

# **Staging and Phasing: Managing a Complex Bus Maintenance Facility Renovation**

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## **PROJECT DESCRIPTION**

The City of Phoenix Public Transit Department commissioned Wendel to provide architectural and engineering services for the renovations, alterations, and additions to their North Transit Maintenance facility.

The Phoenix North Transit Facility (PNTF) is one of three Phoenix bus maintenance facilities and home to approximately (28%) of the City of Phoenix Public Transit Bus fleet. The facility is also home to the one of three City owned LNG fuel silo and fueling stations. The transit facility provides covered bus storage, bus maintenance, fare collections, fueling for both LNG and diesel buses, bus washing and detailing, facilities for drivers, mechanics, and security and administrative staff.

On the surface, the project had a State of Good Repair focus, as aging facility equipment and components were in need of upgrade and/or replacement. However, the City also wanted to maximize and modernize the existing facility by providing state of the art offices, training facilities, lounges and meeting spaces for City staff as well as for the independent contracted-operator. An earlier functional assessment discovered inefficiencies in the public bus transit operations and the need for significant facility improvements.

Working closely with the City of Phoenix staff, Wendel's design team agreed that the upgrades were warranted and that operational efficiencies could be improved in their bus maintenance operations.

The primary scope of work for this project included the following: defining and testing revised bus circulation and parking schemes; relocating fare collections; new and expanded tire storage; removal of multiple UST's; upgrading LNG, diesel and unleaded fueling systems; new bus wash; new bus

shade structures with accommodations for photovoltaic panels; major maintenance bay and equipment upgrades; new dispatch and locker room facilities for drivers and maintenance personnel. Also included were new stairs and an elevator tower to provide direct handicap access to the re-purposed and renovated second floor. Additionally the scope of work also included new roofing systems, HVAC equipment, upgraded perimeter fencing and gates, and a new security building.

With such a complex scope, it became evident that a key issue was to maintain complete facility operations throughout the construction phase. As a result, a phasing plan and on-site staging for the construction activities was developed. The phasing plan would take into consideration the order of tasks that could be performed while maintaining the integrity and safety of operations including fire lanes, employee parking and site security with a goal of minimizing inconvenience while not adding expense to operations.

This project has proven to be a textbook example of how a complicated design and construction project can be broken down into manageable and sound construction practice resulting in a phased project that was delivered within budget and on time.

## **Project Delivery Methodology: Roles and Phases – Feasibility Study/Design/Bid/Build**

This project was performed in multiple phases and contracts with various design professionals. The City initially consulted with an architectural firm to perform a Functional Assessment Report and prepare a formal document that would enumerate the City's needs with recommendations. Wendel was selected to move the project forward from this point. The first step was a thorough review of the Functional Assessment Report and confirmation of the project

needs. This review was documented and presented to the City in the form of a program and order of magnitude construction cost. An initial Phasing and Staging diagram was also produced for discussion.

There are multiple methods of project delivery that can be utilized for the procurement of a project of this nature. The City of Phoenix chose the design/bid/build method. This method is among the most competitive during bidding, and will result in a low bidder to be considered for the award of the Contract for Construction. The City also elected to hire a construction administration firm to provide the oversight of the Contract for Construction. This methodology provides a fresh set of eyes on the contract documents and ensuing construction work.

The City of Phoenix and the project in general benefited from the collaborative synergies developed between the general contractor, the construction administration firm, Wendel and the City/Operator staff. This collaboration is an important dynamic for any construction project, especially one with multiple phases on a tightly constrained site.

Fostering collaborative team relationships leads to a successful implementation for all stakeholders. This becomes exponentially important on a phased project because of the time sensitivity and the need for strict adherence to the project schedule to ensure that overlapping tasks flow naturally and smoothly. Here are some of the steps the team took to create a positive dynamic:

- Encouraging open communication and team problem solving during construction, and creating 'buy in' to the common goal. An example of how this works is: *"We have a situation and here are a few solutions" versus "You have a problem and what are you going to do about it?"*
- Developing a thorough understanding of and communication with the Governing Authorities that have jurisdiction over permitting and the construction approval process. Meeting early in design regarding assumptions and code interpretations so there are no surprises when looking to pull permits.
- Establishing project roles and responsibilities early and make a commitment to keeping all key players well informed.
- Collaboration versus dictation. This type of project required the Owner to be an integral part of the design process. This involvement resulted in a greater commitment to problem solving.

- City Department Standards. Working closely with individual departmental leaders at the Transit Agency regarding City Standards. Eliminating delays, change orders and integrating into existing systems and standards.
- Providing state of the art bus maintenance equipment expertise to analyze existing equipment, remaining life and long term value. Determining which equipment will be replaced and place orders early for long lead items.
- Having a flexible phasing and scheduling plan, which allowed for adjustments based on unforeseen conditions, equipment procurement delays, and avoiding critical path impacts to the schedule. This was only accomplished through close coordination and teamwork among all project stakeholders during construction.

### **Project Details: Scope, Schedule, Improvements to Circulation**

Major renovation projects have a unique set of constraints, scope, existing conditions, and schedule demands that require a careful balancing act to keep the project on track with regards to both time and expenditures.

During the design process, when it became evident that the new design would improve site circulation and reduce wasted or dangerous maneuvering of buses, adjustments to the phasing plan were made. An example of this was the original counterclockwise circulation that had coin removal on the right side of the buses in an existing independent small building. Moving this operation to the west side of the site in an existing space enabled the equipment to be relocated prior to disabling the existing operation. In other words, the operation could continue as is until the switch of equipment was made in a well-planned maneuver. Once that move was completed, other activities, including bus queuing, coin removal, fueling, washing, detailing and maintenance could be sequentially constructed.

Working on an existing facility, the accurate documentation of as-built conditions becomes extremely important. Removing existing UST's would interfere with fueling and washing as the tanks were in line with these operations. Staggered removal of tanks would also be required so that diesel fueling could continue without the need to bring mobile fueling trucks onto the site.

Since many older buildings are often designed and drawn by hand, reproduction of these original

drawings and verification of as-built conditions becomes very important. Experience tells us during construction, adjustments are frequently made in the field. These unknown adjustments can negatively impact a phased project and the goal was to reduce the surprises found behind walls or buried within the structure.

