



An Energy Efficiency Workshop & Exposition
Palm Springs, California

Denver's 16th Street Mall
A Public Transportation Success Story
Featuring TransTeq & Denver's RTD

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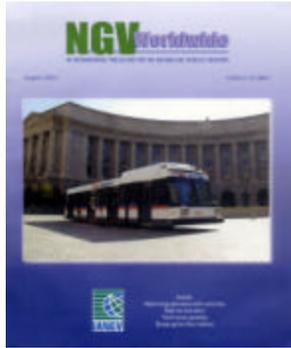


TransTeq
An Introduction

- **World's Largest Fleet Of Heavy Duty Hybrid Electric Vehicles, 36 Vehicles for Denver's RTD**
- **Not Just A Concept, Serving 60,000 Passengers Daily, Operating In Brutal 75 Second Headways, 18 Hour Days, In Altitude And Temperature Extremes**
- **Featured In American Environmental Review, A PBS Show Hosted By Morely Shafer, For Innovation And Advances In Public Transportation**
- **Vehicles Designed and Manufactured For LAX in 2002**



TransTeq An Introduction In Pictures



FTA BRT Meeting, Washington, D.C.



In Service, Denver, Fall 2000

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Global Transportation Challenges

- **Ease Urban Congestion**
- **Lessen Dependence on Oil**
- **Improve Air Quality**
- **Improve Service to Passengers**
- **Increase Utilization of Public Transportation**
- **Stimulate Economic Vibrancy**

Denver's Solution...

**The 16th Street Mall – A Transit Pedestrian Mall
Providing Transportation & Economic Solutions**

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Denver Pre-16th Street Mall A Depressed Downtown

- **Circa 1977**
- **Traffic Congestion
During Rush Hours**
- **Diesel Buses**
- **Limited Pedestrian
Traffic During Day**
- **Streets Vacated After
Dark**
- **Office Vacancy Rate
Leading the Nation**



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Transformation

- **Community Leaders
Join With Denver RTD
To Develop Mall in
1977**
- **Downtown Denver
Partnership, An Urban
BID, Begins In 1978**
- **I. M. Pei Hired To
Design Mall**
- **Cost of \$76 Million**



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Early Operations



- **Mall Opens in 1982 – Much Fanfare**
- **Riders Average 15,000 Per Day**
- **RTD's Hub Route Eliminated Over 300 Downtown Crossings**
 - Market Street & Civic Center Stations for Arterial & Commuter
 - Mall Vehicles
 - European Airport Design
 - 70 passenger capacity
 - Mostly Diesel powered, 4 Battery
- **Provided Future Connectivity For Multi-Modal Transit Expansions**
 - Four Light Rail Lines, BRT and Union Street Station (Rail)

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Phase II Vehicle Dilemma Circa 1997

- **Improve Vehicle Capacity from 70 to 116**
 - Lighter Vehicle for Higher Payload
- **Unload and Board 116 Passengers in 20 seconds**
 - Four doors for Passengers
 - Level and Flat Floor
- **Utilize Compressed Natural Gas Fuel**
- **Deliver 20+ Hour Operating Range**
- **Right Hand Steering For Safety**
- **Utilize Hybrid Electric Drive Train**
- **Industry Response – No Bid, Not Possible**

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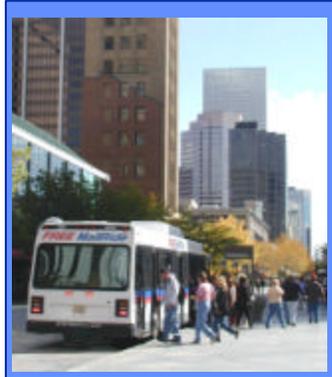
TransTeq Solution White Paper Design Solution

□ Best In Class Deliverables

- Passenger Service
- Life Cycle Costs
- Emissions
- Operating Ease

□ TT Core Competencies

- Adaptive, Series Hybrid Technology
- Innovative Vehicle Design
- Speed to Market
- Political Awareness



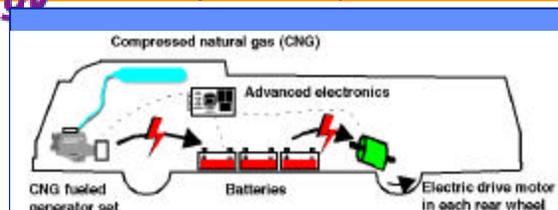
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TransTeq's Hybrid Technology Benefits Today and Tomorrow



