Preliminary Feasibility Assessment to Transition Yosemite National Park Bus Operations and Maintenance (O&M) to the NPS Valley Garage

Submitted to

Yosemite National Park
and
Dornbusch Associates

Final Draft Submittal

by

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Table of Contents Page

1. Introduction 1
2. Yosemite Valley Shuttle Fleet Facility Requirements 1
3. NPS Valley Garage Evaluation and Analysis 7
4. Additional Facility Analysis 27
5. Additional Capacity Analysis 28
6. Conclusions 30

BIBLIOGRAPHY 32

APPENDIX

Appendix A: Automatic Bus Wash System Sample Products
Appendix B: In-Ground Lift Sample Product Information
Appendix C: Portable Lift Sample Product Information
Appendix D: Lubricant and Oil Filling System Product Information
Appendix E: Exhaust Gas Extraction Sample Product Information

List of Exhibits

Current Bus Maintenance Facility (BMF) Daily Maintenance Routine 3
Utility Building Portion to be Modified Into Proposed Bus Maintenance Facility (BMF) 8
Current Utility Building Exterior Conditions 9
Building Roof Truss Elements Requiring Modification 12
40 Foot Design Vehicle Recommended Design Turning Template 16
Proposed Retaining Wall Relocation 17
Proposed Soundwall Location 18
Proposed Bus Vehicle Parking Configuration in Front of Fort BMF 24
Yosemite Valley Garage Modification Order-of-Magnitude Cost Estimate 26

Table of Contents (con't)

List of Figures

Proposed Fort BMF Demolition Plan 11
Proposed Truss Modification Design 13
Proposed Fort BMF Interior Layout 14
Proposed Fort BMF Vehicle Circulation Layout 22
Proposed Fort BMF Surrounding Area Vehicle Circulation 23

List of Tables

Current Concessioner Garage Functional Area Size Allocations 4
Functional Area Size Guidelines 28
New Facility Functional Area Quantity Requirements 29

1. Introduction

Yosemite Valley has undergone extensive changes over the last century in terms of transportation utilization and its application. The current shuttle bus transit fleet at Yosemite combines new technology within an aging infrastructure. The continued use of the concessioner vehicle maintenance facility is an example of this outdated infrastructure which was not designed to service large bus vehicles. To address this issue and others, the following analysis serves to explore and document the feasibility of removing the existing concessioner assigned garage from the concessioner's land assignment and replacing it with a portion of the current NPS Valley Garage (the 'Fort').

How large should an ideal bus maintenance facility (BMF) actually be and how should it be equipped? How many square feet are needed to accommodate the different functions which must be contained both on the site and within a building structure? Answering questions of future design size and functionality with certainty cannot be done[4]. Uncertainty arises resulting from management policies and decisions, desired maintenance efficiency of vehicles, parking issues, potential fuel shortages, type and amount of transit service provided, availability of funds, and other factors. Historically, these uncertainties have been addressed given the underlying assumption that the existing garage must remain and only minor adjustments are possible. Through evaluating a new facility (the Fort), an opportunity is now possible to enhance historic decisions and set a course towards significantly improved bus operations into the future.

Several scenarios are evaluated within this analysis which explore changes in the activities, facilities and levels of support for shuttle operations and corporate fleet. While the new assigned space would be physically smaller than the existing concessioner-assigned garage, several efficiency enhancements could be realized. An underlying assumption is that private vehicle repair service could be eliminated if space limitations dictate. The priority for this new space would be shuttle bus fleet maintenance. In assessing the space and facility capability needs, it is noted that the vast majority of the fleet is in use daily during the peak summer period so that facility capacities need to be sufficient to service all vehicles during non-service periods.

2. Yosemite Valley Shuttle Fleet Facility Requirements

Yosemite shuttle buses are operated and maintained by the Yosemite Concessioner Service (YCS) utilizing the existing Bus Maintenance Facility (BMF) within Yosemite Valley. All minor repairs and scheduled maintenance including daily routine and periodic preventative maintenance inspection activities on the buses are performed at this facility. All major repairs require a transfer to the larger El Portal maintenance facility or to other off-site vendors for major overhauls.

This existing BMF is equipped with standard bus/auto garage and shop equipment including a service pit, heavy duty light duty vehicle lift apparatus, tire rotation/balancing equipment, pressurized wash equipment, welders, hydraulic press, sand blasters, oil filter recycling devices, air hoses, lockers, and other. At the rear perimeter of the existing BMF main

structure, a tank farm exists and consists of three (3) above ground storage tanks utilized to store used antifreeze, used motor oil, and #2 diesel fuel for space heating purposes.

The existing facility has a maximum total power rating of approximately 76 kW (three phase) providing both standard 110-volt single phase AC and 208 volt three phase power. Numerous electrical panels, electrical outlets (indoor and outdoor), electrical quick disconnects, and sewers within the BMF are installed.

Each day, every vehicle is subjected to a routine process to be cleaned, inspected, serviced, fueled, and parked by the maintenance crew. Normal times for these 'pull-in' operations are between 5 P.M. and 2 A.M. Specific items included within these daily activities include:

- Body inspection (dents and damage);
- Exterior wash;
- Tire Pressure Inspection;
- Light and Signals Inspection;
- Door Operation Inspection;
- Engine Oil Level Inspection;
- Transmission Oil Level Inspection;
- Coolant Level Inspection;
- Interior Cleaning;
- Fueling;
- Parking.

Exhibit: 'Current Bus Maintenance Facility (BMF) Daily Maintenance Routine' describes this routine graphically. Table: 'Current Concessioner Garage Functional Area Size Allocations' describes the approximate sizes of various functional space allocations within the current concessioner garage facility.

EXHIBIT

Current Bus Maintenance Facility (BMF) Daily Maintenance Routine

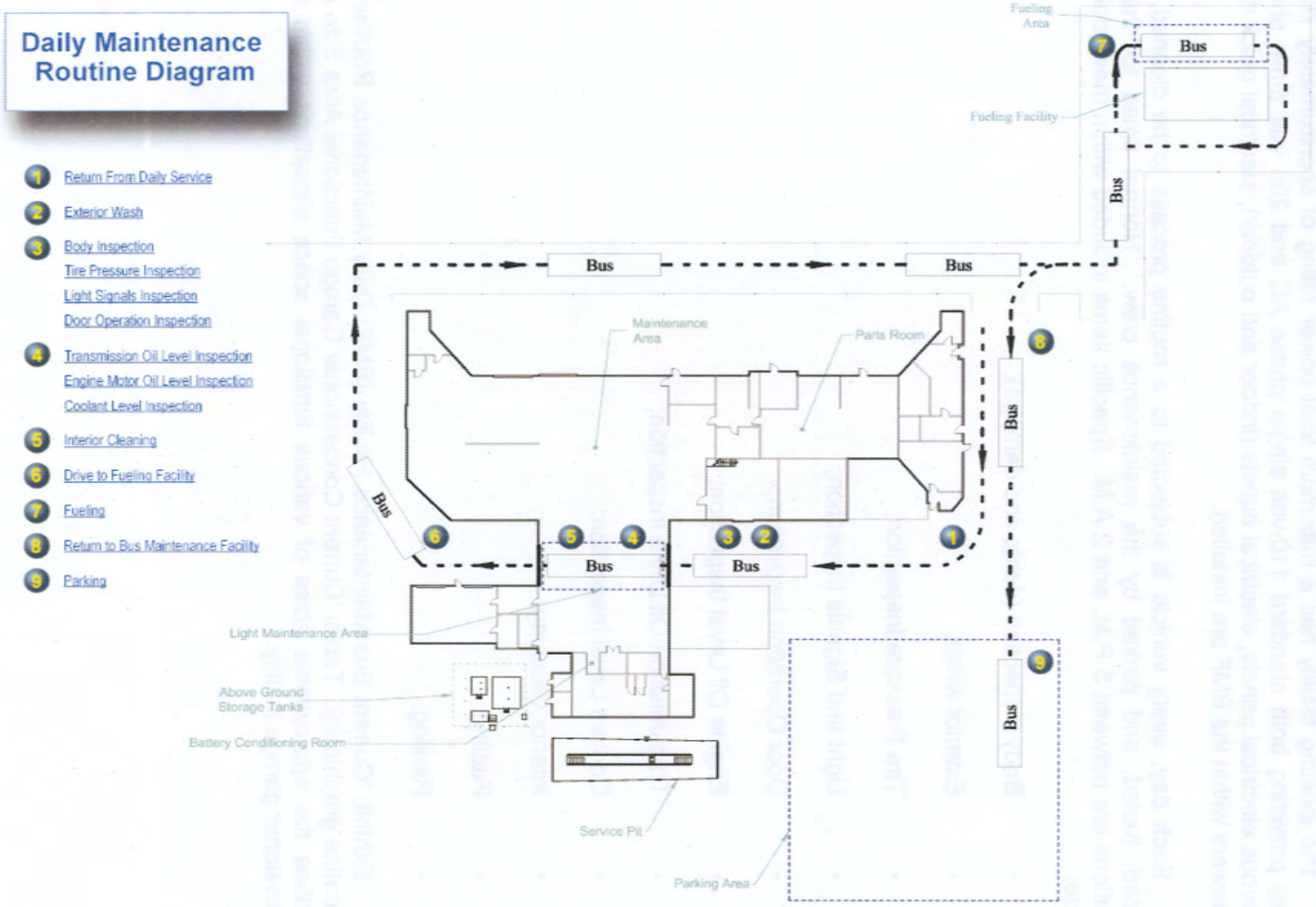


TABLE
Current Concessioner Garage Functional Area Size Allocations

Element	Area (S.F.)
Spare Parts Room	1305
Administrative Services	769
Dispatcher	341
Operator Break Room	362
Bus Repair Bay	2728
Light Duty Vehicle Repair Bay	894
Machine & Electrical Repair	692
Tire Repair & Storage	1142
Paint & Body Area	811
Cleaning/Washing	681
Maintainer Break Room	182
Washroom	602

2.1 Maintenance Activities

The existing maintenance and repair program within Yosemite Valley represents a good fundamental system refined over the last 40+ years of actual operation. It can be considered a 'medium' maintenance service capability as major component repair, overhaul, or replacement ('heavy' maintenance) is performed externally to the Park. In addition to those maintenance tasks outlined above, basic maintenance functions/activities include:

- Tire replacement and repair;
- Engine belt/transmission inspection, repair, and replacement;
- Brake system repair and adjustment;
- Cooling system maintenance;
- Engine oil change;
- Vehicle component troubleshooting and replacement;
- Hybrid system battery repair and maintenance;
- Minor body repair and reconstruction.