It was also important to understand the existence and locations of environmental concerns such as asbestos or lead paint. Findings such as these can cause significant delays to the project and are detrimental to time sensitive, interdependent phased tasks.

With alterations made to the bus circulation on the site, almost all operations on site were directly affected by the new construction. Continued dialogue with the client and continued refinement to the relationship of internal and exterior (site) operations became critical. Staying one step ahead of the next move was important. Making the new home for the relocated operation, then moving the equipment and that operation in a systematic method, in conjunction with site changes, was critical.

A significant portion of the site consisted of open bus storage. With the excessive heat gain from the Arizona sun, providing new bus canopies and shading structures was a given, in order to reduce bus cool down cycle time prior to bus pull outs during the heat of the summer. However, using these large paved areas of the existing parking lots in the beginning phases of construction for staging equipment and materials proved effective. Once the site work was accomplished and the paved areas were available for construction, the large structural shade structures were raised.

### **Project Challenges**

While all construction projects have challenges, renovation/alteration projects present unique challenges when they must remain operational 24/7/365 during construction, which was required of this project. The Phoenix North Transit Facility had several other unique challenges. Two of them were the location of an LNG silo and access to parking by PNTF staff.

The property is home to an LNG silo which is designated a National Homeland Security risk. LNG is volatile and under the wrong conditions can create an explosion hazard. With the PNTF nestled in a residential neighborhood, the site is continuously monitored to prevent non-authorized personnel from entering the site.

Maintaining site security at the periphery of the site during the construction of these new features was critical. The property was then secured by a new masonry wall along the south property line, two horizontal beam barriers and two new security gates located in the masonry wall, along with continuous fencing. A new security kiosk was added at the new bus entrance to the site in the southwest corner, augmenting the internal security office located in the existing facility.

Access to paved car parking for staff and visitors was restricted to one narrow access driveway. The staging and phasing of repaving required a strategic approach. Maintaining the access road at all times was mandatory, while paving of the parking areas was staggered to avoid disabling the entire area at any one time.

Additional challenges included:

- Maintaining safe, code-compliant egress from occupied spaces, while demolishing existing corridors.
- Removal and replacement of UST's "in line" of fueling / bus wash.
- Operations / staff working in buildings to be remodeled during construction.
- "Phasing" of construction from constructability as well as logistical perspective while not disrupting operations.

### **Site and Building Project Constraints**

In some cases a site may not be constrained on all sides, however in the case of the Phoenix North Transit Facility the site was land-locked. This presented a challenge for material and product delivery. It also eliminated the use of a construction road that could be dedicated for the use of construction vehicles. The main entrance to the site was shared by City buses, staff and construction vehicles.

These constraints required a great deal of flexibility and willingness to work out of the "norm" for the both the client and the contractor but in the long run, these adjustments paid dividends.

Other project constraints included:

- Identifying and understanding the changing process /flow of buses and people on site as the project evolved over the course of construction.
- The plan needed to study and incorporate phasing and continuity of safe exiting of occupied spaces during all phases.
- The need to establish temporary facilities and work with the contractor to understand the requirements of each space. For

example: temporary office trailers that require power, data, and communications requires coordination with the Agencies IT, Public Transportation and Operations divisions. Temporary occupancy permits may be required for these facilities including ramps, stairs and other items since these will be occupied by staff and will have to comply with Life Safety and ADA codes.

### **Project Strategy**

The Phasing and Staging plan should be a proactive and agreed upon strategy. When possible, it is a good idea to include the GC / CM or CMAR in the phasing and staging plan. If this is not possible because of the project delivery model (as was the case on the PNTF), we recommend a general phasing and staging plan in the bidding documents with the stipulation that the successful bidder would propose an acceptable phasing plan to the Owner within the general constraints provided in the construction bidding documents. This plan allows flexibility for the contractor without dictating means and methods, but also allows for approval by the Owner prior to commencing construction. The basic premise is that a phasing plan proposed by the contractor and approved by the owner would ensure that the daily operation of the facility would not be interrupted in any way.

### **Strategies Employed and Recommendations for a Successful Project**

The following strategies were employed on the Phoenix North Transit Facility:

- Worked with Owners contractor to establish temporary facilities and the requirements of each.
- City PT/Department Standards. Worked closely with individual departmental leaders at Transit Agency regarding city standards. Eliminated delays, change orders and integrate into existing systems and standards.
- Worked closely with local vendors to ensure products and equipment were available and could be delivered on time.
- Plan Ahead. Knew the next three steps on the schedule. Be prepared by relocating staff, equipment, etc., so they do not interfere with the construction process or become liabilities from a safety perspective.
- Made certain all materials and products on the critical path were always on deck with shop drawings approved, orders placed and materials / products on site before they were needed.

- Kept the staff apprised of what was going on and what was coming up next. Remove any anxiety of the unknown. Having City employees and vendors on site during construction was a risk. The better informed everyone was, the safer the site would be.
- Responded to unknown issues promptly and expeditiously.
- Developed a thorough understanding of and communication with Governing Authorities having jurisdiction over permitting and construction approval process. Met early in the design regarding assumptions and code interpretations so there were no surprises when looking to pull permits.
- Clearly established and memorialized project goals and objectives. Established priorities and stuck to them. Decided who would be involved in the steps to accomplish the priorities and when necessary, over-communicated.
- Reduced, if not eliminated, the unexpected.
- Discussed philosophy and willingness to “share” operations and space during transition periods.
- Broke project schedule into tasks and sub-tasks.
- Verified that utility capacities could handle new demands placed on them by additions and alterations. Staged shut downs and switch overs at non-peak operational times. Made certain back-up devices like generators and water trucks were in place and operational before shutting down.

### **Project Completion**

In the end, the project was completed in an exemplary manner from all perspectives

- It was completed on time
- It was completed under the construction budget of \$13.5 million.
- It was completed with change orders less than \$260,000, or 2.3% of the construction contract amount.
- It was completed without any construction claims.

