Destination Success: Lessons Learned in the Design and Construction of the Charlotte Light Rail Transit System

35th Annual Energy and Environmental Conference
Quality Assurance: Back to Basics T23
Light Rail Characteristics

- Opened November 24, 2007
- Uptown Charlotte to I-485
  - 9.6 miles
- 15 stations (8 walk up and 7 park & rides)
- Operates seven days a week from 5:30 a.m. to 1:15 a.m.
- Service frequency
  - Rush hour: 7.5 minutes
  - Non-rush hour: 15 minutes
- Bus/rail integration serves the Blue Line directly:
  - 20 new and modified routes
LYNX BLUE LINE

Vehicles and Facility-
16 Siemens S-70 Light Rail Vehicles and 3 Replica Trolleys.
South Boulevard Light Rail Facility – Administrative and Maintenance Offices for Rail Operations, Call Center and Bus Operations Control Center.

Employees-
105 Full Time Positions
• 27 Rail Operators
• 55 Technicians and Maintenance Staff
• 23 Administrative and Supervisory Staff
LYNX Blue Line Success!

- LYNX Blue Line ridership averaging over 16,000 daily in July 08
  - Original projection: 9,100 by the end of the first year
  - Vehicles often at capacity
  - Some Park & Ride lots at/near capacity
- Ticket vending machines
  - Added round-trip ticket
  - Added credit/debit card function
- Over $1.5 billion in actual and proposed corridor development through 2011
Summit Grandview

Before

• 266 Residential Units
• Approx. 70,000 sf commercial
• 465 Parking Spaces
• $70M Project Cost

After
NASCAR Hall of Fame
FTA Project Development

Major Investment Study
1999-2000

System Planning
1990’s

Final Design
2003-2005

Preliminary Engineering
2000-2003

Environmental Impact Statement
April 2003

Record of Decision
May 2003

Full Funding Grant Agreement
May 2005

Construction
2004-2007

Operation
November 2007!
Federal Transit Administration
• Project Management Oversight Contractor

Charlotte Area Transit System
• Design – Project Management Support Services Consultant
• Construction - Construction Management Consultant

Design - A/E Consultant
• Subcontractors
• Construction – Contractor
• Subcontractors
FTA grantees undertaking major capital programs are required to follow the FTA GRANT MANAGEMENT GUIDELINES, FTA Circular 5010.1C.

This provides the guidelines for preparing a Project Management Plan (PMP) including a Project Quality Plan.
FTA 15 Quality Elements

1. Management Responsibility
2. Documented Quality Management System
3. Design Control
4. Document Control
5. Purchasing
6. Product Identification and Traceability
7. Process Control
8. Inspection and Testing
9. Inspection, Measuring, and Test Equipment
10. Inspection and Test Status
11. Nonconformance
12. Corrective Action
13. Quality Records
14. Quality Audits
15. Training
Missing Elements

1. Contract review
2. Control of customer supplied product
3. Handling, storage, packaging, preservation & delivery
4. Servicing
5. Statistical techniques
Quality Assurance

“All those planned and systemic actions necessary to provide adequate confidence to the management that a product or service will satisfy given requirements for quality.”

Quality Control

“The operational techniques and activities that are used to fulfill requirements for quality”
Quality Assurance Activities

Provide Quality Assurance Oversight
Audit plan included the following:

- Light Rail Vehicle Supplier
- Annual audits
  - CATS Project
  - Inspection and Testing Facilities
  - Contractors and Suppliers
  - Construction Management Consultant
  - Resident Engineers
Construction-Document Control

Records Management

- Primavera – Expedition
- RFIs, Meeting Minutes, NCNs, Submittals,
  - TRACS (Change Orders)
- Project records by Contract
Quality Assurance Activities

Process Improvement

Coordination
Quality Assurance Activities

Reports
Key Lessons Learned

Preliminary Design
Key Lessons Learned

Preliminary Design

- Take Preliminary Engineering to 65% level before finalizing budget with the FTA (30% LYNX BL)
- Project Review at 15%, 30% and maybe 50% levels.
- Finalize third party agreements
- Consider Timing of revenue equipment order
- Include Extra contingency for property acquisition budge line
  •
Key Lessons Learned

Final Design
Key Lessons Learned

Final Design

• Insure feedback and comments are addressed
• Track issues and resolutions
• Adequate time for design review by agency and local jurisdiction staff
• QA/QC responsibility clearly delineated
Key Lessons Learned

Construction
Key Lessons Learned

Construction

- Consultant project management staffing
- Contractor field supervision levels
- Adequate Liquidated Damages for schedule slip/or incentive payment arrangements
- Resolution of disputes
South Corridor Cost Lessons

- Inflation During Project Implementation
- Scope Changes
- Increasing Property Values due to Project Implementation
- Third-Party Requirements
- Design Errors and Omissions
- Contracting Approach and Packaging

- Cost $227,000,000 → $465,000,000
Blue Line Extension Characteristics

- Uptown Charlotte to I-485 at N. Tryon Street
- Total project length: 11 miles
- Extension of the LYNX Blue Line- South Corridor
  - Improves operational effectiveness
  - Better leveraging of public investment
- 13 stations
  - 6 Walk-up stations
  - 4 Surface park & rides
  - 3 Parking decks
- Supports development in NoDa and along N. Tryon Street
Proposed
Locally
Preferred
Alternative
• Review and revise team structure and staffing.
• Set a schedule and scope that allows for collaboration.
• Ensure that we make use of internal expertise.
• Project team members will be involved in all decisions regarding scope and cost reductions.
Concepts and Guidelines

• **Develop Standard Design Guidelines:**
  – Determine who is responsible for what.
  – Provide definition of when issues/items need to be addressed.
  – Update/Develop design standards based on South Corridor Light Rail experience

• Design Criteria/Basis of Design - adopted by the Growth Strategy Steering Team, foundation for engineering work throughout Project lifecycle
Communication

• Expected behaviors that address collaboration and communication need to be developed to apply to staff and consultants.
• Roles should be clearly identified.

Team Meetings

• “One Corridor – One Project”
Issues Resolution

• Issues Tracking System
• Project Disposition and Resolution sheets
• All agencies involved
• Growth Strategy Steering Team final decision
• Agreed upon resolution
• A quick resolution method
PMOC QUALITY ISSUES

- Control of Non Conformance (NCN)
- Inspection of Track Alignment & Welding Certification
- Oversight of Contract Quality Control