

# **SCHOOL BUS MAINTENANCE FACILITY PLANNER**

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## Foreword

A recent study found that, of all the various modes of transportation used by students in the United States to get to and from school, the yellow school bus is by far the safest. Only two percent of student deaths in school-related traffic accidents are accounted for by bus trips, whereas 25% of the total trips to and from school are by school bus. A large part of keeping the school bus a safe mode of transportation for students takes place in and around the school bus maintenance facility. In North Carolina 14,000 school buses were carrying students to and from school in 2010. The maintenance program implemented by the transportation directors and their staff requires properly designed facilities to care for these buses. This publication serves as a source of information for the professional designers, architects, and engineers who will design these facilities and oversee their construction. We hope it will be helpful in the effort to keep the school children of North Carolina safe as they travel to and from school.



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# INTRODUCTION

- State Board of Education policy TCS-H-005 addresses school bus inspections, preventive maintenance and vehicle replacements. The Transportation Services Section of the School Support Division of the N.C. Department of Public Instruction's publication entitled "N.C. Bus Fleet: North Carolina School Transportation Fleet Manual" can be referred to for a full explanation of this program at this web address: [www.ncbussafety.org](http://www.ncbussafety.org).
- Each vehicle within a school system is usually assigned to a specific mechanic.
- It is recommended that a school system have one bus maintenance garage for each 250 buses (active route buses) or fraction thereof. Anything larger than this can be inefficient and cumbersome. A school system with a greater number of buses should have more than one garage. **The recommendations within this publication assume that no individual garage will serve more than 250 buses**
- Of course, the decision on how many buses a garage will serve will be made by the individual LEA and will be based on economic and need factors.
- General Statute 115-C248(a) requires that all active school and activity buses be inspected each 30 calendar days (when school is in session).
- The overall preventive maintenance program relies heavily on the 30-day inspection.
- It is recommended that all service pickups, fuel trucks, wreckers and tire trucks also be inspected every 30 days.
- Bus Servicing frequency:
  - new buses pre-delivery inspection
  - preventive maintenance: 5,000-mile intervals
  - annual N.C. State inspection (D.M.V.)



# **SCHOOL BUS GARAGE PLANNING TEAM**

Each team should include:

- board of education/superintendent representative
- architect
- engineer

Also involve school personnel who will represent various users.

- transportation administration
- technicians (mechanics)
- dispatchers
- supervisors
- clerks

In early stages:

Consider involvement of other governmental agencies.

- may be able to share this facility with local government
- may be able to share this facility with adjacent county school systems

Visit several school bus maintenance facilities in other school systems of similar size.

## **SITE**

Adequate bus parking areas:

- buses awaiting service
- activity buses
- secure daily and / or summer storage of school buses:
  - route buses
  - spare buses (available for use)
  - surplus buses (awaiting sale)

Security fence around entire site

Parking for other vehicles:

- local service trucks
- fuel tankers
- wrecker
- vans
- bus driver, staff and visitor vehicles

Min. site size recommendations:

<u>No. of buses</u>	<u>Useable Acres</u>
150	12

## **GENERAL REQUIREMENTS**

- The 2009 North Carolina Building Code classifies a Motor Vehicle Repair Garage as “Storage Group S-1”, Moderate-hazard storage.
  - Maximum allowable quantities of hazardous materials are listed in Table 307.1(1) (See Section 406.6).
  - Garages shall be ventilated per the North Carolina Mechanical Code. The ventilation system shall be controlled at the garage entrance.
  - Heating equipment: Should be placed in another room with 2-hour fire rated separation, entrance from outside only or by vestibule with a two doorway separation between the mechanical room and the garage area. Exceptions: (1) Unit heaters suspended a minimum of 8’ above garage floor are acceptable. (2) A one-door separation is allowed if the sources of ignition in the appliance are at least 18” above the floor. The preferred method of heating is an indirect system. A heating appliance with an open flame is prohibited in the garage area. In the administration area, a separate air conditioning system should be used that serves only this area. The recommended system is a split system heat pump with the indoor air handling unit in a mechanical room. Other split system arrangements or single-package systems can also be used. Fresh air meeting code requirements should be introduced into the system at the return air side of the air handling unit. This serves to create a positive pressure in this area with respect to other areas of the building.
  - Concrete floors
- NFPA 101, Life Safety Code classifies a repair garage to be a “Special-purpose industrial occupancy.”
  - Automatic sprinkler protection, installed in accordance with the requirements of NFPA 13, shall be provided if a one-story repair garage exceeds 12,000 sf in floor area (Section 903, N.C. Fire Code).
- OSHA requires that the office areas have a positive air pressure.

## **TRANSPORTATION PERSONNEL/SPACES NEEDED**

- Director of Transportation:
  - Overall responsibility for school bus transportation system
  - Area: 150-200 sf
- Maintenance Supervisor/Shop Foreman (recommended when school system has 100 or more active route buses):
  - Supervise garage personnel
  - Make up daily work schedule
  - Area: Varies, 150 sf minimum

- Receptionist/Secretary:
  - Typical receptionist and secretarial duties
  - In small systems may also do a combination of several jobs, including dispatcher, cost clerk, etc.
  - Area: 150-200 sf minimum
- Waiting: 200-300 sf: less in very small systems
- TIMS Data Technician:
  - Input data for the Transportation Information Management System, a comprehensive computer-assisted school bus routing and scheduling system
  - Area: 150-200 sf
- Cost Clerk:
  - Keying in data regarding fueling of vehicles, other cost information
  - Filing related paperwork
  - Area: 100-150 sf
- Parts Person:
  - Overseeing the parts storage room, issuing parts to mechanics and keeping up with the related paper work
  - Office may be a separate room (100-150 sf) or a part of the parts storage room near the pass window
- Dispatcher:
  - Field phone calls, make sure routes are staffed, maintain communication with drivers (2-way radio or cell phones)
  - May need extra help fielding phone calls at beginning of school year
  - Possible additional duties: Routing, scheduling field trips, handling discipline problems
  - Area: 100-150 sf
- NOTE: For smaller school systems containing only two or three persons total within the administrative office area of a school bus garage, many of the above functions will need to be done by only one or two people and require less total square footage.
- In larger school systems, office space for area supervisors may be needed for those persons who are the liaison for the transportation department, the schools and the public. Individual offices of 120sf minimum is recommended.
- Work Room:
  - Separate room containing photocopying machine, FAX and other equipment, used jointly by administrative staff
  - Area: 100-120 sf
- Technology Closet:
  - Contains routers, hubs, servers, etc. (all offices, the parts storage room office area and the maintenance bay area will require computer and telephone outlets).
- Break Room
  - A break room for mechanics and administrative personnel of sufficient size for seating at tables, a refrigerator, microwave oven, vending machines and some counter top space with a sink is desirable.
  - Size will depend on number of seats, vending machines, etc. desired.

