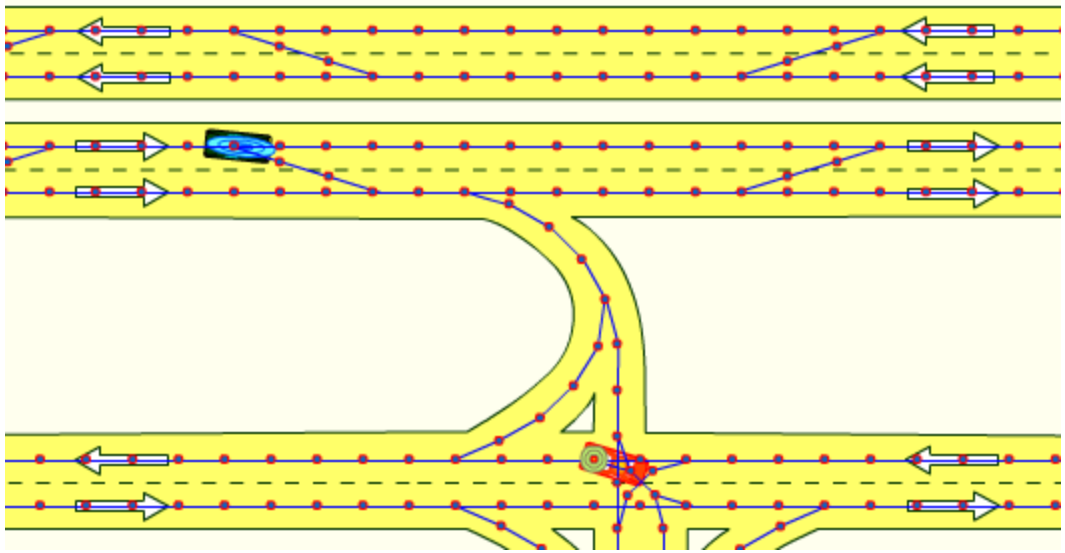
For more, see Wikipedia, PRT entry

AUTOMATED TRANSPORT SYSTEM (ATS)
Roadway-Based

What is it?

• A system using automated cars, similar to PTS

• Automated roadways and driverless cars



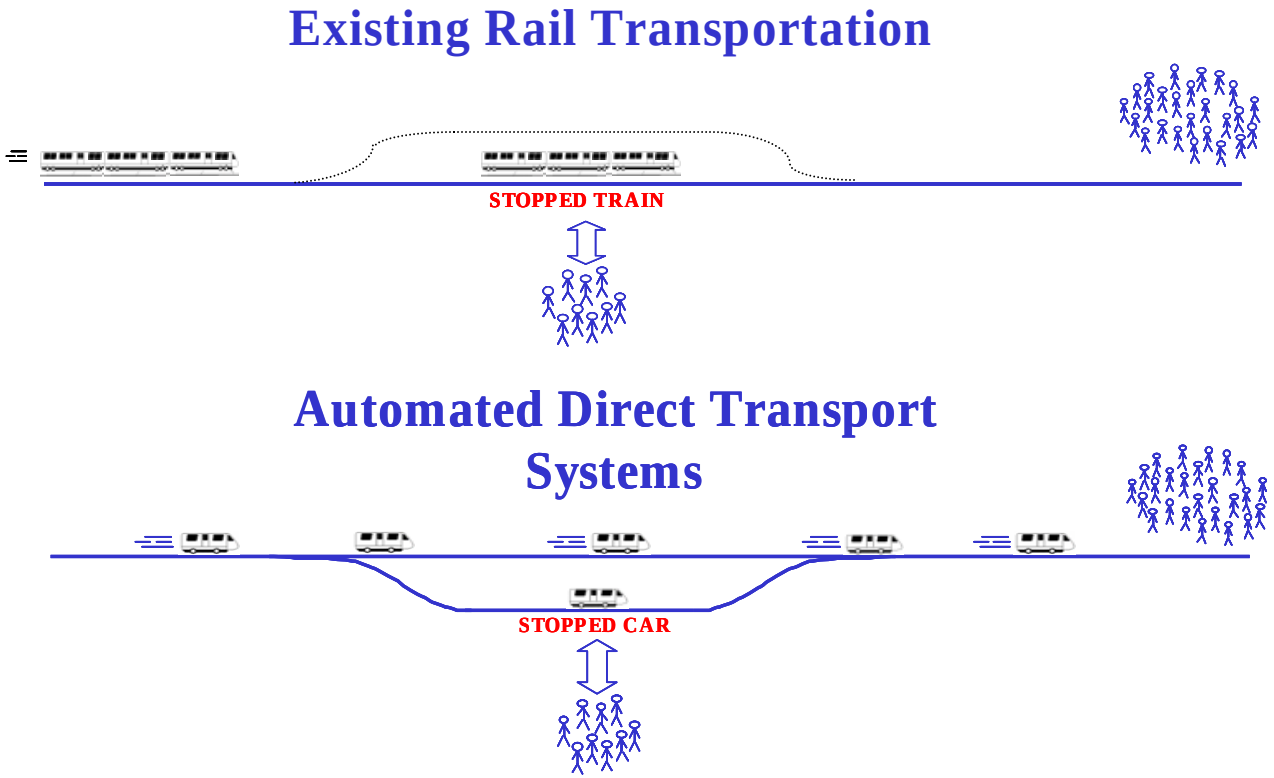
Why?

