



CARB/ICAT BPM Demonstration Program

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[ICAT 04-4]

An Innovative Means to Minimize Electric GSE Charging Infrastructure Costs

[Electric GSE]

- eGSE—Electric Ground Support Equipment
- Reduce emitted pollutants from gasoline and diesel engines
- Bag tractors, belt loaders, pushback tractors

[Roadblock to eGSE]

- Infrastructure
- Most airports are lacking the available power and circuits to power battery charging equipment
- Costly to bring new power to the air side

[Power Costs--Example]

- 5 chargers installed at Long Beach
- Charger cost = \$125,000
- Cost to install new circuits:
 - **>\$100,000!**

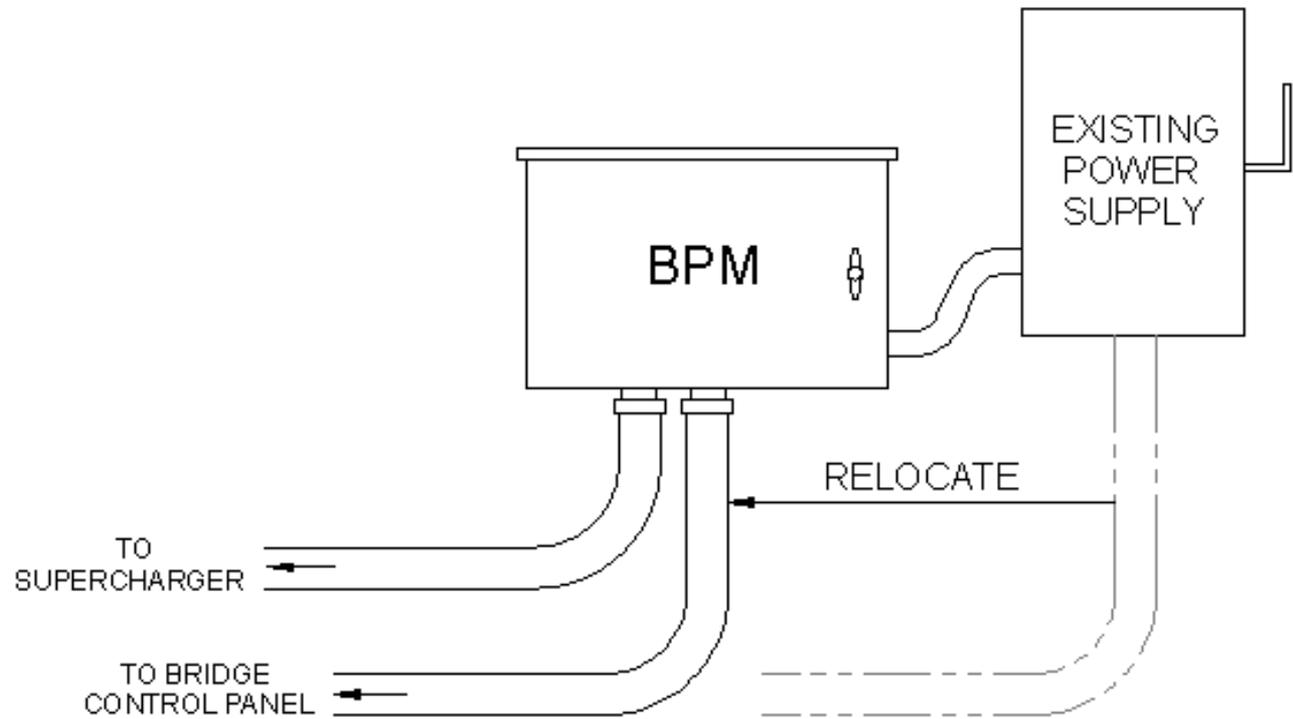
[What is the solution?]