The current Concessioner Garage has comprehensive tire replacement and repair capabilities. Tires are rotated, balanced, repaired, and replaced on-site. The current process to remove and replace tires is time consuming and cumbersome. Maintainers must drive the bus vehicle to a flat surface in the maintenance garage and roll a hydraulic floor jack underneath the vehicle axle. The vehicle is manually lifted with the floor jack until the tire is approximately one

foot off the ground. A tire dolly is then rolled under the tire to be removed or replaced. Lug nuts are then removed.

Comprehensive brake service and repairs are currently conducted within the Concessioner Garage. Brake adjustments must ensure correct clearances between pads/rotors and linings/drums (as well as correct push rod travel and correct brake balance as applicable). Brakes are routinely cleaned, inspected, lubricated, and adjusted. During a major overhaul on-site, several parts and components are inspected and/or replaced, including:

- Brake pads for excessive wear and linings for wear and loose rivets;
- Brake shoes for wear at both ends;
- Camshaft head and bushings for wear (as applicable);
- Return springs of brake shoes (as applicable);
- Drums for cracks, deep scratches or other damage (as applicable);
- Wheel bearings for wear.

Hybrid battery packs require minimal routine maintenance. The external condition of the high-voltage battery packs and battery cables are checked periodically (particularly during 3,000 and 6,000 mile inspections)[13]. Terminals, connections, cables, and harnesses are further inspected for proper tightness, corrosion, and/or damage. Of note, the Concessioner has recently certified (by Cummins) two of its own technicians to conduct/upgrade a hybrid battery replacement program. As the first hybrids to enter service in Yosemite in 2005 are at or near their midlife overhaul period, this activity can be considered part of routine maintenance.

The torque blending 'transmission' utilized on the In-Valley hybrid fleet are inspected by the Concessioner in detail every 6,000 miles. The transmission output shaft seal is inspected for leaks. Further, transmission oil and filters are routinely changed at this interval.

2.2 Service Activities

Routine service activities include vehicle washing, fueling, and daily inspections/audits. For vehicle washing, a pressurized water wash machine is utilized by vehicle wash staff and requires approximately 15 minutes per bus vehicle. Wash staff must operate the pressure washer by holding and moving the nozzle around the bus to cover all possible exterior area. Pressure washer cleaning is frequently augmented by manually operated scrub brushes. Internal vehicle vacuuming and washing is then conducted.

After washing, vehicles are brought into the Concessioner Garage for routine daily inspections. These activities include:

- Fluid level inspection (transmission, motor oil, coolant);
- Light signals check;
- Tire pressure check;

- Body (dents) check;
- Interior cleanliness check;
- Warning gauge check;
- Air brake test;
- Radio functionality check;
- Seat and upholstery integrity check;
- Air pressure gauge check;
- Door operation check;
- Horn check;
- Wheelchair ramp operational check;
- Route number and destination sign check;
- Window damage check;
- Air conditioning system check;
- Heater/defroster functionality check;
- Mirror check.

Upon completion of washing, cleaning and inspections, vehicles are driven to the fueling station. An authorization code is entered at the input panel located in the middle of the fueling island by the fueler who then operates the fuel pump. The bus vehicle is then driven back to parking with the total fueling operation requiring approximately 20 minutes.

2.3 Administrative and Driver Support Activities

Existing administrative and driver support activities include administrative offices, a dispatch center, and operator day room. Administrative functions include those of the transportation/maintenance manager, stocking, supply, and procurement activities, and other. The dispatch functions coordinate vehicle/shift scheduling activities, route coordination, safety/communication, and other. A newly implemented GPS based service coordination system has recently been added to system operations. The operator day room provides a space for operators to take breaks, have meals, conduct meetings and obtain key job briefings.

2.4 Spatial Utilization Considerations

The spatial utilization of the existing Concessioner Garage can be significantly improved in terms of efficiency. For example, portions of the garage (such as the southeast wing) has limited vehicle access and height clearance issues thereby rendering it ineffective for bus and light duty vehicle servicing. Instead, this area is currently utilized primarily as equipment storage and longer term component repair – neither of which are typically considered elements of an efficient bus maintenance facility.

To a lesser extent, both limited vehicle access potential and service height restrictions plague the entire existing Concessioner Garage in terms of becoming an efficient service facility. The primary bus vehicle drive thru service bay does not have adequate height to effect any vehicle lift operations. Conversely, the remaining three indoor bus vehicle service bays can only be accessed directly thru one roll-up service door at the entrance to one of these bays. Bus vehicles must be maneuvered internally within the building to realize any utilization of the other two adjacent service bays.

3. NPS Valley Garage Evaluation and Analysis

The NPS Valley Garage (the 'Fort') is currently a multi-use facility located along the western edge of Yosemite Valley near the village area. The current uses of the Fort facility include:

- A fire station;
- A carpentry shop;
- Law enforcement/detention;
- Roadway maintenance;
- Trail maintenance;
- Heavy vehicle repair and maintenance;
- Storage;
- Other.

As further described below in the following discussion, the southwesterly portion of the garage (comprising approximately 9,750 square feet) which is currently utilized as a vehicle heavy repair facility would form a solid solution for conversion into a BMF. It appears to have adequate utility and power connectivity, sufficient spatial potential, and can form a complementary use to adjoining neighbors within the service area.

Exhibit: "Utility Building Portion to be Modified Into Proposed Bus Maintenance Facility (BMF)" graphically describes the portion of the utility building to be converted into a BMF. Exhibit: "Current Utility Building Exterior Conditions" graphically depicts the exterior condition of the building today.

EXHIBIT
Utility Building Portion to be Modified into Proposed
Bus Maintenance Facility (BMF)

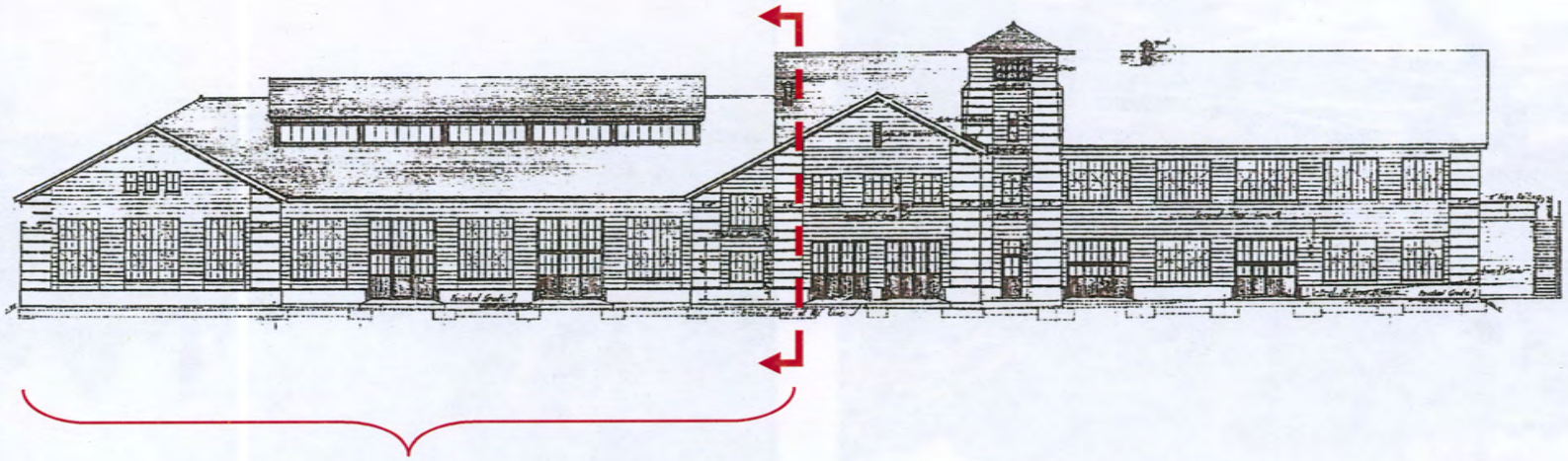
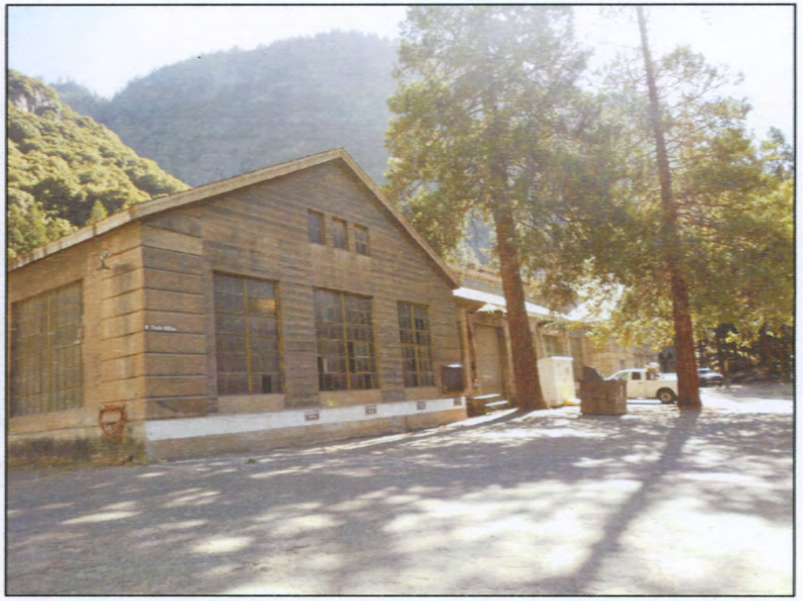


EXHIBIT
Current Utility Building Exterior Condition



3.1 Recommended Site Strategies

Building Interior Modifications

In terms of required building interior modifications required to service the bus vehicle fleet, relatively minor modifications must be addressed. The first is related to interior preparation and limited non-structural area demolition. Figure: 'Proposed Fort BMF Demolition Plan' describes the interior wall and second floor mezzanine demolition requirements necessary to clear the space to a workable condition. This work will not adversely impact the overall structural integrity of the building space.