• Increased safety and R.O.W. utilization

Why not?

• Extremely complex
• Extremely expensive
• Poor land use
• Impervious surface
• Does not exist

AUTOMATED TRANSPORT SYSTEM (ATS)
Rail-Based



ADT advocates seem to believe that sidings are a new concept!

To reflect reality I have added a rail siding to their top figure.

MONORAIL

What is it?

• A single rail serving as a track for a wheeled vehicle; also, a vehicle traveling on such a track.

Why?

- Minimal space, vertically and horizontally
- Quiet
- Up and out of traffic
- Not physically capable of derailing

MONORAIL

Why not?

- Cannot be built at grade, making exit in an emergency problematic
- Very expensive (~$80-300 million /mile) *
- Heavy and clumsy crossover mechanism requires double track
- Incompatible with any other type or rail; makes shared track impossible
- Has never advanced past novelty stage

* http://www.planetizen.com/node/70 and http://www.lightrailnow.org/facts/fa_monorail.htm

MAGNETIC LEVITATION (MAGLEV)

Shanghai maglev

What is it?

• Form of transportation that suspends, guides and propels trains using electromagnetic force; uses track similar to monorail

Why?

• Low friction translates to high speeds, especially over long distances
• Electric operation
• New and sexy

MAGLEV

Why not?

- Extremely expensive—average cost, 2002 dollars, 7 systems: $138 million per mile*
- Monorail-like superstructure required—crossover problems
- Questionable in start-stop operations
- Steel wheel on steel rail technology has essentially matched maglev's potential operating speed
- Incompatible with any other rail operations or connections
- Very noisy at high speed
- Negligible energy savings

* Sources: Capital Metro, Rapid Transit Project, Draft B Milestone 2 Executive Summary: Urban Transit Vehicles@, 1 October 2001; Steve Arrington, Jacksonville Transportation Authority, 12 October 2001; Leroy Demery, Jr., May 2002; Monorail Malaysia, news release, 23 April 2001; Jacob Snow, The Las Vegas Monorail@, Monorail Society website, 2002/11/02. Calculations by Light Rail Progress]

BART Extension

Why?

- Connect with the rest BART system
- Established transit system
- Known technology

Why not?

- Non-standard rail
  - SMART tracks would have to be completely replaced
  - Would make SMART ROW unusable for freight
  - Would make connection to standard gauge rail systems impossible
- Extremely expensive
  - SFO extension: 8.7 miles, 4 stations = $1.5 Billion or $170 million/mile
  - 16.1-mile BART extension from Fremont to Santa Clara: $4.7 billion

More realistic options

- Bus Rapid Transit
- Electrified light rail
- Dual Mode Vehicle
- Diesel Multiple Units (DMUs)
- Keep driving

BUS RAPID TRANSIT (BRT)

What is it?

• High speed bus system operated within an exclusive right-of-way

• Incorporates exclusive transitways, modern stations, on-board fare collection, high-tech vehicles and frequent service.

Why?

- Might eliminate one mode change for passengers (rather than train+bus)

Why not?

- Requires paving over the tracks, eliminating their use for freight
- Would not promote TOD land-use pattern
- Retains rolling resistance of rubber tires
- Travel experience not good enough to compete with autos

DUAL-MODE VEHICLES (DMV)

What is it?

• Vehicle that runs on rail and road

Why?

• Provides some flexibility by running off-track onto local roads

Why not?