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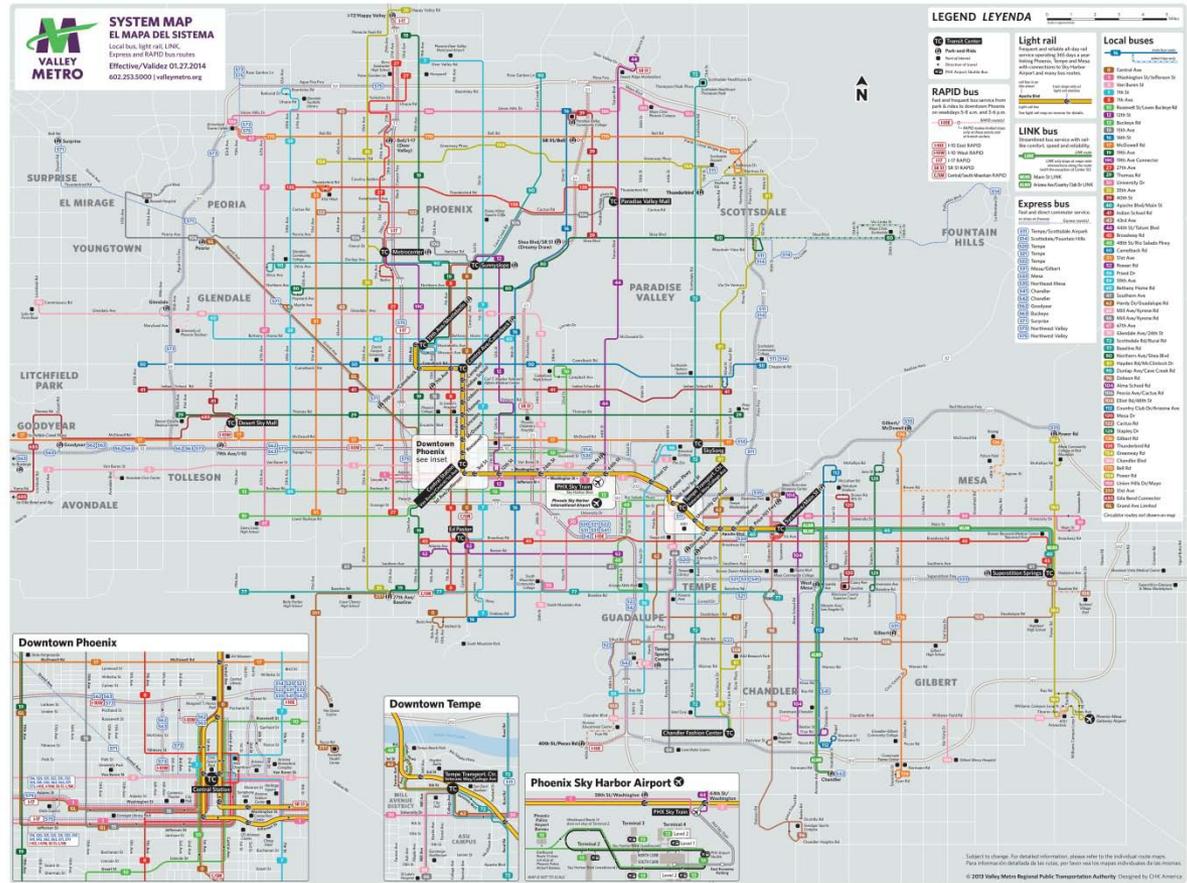
# Staging and Phasing:

Managing a complex bus maintenance facility renovation

APTA BUS & PARATRANSIT CONFERENCE  
KANSAS CITY, MO  
May 4-7, 2014  
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# about phoenix public transit

- Regional Transit System
- Operators
- Transit Services
- Fleet
- Ridership
- Revenue Miles
- Contracted Services
- Operating Facilities



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**City of Phoenix**



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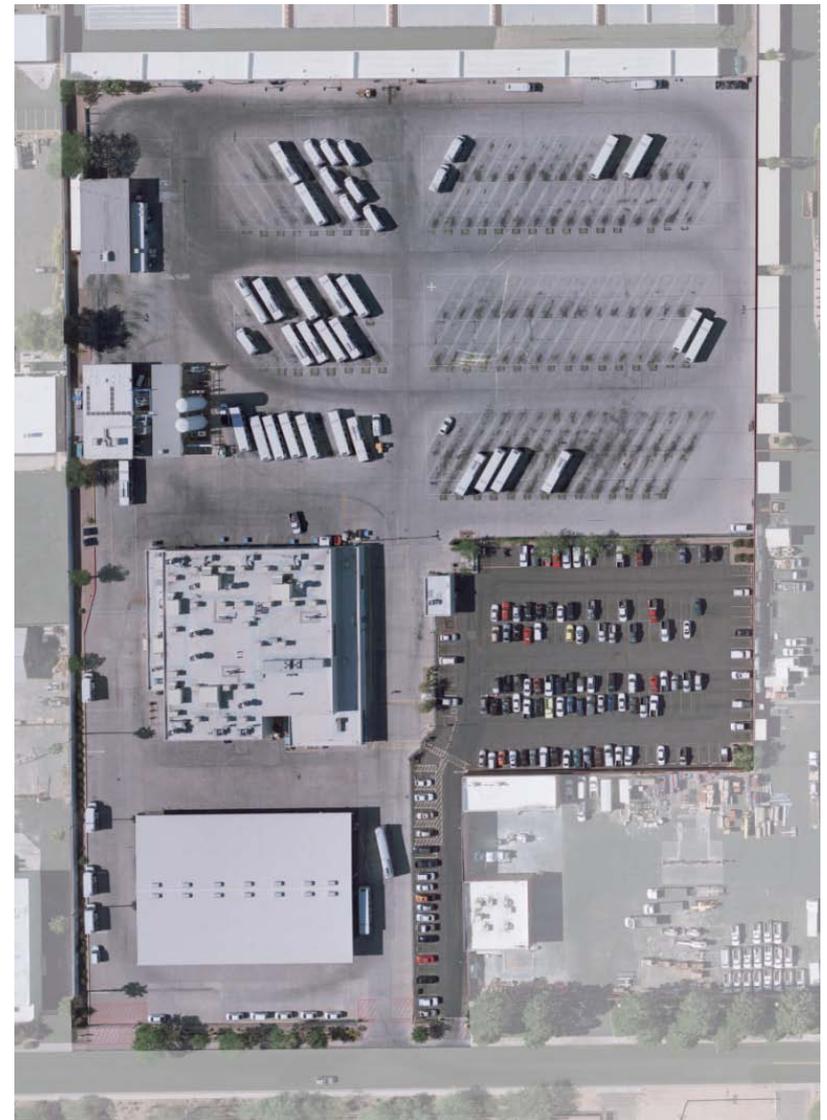
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- **Operating Garages**