To accommodate the two proposed bus service bays equipped with vehicle lift apparatus, limited modifications will need to be made to roof support truss members. Specifically, the T-14 roof truss configuration will need to be altered in four (4) places and reconfigured higher to allow for adequate clearance of the bus vehicles in the lifted position. Exhibit: 'Building Roof Truss Elements Requiring Modification' graphically describes the four roof lower chord frame truss members which must be removed. Figure: 'Proposed Truss Modification Design' graphically describes the proposed preliminary design layout for these modified elements. This should enable at least an additional two (2) feet of clearance for servicing of the bus vehicles and additional clearance for adequately servicing of rooftop mounted hybrid bus equipment.

Figure: 'Proposed Fort BMF Interior Layout' graphically illustrates a proposed functional layout for the new facility and equipment. It includes:

- Two (2) bus service bays with vehicle lifts;
- Two (2) bus service bays without vehicle lifts;
- Two (2) light duty vehicle service bays with vehicle lifts;
- Drive-thru bus vehicle wash and cleaning lane;
- Portable rooftop scaffolding system [2];
- Dedicated body shop repair area;
- Dedicated tire repair and storage area;
- Dedicated spare parts inventory area;
- Administrative and breakroom areas; and,
- Miscellaneous maintenance and repair equipment.

FIGURE
Proposed Fort BMF Demolition Plan

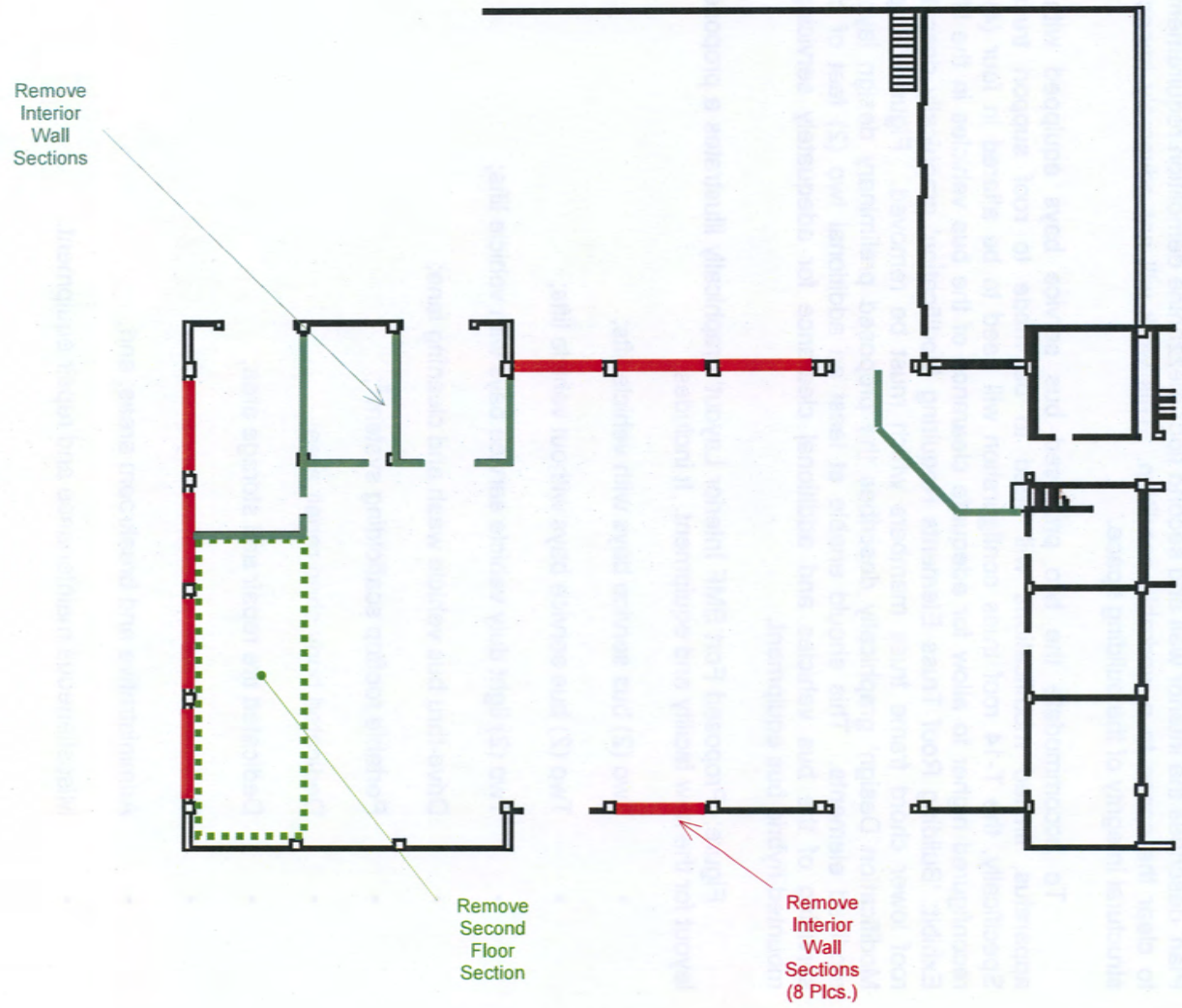


EXHIBIT
Building Roof Truss Elements Requiring Modification

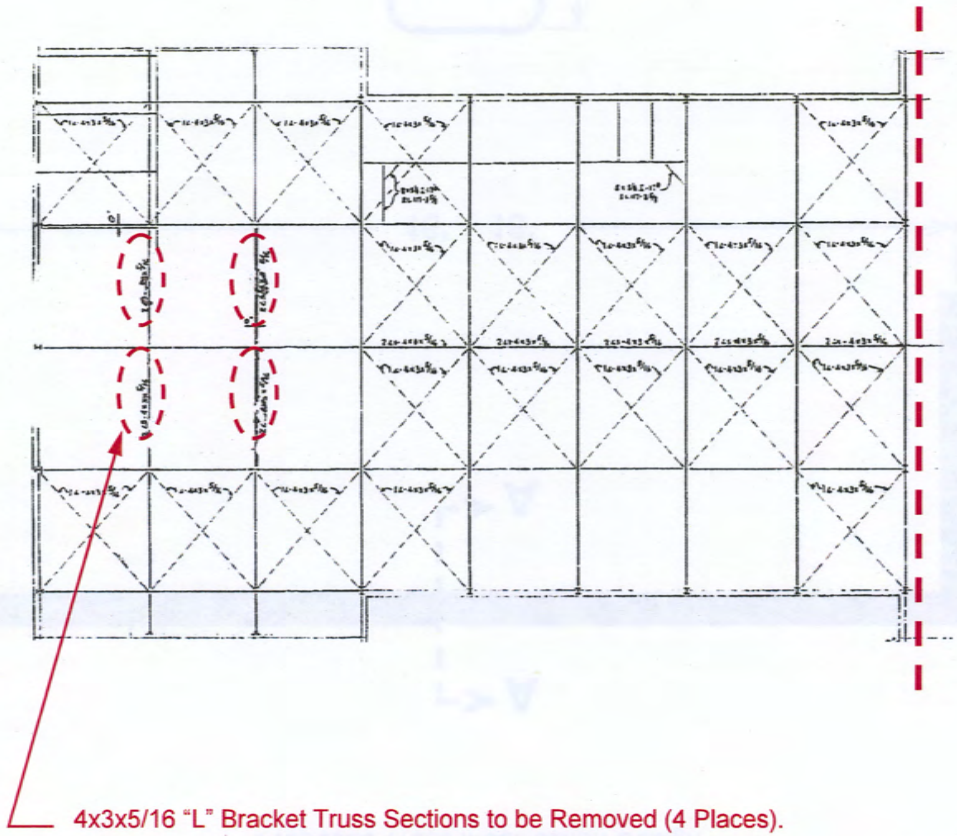
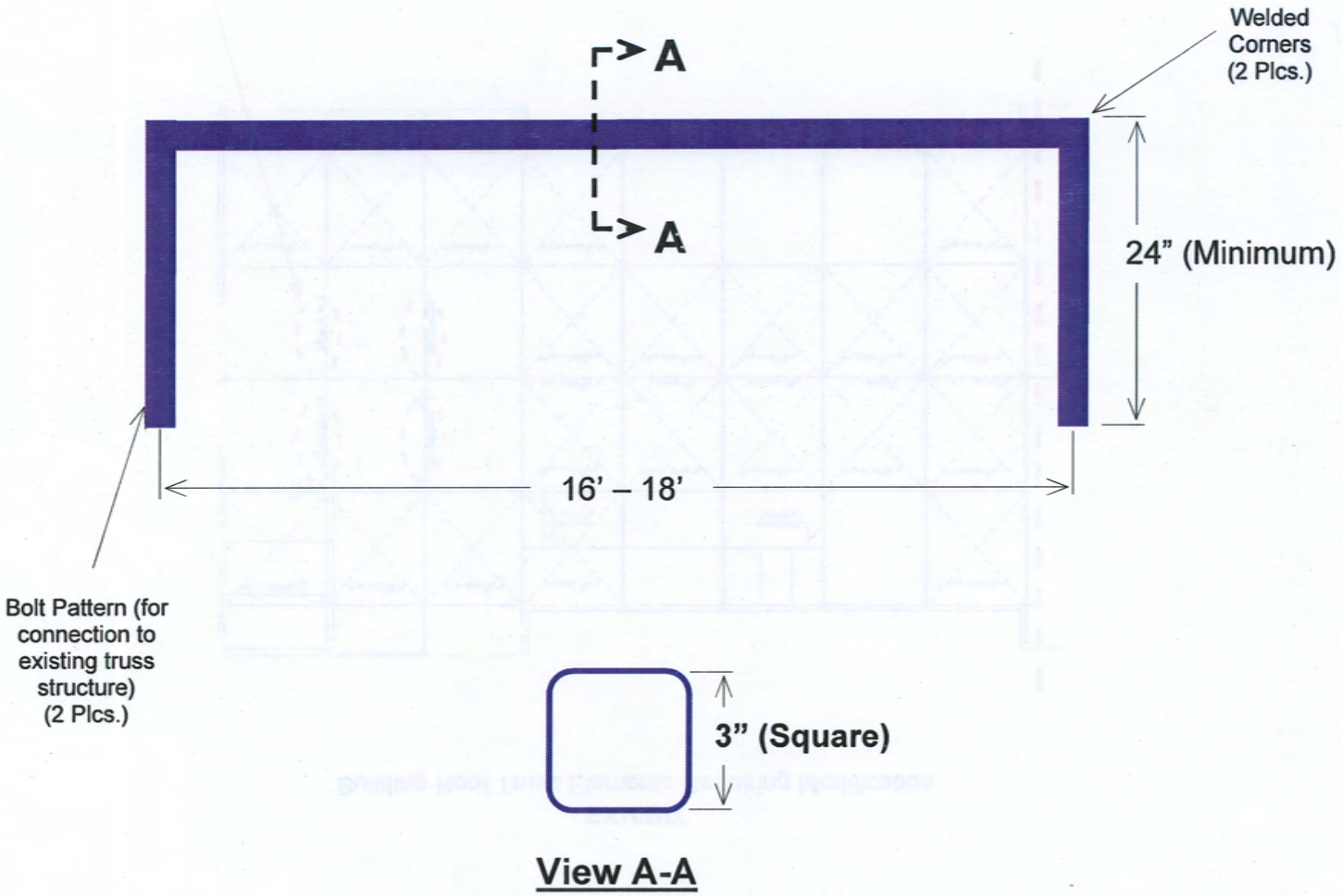
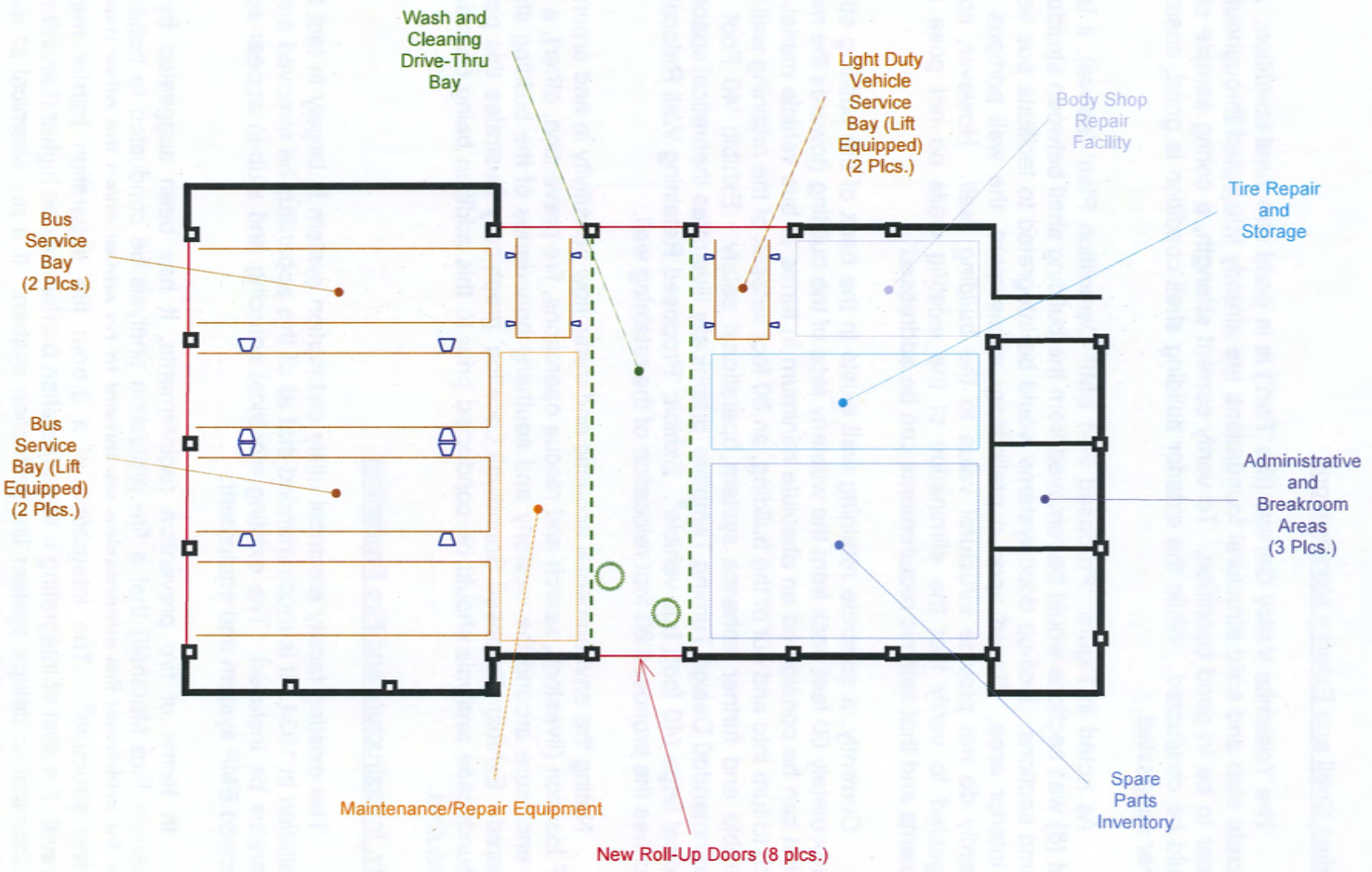


FIGURE
Proposed Truss Modification Design



View A-A

FIGURE
Proposed Fort BMF Interior Layout



Building Shell and Exterior Modifications

The Yosemite Valley Garage (the 'Fort') is in good structural condition. A 5-6 inch thick concrete slab and solid structural foundations are already integrated throughout the facility and appear to be in good condition. To verify current strength, a coring sample strength analysis should be conducted. While the exterior building shell condition is good, cosmetic cleaning is further suggested.