- Tare weight reduces performance
- Minutes required to re-rail
- Same discomforts as bus (no tables, cannot walk around, no restrooms/food/Wi-fi)
- Low capacity per driver

SELF-POWERED MULTIPLE UNITS

What is it?

• Rail passenger vehicle with diesel-hydraulic drive train.

• Can be operated singularly, or with multiple units coupled together and controlled by a single operator.

Why?

• Runs on standard-gauge rails
• Allows extra passenger capacity to be added/reduced as needed
• Modern FRA-compliant filters mean very low particulate emissions
• Can run on bio-diesel; hybrid vehicles under development
• Lowest rolling resistance
• Can be operational two years from go-ahead
• Already in commercial service

SELF-POWERED MULTIPLE UNITS

Why? (continued)

- System is less vulnerable to outages because each unit propels itself and can pull others
- No overhead structures or electrified track
- Can serve as stepping stone toward electrified system

Self-Powered Vehicle: Interior of SMART Type of Railcar

SMART-type self propelled vehicle with wrap-around glass

Why not?

- Still requires foreign oil
- Must carry fuel on board (thus heavier than electric railcars)
- Shorter engine life than electric motors

KEEP DRIVING

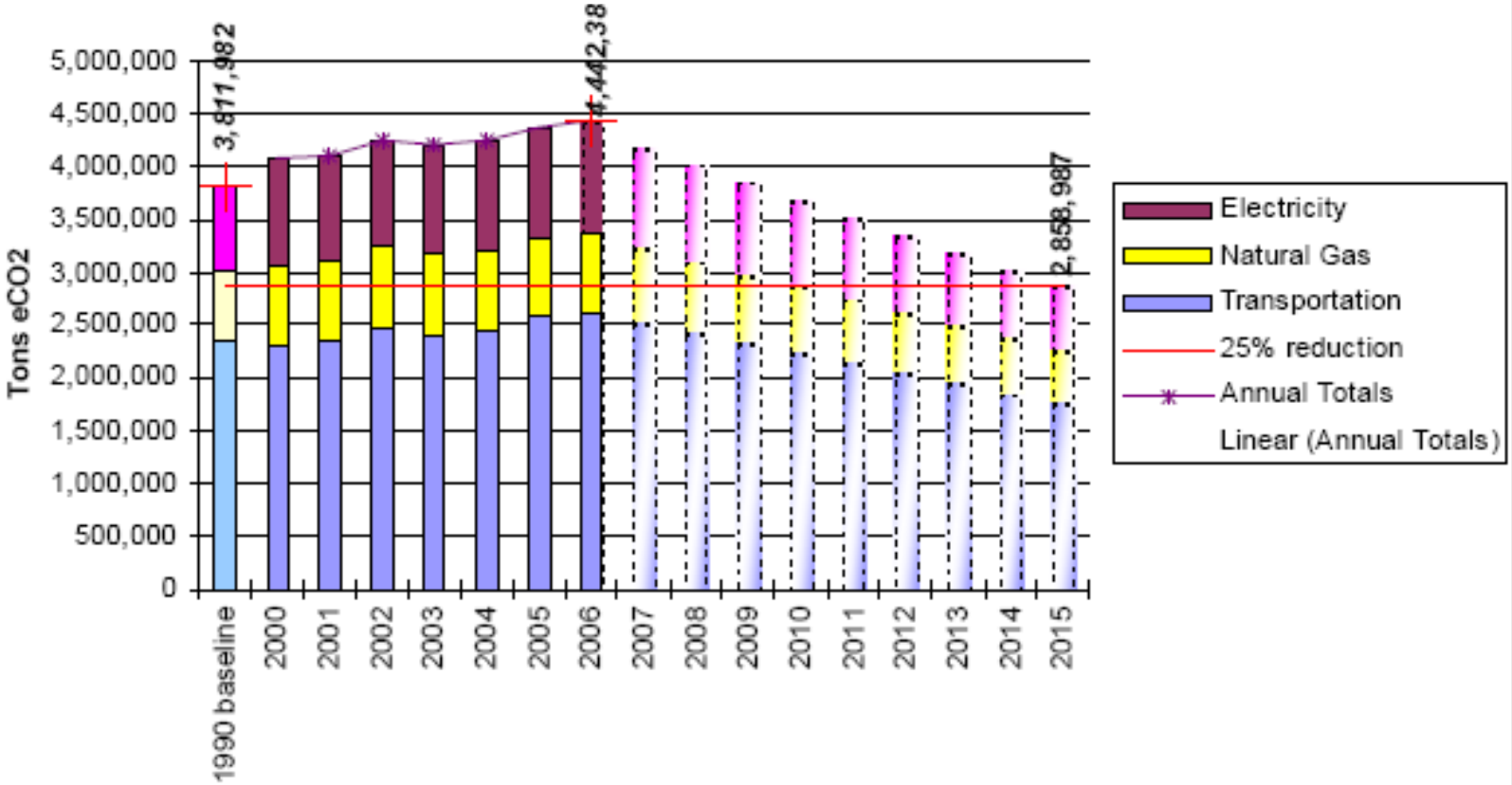
"More than 90% of those responding to a recent survey agree that traffic congestion in Marin County is a moderate or major problem. " TAM Communications Plan, 4/06