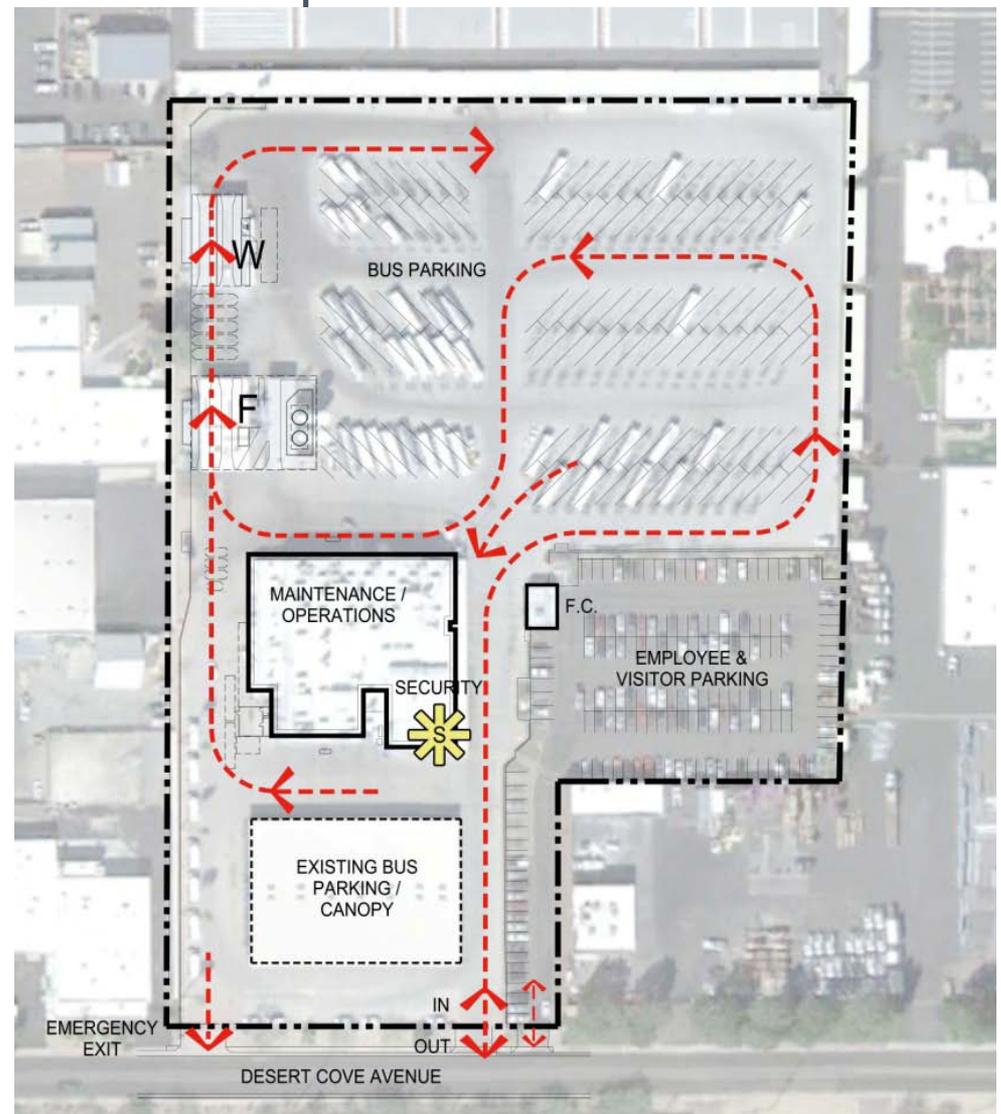
# project overview

- Why needed
  - State of Good Repair
  - 24/7/365
  - Constrained site & site access
  - Security
  - Large scope need for improvements
- Typical Phoenix approach
- New approach



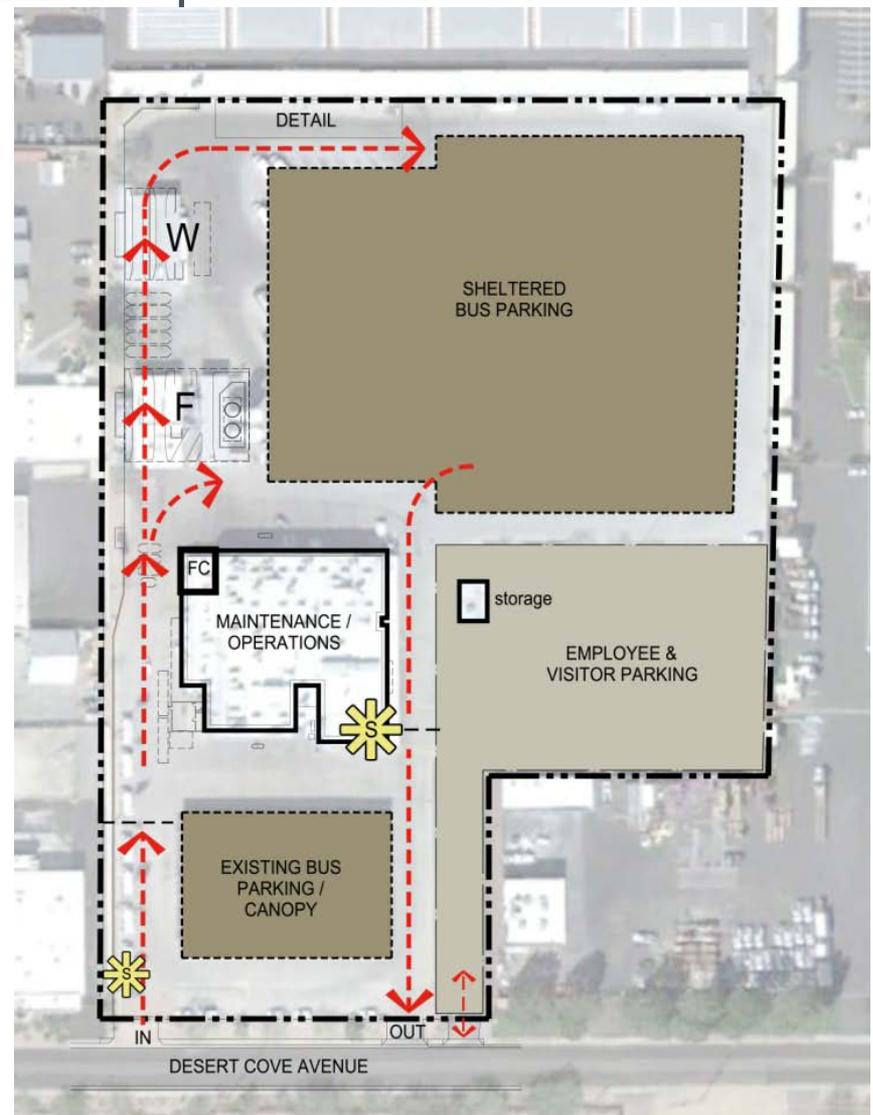
# key project challenges & scope of work