- ◆ Series HEV - Electric Vehicle With On-Board Battery Charger
- ◆ Zero Emission Capability - Run With The Engine Off
- ◆ Engineered For Alternative And Developing Technology
 - ◆ **Fuel Cells Included!**
- ◆ Minimizes Risk to Technological Obsolescence

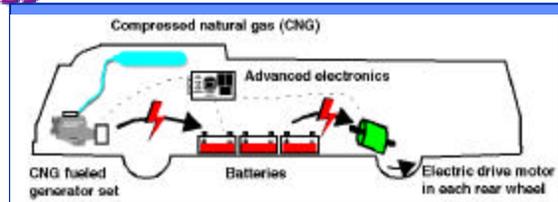
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TransTeq's Hybrid Technology Efficient Energy Management



- CNG fueled, 70 hp, four cylinder industrial ICE, provides electricity to charge pack of 26 lead acid batteries
- DC Electric Motors deliver 440 hp to drive wheels electrically
- Advance Electronics Controls and Manages Energy Creation, Storage & Use
- Captures Energy Normally Lost During Idle and Braking
- Eliminates the "Black Cloud Of Acceleration"

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Innovative Approach Adaptive Vehicle Design

"Ride Like A Train, Update Like A Plane"

- **Patented series hybrid propulsion technology**
 - True Electric Vehicle Operation
 - Drive By Wire, High Voltage Systems
 - Integrated Advanced Control Electronics
- **Fuel, Power Creation and Energy Storage Neutral**
 - Embraces Developing Technology
 - Accommodates Operator Preferences/Infrastructure
- **Lightweight, High Capacity, Stainless Steel Space Frame**
 - Lower Weight, Long Life
 - Ability to "Re-Skin"

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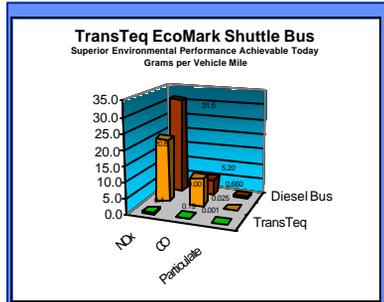
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Environmental Performance Why Wait?

- **Adaptable to All Urban Vehicles**
- **Fuel Neutral**
- **Most Out of Fuel, Least Into Air**
- **Favorably Compares Wellhead to Wheel**
- **Zero Emission Capable**



Sources: Tests performed on TransTeq 2.5 liter Ford LRG-425 engine May, 1999 by Colorado State University at its Engines & Energy Conversion Laboratory representing optimal performance. Comparative data obtained from SAE technical paper, Natural Gas and Diesel Transit Bus Emissions, 1997. Orange bars are CNG bus.

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TransTeq Leadership In Hybrid Technology



The EcoMark Bus Carries 116 Passengers with only a 70 HP Engine

	Toyota Prius	Honda Insight	TransTeq EcoMark
Engine Power	70 HP	68 HP	70 HP
Hybrid Type	Parallel - Gas	Parallel - Gas	Series - CNG
Curb Weight	2,765 lbs	1,847 lbs	25,300 lbs
Gross Weight	3,650 lbs	2,200 lbs	42,700 lbs
Passengers	5	2	116

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Impact of 16th Street Mall Now No. #1 Tourist Destination



- **Improved Air Quality**
 - Non-Attainment Status Addressed
- **Increased Public Transportation**
 - Last Mile Solved! Riders Grow From 15,000 To Over 60,000 Per Day
- **Real Estate Investment Soars**
 - Over \$1 Billion in 20 Years
- **Urban Vibrancy Returns**
 - Professional Sports, New Stadiums, Return Downtown
 - Residential Growth
 - Place To Go After Dark

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Next Applications & Markets LAX, National Parks, BRT

- **BRT, Bus Rapid Transit, Combining The Best of Light Rail and Bus Services**
 - Not just a vehicle, but a complete transportation solution
 - Rail-like service with flexibility and significant cost advantages
 - Dispel the bus image of dirty, slow & noisy
 - Utilize technological and roadway design improvements
- **Major FTA Effort To Develop Vehicles Underway**
 - Legal and Political Issues Open For TEA 3
 - Buy America, Testing Requirements, Foreign Government Funded Vehicles



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