- Time: Travel time to work and lost opportunity costs
- Social equity: provide transportation for those who cannot drive
- Environmental: over 60% of Marin-Sonoma GHG emissions come from motor vehicles
- Safety: Car crashes kill an estimated 1.2 million people worldwide each year, and injure about forty times this number (WHO, 2004)

How to make comparisons?

- Sales Reps and lobbyists?
- Column inches?
- Technological optimism?
  - denial
  - minimization
- Cost-benefit analysis?
- *Shalom* approach

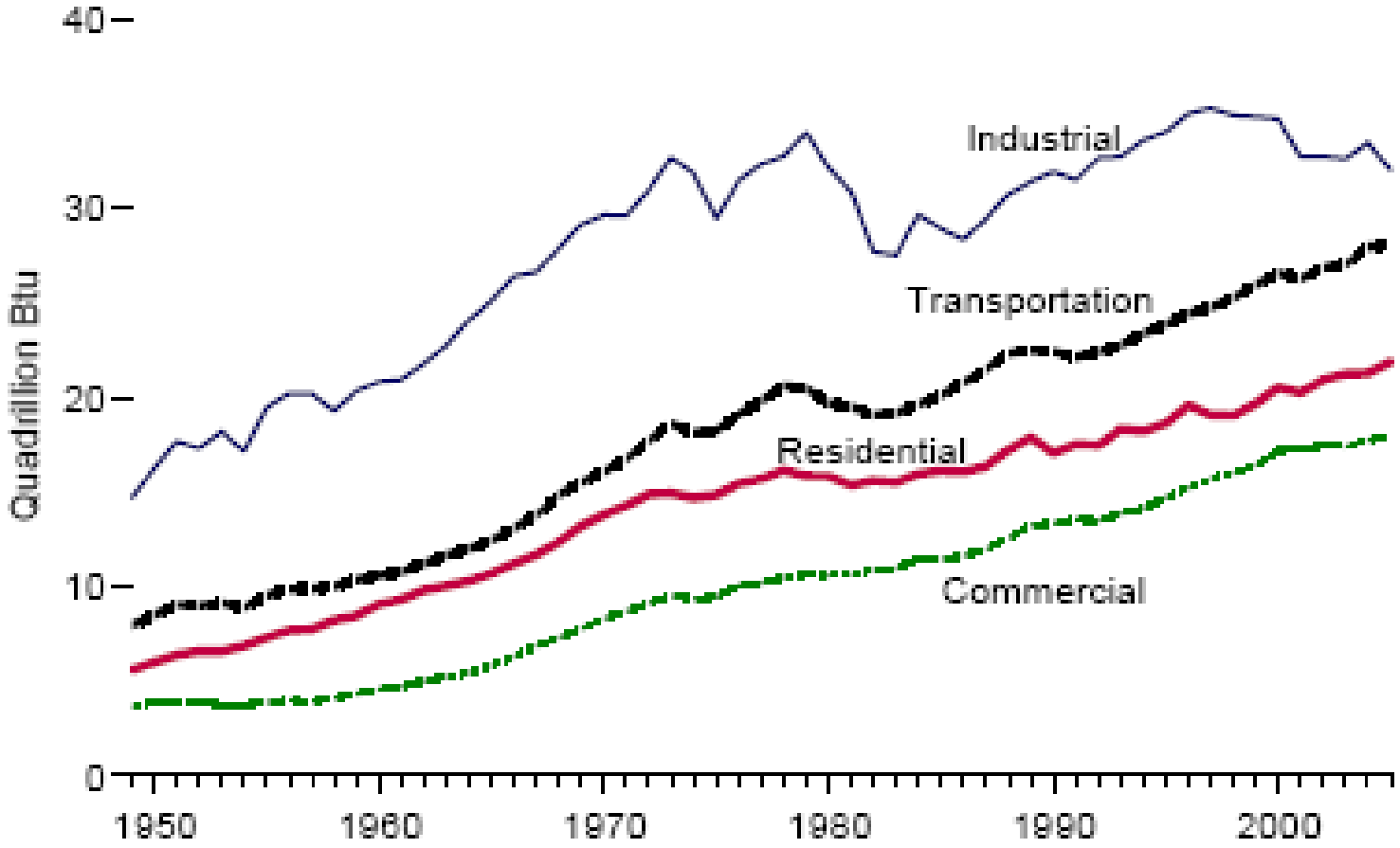
Transportation accounts for more than half of all GHG emissions in Sonoma County