As noted in Figure: 'Proposed Fort BMF Demolition Plan' (above), it is proposed that eight (8) wall sections would be removed from the building shell between structural roof support column sections. Roll-up door systems would be integrated to facilitate bus vehicle access to the interior area. Based upon a preliminary assessment, the wall portions to be removed currently do not provide structural value to the building itself. However, some analysis is suggested to verify that the elimination of the existing walls do not pose any shear wall problems and that seismic requirements can be addressed[7].

Currently, a concrete retaining wall exists in the back of the building structure which is approximately 60 feet back from the westerly face of the building (towards the mountain). While 60 feet can be considered an absolute minimum in terms of bus vehicle maneuvering space in which to turn into and out of the building, an 80 foot setback of the retaining wall would be highly desirable and further enhance system operational safety. Exhibit: '40 Foot Design Vehicle Recommended Design Turning Template' graphically illustrates theoretical space constraints for a typical large (40 foot) bus vehicle[8]. Exhibit: 'Proposed Retaining Wall Relocation' graphically describes the proposed 80 foot relocation of the retaining wall.

Noting the environmental acoustic and traffic flow sensitivity in and around the proposed BMF location (livestock, search and rescue operations, fire prevention, other), a retaining/sound wall enclosure around the westerly and southerly boundaries of the building should be further explored. Exhibit: 'Proposed Soundwall Location' graphically illustrates this potential addition. A soundscape analysis should be conducted prior to this addition being considered necessary or required.

Utility, Infrastructure and Fire Prevention

The existing facility electrical utility distribution system is largely in tact from its original installation in 1934. It is recommended that all of this apparatus be removed and new electrical apparatus be installed. The existing electrical sourcing and stub-in appear adequate for the proposed BMF system and equipment.

In terms of fire prevention requirements, it has been suggested by Don Coffman (Yosemite Fire Marshall) that a fire protection analysis be conducted to better determine the need for additional fire suppression equipment to be added given the other uses of the overall building structure[6]. The integration of a 2-hour fire separation barrier may be required. However, the cost of integrating a fire separation barrier may be higher than integrating a limited dry chemical or deluge system fire protection system. If a dry chemical or deluge system is required, a dedicated riser is also recommended.