- Conference/Meeting Room:
  - A conference room for presentations/meetings with mechanics, bus drivers, or other groups of 25-30 persons or more is sometimes desired. Some transportation departments prefer not to have to take on the burden of keeping up with the scheduling of this space for system-wide usage and elect to use available space at a conveniently located school or at the central office instead.
  - Meeting room is often the best location for a computer workstation for general use including, but not limited to, on-line training for technicians.
  - Size: varies from 400-850 sf
- Bus Drivers' Facilities:
  - Some school transportation systems are organized such that the drivers come to the transportation department/maintenance facility by private vehicle, park their vehicle in a designated area, get in their assigned bus parked on the premises, drive their bus route, return their bus to the bus lot and then drive home.
  - An office for a driver training supervisor and for lead drivers is desired, as well as a small but functional bus driver lounge/break room
  - It has been suggested that, if bus drivers (accompanied sometimes by their small children) begin and end their bus routes at the bus maintenance facility, their offices, those of the driver training supervisor, etc. on the bus facility site be remote from the bus garage for safety reasons. Bus drivers and their children sometimes loiter around the maintenance bays and can be hurt
- Technicians (Mechanic): \*
  - Analyze and repair driver-reported bus defects on the day he is at the school as scheduled by the shop foreman (repairs that can be done without bringing the bus to the garage)
  - After repairing these bus defects at school, 30-day inspections are initiated
  - On days the mechanic is at the garage: routine preventive maintenance or forced maintenance (unscheduled repairs)
- Fuel Truck Driver: \*
  - Fuel vehicles and do paperwork involved
    - Usually, the buses are fueled by tanker on the school site where the bus is parked awaiting the afternoon trip
    - See "Bus Drivers' Facilities" above for different scenario where buses are fueled while on the bus maintenance facility lot between morning and afternoon trips
  - Check oil, water, tires
  - Under hood observation
  - Other duties, if assigned:
    - Analyze and repair driver-reported bus defects on the day the fuel truck driver is at the school
    - Also help with 30-day inspections while there

\* As described in the "N.C. Bus Fleet: North Carolina School Transportation Fleet Manual" (2006) published by NCDPI, School Support Division, Transportation Services



TIMS OFFICE



TIMS OFFICE



TIMS OFFICE

## **MAINTENANCE BAYS**

One of the key elements to the design of a school bus maintenance facility is “how many maintenance bays will be needed?” Obviously, it has to do with how many route buses a school system has and what is a reasonable number of buses that can be maintained by each mechanic? School systems will usually assign buses and a maintenance bay to an individual mechanic (or mechanic team). Some planning sources recommend as a minimum that a maintenance bay be provided for each 25-30 buses that are being used on the active bus routes. The 2002 average for North Carolina is 15 buses per mechanic position (see Appendix). Of course, it is up to the transportation leadership, within the confines of available funding, to determine what the ratio for their system should be.

- Maintenance bays should be positioned so that each pair of bays that face each other can be “drive-thru” if needed. The mechanics’ tool storage and work cabinet/storage units can be located in the space between the facing buses with a cleared walkway between for the required exit path. Portable cabinetry on lockable castors can then be moved out of the way for a “drive-thru” situation, such as a wrecker bringing a bus into the garage.
- Maintenance bay size: all full-sized school buses are 8’-0” wide, but the lengths vary from a 42-passenger bus 25’-6” long to a 72-passenger bus 39’-11” long (See Appendix). Typical maintenance bays should be 20’x50’ minimum. A maintenance bay having a solid wall on one side should be 24’ wide to allow proper clearance for some procedures (such as pulling rear dual wheels). For the longest (39’-11”) 72-passenger bus, careful attention to placement of tool/storage units and other encroachments on the 50’ length of the maintenance bay will need to be made.
- Maintenance bay height: 18’ clear, minimum (verify with the lift manufacturer)
- Maintenance bay doors: Upward acting roll-up/sectional doors, electrically operated, 12’w x 16’h, insulated and with a vision panel.
- Bollards: 8” steel pipe filled with concrete with a 4’ height above pavement. One near each bay door jamb for protection of building from vehicle damage.
- Concrete apron extending 50’ out from building along bay doors, continuous
- Provide overhead reels above and to the side of each maintenance bay for dispensing oil, anti-freeze, transmission fluid, air and gear lube (see Fluids Room).
- Provide on interior side of the exterior wall of each maintenance bay:
  - one 120v. and one 240v. electrical outlet mounted more than 18” above finished floor
  - duct to exterior for engine emissions exhaust (install a “user-friendly” system to facilitate mechanics’ use of it). If a simple duct to the exterior is not possible, a fan-powered tailpipe exhaust system should be installed.

- Maintenance bay floor: 6" minimum thick, reinforced concrete slab with light-colored pigmented hardener and a clear sealer. Take into consideration any surface-mounted lifts and their design loads that are transferred to the floor slab. Slope floor to drain 1/8" per foot from center of building each way toward trench drains running parallel to the exterior wall. Locate trench drains approximately 5' to 6' inside and away from exterior wall. Run piping from trench drains to approved oil/grease separators discharging into the sanitary sewer (contents of oil/grease separators to be collected and removed from the premises periodically to prevent oil from being carried into the sewer).
- Minimize floor obstructions.
- Monorail and hoist (if desired): one (or two) 2-ton hoist/s overhead to be used for pulling engines, etc. (must be ANSI-approved).
- Hand wash sink/s (semi-circular type that allows several persons to wash simultaneously).
- Emergency shower and eye wash.
- Drinking fountain or water cooler.
- Portable fire extinguishers (50' maximum travel distance to extinguisher per OSHA requirements).
- Aisles in shop must meet exiting requirements and be appropriately marked on the floor in a permanent fashion and kept clear.
- Provide personnel doors to comply with exiting requirements.
- Full spectrum lighting is recommended in maintenance bays.
- Provide one power and data outlet for a computer for each four maintenance bays in the garage area for mechanics' use.
- As a minimum, the space needs to be heated and ventilated. If cooling is desired, it should be a 100% fresh air heating and cooling unit with heat reclaim. Ventilation shall be mechanically powered in accordance with the North Carolina Mechanical Code and shall be controlled at the entrance to the space.