- Use existing circuits
 - Low utilization
 - Large enough to power charger
 - Critical: Ensure uninterrupted operation for critical systems
- Jet bridge is a good candidate
 - High ampacity
 - Low utilization

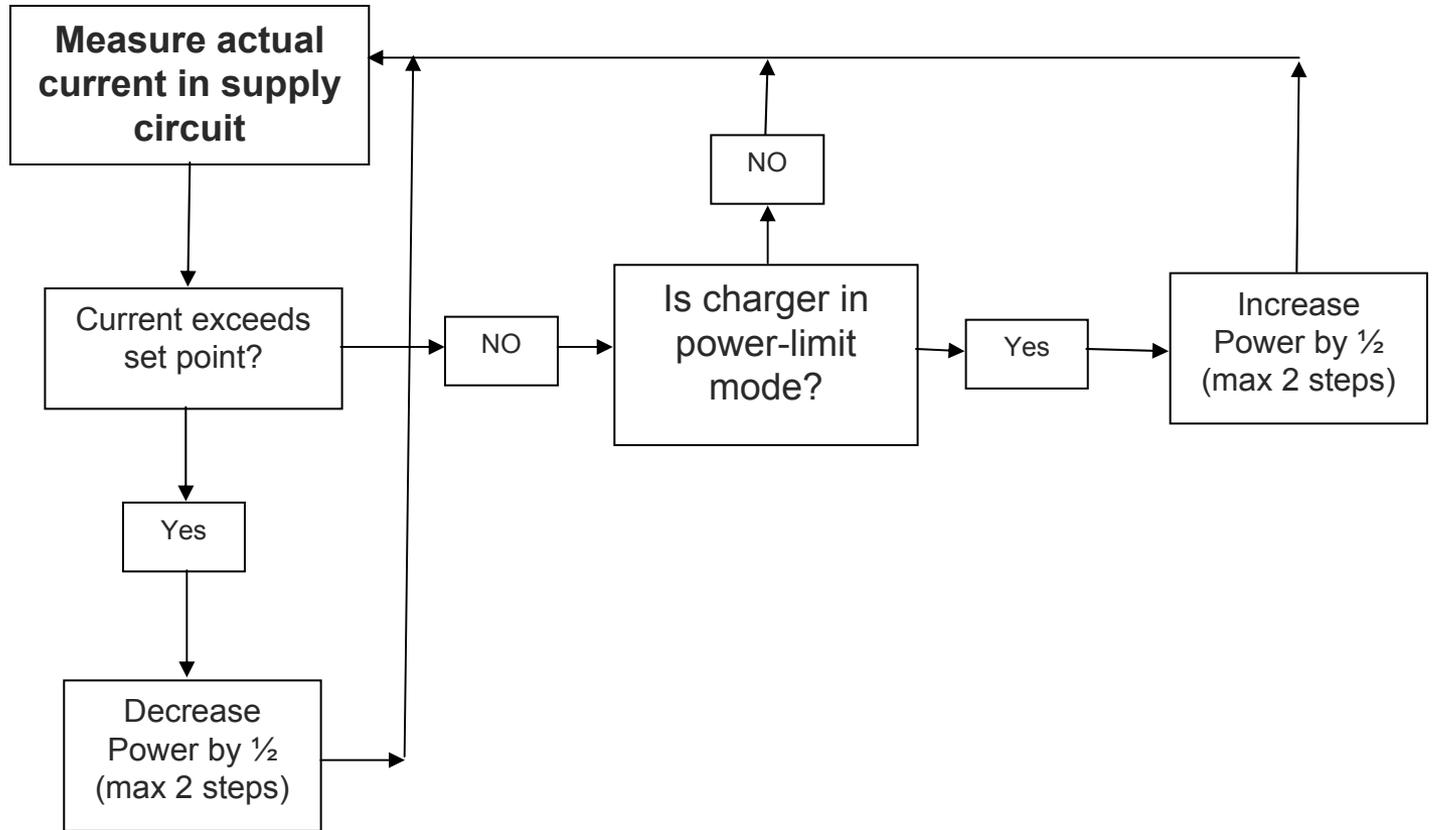
[Bridge Power Manager (BPM)]

- Installed on existing jet bridge circuit
- Provides branch circuit to charger
- Monitors total current throughput
- Controls charger to keep total below design limit (circuit breaker)

[BPM Installation]



BPM Logic



[BPM Operation]

- BPM has NO control over jet bridge—always has power
- BPM can ONLY control charger
- Charger won't operate without communication from BPM
- Circuit breaker is last line of defense
- No operator interaction required

ICAT 04-4: Project Plan

- Demonstrate BPM at OAK, Gate 32
 - Bridge traction power and fast battery charger
 - Use existing 60A circuit—Bridge Transport Motor
- Operate eGSE
 - Use BPM/Charger system
 - SWA to provide eGSE
 - 6-month field demonstration
- Evaluate efficacy
 - Did power sharing affect ability to charge and maintain operations?