EXHIBIT
40 Foot Design Vehicle Recommended Design Turning Template

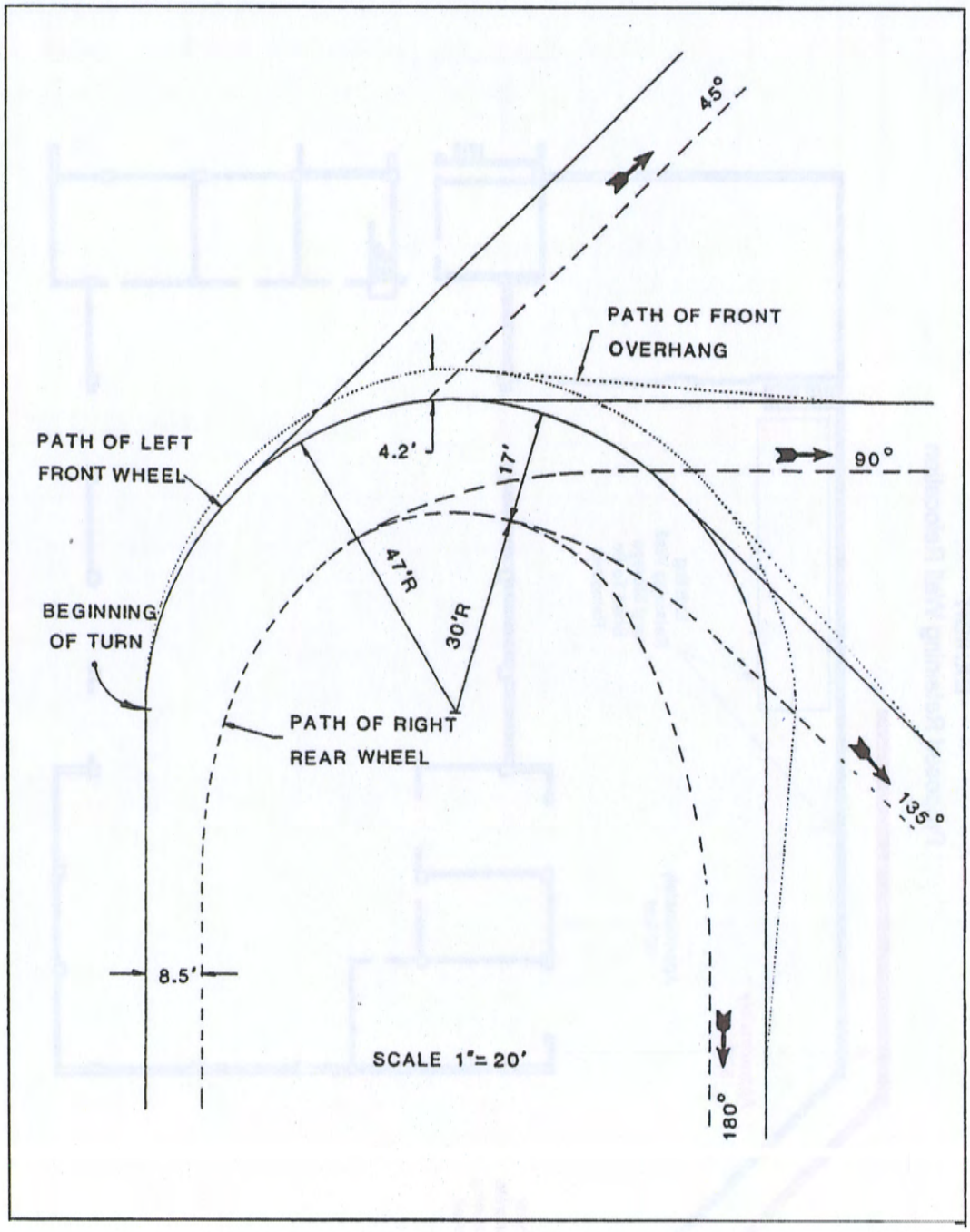


EXHIBIT
Proposed Retaining Wall Relocation

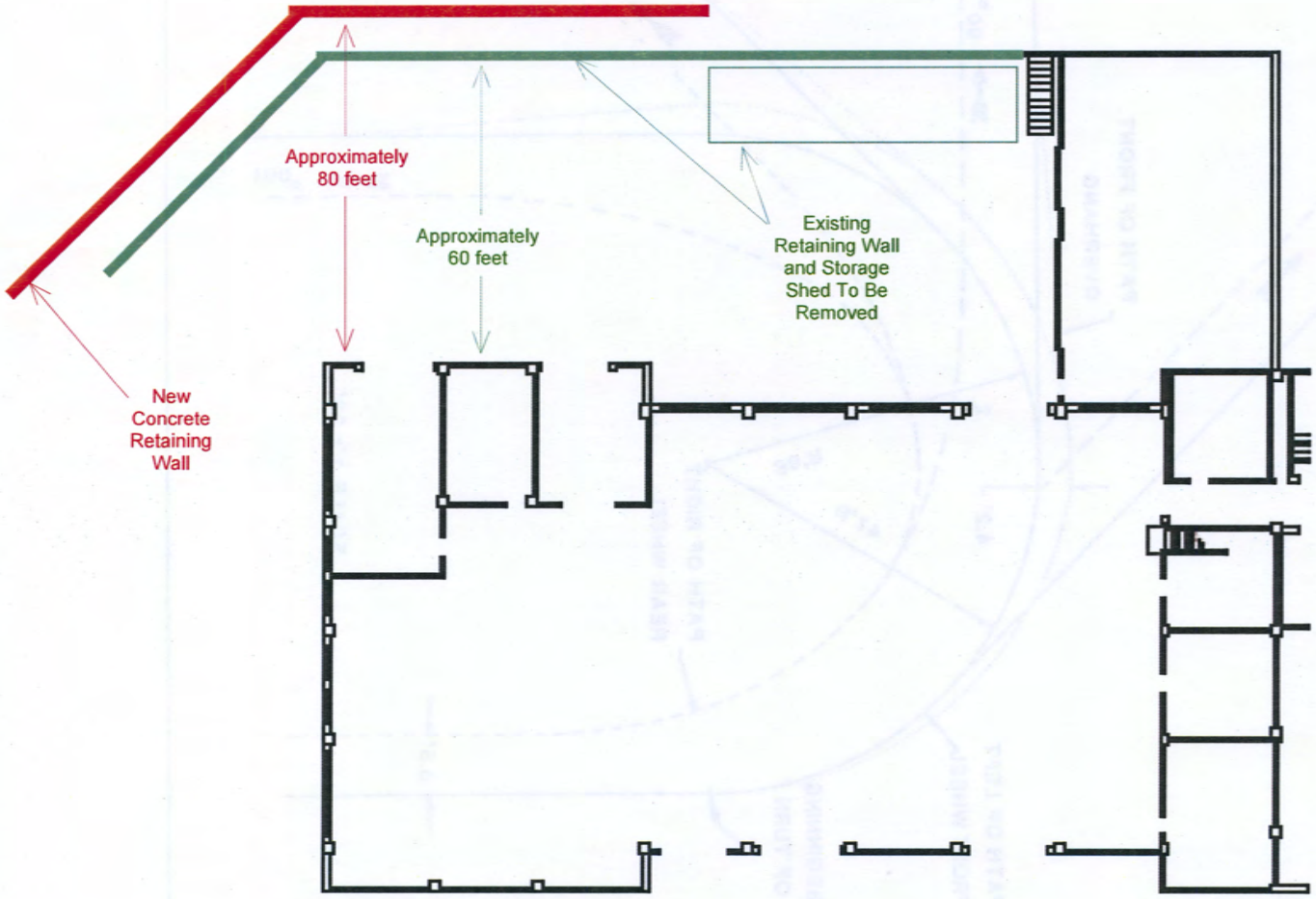
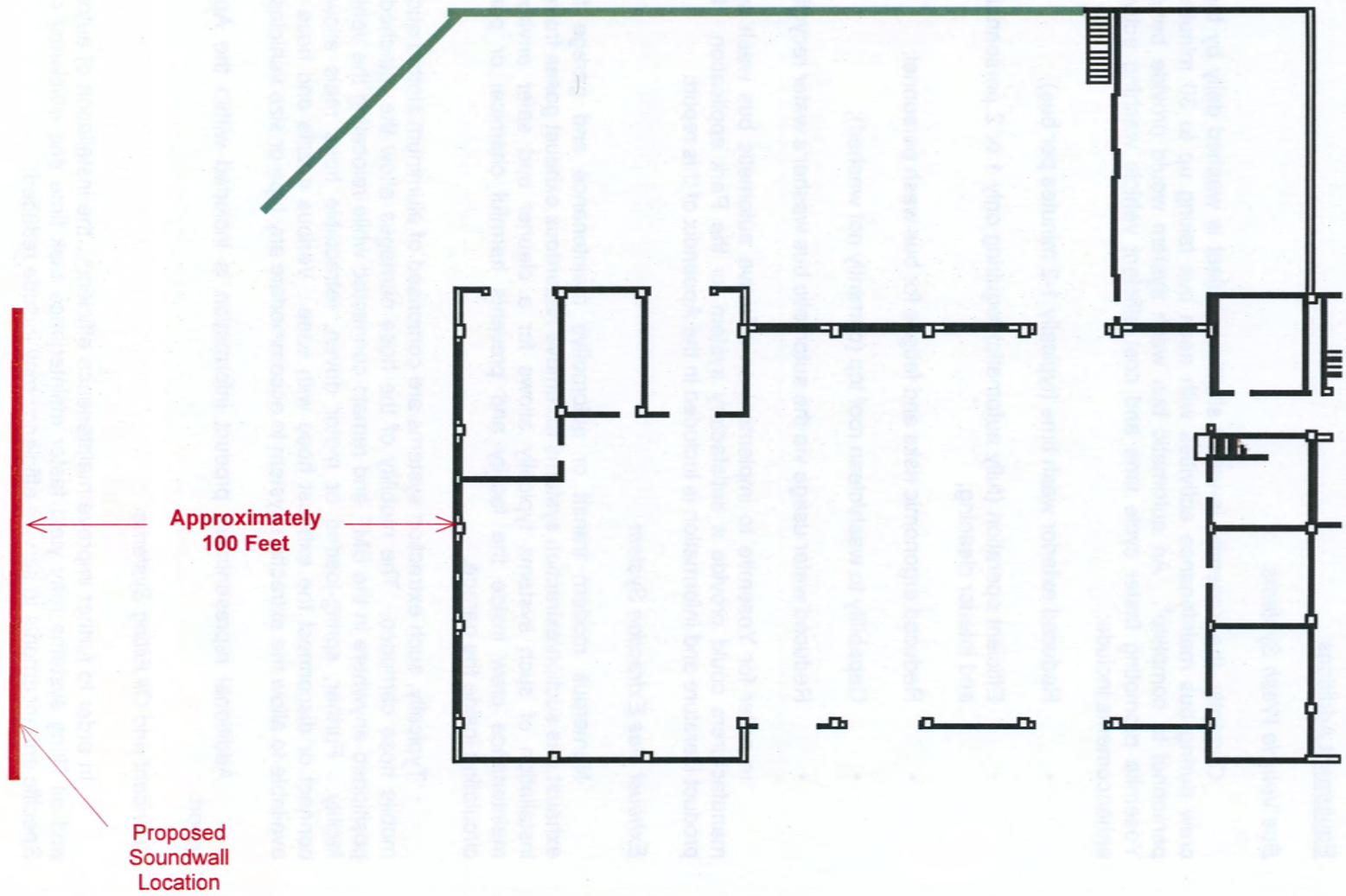


EXHIBIT
Proposed Soundwall Location



Equipment Additions

Bus Vehicle Wash Systems

Currently, the Yosemite in-valley shuttle bus fleet is washed daily by the maintenance crew during bus maintenance activities with each bus taking up to 30 minutes and up to 3 personnel to complete[9]. An automatic bus wash system would provide beneficial value to Yosemite promoting faster cycle time and cost efficient vehicle washing activities. Specific enhancements include:

- Reduced exterior wash time (typically 1-2 minutes per bus);
- Efficient operation (fully automatic) requiring only 1 or 2 personnel for monitoring and interior cleaning;
- Reduced ergonomic risks and fatigue for bus wash personnel;
- Capability to wash/clean roof top (currently not washed);
- Reduced water usage via the automatic bus washer's water recycling system.