- Circulation
- Security
- Flow of Operation
  - Deployment of buses
  - Bus Queuing
  - Fare removal
  - Fueling
  - Washing
  - Detailing
  - Maintenance
  - Parking
- Shade for buses
- 2<sup>nd</sup> floor re-use (efficiency)
- 2<sup>nd</sup> floor accessibility (new elevator & stair)
- UST's



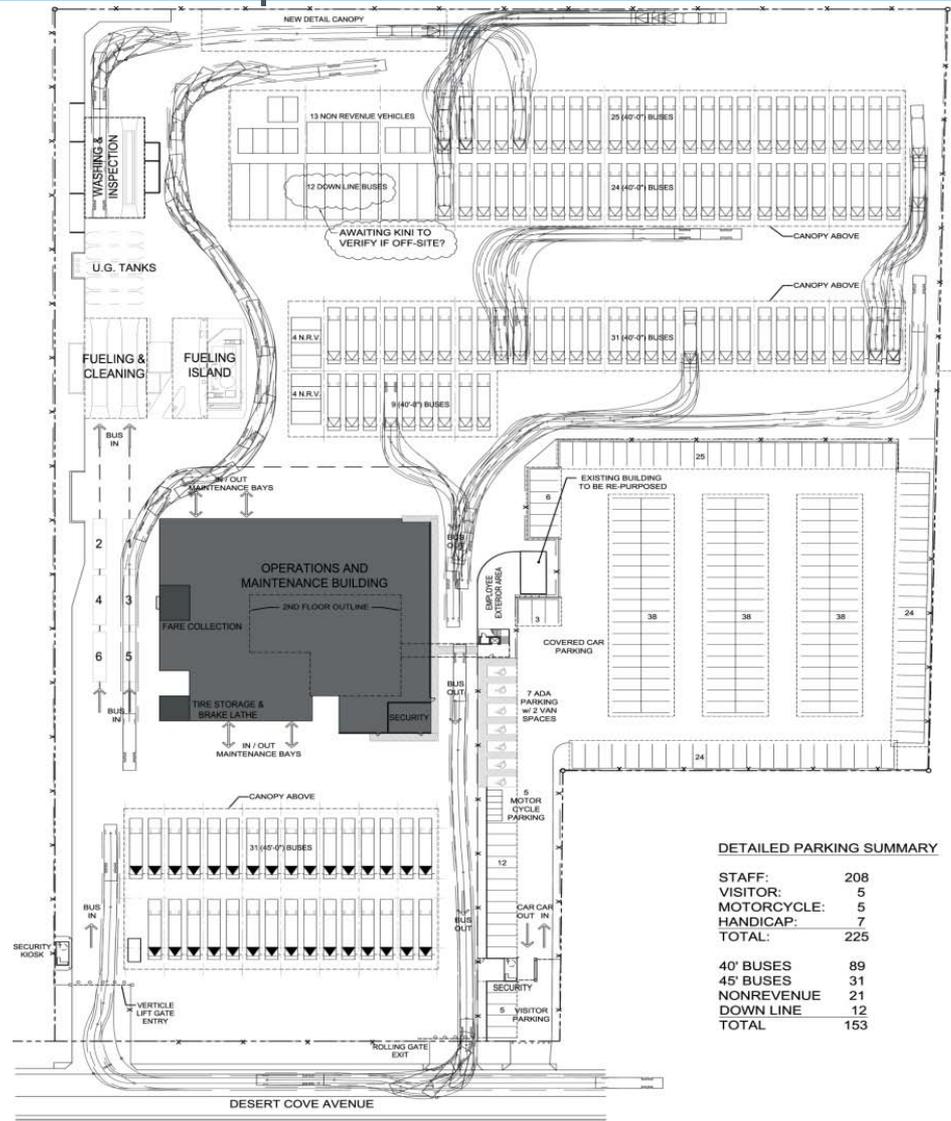
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DETAILED PARKING SUMMARY

STAFF:	208
VISITOR:	5
MOTORCYCLE:	5
HANDICAP:	7
TOTAL:	225
40' BUSES	89
45' BUSES	31
NONREVENUE	21
DOWN LINE	12
TOTAL	153