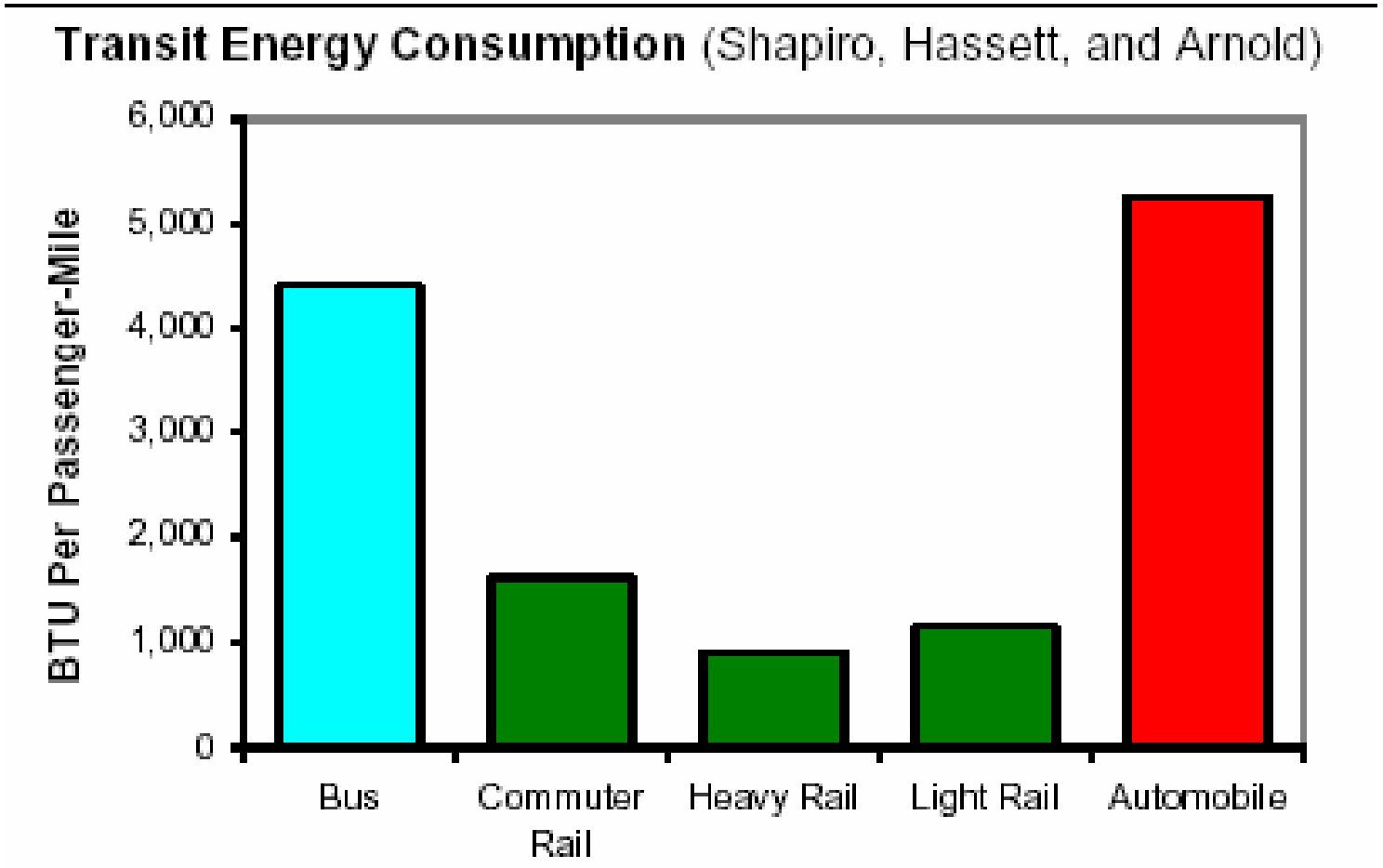
The goal is based on what will be needed if Sonoma County is to meet its obligations as a member of the global community – a 25% reduction from the base year of 1990. This graph shows that we expect transportation to make a GHG reduction of approximately 30% in 9 years, in the face of having gotten worse nearly every year since the 1990 baseline.