In order for Yosemite to implement an effective automatic bus wash system, several manufacturers could provide a satisfactory system for the Park application. Representative product literature and information is included in the Appendix of this report.

Exhaust Gas Extraction System

Numerous modern transit or automotive maintenance and garage facilities utilize exhaust gas suction/extraction systems to remove hazardous exhaust gases from vehicles. The installation of such systems typically allows for a cleaner and safer environment for the maintenance crew inside the facility and prevents harmful chemical or particulates from circulating inside the garage.

Typically, such extraction systems are comprised of aluminum slotted suction ducts with mobile hose carriages. The mobility of the hose carriages allow the attached vehicle to be positioned anywhere in the BMF and remain connected while relocating the vehicle around the facility. Further, spring-loaded or motor driven, retractable hose reels allow personnel to connect or disconnect the exhaust hose with ease. Various nozzle and hose sizes are also available to allow the extraction system to accommodate any type or size vehicles.

Additional representative product information is included within the Appendix of this report.

Lubricant and Oil Filling Systems

In order to further improve maintenance efficiency, the installation of automatic lubricant and oil filling systems may yield faster maintenance task time and efficiency enhancements. Specific enhancements to service efficiency may include reduced:

- Fluid refilling frequency and fluid cost;
- Space requirements;
- Maintenance time;
- Potential spilling risks and other mishaps;
- Fluid waste via precise fluid measurement and dispensing.

The majority of lubrication and oil filling systems are comprised of centralized fluid tanks or drums, air pressure pumps, air regulators, roof mounted overhanging hose assemblies, valves, hose reels, nozzles, monitoring gauges, and fluid measurement systems. Six hose reels per set are often sufficient to deliver two different types of motor oil, antifreeze, transmission oil, water, and air. A suitable lubricant and oil filling system typically cost in the range of $12,000 to $20,000. Sample product literature and information are included within the Appendix of this report.

Bus Vehicle Lift Systems

A majority of under-chassis maintenance tasks and repairs are currently conducted either utilizing floorjacks indoors or the exterior service pit located at the east side of the Concessioner Garage building[9]. The adoption and implementation of a bus vehicle lift system (either portable or in-ground) would facilitate enhanced service flexibility and efficiency and mitigate seasonal maintenance challenges associated with outdoor service operations. The greatest advantage of in-ground axle lift systems are that they allow ready brake and axle servicing as they do not depend upon the bus vehicle wheels as lift points.

In-ground bus vehicle axle lift systems typically require at least two telescoping hydraulic lifting systems to be mounted in dedicated below ground pits often twelve to fifteen feet in depth below surface. Costs and potential feasibility high in terms of facility retrofit applications. An alternative is a new lift concept from Stertil Koni entitled 'EcoLift'. The unique feature of this concept by its design is that it only requires an installation pit depth of 34 inches[11]. Further, the cost factor is relatively competitive at approximately $130,000.00 per repair bay lift system. Additional geologically test evaluation would be required to determine if adequate clearance is available below the foundation of the existing Fort facility.

Electro-hydraulic portable bus vehicle lift systems can be procured for $6000.00 - $7,000.00 per column lift (depending upon the required loading and configuration[10]. Sets of four lifts are usually procured and can be operated automatically to any desired height. Basic performance parameters typically include:

- Integration of lift height tracking system;
- Capable of full automatic controls when locking, lift height tracking system and emergency stop button;
- Integrate lockable wheels;
- Be capable of a minimum 10,000 pound load per lift;

- Integrate a fail safe design with mechanical safety locks.

Sample products and information are included within the Appendix of this report.

Rooftop Servicing Apparatus

In addition, the current fleet of hybrid shuttle bus vehicles do have a significant amount of rooftop mounted equipment (including batteries, controllers, other). Within the current operation at the Concessioner Garage, it is a cumbersome, outdoor activity to repair and/or replace any of this rooftop mounted equipment. A major efficiency and safety improvement within the new facility would be the addition of a portable, rooftop scaffolding system[2]. These systems have relatively minor cost loading factors and significantly improve the efficiency of system operations.

Traffic Circulation

Figure: 'Proposed Fort BMF Vehicle Circulation Layout' graphically describes the proposed functional traffic flow and circulation in and around the new Fort BMF structure. Figure: 'Proposed Fort BMF Surrounding Area Vehicle Circulation' graphically describes the proposed traffic circulation. This represents a proposed scenario for bus vehicle traffic flow both to and from the Fort. Bus vehicles would enter the Fort BMF from a southbound direction from Village Drive and depart along an easterly direction along Village Drive.

As space in and around the Fort area is relatively constrained with physical barriers (buildings, trees, livestock area, other), relative bus vehicle speeds will need to be limited to perhaps 5 miles per hour. It is suggested that a more rigorous driver training program be initiated to help enhance low speed driver operator skill which, in turn, will improve operational safety.

Parking

As stated, it theoretically desirable if both bus vehicle servicing and parking could be co-located within the same facility. Exhibit: "Proposed Bus Vehicle Parking Configuration in Front of Fort BMF" graphically describes a proposed configuration in which this would be possible at the Fort BMF. It would require a total displacement of existing at-grade light duty vehicle parking currently utilized by other groups (including trails, roads, search and rescue, other). The current light duty vehicle impound yard located at the Fort facility would need to be eliminated. Proposed bus vehicle parking would be a combination of in-line and angled parking configurations[3].

A challenge with this approach concerns the light duty vehicle parking needs of Fort BMF staff and bus vehicle operators. This parking will need to be accommodated in an off-site location (along Village Drive, at the adjacent DNC warehouse facility, other). In addition, no consideration is given to the potential for Park visitor light duty vehicle repair and service operations.