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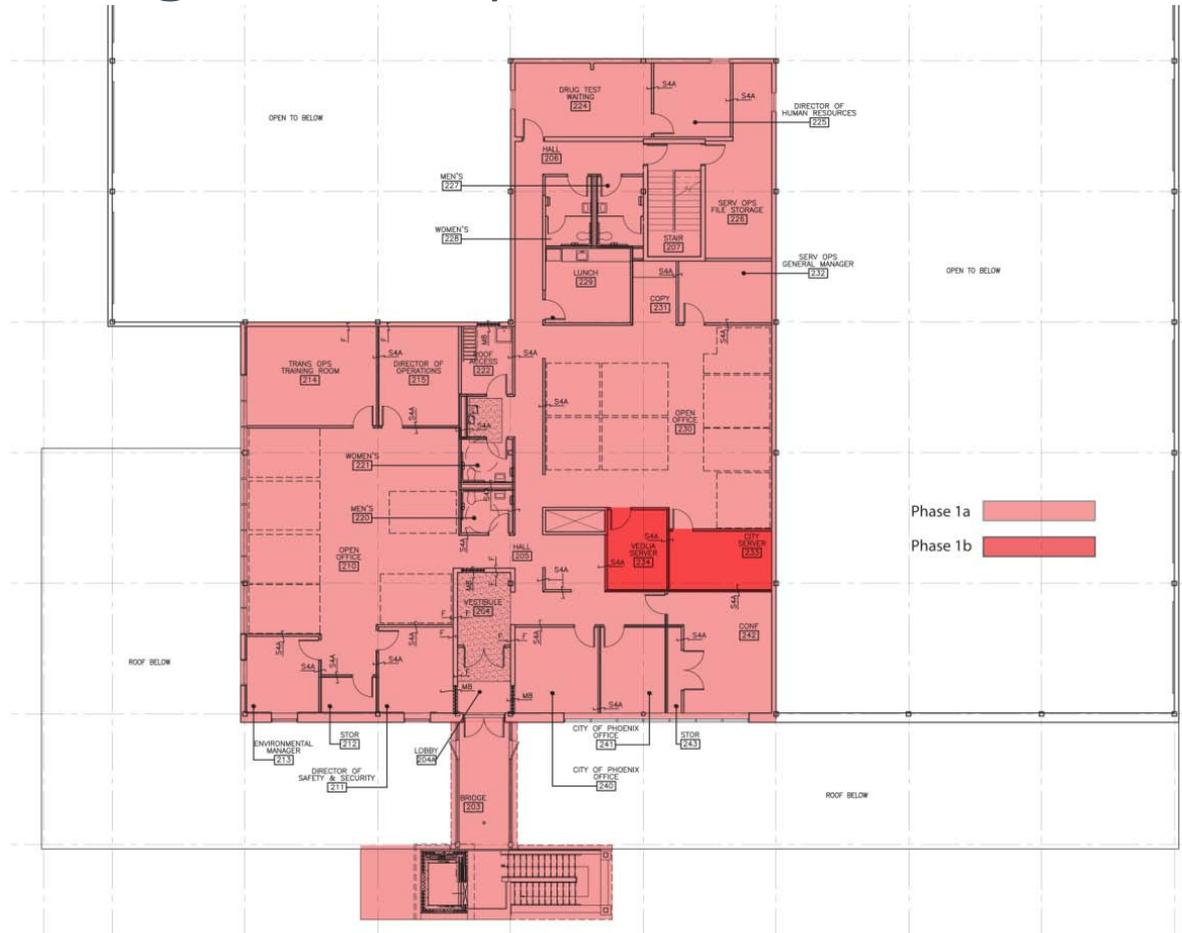
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Phoenix North Transit Facility - Concept Phasing Plan - Wendel Duchscherer Architects  
Proposed Second Floor Plan

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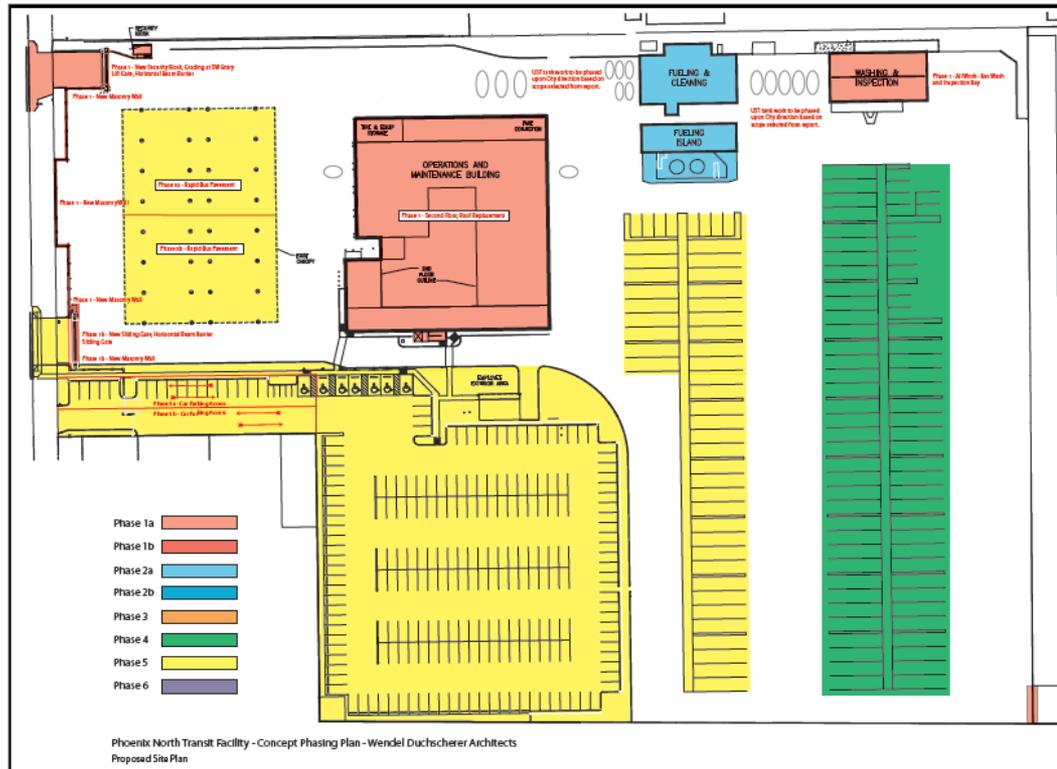
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# the plan for staging & phasing

- Not a directive but a suggested approach
- Sole responsibility of successful bidder to propose an acceptable Phasing Plan with the Owner
- Must be 'approved' by Owner prior to commencing construction
- Plan will not cause daily operation of facility to be interrupted in any way