## **Lifts:**

- How many?: One drive-on lift per four maintenance bays, minimum.
- Additional lifts may be needed to satisfy frequency of maintenance/inspections.
- Two basic types of lifts: in-ground and surface-mounted:
  - In-ground lifts are not recommended for school bus garages because they are more expensive and are a potential soil/groundwater contamination hazard. The positive aspects of in-ground lifts are that they allow the most flexibility of the use of the maintenance bay in which they are located, since all floor obstructions can be gotten out of the way. They also have high load capacities and provide greater access to the underside of a vehicle. Also, some manufacturers advertise that their in-ground units have solved the potential environmental issue of leaking oil by providing an underground sealed steel "box". The first cost and installation expenses are still the most important characteristics that are on the negative side.
  - Surface-mounted lifts have lower initial cost, can be moved/relocated, are environmentally friendly (no fluid below ground). The concrete floor slab must be designed for the operational weight of the surface-mounted lift and its load. Outboard columns sometimes get in the way of external areas of the vehicle. Four post lifts require a large footprint area in the shop.

- Lifts must meet American National Standards Institute (ANSI) requirements.
- Warranty: Is the service rep nearby? Or is the supplier just a mail order company?
- 98% of automotive lifts in the United States are electric/hydraulic.



Maintenance Bays: Buses facing each other (drive-thru type configuration)



Maintenance Bays: Overhead reels



Maintenance Bays:  
Handwashing basin



Maintenance Bays:  
Emergency shower &  
eyewash



Maintenance Bays: Engine emissions exhaust port and trench drain



Maintenance Bays Exterior Entrances: Bollards & engine emissions exhaust port

## Pits

- N.C. Department of Public Instruction, School Planning and Transportation Services Sections do not recommend pits. In lieu thereof, use drive-on, surface-mounted lifts because they are safer and less expensive
- If the decision to use pits is made, safety requirements of the North Carolina Fire Code, Electric Code, NFPA and OSHA must be met, including the following:
  - Sliding pit cover, or similar device to prevent falls when pit is not in use
  - Proper egress in two directions, kept clear of obstructions at all times
  - Good lighting
  - Pits are classified as a hazardous location by the North Carolina Electrical Code and explosion-proof electrical devices are required because of the likelihood of the presence of heavier-than-air flammable fumes.
  - NFPA 30A requires an individual ventilating system capable of providing (1.0 cu.ft. per minute per sq.ft. with exhaust air taken from within 12" of pit floor.) The North Carolina Fire Code and Mechanical Code says 1.5 cu.ft. per minute per sq.ft.).
  - NFPA also requires that in a sloped pit floor with a floor drain, piping must carry any liquids through an oil separator before being discharged into the sanitary sewer
- Provide a used oil/antifreeze handling system.



Maintenance bay with lubrication pit

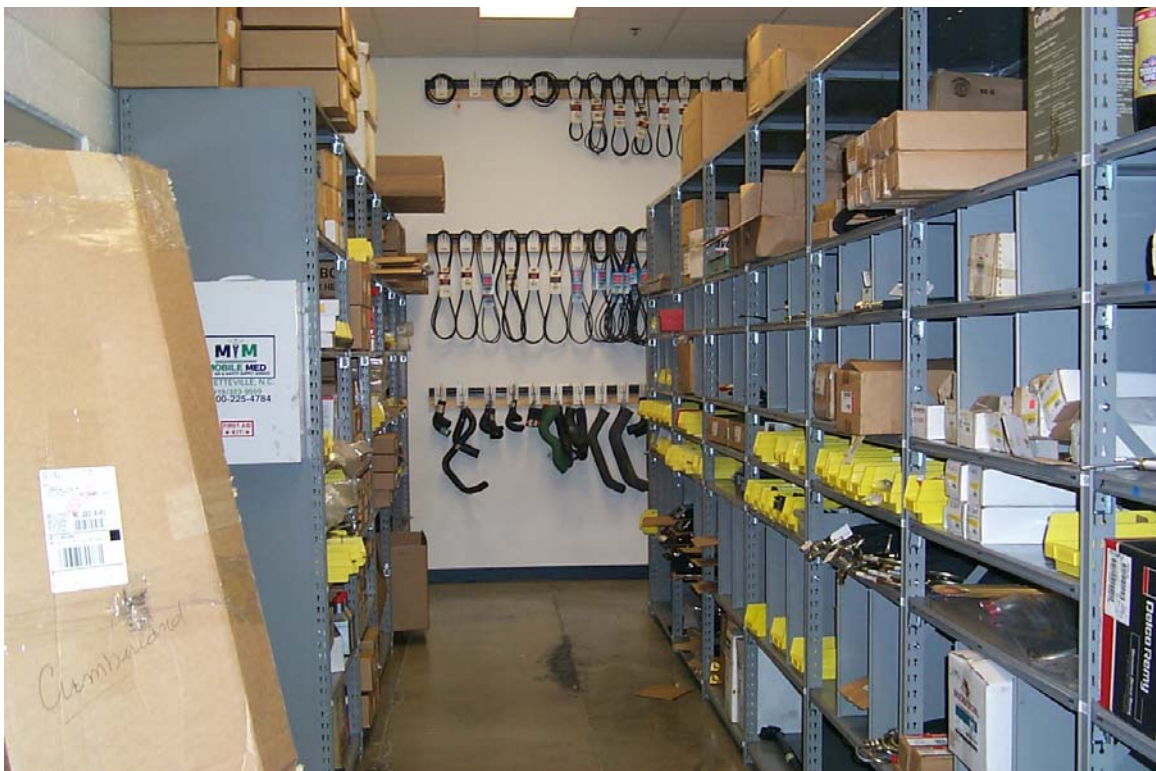
## **PARTS STORAGE/DISPENSING ROOM**

- Located convenient to maintenance bay areas
- \* Size will vary from 600 to 1000 sq. ft., depending on the number of route buses a system has (assuming serving a maximum of 250 route buses for any one bus garage) and whether or not quick access to parts delivery can be used to reduce inventory
- A counter with windows for parts pick-up (or dutch door for small systems)
- Space for parts person to do paper work or other duties assigned
  - Can be separate office, if desired (100-150 sq.ft. is included in recommended area above for office functions)
- Varying types of metal shelving to suit inventory. Some deep shelving for large items are needed but excessively deep shelving is wasteful. Less deep shelving, some with drawers, should be provided for small things
- At least one pair of doors to the maintenance bay area for the passage of large items.
- A split system heating and cooling system should be provided for this space. The system could serve only this space or could also serve other spaces such as toilet/locker spaces so long as the zoning requirements are compatible. Appropriate ventilation will be introduced at the return side of the air handling unit.