FIGURE
Proposed Fort BMF Vehicle Circulation Layout

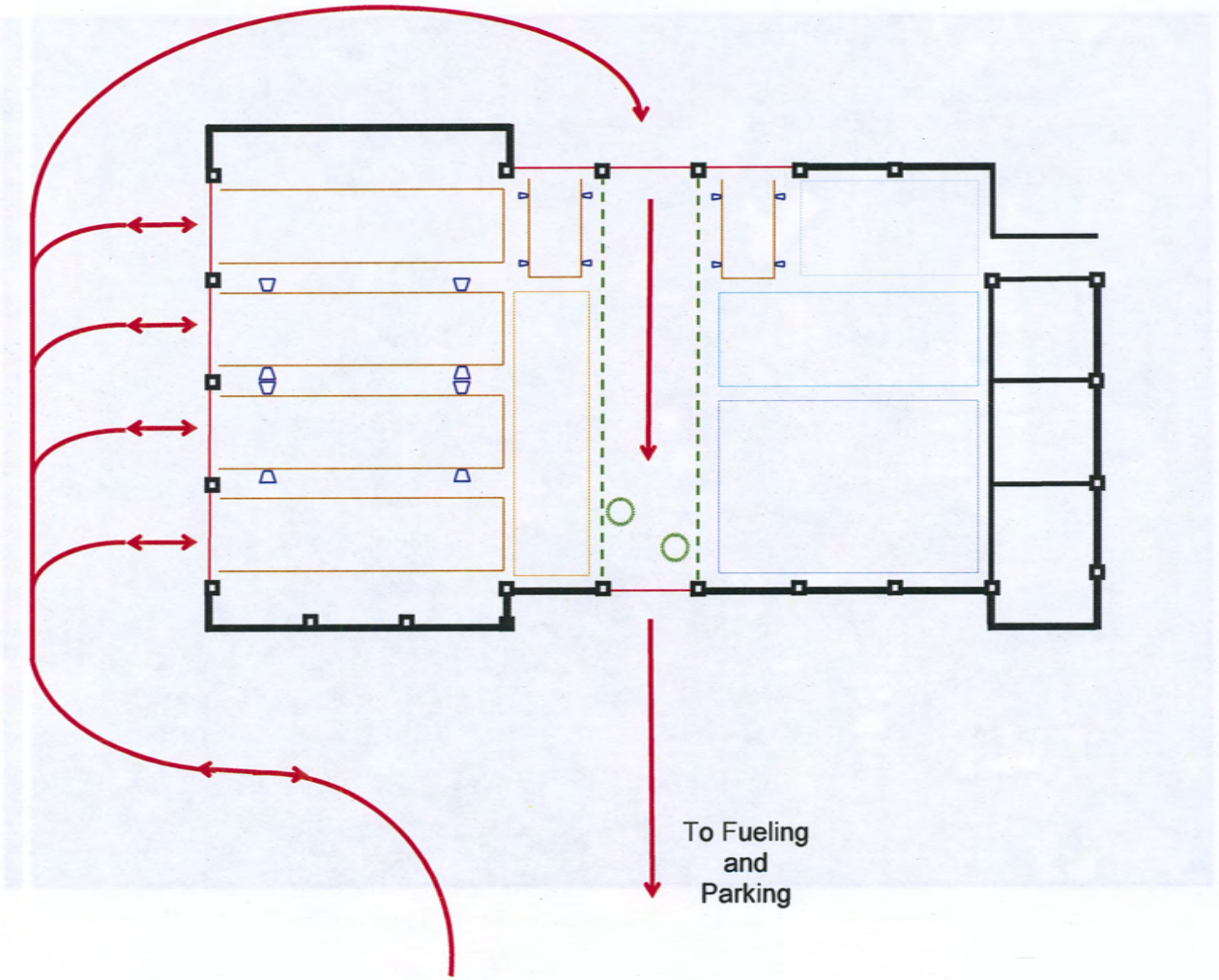


FIGURE
Proposed Fort BMF Surrounding Area Vehicle Circulation

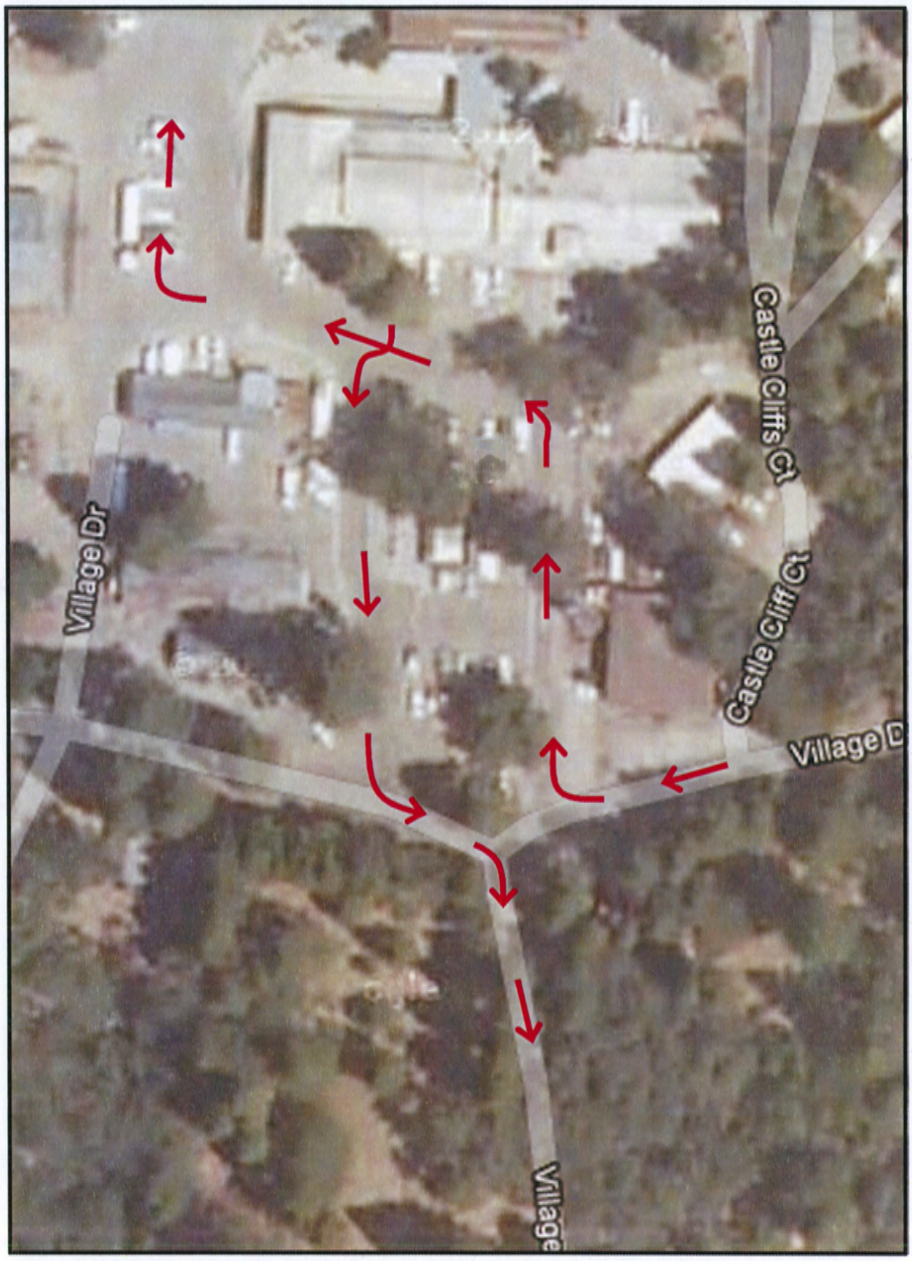
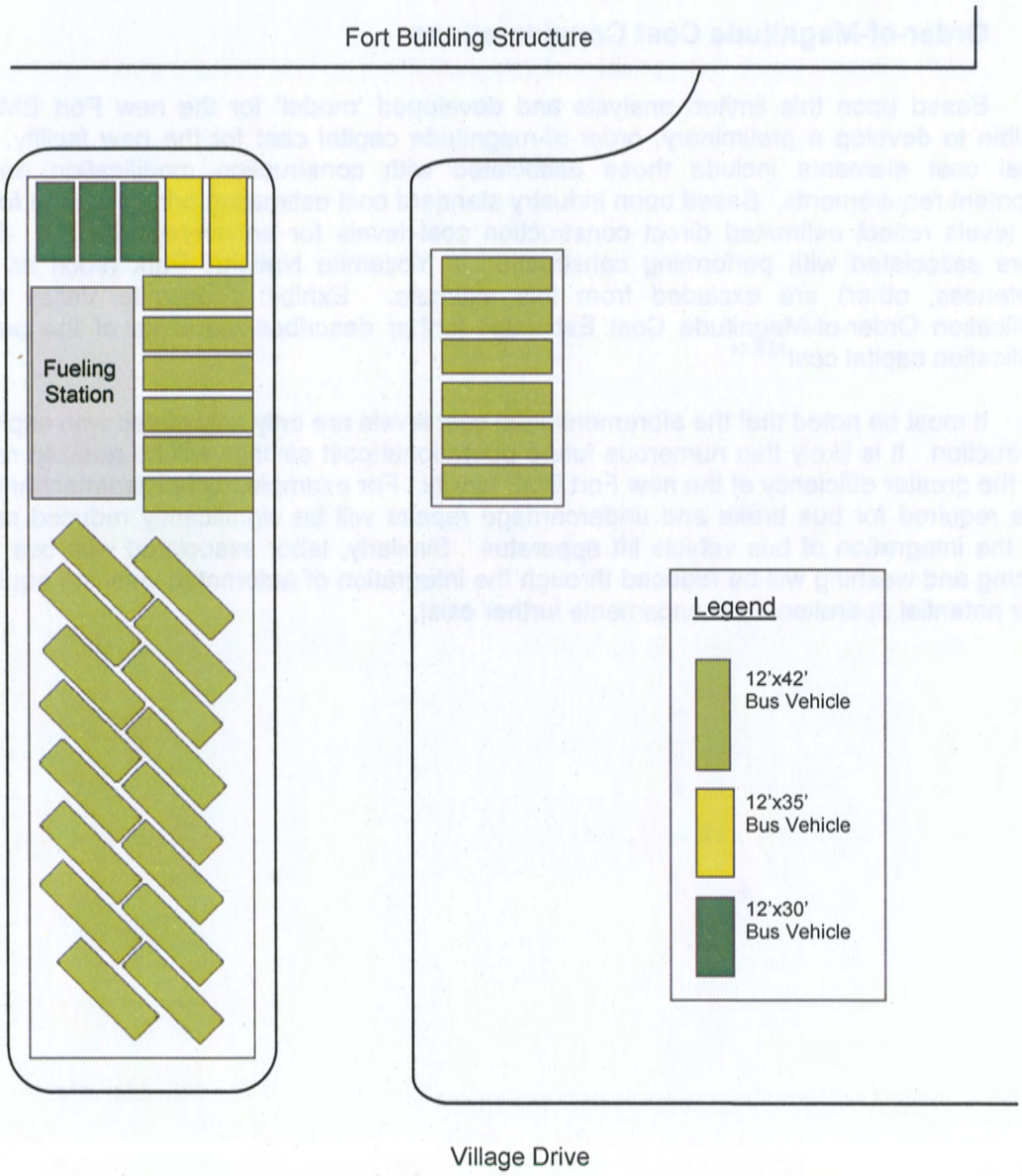


EXHIBIT
Proposed Bus Vehicle Parking Configuration
In Front of Fort BMF



As an alternate to locating bus vehicle parking at the Fort BMF headquarter facility, bus system parking in its current location could be maintained. Vehicle operators could be shuttled (vanpool, other) from the Fort BMF facility to their bus vehicles. While less efficient, this approach would enable light duty parking considerations to be maintained on the easterly side of the Fort building. Further analysis would be required relative to placing a limited shuttle into operation for bus transit system staff.

3.2 Order-of-Magnitude Cost Considerations

Based upon this limited analysis and developed 'model' for the new Fort BMF, it is possible to develop a preliminary, order-of-magnitude capital cost for the new facility. Basic capital cost elements include those associated with construction modification and new equipment requirements. Based upon industry standard cost estimating principles, the following cost levels reflect estimated direct construction cost levels for an average facility. Specific factors associated with performing construction in Yosemite National Park (such as jobsite remoteness, other) are excluded from this estimate. Exhibit: "Yosemite Valley Garage Modification Order-of-Magnitude Cost Estimate" further describes elements of the proposed modification capital cost[12,8,14].

It must be noted that the aforementioned cost levels are only associated with capital cost construction. It is likely that numerous future operational cost savings will be realized resulting from the greater efficiency of the new Fort BMF facility. For example, technician/mechanic labor hours required for bus brake and undercarriage repairs will be significantly reduced resulting from the integration of bus vehicle lift apparatus. Similarly, labor associated with bus vehicle cleaning and washing will be reduced through the integration of automated washing equipment. Other potential operational enhancements further exist.