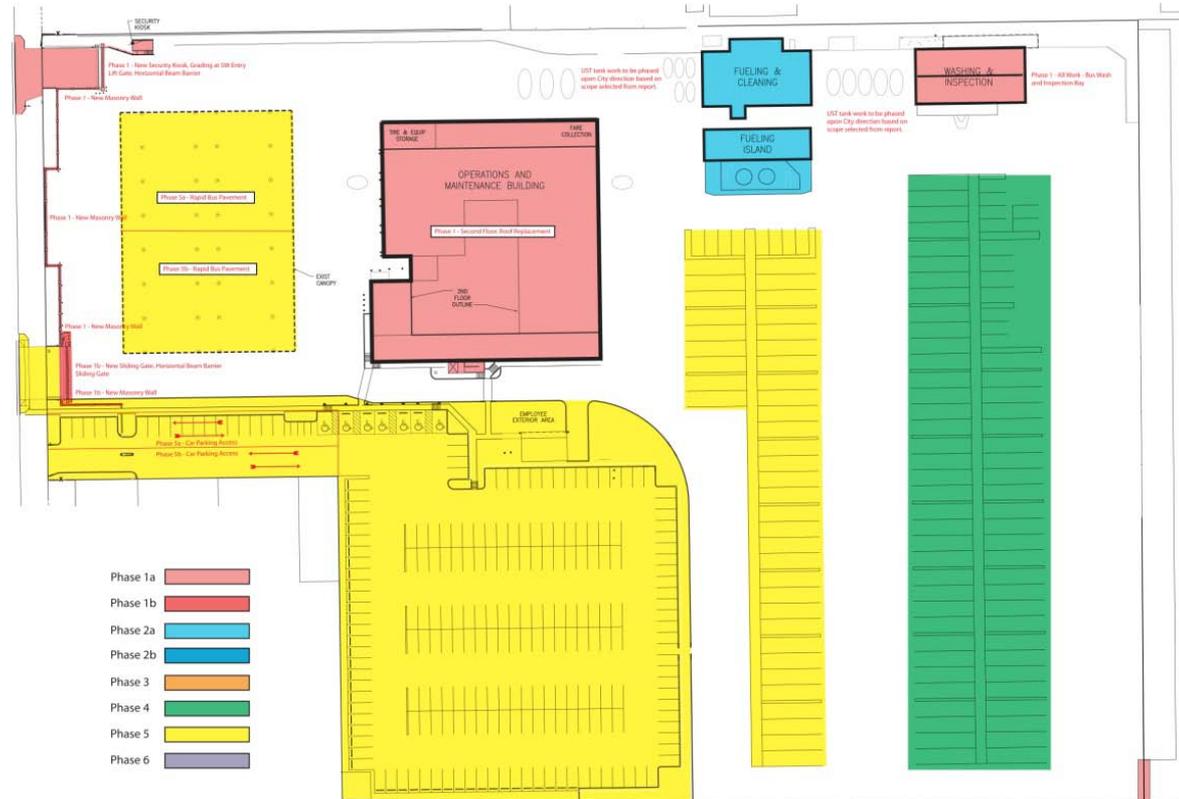


Six Phases recommended in Wendel's Concept Phasing Plan

# phase 1a & 1b

## Site

- Maintain Circulation “as is”
- Do not disturb existing security office
- Create “contractors” entrance at existing freight elevator
- Prepare new SW “Entry”
- Construct new masonry security wall on South property line including new gates and Security Kiosk
- Upgrade Bus Wash
- Remove / Replace UST’s
- Fencing, security measures



Phoenix North Transit Facility - Concept Phasing Plan - Wendel Duchscherer Architects  
Proposed Site Plan

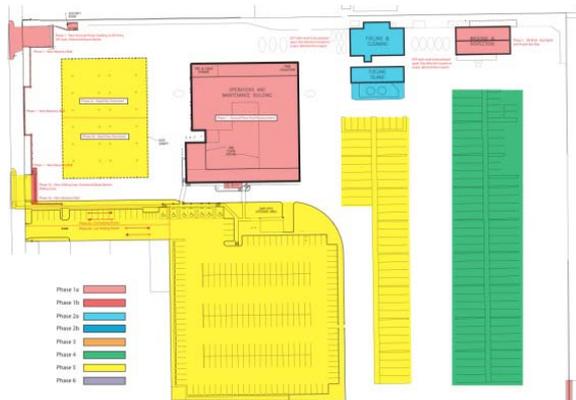
# phase 1a & 1b

- Building
  - Prepare second floor for new construction
  - New addition 1st floor maintenance
  - New Stair / Elevator Addition
  - Complete tear off and new roof
  - New mechanical
  - Fall protection at roof
  - Ships ladders at roof
  - Temp office trailers
  - Complete separation of Veolia & COP Servers

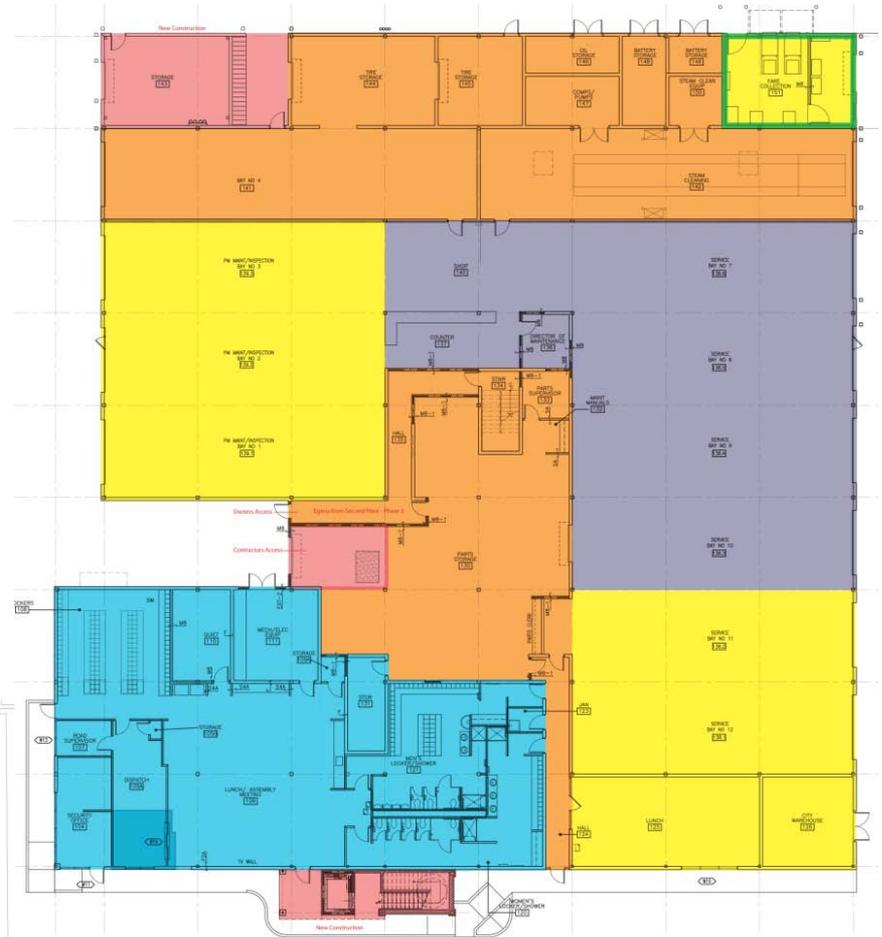


# phase 2a & 2b

- Site
  - Maintain Circulation “as is”
- Building
  - Move dispatch, drivers to site trailer
  - Move toilets, lockers to temp facility
  - Fueling station, LNG – phased approach
  - New landscaping, project ID sign
  - Move security office to new location