\* Some school systems may elect to not restrict their bus garage to serve a maximum of 250 buses and the size of the parts room will be larger than the 600 to 1000 sf recommended here.



**Parts Storage Room: Parts Window**



**Parts Storage Room**

## **BODY SHOP BAY**

- 20' x 50' (minimum)
- Located conveniently to paint spray bay
- In addition to heavier body repair operations, this is the space in which preparations are made before spray painting is done.
- As a minimum, the space needs to be heated and ventilated. If cooling is desired it should be a 100% fresh air, heating and cooling unit with heat reclaim. Ventilation shall be mechanically powered in accordance with the North Carolina Mechanical Code and shall be controlled at the entrance to the space.



Body Shop Bay

## **PAINT SPRAY BAY**

- Paint Spray Bay: not classified in “H” occupancy (NCSBC 307.1.3 and 416)
  - Considered “Incidental Use” and would be classified “S-1” in repair garage requiring 1-hour fire separation in fully-sprinklered building (NCSBC 508.2.1)
- Size: 30’x50’
- A paint spray bay is recommended when a school system has 100 or more route buses. Smaller systems may want to share this function.
- Pre-fabricated spray booth constructed with approved non-combustible materials (aluminum not to be used) within the paint spray bay is recommended.
- Independent exhaust duct system (not constructed of aluminum) discharging to the outside per the North Carolina Mechanical Code and the North Carolina Fire Code.
- Explosion-proof electrical wiring, devices and equipment, approved by the North Carolina Electrical and Fire Codes, are required to be used in such hazardous locations as paint spray booths and near their entry doors.
- Metal parts of the paint spray booth, exhaust ducts and piping systems are to be electrically grounded per North Carolina Electrical and Fire Codes.
- An interior space should be provided for preparation of the bus for entering the paint spray booth, not an exterior space nor the spray booth itself (see “Body Shop Bay”).
- Means of egress door from pre-manufactured spray booths shall be 36” wide x 80” high (minimum) and shall comply with NFPA 101 and the North Carolina Building Code.
- 2 methods for painting school buses are generally being used:
  - compressed air: provides quality finish but results in excessive overspray
  - electrostatic: electrically charged paint particles with reduced overspray
- Portable fire extinguisher/s per section 906 North Carolina Fire Code and OSHA
- Metal lockers for storage of spray-finishing employees’ clothing, if left on premises overnight
- Metal waste cans for rags or other waste impregnated with finishing material
- Separate flammable storage room or approved cabinets (See “Flammable Storage/Mixing Room” following).
- NFPA 33, among other things, requires the following:
  - Spray booths shall be separated from other operations by a minimum distance of 3 feet or by a partition, wall, or ceiling assembly having a minimum fire resistance rating of one hour.
  - An automatic fire extinguishing system (sprinklers) is required in the paint spray booth and mixing room per NFPA 13. Overspray residue protection per chapter 9 of NFPA 33 shall be provided the sprinkler heads for proper operation.
  - Maintain 3’ wide clear space, kept free of any storage or combustible construction, on all sides of spray booth for cleaning. (Can be located closer to or directly against interior partition, wall, exterior wall or roof assembly if it has a minimum 1-hour fire-rating, provided the spray booth can be adequately maintained and cleaned.)
  - Ventilation and exhaust systems shall comply with the applicable requirements of NFPA 91.
  - The intake for clean make-up air shall be located so that air exhausted from spray operations is not recirculated.
  - Air exhausted from spray operations shall be conducted directly to the outside of the building, but not through any fire wall. Minimum distances of the exhaust discharge as further listed from

exterior walls, roofs, and combustible construction shall be maintained (see Codes & Standards requirements outlined in the latter portions of this publication.)



Paint Spray Bay/Booth



Back of Paint Spray Booth

### **FLAMMABLE STORAGE/MIXING ROOM (for paint booth)**

- Storage, handling, and mixing of flammable and combustible liquids shall meet all applicable requirements of NFPA 30 and NFPA 33.
- NFPA 33 requires, among other things:
  - Dispensing or transfer of liquids from containers, mixing of liquids, and filling of containers, including portable mixing tanks shall be done only in a mixing room or in a spray area.
  - Mixing rooms shall be designed to contain a spill of the contents of the room
  - Mixing rooms shall have continuous mechanical ventilation (1 cfm of air movement per sq. ft. minimum or 150 cu.ft. per minute, whichever is greater.)
  - Dispensing and mixing rooms shall be classified electrically the same as enclosed spray booths (4.3.4)
  - An automatic fire protection system per chapter 9, NFPA 33 is required
  - Portable fire extinguishers: located in accordance with NFPA 10.
  - Mixing rooms: 150 s.f. (maximum size).



Flammable Storage/Mixing Room



Flammable Storage/Mixing Room: Exhaust system (note sprinkler head)

## **WASH BAY**

- Per the “N.C. Bus Fleet: North Carolina School Transportation Fleet Manual” (2006) published by the N.C. Department of Public Instruction, School Support Division, Transportation Services Section:
  - Clean buses are a part of a good maintenance program.
  - Engine washing and battery compartment cleaning is to be done at 12,000 mile intervals.
  - Service vehicles are to be cleaned inside and out once a month (minimum).
  - Used batteries are to be washed before recharging or storage in battery room.
  - All tires and wheels to be repaired are to be washed before being taken to the tire shop.
- Provide one wash bay (minimum).
- Size 24’x50’
- Wash bay can be open on three sides with a roof and located at the end of the building; as a “shed-type” bay if desired.
- Provide a sloped floor (1/4” per foot, minimum) to drain, which discharges into an oil separation device where oil can be periodically removed from the premises and keep it from flowing into the sanitary sewer.
- Consider a water recovery system.