[Project Plan]



Bridge Traction Supply



**Bridge Traction Breaker;
Distribution Box**

[Project Timeline]

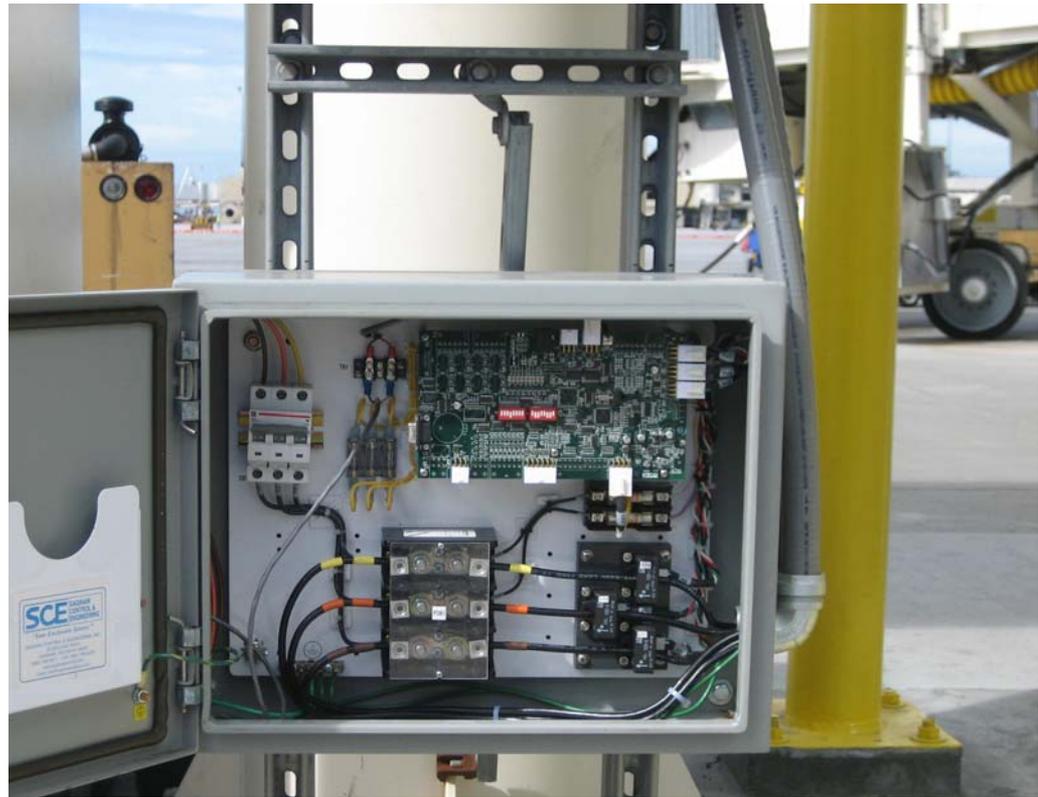
- BPM and Charger installed
 - Early September, 2007
 - Gate 32
 - Port of Oakland provided much-needed support to streamline equipment installation
- System Operating

[BPM Installed]



[BPM Installed]

BPM Internal Hardware



[Field Operation]

- Operate eGSE and charge as needed
- Collect Data from Charger
 - Charge event details
 - BPM interruptions
 - Monthly collection
- Analyze Data
 - Use patterns
 - Number/Duration of interruptions
- SWA Ops
 - Issues/Concerns

[Project Results]