Phoenix North Transit Facility - Concept Phasing Plan - Wendel Duchscherer Architects  
Proposed Site Plan



Phoenix North Transit Facility - Concept Phasing Plan - Wendel Duchscherer Architects  
Proposed First Floor Plan

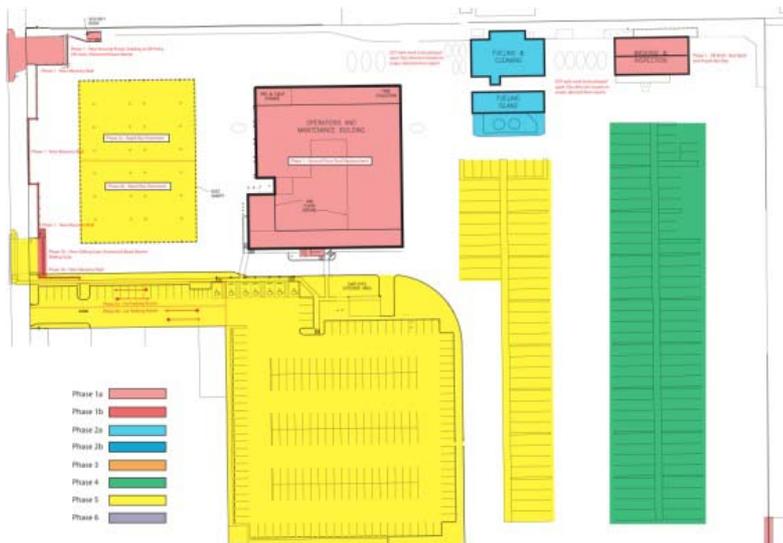
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|----------|----------|----------|----------|
| Phase 1a | Phase 1b | Phase 2a | Phase 2b |
| Phase 3  | Phase 4  | Phase 5  | Phase 6  |



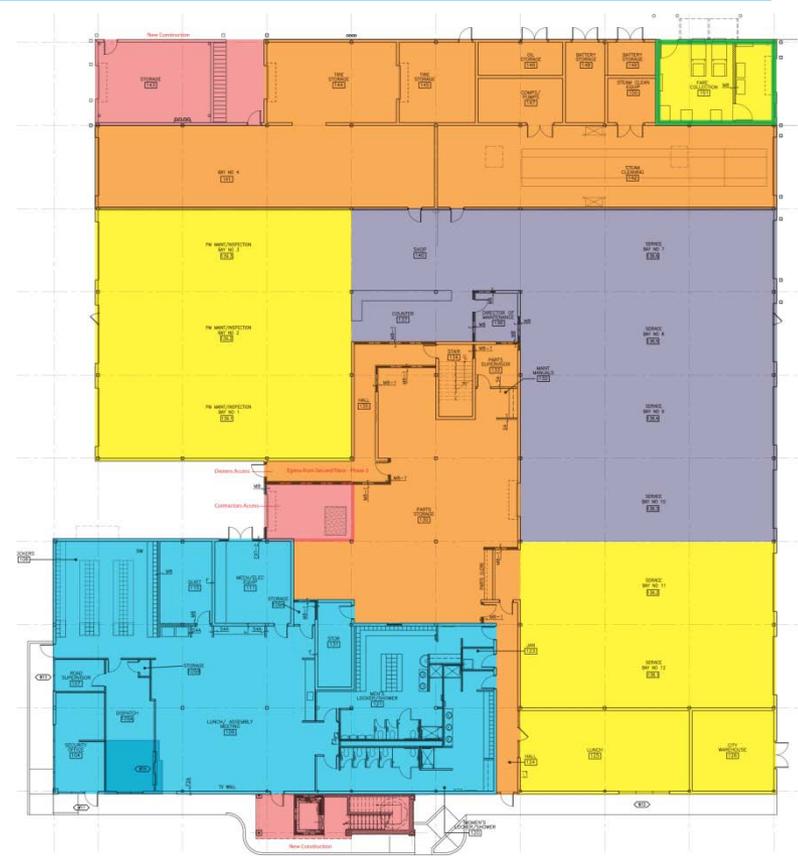


# phase 5

- Move fare collections equipment & operation
  - Provide redundancy
  - Avoid ANY downtime
- Rotate circulation on site
- Expand/establish new security delineation
- New employee outdoor area
- Staff parking lot
- Upgrades to bays – 1 ,2, 3 (south), 11, 12 (north)
- Upgrades to lunch room/maintenance shop
- South bus canopy erection
- Rapid bus pavement



Phoenix North Transit Facility - Concept Phasing Plan - Wendel Duchscherer Architects  
Proposed Site Plan



Phoenix North Transit Facility - Concept Phasing Plan - Wendel Duchscherer Architects  
Proposed First Floor Plan

# phase 6

- Shop 140
- Shop counter and Director of Maintenance Shop
- Bays 7, 8, 9, 10 (north)
- Exterior painting



# lessons learned

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- Need for a **Good Project Team**
- **Collaboration** is Key
- Can never have too much **Communication**
- Embrace **Flexibility** to Changing Conditions
- **Low Bid Can Work** on a large, complex project



**City of Phoenix**



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# project completion stats

- Completed on time
- Under the \$13.5 million construction budget
- Less than \$260,000 in change orders
  - 2.3% of the construction contract amount
- No construction claims



Thank you!

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**Any questions?**