## **FLUIDS ROOM**

- Contains fluids such as oil, antifreeze 50/50 mix, windshield washer fluid, transmission fluid, gear lube, etc. usually in 55 gallon drums or larger containers (250 and/or 1000 gal), fitted with a pump on top, from which the liquids are forced into overhead piping leading to the maintenance bays reels
- The fluids room should be located away from the administration offices area of the building.
- The fluids room shall be mechanically ventilated per Section 2704 of the N.C. State Fire Prevention Code and installed according to the N.C. State Mechanical Code.
- Spill containment (recommended by School Planning whether or not required by Building Code or other standards): By providing a liquid-tight curb or by depressing the floor such that the volume of containment will equal the volume of a spill from the largest container. If a sprinkler system is provided for fire protection, the volume of the spill containment shall include a 20-minute flow of the fire protection water as well. Provide a sump and sloped floor (1/8"/ft. minimum) to facilitate collection.
- Portable fire extinguisher per Section 906 N.C. State Building Code: Fire Prevention Code and OSHA
- The fluids room, is classified as "S-1 Occupancy" per North Carolina Building Code.
- Any storage shelving shall be braced and anchored in accordance with the seismic design requirements of the North Carolina Building Code.
- Concrete masonry walls
- The following classifications of Flammable and Combustible Liquids can be found in NFPA 30A Annex "B":

Antifreeze	IIIB
Brake Fluid	IIIB
Chassis grease	IIIB
Crankcase drainings	IIIB
*Diesel Fuel	II
*Gasoline	IB
Gear Lubricant	IIIB
Lubricating oils	IIIB
Power steering fluid	IIIB
Transmission fluid	IIIB
Windshield washer fluid	
Methanol/water mixture:	
100% methanol	IB
50% methanol/50% water	IB
29% Methanol/71% water	II
20% methanol/80% water	II
5% methanol/95% water	IIIB

- Maximum allowable quantities of each liquid listed above allowed within a control area (1-hour or more fire-rated separated area) are listed in the N.C. State Fire Prevention Code, table 2703.1.1(1) (see the excerpt from this table in the Codes and Design Standards outline later in this publication)
- Area: 200-500 sf

**\*Diesel fuel and gasoline will not normally be located in the fluids room of a bus garage**



Fluids Room: Storage drums with pumps to overhead reels system

## **TIRE REPAIR ROOM**

- This room is where tires are broken down, repaired, re-mounted on rims, etc.
- The tire storage room is required to be a separate room from the tire repair room.
  - The North Carolina Building Code requires that the tire storage room be separated by fire-rated construction from the remainder of the garage.
- Portable fire extinguisher per Section 906 North Carolina Fire Code and OSHA
- Area: 450-700 sf
- Provide an OSHA-approved tire inflation cage.
- As a minimum, the room shall be heated and ventilated. Ventilation shall be in accordance with NFPA 91.
- Cooling of the space is optional.



Tire Repair Room: Balance Machine



Tire Repair Room: Breakdown Machine



Tire Repair Room: Mounting Machine



Tire Repair Room (Adjacent): Tire inflation cage

## **TIRE STORAGE ROOM**

- Locate tire storage room adjacent to parts room and tire repair breakdown room.
- Tire storage room is to be a separate room from the tire repair room (see fire separation requirement below).
- Store tires sitting up-right on treads (if tires are laid flat, the beads won't space properly on the rim when inflating) only one tire high, and with simple, intermittent pipe or angle vertical braces to help keep tires in place.
  - Bus tires weigh over 100 lbs each, even without rims (see next item!!).
- North Carolina Fire Code may require tire storage rooms above 500 sq.ft. to be sprinklered. (see Table 2306.2).
  - This requirement will only apply for "High-Piled Combustible Storage", defined for rubber tires as stored in racks or other configurations exceeding 6 feet in height (see North Carolina Fire Code, Chapter 23, page 216).
- Some school bus garages store used tires awaiting retreading in enclosed trailers on site, sometimes provided by the re-treading contractor.
- Portable fire extinguisher per Section 906 North Carolina Fire Code and OSHA
- Tire storage shall comply with Chapter 25 "Tire Rebuilding and Tire Storage" in the North Carolina Fire Code.
- North Carolina Building Code: Tire storage is classified as "Moderate-hazard storage, Group S-1."
  - Requires fire-rated separation from remainder of garage
- Area: 300-800 sf



Tire Storage Room

## **BATTERY ROOM**

- The room where battery charging is done must be separated from the remainder of the building by fire-rated construction because fumes from flammable or combustible liquids can be present. Maintenance bays or other like areas are classified as “class I locations” by the North Carolina Electrical Code (up to 18” above finish floor)
- Mechanically ventilate the battery room per the requirements of Section 608 of the North Carolina Fire Code and Section 502 of the North Carolina Mechanical Code to prevent a dangerous accumulation of flammable gases.
- Area: 100-300 sf
- Provide proper shelving for battery storage that doesn’t promote gradual leaking of the charge (do not store batteries directly on the concrete floor).
- Used batteries should be washed and cleaned properly before being placed in the battery room for recharging or storage
- Eye wash



Battery Room

## **MACHINE/WELDING ROOM**

- Room separate from the main maintenance bays area specifically for rebuilding or repairing transmissions, differentials, cylinder heads, engines (out of the chassis), etc.
  - Some school systems contract out engine and transmission repair and rebuilding.
- Classified as F-1 occupancy by the North Carolina Building Code.
- Handle and store gas cylinders per OSHA's requirements.
- Provide portable fire extinguisher/s per the North Carolina Fire Code (within 30 feet of where "hot" work is done).
- Periodic scrubbing and hosing out is needed.
  - Provide floor drain piped to oil/water separator and minimum 1/8" per foot sloped floor.
- Area: 350-1000 sf
- As a minimum, the room shall be heated and ventilated. Cooling of the space is optional.
- A countertop welding booth with powered exhaust is recommended.

## **STORAGE**

- Storage for major components and sub-assemblies replaced by stock units such as transmissions, engines, differentials, alternators, governors, starters, solenoid switches, brake cylinders, carburetors, etc. awaiting future rebuilding needs a designated area.
  - Storage of the above items convenient to the machine room where they will be rebuilt is desirable.
- Some bulky, light-weight items such as tailpipes, salvaged bus parts, etc., can be stored above the parts room.
  - OSHA requires a fixed plate with the maximum floor load information on it for structural floors.
  - Good access to this mezzanine area is needed to facilitate the handling of bulky items.
- Area: 500-1500 sf

Machine  
Shop





Storage



Storage

## **TOILETS/LOCKERS/SHOWERS**

- Provide toilets per the requirements of the North Carolina Building Code, North Carolina Plumbing Code, North Carolina Mechanical Code and ADA.
- Locker and shower rooms for mechanics:
  - Hard, durable finishes that allow easy clean-up and continued, long-term sanitary conditions are a must. These areas will not be used unless they are well maintained.
- NFPA 30A Motor Fuel Dispensing Facilities and Repair Garages (9.7.9.4) require metal lockers for employees' clothing.
- Heating and cooling should be provided by a split-system air conditioning unit.
- The spaces shall be exhausted/ventilated in accordance with the North Carolina Mechanical Code.