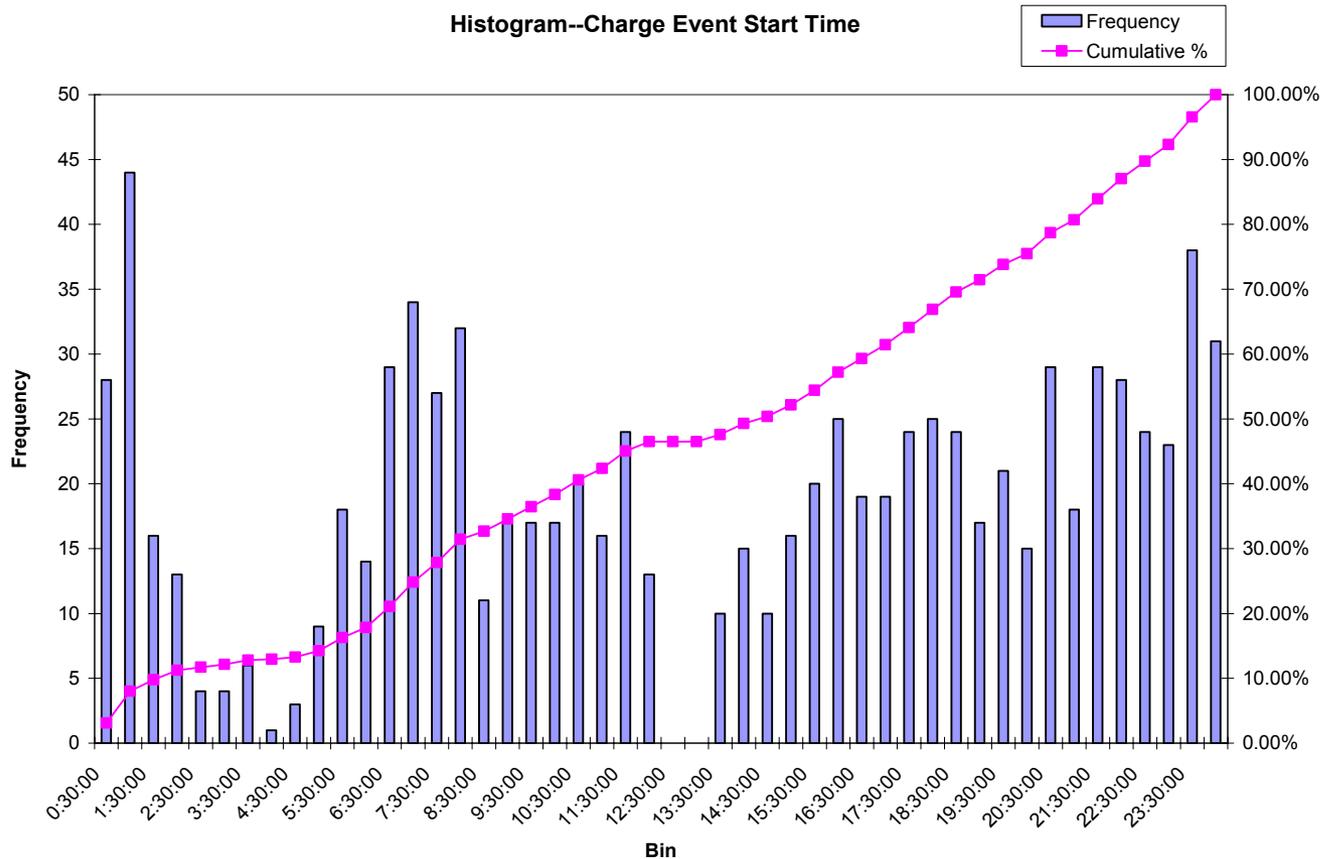
- Data collected for 6 months
- Three recorded BPM interruptions
 - April 8, 9:06 am
 - April 10—Demonstration for OAK and CARB (forced events)