EXHIBIT
Yosemite Valley Garage Modification
Order-of-Magnitude Capital Cost Estimate

Fort Building Demolition		
Interior Wall Section Removal		$11,600.-
Exterior Building Wall Section Removal		$41,000.-
Balcony/Mezzanine Removal		$16,000.-
Electrical/Lighting/HVAC Removal		$25,000.-
Roof Truss Modification (T-14)		
Fabrication, Modification, Installation		$17,000.-
New Building Structure Equipment		
Roll-Up Doors (8)		$120,000.-
Fire Suppression Equipment/Apparatus		$500,000.-
New Facility Equipment		
Vehicle Lifts (2 Bus, 2 Light Duty)		$300,000.-
Aerial Lubrication System		$27,000.-
Exhaust Evacuation System		$21,000.-
Portable Vehicle Rooftop Scaffolding		$9,000.-
Bus Wash System		$400,000.-
Pneumatic System		$15,000.-
Miscellaneous		$25,000.-
External Building Betterments		
Modification of Westward Retaining Wall (behind building)		$35,000.-
Addition of Soundwall		$132,000.-
Utility Upgrades		
Electrical/Lighting/HVAC		$150,000.- (lot)
New Interior Building Construction		
Spare Parts Storage Room		$10,000.-
Driver/Maintainer Lounge		$12,000.-
	Subtotal:	$1,769,600.-
Architectural/Engineering Services		
20% of Subtotal		$353,920.-
	Subtotal:	$2,123,520.-
Contingency		
20% of Subtotal		$424,704.-
	TOTAL:	**$2,548,224.-**

Assumptions:
1.) All existing repair, maintenance, operations, and administrative equipment (including above ground liquid storage tanks) to be re-used.
2.) R.S. Means 2010 Building Construction Cost Data used as a reference unit costing source
3.) Further detailed analysis required.

4. Additional Facility Analysis

In theory, an optimum bus maintenance facility should be built on a site which is level, rectangular, and located within the planned service region. It should be free of environmental contamination and be of an expandable size to accommodate both present needs and any future potential expansion. It should have adequate utility service and be free of neighbors resulting from traffic, noise, and congestion. The best method of selecting and constructing a satisfactory site is to weigh the implications of all available site options prior to deciding the best way to proceed.

Typical elements[1] governing the planning and feasibility of a useful BMF site (theoretically) include:

- Include all stakeholders in the process;
- Establish proper funding protocols;
- Consider both existing and planned service requirements;
- Design towards future expansion;
- Verify adequate utility service;
- Consider traffic loading on surrounding roadways;
- Evaluate applicable building and zoning codes;
- Other.

Bus maintenance facilities are comprised of five primary functional areas[4]. These include general offices, operations areas, repair areas, vehicle storage, and an outside area. In addition, several basic circulation requirements are essential to the proper functioning of the facility. Bus vehicles need ready access from the street to return bus area and simplified access to their service route to initiate scheduled service. Within a given site, buses must be able to circulate through the fueling, cleaning, and washing 'line' every night and then to the repair bays or storage area. Further, employees should be able to circulate readily between general offices, the operations area, and the repair areas.

4.1 Theoretical System Requirements

Based upon the above definition, JAI has compiled a theoretical tabulation of space and size appropriations for functional BMF areas. It is critical to note that this is a theoretical guideline based upon an 'average' BMF in an 'average' location anywhere within the U.S. Table: 'Functional Area Size Guidelines' describes industry standard space and size allocation averages[4,5].

TABLE
Functional Area Size Guidelines

Element	Area Required		
Spare Parts Room	10	S.F.	Per bus
Maintenance Storage	3	S.F.	Per bus
Administrative Services[1]	750	S.F.	Lot
Admin. Services Interior Circulation	15%	of Subtotal	
Dispatcher	4	S.F.	Per bus
Operator Break Room	17	S.F.	Per bus
Operator Locker/Restroom	11	S.F.	Per bus
Operations Interior Circulation	10%	of Subtotal	
Bus Repair Bay	86	S.F.	Per bus
Machine & Electrical Repair	46	S.F.	Per bus
Tire Repair & Storage	5	S.F.	Per bus
Paint & Body Area	64	S.F.	Per bus
Cleaning/Washing	2000	S.F.	Lot
Maintainer Locker/Restroom	3	S.F.	Per bus
Bus Parking	504	S.F.	Per bus (40')
Vehicle Circulation	15%	of Subtotal	
Notes [1]Private offices, transportation supervisor, maintenance supervisor, office manager, other.			

5. Additional Capacity Analysis

Table: 'New Facility Functional Area Quantity Requirements' defines the theoretical space requirements necessary to expand the bus vehicle fleet by up to 20 additional hybrid bus vehicles.

TABLE
New Facility Functional Area Quantity Requirements

Element	Total Area Required (S.F.)		
	Specified Fleet (35 Buses)	35 Buses + 10 Additional Hybrids	35 Buses + 20 Additional Hybrids
Spare Parts Room	350	450	550
Maintenance Storage	105	135	165
Administrative Services[1]	750	750	750
S/T	1205	1335	1465
Admin. Services Interior Circulation	181	200	220
Dispatcher	140	180	220
Operator Break Room	595	765	935
Operator Locker/Restroom	385	495	605
S/T	1120	1440	1760
Operations Interior Circulation	112	144	176
Bus Repair Bay	3010	3870	4730
Machine & Electrical Repair	1610	2070	2530
Tire Repair & Storage	175	225	275
Paint & Body Area	2240	2880	3520
Cleaning/Washing	2000	2000	2000
Maintainer Locker/Restroom	105	135	165
Bus Parking	17640	22680	27720
Vehicle Circulation	2646	3402	4158
Total Square Feet	32,044	40,381	48,719
Notes			
[1]Private offices, transportation supervisor, maintenance supervisor, office manager, other.			

The aforementioned results again depict a 'theoretical' amount of space being required. Neither the current Concessioner Garage nor the proposed Fort BMF affords this ideal amount of space. However, what can be discerned from this comparative analysis is that the addition of 20 more hybrid vehicles to the in-valley shuttle fleet will require approximately 50% more maintenance space and parking. While the proposed Fort BMF does have some future expandability flexibility, adding a 50% magnitude will likely not be realistic in the foreseeable future unless the entire Fort facility were converted to a BMF.

However, it should also be noted that there is no existing single facility within Yosemite Valley which would accommodate a fully expanded fleet. If and when the fleet is expanded to

this larger number of vehicles, further analysis and management involvement will be required to make the right decisions.

5.1 Ability to Integrate Corporate Fleet Maintenance

The current corporate fleet is comprised of in excess of 260 light duty vehicles. Currently, all corporate fleet light duty maintenance is conducted at the Concessioner Garage utilizing primarily the two service lifts which are also shared for Park visitor repair operations. Spare parts inventory and storage are further accommodated within this facility. As the new Fort BMF will also retain the two vehicle lift feature, similar accessibility, and comparable spare parts inventory spatial allocations, the integration of the corporate fleet should be realistic.

6. Conclusions

Based upon the aforementioned analysis, several conclusions and next steps can be drawn, including:

- The conversion of the westerly side of the Yosemite Valley Garage (the 'Fort') west of the existing fire house area to a bus maintenance facility (BMF) for the in-valley shuttle and DNC bus fleets IS feasible and presents no apparent critical barriers or fatal flaws;

- It is clearly advantageous from economic and efficiency perspectives to modify the Fort facility into a BMF and move existing operations as opposed to moving all bus operations to a remote facility (such as in El Portal, CA);

- The existing Concessioner Garage comprises similar functional area and square footage areas relative to that possible within the Fort structure for bus operation and maintenance activities;

- Adequate bus vehicle fleet parking for current fleet (approximately 35 vehicles) is possible on the easterly side of the Fort structure providing all current light duty vehicle parking could be relocated. No space would be available within these confines for additional bus vehicle parking (future system growth) nor any administrative light duty vehicles. As an alternate, existing bus parking within its current location near the Concessioner Garage could be maintained and system operators could be shuttled between bus vehicles and the Fort BMF headquarters facility. Further analysis would be required;

- The current light duty vehicle service capability offered at the Concessioner Garage for Park visitors should not be ignored as it does provide a valuable customer service element for Park patrons. Currently, approximately 60 Park patron service activities are provided weekly at the Concessioner Garage. If structured accordingly, this function could also become a revenue generation source for the NPS. Further analysis should be conducted regarding this topic to evaluate suitable alternatives;

- Adequate capacity is available within the Fort BMF for corporate light duty vehicle service operations. However, parking would be constrained. Upon

examining the current Concessioner Garage, it would appear that parking would likewise be constrained for the corporate light duty vehicle fleet;

- A fire suppression analysis should be conducted given the other uses of the building (such as the detention, fire, and carpentry shops;
- A determination by senior NPS management (after completion of the fire suppression analysis) will need to be made in terms of whether a new full building fire suppression system would be required;
- A concrete core sample analysis and compression test should be conducted to validate strength considerations of the concrete slab floor in the proposed facility;
- A seismic analysis should be conducted to validate re-design functionality and safety of replacing existing facility window structures with roll-up door equipment;
- A geotechnical analysis of the area along the westerly side of the existing concrete retaining wall behind the proposed facility should be conducted to determine potential obstacles to relocation of the retaining wall structure;
- This analysis did not consider the functional or economic impact of relocating specific existing operations and facilities (such as the Roads and Trails group or vehicle parking). Further analysis would be required of these elements if desired;
- Expanding the fleet by another 20 hybrid in-valley shuttle bus vehicles cannot be accommodated within what is currently being considered for the Fort BMF as there is simply not enough building or parking space. When the time comes to expand the fleet by 20 (or more) vehicles, it is suggested that further evaluation be considered of converting the entire Fort facility to become a BMF and/or move some of the shuttle operations to the NPS base in El Portal;
- Considering the above, further planning consideration should be allocated to conducting a limited 'sensitivity' analysis in terms of potential noise and visual impacts to adjoining facilities (adjoining the Fort facility) and increased potential traffic flow on Village Drive;

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