## **FUEL DISPENSING STATION**

- Fuel tanker trucks are usually filled at the bus garage site and then driven out to the buses for refueling as the buses are parked on the school grounds or at other locations between the morning and afternoon bus trips.
- Fuel dispensing stations shall be stand-alone/remote from the bus garage itself. Provide cover for inclement weather protection.
- North Carolina State Building Code classifies fuel dispensing stations as Group H-3.
- The North Carolina Fire Code requires, among other things:
  - Portable fire extinguishers not more than 75' from pumps, dispensers or storage tank fill-pipe openings
  - Dispensing devices locations:
    - 10 ft minimum from property line
    - 10 ft from a building having non-combustible exterior wall surfaces that are not a part of a 1-hour fire resistant-rated assembly (except canopies constructed per NCSBC for weather protection for fuel islands)
    - Such that all portions of the vehicle being fueled will be on the premises of the fuel dispensing station
    - Such that the nozzle, when the hose is fully extended, will not reach within 5 feet of building openings
    - 20 ft minimum from fixed sources of ignition
  - Emergency disconnect switch located within 100 ft (but not less than 20 ft) from the fuel dispensers
  - Underground and above-ground motor fuel storage tanks shall comply with Chapter 34 of the North Carolina Fire Code.
  - Minimum separation requirements for the above-ground tanks shall comply with Table 2206.2.3, Chapter 22.
  - Above-ground tanks containing motor fuels shall not exceed 12,000 gallons in individual capacity or 48,000 gallons in aggregate capacity.
  - Spill control: prevention of liquids spilled during dispensing operations from flowing into buildings. Grading of paved areas, raising of door sills, or other approved means can be used.
  - Bollards (guard posts) shall be provided to protect above-ground tanks from impact by motor vehicles. (Minimum per section 312, North Carolina Fire Code)
  - Design, construction and general installation of tanks shall comply with NFPA 30.
- OSHA: 1910 General Industry Standards: Comply with Table H-19 Electrical Equipment Hazardous Areas – Service Stations
- North Carolina Department of Public Instruction, School Support Division; Transportation Services Section recommends a minimum motor fuel storage capacity as follows:

gasoline\_\_\_\_\_10,000 gallons

diesel\_\_\_\_\_ 20,000 gallons (up through 300 route buses)  
30,000 gallons (more than 300 route buses)

including one shop pump for each fuel type and one bulk pump for diesel

- The North Carolina school bus fleet became 100% diesel in 1999 (bulk gasoline is not being loaded anymore).
- Concrete paving should occur around the dispensing station.



Bulk Fueling  
Station



Above-Ground Fuel Storage Tanks

SUGGESTED SPACES AND AREAS PER BUS GARAGE						
	Number of Route Buses					
<b>Minimum Number Recommended per Garage</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>200</b>	<b>250</b>	<b>Remarks</b>
Number of Maintenance Bays	4	7	10	12	13	Bay 20'x50' = 1000 sf (+ 4 bays@ 24'x50') Note #1
Paint Spray Bay	0	1	1	1	1	Bay 30'x50' = 1500 sf Note #2
Body Shop Bay	0	1	1	1	1	Bay = 20'x50' = 1000 sf
Wash Bay	1	1	1	1	1	Bay = 24'x50' = 1200 sf
<b>Administrative Spaces</b>	<b>Area (square feet)</b>					
Director of Transportation	150	150	150	200	200	
Maintenance Supervisor/Shop Foreman	0	150	150	150	150	Note #3
Receptionist/Secretary	350	150	150	200	200	Note #4
Waiting		225	250	275	300	Note #4
TIMS Data Technician	200	150	170	185	200	Note #4
Cost Clerk		100	120	150	150	Note #4
Dispatcher		100	120	150	150	Note #4
Work Room	100	100	100	120	120	
Technology Closet	60	60	60	80	80	
Break Room	150	200	250	300	350	
Conference/Meeting Room	400	500	600	700	800	Note #6
<b>Maintenance Spaces</b>						
Maintenance Bays	4,800	7800	10,800	12,800	13,800	Note #1
Parts/Storage/Dispensing	600	700	800	900	1,000	Includes office space of 100-150 s.f.
Paint Spray Bay	0	1,500	1,500	1,500	1,500	
Flammable Storage/Mixing Room	0	150	150	150	150	For paint spray booth
Wash Bay	1,200	1,200	1,200	1,200	1,200	

	Number of Route Buses					
	50	100	150	200	250	Remarks
<b>Maintenance Spaces (continued)</b>	<b>Area (Square Feet)</b>					
Fluids Room	200	275	350	425	500	
Tire Repair Room	450	500	575	650	700	
Tire Storage Room	300	350	525	700	800	
Battery Room	100	150	200	350	300	
Machine/Welding Room	350	500	675	850	1,000	
Storage	500	750	1,000	1,250	1,500	
Body Shop Bay	0	1,000	1,000	1,000	1,000	
<b>Sub-Totals (net area)</b>	9,910	16,710	20,845	24,150	26,100	Note #4
<b>Net x 1.35 (gross area)</b>	13,379	22,559	28,141	32,603	35,235	Note #4,5

#### NOTES:

1. End maintenance bays adjacent to walls should be 24' wide.
2. It is recommended that a prefabricated paint spray booth be constructed within the paint spray bay (rather than building a "paint spray room").
3. It is recommended that a maintenance supervisor/shop foreman be provided in school systems with 100 or more route buses.
4. For school systems with the smaller numbers of route buses, administrative positions may be combined, resulting in a reduction of number of individual rooms and total square footage.
5. Toilets, shower and locker areas are included in the 1.35 multiplier, as are mechanical rooms, corridors and wall thicknesses.
6. Some school systems elect not to have a conference room at the bus garage but, instead, use a space at the central office or a nearby school for this function.
7. Square footages for the canopy over the fuel dispensing station or for weather protection of the wrecker are not included in this space matrix, but they are recommended.