Project Results

Charge Events Start Time

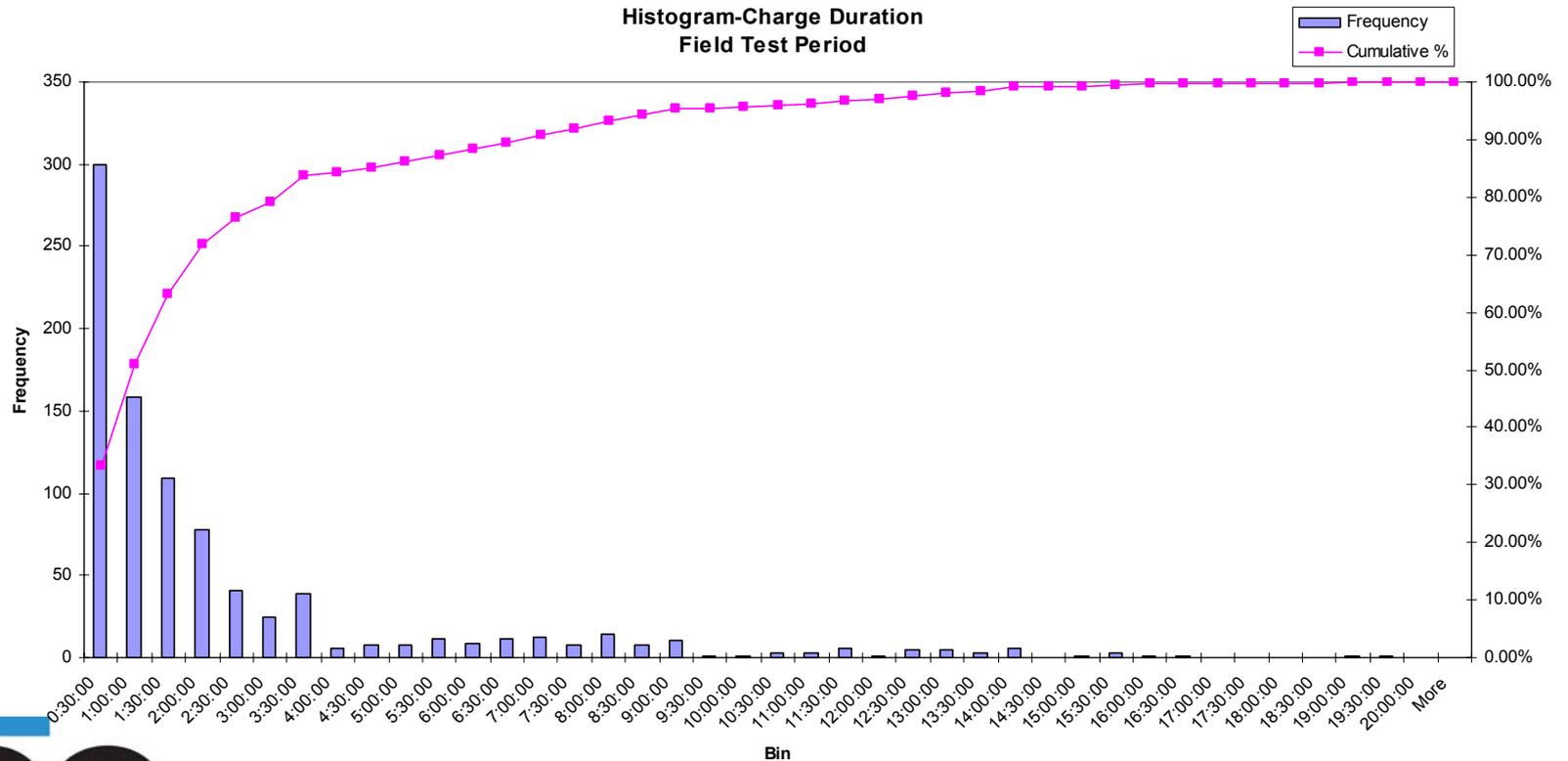
--897 events

--SWA able to charge throughout the day



Project Results

Charge event duration across field test period



BPM Interruption--Demo



Typical charger display during charge event

Charger display during BPM interruption



[Project Summary]

- The BPM worked
 - Uninterrupted operation of the jet bridge
 - Near-uninterrupted operation of the charger
 - eGSE operation without problem

[Project Summary]

- Question: why is the BPM required if it almost never interrupts the charger?
- That ONE time—popping the breaker is unacceptable to Operations
- Answer: NEC and local codes will not allow additional loads that will exceed the design limit of existing circuits
- The BPM is TÜV certified as a power management device

[Project Summary]

- SWA is expanding eGSE at OAK
- 10+ chargers being installed
- 6 BPM units recently installed
 - (OAK installed a few dedicated charger circuits during 2007 terminal renovation)

[Acknowledgements]

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- The statements and conclusions in this report are those of the grantee and not necessarily those of the California Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.