Energy Consumption

Transportation's share of US energy use is growing…

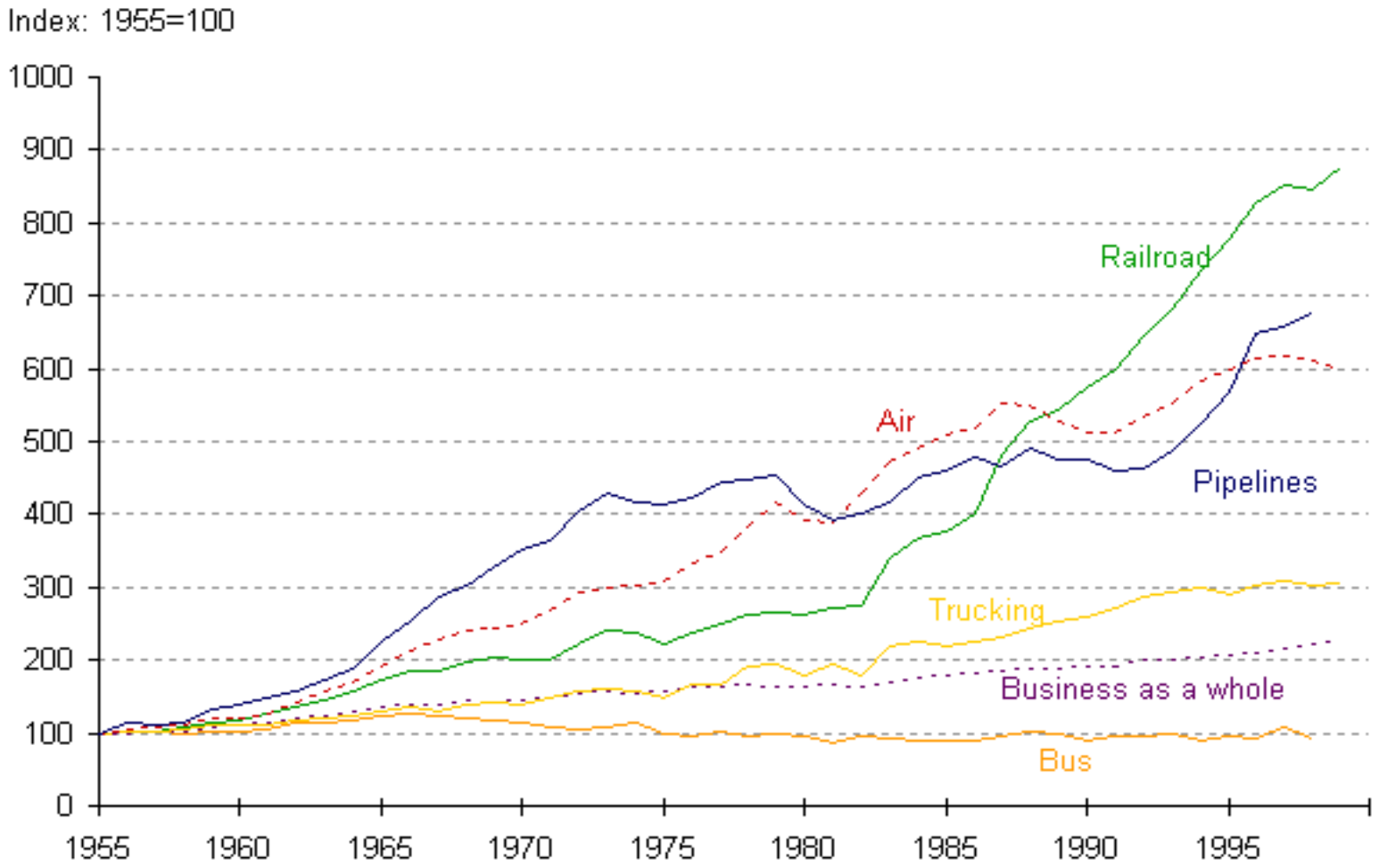


But a shift to rail would make a major impact



Labor productivity

Rail's productivity advantage continues to grow



Criteria for comparing alternatives

Social
- Provides choices
- Operational by 2010
- Reduces petroleum imports
- Permits multi-tasking by riders
- Fits MTC Regional Plan
- Geographically flexible