## **AGENCIES FOR REVIEWS, PERMITS AND APPROVALS**

- North Carolina Department of Insurance (NCDOI), Office of State Fire Marshall: compliance with the North Carolina State Building Code
- Local Fire Marshall
- Local Building Inspector
- Local Ordinances
- North Carolina Department of Environment and Natural Resources (NCDENR) See Appendix
- North Carolina Department of Public Instruction, Division of School Support, School Planning Section

## **CODES AND DESIGN STANDARDS**

The following outline of various codes' and standards' requirements for repair garages is not intended to be a complete and comprehensive list of what may be applicable to any school bus maintenance facility project. Instead, it is an attempt to highlight some of the major issues that will arise. Hopefully, this information will be helpful in the design process. **KEEP IN MIND, HOWEVER, THAT CODES AND DESIGN STANDARDS MAY CHANGE OVER TIME.** You will note that in some instances codes and standards will conflict. The most stringent will need to be followed. Local building officials and/or the North Carolina Department of Insurance, Office of the State Fire Marshall, may be needed to resolve some conflicts.

Note:

Reference to the International Codes includes those codes with North Carolina Amendments.

## **2009 NORTH CAROLINA BUILDING CODE (2006 International Building Code with North Carolina Amendments)**

### Chapter 3 Use and Occupancy Classification

Section 302 classification

Section 303 Assembly Group A

Section 304 Business Group B

Section 306 Factory Group F

- 306.2 Factory Industrial F-1 Moderate-hazard occupancy
  - Tire repair, machine/welding room, body shop bay

Section 307 High-Hazard Group H

- Table 307.1(1): maximum allowable quantity per control area of hazardous materials posing a physical hazard (see also Table 2703.1.1(1) in Chapter 27 of the N.C. Fire Code, outlined in the next portion of this publication)
- 307.1 Exceptions: Buildings that contain not more than the maximum allowable quantity per control area per Table 307.1(1) shall not be classified in Group “H”.
  - Paint spray rooms / booths conforming to the requirements of Section 416 of the North Carolina Building Code and the North Carolina Fire Code shall not be classified in Group “H” (307.1.3)

Section 311 Storage Group S

- 311.2 Moderate-hazard storage, Group S-1
  - Motor Vehicle repair garages not exceeding maximum quantities of hazardous materials in table 307.1(1); Tire Storage, Parts Room, Storage Room and Maintenance Bay area will be classified S-1 occupancy.

### Chapter 4 Special Detailed Requirements Based on Use and Occupancy

#### Section 406 Motor-Vehicle Related Occupancies

406.5 motor Fuel dispensing facilities

- must comply with North Carolina Fire Code
- canopies = clear, unobstructed height of not less than 13’-6” in vehicle drive-thru area made of non-combustible materials

406.6 Repair Garages

- Repair garages constructed per North Carolina Fire Code, for motor fuel-dispensing facilities, See Section 406.5.
- Mixed uses are allowed in the same building as a repair garage, subject to Section 508.3 requirements.
- Garages to be mechanically ventilated per North Carolina Mechanical Code
- Ventilation system to be controlled at garage entrance
- Floors: concrete
- Heating equipment: placed in another room with fire-rated separation (verify number of hours with type of system); entrance outside or by vestibule with 2 door separation except: single interior door okay if ignition source is 18” minimum above floor

#### Section 413 Combustible Storage

- concealed spaces used for storage of combustible materials: protected on storage side with one-hour fire-resistant construction (Exception: areas protected by automatic sprinkler system)
- openings protected with self-closing 1 ¾" solid core wood doors (Exception: areas protected by automatic sprinkler system)

#### Section 414 Hazardous Materials

- Ventilation per North Carolina Fire Code and North Carolina Mechanical Code
- Manual shut-off control for ventilation equipment outside of principal access to the room. Switch shall be break-glass type with label as required.

#### Section 416 Application of Flammable Finishes

- Shall comply with the North Carolina Fire Code.
- Provide automatic fire-extinguishing system installed per Chapter 9 in paint spray rooms.

#### Section 508 Mixed Use and Occupancy

- 508.2 Incidental Uses: Separated and/or protected per Table 508.2.
  - Hydrogen cut-off rooms not classified as Group H (Battery rooms): 1-hour in Groups B, F and S occupancies.
  - Paint shops not classified as Group H: 1-hour separation and provide automatic fire extinguishing system.
  - Storage rooms over 100 sf: 1-hour separation or provide automatic fire-extinguishing system.
- 508.3 Mixed Occupancies
  - 508.3.1 Accessory Occupancies: Individually classified per Section 302.1. max. area of aggregate Accessory occupancies limited to 10% of area of the floor on which they occur and shall not exceed values in Table 503. No separation required between accessory occupancies or main occupancy (except H-2 and H-3 occupancies shall be separated from all other occupancies per Section 508.3.3).
  - 508.3.2 Non-separated Occupancies: Individually classified per Section 302.1 and allowable area and height per Section 503.1. No separation required between occupancies (except H-2 and H-3 occupancies shall be separated from all other occupancies per Section 508.3.3).
  - 508.3.3 Separated Occupancies: Individually classified per Section 302.1 and allowable area and height per Section 508.3.3.2 and 508.3.3.3 respectively. Individual occupancies separated from adjacent occupancies per Table 508.3.3.

# **2009 NORTH CAROLINA STATE BUILDING CODE: FIRE PREVENTION CODE (2006 INTERNATIONAL FIRE CODE WITH NORTH CAROLINA AMENDMENTS)**

## **CHAPTER 9: FIRE PROTECTION SYSTEMS**

### Section 903 Automatic Sprinkler Systems

- All Group “H” occupancies require automatic sprinkler systems (903.2.4.1)
- A repair garage or other Group “S-1” occupancy, if fire area exceeds 12,000 sf, will require automatic sprinkler system (903.2.8)
- Additional required fire-extinguishing systems: see Table 903.2.13.

### Section 906 Portable Fire Extinguishers

- Fire extinguishers selected, installed and maintained in accordance with this section and NFPA 10
- Maximum travel distance to extinguishers per table 906.3(1) or 906.3(2)
- Height above floor per 906.9

### Section 907 Fire Alarm and Detection Systems

## **CHAPTER 15: FLAMMABLE FINISHES**

### Section 1503 Protection of Operations

- Electrical wiring and equipment must comply with North Carolina Electrical Code (Explosion-proof where required).
- Grounding of all metal parts of spray booths, exhaust ducts and piping systems is required.
- Storage, use and handling of flammable and combustible liquids must comply with Chapter 34.
- Metal waste cans with self-closing lids are required for rags or waste impregnated with finishing material.