Environmental
- No new ROW required
- Compatible with bike-ped path
- Facilitates Transit-oriented development
- Reduces greenhouse gas emissions
- No impermeable surface
- Reduces VMT and VHT

Aesthetic
- No overhead structures
- Minimal land use
- Reduces smog
- Quiet
- Competes favorably with auto in terms of comfort and speed

Economic
- FRA compliant
- Saves commute time
- Capital cost under $6M/mile
- Uses existing infrastructure
- Doesn't preclude other options

Comparing alternatives

Why and why not?
Positive attributes of proposed alternatives

		Alternatives										
		Keep driving	EMU Electrification	BART	Bus Rapid Transit	Dual mode vehicles	AutoTram	Personal Rapid Transit	Automated direct transit	Monorail	MagLev	DMU
Environmental	No new right-of-way required	0	5	5	5	9	0	0	0	5	0	9
	Compatible with bike-ped path	5	9	0	0	5	9	9	9	5	0	9
	Facilitates T-O-D	0	9	9	0	0	0	0	0	9	9	9
	Reduces Greenhouse gases	0	5	5	5	5	5	5	5	5	9	5
	No impermeable surface	0	9	9	0	5	5	5	5	5	0	9
Economic	FRA Compliant	9	9	5	0	0	9	9	9	5	0	9
	Saves commute time	0	9	9	9	9	5	5	5	9	9	9
	Capital cost under $6M/mile	0	0	0	0	9	0	0	0	0	0	9
	Uses existing infrastructure	5	5	0	5	9	0	0	0	0	0	9
	Doesn't preclude other options	0	5	0	0	9	0	0	0	0	0	9

Comparing alternatives, cont'd

Social	Reduces VMT and VHT	0	9	9	5	5	9	9	9	9	9	9
	Provides choices	0	9	9	9	5	9	9	9	9	9	9
	Operational by 2010	5	5	0	9	9	0	0	0	0	0	9
	Reduces petroleum imports	0	9	9	5	5	9	9	9	9	9	5
	Permits multitasking	0	9	9	9	9	9	9	9	9	9	9
	Fits MTC Regional Plan	0	9	5	0	0	0	0	0	0	0	9
	Geographically flexible	9	0	0	5	5	0	0	0	0	0	0
Aesthetic	No overhead structures	5	0	0	9	0	0	0	0	0	0	9
	Minimal land use	0	9	9	5	5	0	0	0	5	5	9
	Reduces smog	0	5	5	5	5	9	9	9	9	9	9
Sum		38	129	97	85	108	78	78	78	93	72	163

Strength of Contribution:

9 **Major—9 points**

5 **Moderate—5 points**

0 **Weak or none—0 points**

Numerical values assigned to produce spread/ qualitative value not implied

Summary

Make your own assessment.

Can you beat DMUs?

Positive Attributes of proposed alternatives for SMART		Alternatives										
		Keep driving	CalTrain-like	BART Extension	Bus Rapid Transit	Dual Mode Vehicle	AutoTram	Personal Rapid	Automated Direct	Monorail	MagLev	Colorado Railcar
Environmental	No new right-of-way											
	Compatible with bike-ped											
	Facilitates T-O-D											
	Reduces Greenhouse											
	No impermeable surface											
Economic	FRA Compliant											
	Saves commute time											
	Capital cost under $6M/mile											
	Uses existing infrastructure											
	Doesn't preclude other											
Social	Reduces VMT and VHT											
	Provides choices											
	Operational by 2010											
	Reduces petroleum imports											
	Permits multi-tasking											
	Fits MTC Regional Plan											
	Geographically flexible											
Aestheti	No overhead structures											
	Minimal land use											
	Reduces smog											
Sum												

Correlation:

9 Strong—9 points **5** Moderate—5 points **0** None—0 points

Numerical values assigned to produce spread/ qualitative value not implied