### Section 1504 Spray Finishing

- Spray booth design and construction must comply with this section and NFPA 33.
- Spray booth shall be constructed of non-combustible materials (aluminum not to be used).
- Means of egress per Chapter 10.
- Spray booth installed so that all parts of the booth are readily accessible for cleaning.
- Clear space of not less than 3 feet shall be maintained on all sides of the spray booth (kept free of any storage or combustible construction).

### Exceptions:

- This requirement shall not prohibit spray booths closer than 3 feet to or directly against an interior partition, wall or floor/ceiling assembly if that construction is rated 1 hour minimum (provided the spray booth can be adequately maintained and cleaned).

## **2009 NORTH CAROLINA STATE BUILDING CODE: FIRE PREVENTION CODE WITH NORTH CAROLINA AMENDMENTS (CONTINUED)**

- Nor shall it prohibit closer than 3 feet to an exterior wall or roof assembly provided they are constructed of non-combustible materials and provided the spray booth can be adequately maintained and cleaned.
- Individual spray booth in a building: maximum size = 1500 sf (1504.3.2.6)
- Mechanical ventilation of spraying areas must comply with Section 510 of the North Carolina Mechanical Code.
- Air exhausted from spraying operations shall not be recirculated.
- Exhaust duct-termination points:
  - 30 ft. min. away from property line
  - 10 ft. min. from openings into the building
  - 6 ft min. from exterior walls and roofs
  - 30 ft. min. from combustible walls or openings into the building which are in the direction of the exhaust discharge
  - 10 ft. min. above adjoining grade
- Spray booths shall be protected by an approved automatic fire- extinguishing system complying with Chapter 9.
  - residue accumulation protection for sprinklers per 1504.5.2

## **2009 NORTH CAROLINA STATE BUILDING CODE: FIRE PREVENTION CODE WITH NORTH CAROLINA AMENDMENTS (CONTINUED)**

### **CHAPTER 22: SERVICE STATIONS AND REPAIR GARAGES**

#### Section 2203 Location of Dispensing Devices

- 10 ft. minimum from property lines
- 10 ft. from a building having non-combustible exterior wall surfaces that are not part of a 1-hour fire resistant rated assembly (except canopies constructed per NCSBC for weather protection for fuel islands)
- Such that all portions of the vehicle being fueled will be on the premises of the fuel dispensing station
- Such that the nozzle, when the hose is fully extended, will not reach within 5 feet of building openings
- 20 ft. minimum from fixed sources of ignition
- Emergency disconnect switch located within 100 ft. (but not less than 20 ft.) from the fuel dispensers is required

#### Section 2205 Operational Requirements

- Spill control: prevention of liquids spilled during dispensing operations from flowing into buildings. Grading of paved areas, raising of door sills, or other approved means can be used.
- Portable fire extinguishers per Section 906 shall be located not more than 75' from pumps, dispensers or storage tank fill-pipe openings.

#### Section 2206 Flammable and Combustible Liquids

- Underground tanks and above-ground tanks shall comply with Chapter 34.
- Minimum separation requirements for above-ground tanks shall comply with Table 2206.2.3., Chapter 22.
- Above-ground tanks shall not exceed 12,000 gallons in individual capacity or 48,000 gallons in aggregate capacity. (Approved vault protection of these tanks will allow the individual capacity to be increased to 15,000 gallons).
- Guard posts (bollards) shall be provided to protect above-ground tanks from impact by motor vehicles, minimum per Section 312, North Carolina Fire Code.
- Above-ground tanks shall be provided with drainage control or diking in accordance with Chapter 34.
- Fuel dispensing systems design, fabrication and installation shall be in accordance with 2206.7.

## **2009 NORTH CAROLINA STATE BUILDING CODE: FIRE PREVENTION CODE WITH NORTH CAROLINA AMENDMENTS (CONTINUED)**

### **CHAPTER 22: SERVICE STATIONS AND REPAIR GARAGES (CONTINUED)**

#### **Section 2211 Repair Garages**

- Repair garages shall comply with this section and the North Carolina Building Code.
- Where a repair garage also includes a service station, the fuel dispensing operation shall comply with the requirements of this chapter for service stations.
- The storage and use of flammable and combustible liquids shall comply with Chapter 34 and Sections 2211.2.1 thru 2211.2.4.
- Waste oil, motor oil and other Class IIIB liquids shall be stored in approved tanks or containers which are allowed to be in and dispensed from repair garages.
- Tanks storing Class IIIB liquids in repair garages are allowed to be located at, below or above grade, provided that adequate drainage and containment are provided.
- Crankcase drainings shall be classified as Class IIIB liquids and shall not be dumped into sewers, streams or upon the ground but shall be stored in approved tanks or containers in accordance with Chapter 34 until removed from premises.
- Garage floor drains shall drain to approved oil separators or traps discharging to a sewer in accordance with the North Carolina Plumbing Code. Contents of the oil separators, etc., shall be collected at sufficiently frequent intervals to prevent oil getting into sewer.
- Self-closing metal cans shall be used for oily waste.
- Sources of ignition shall not be located within less than 18" above the floor and shall comply with Chapters 3 and 26.
- Appliances and equipment installed in a repair garage shall comply with North Carolina Building Code, North Carolina Mechanical Code and the North Carolina Electrical Code.
- Below grade work areas and pits shall comply with the following:
  - constructed in accordance with the North Carolina Building Code
  - means of egress in accordance with Chapter 10
  - ventilated per North Carolina Mechanical Code: minimum rate of 1.5 cu.ft./min. per sq.ft.
- Cleaning of parts shall be conducted in listed and approved parts cleaning machines in accordance with Chapter 34.

# **2009 NORTH CAROLINA STATE BUILDING CODE: FIRE PREVENTION CODE WITH NORTH CAROLINA AMENDMENTS (CONTINUED)**

## **CHAPTER 23: HIGH-PILED COMBUSTIBLE STORAGE**

### Section 2302 Definitions

- High-piled combustible storage includes rubber tires where the top of storage exceeds 6 feet in height.

### Section 2303 Commodity Classification

- High-piled rubber tires are considered “high-hazard commodities.”

### Section 2306 General Fire Protection and Life Safety Features

- Table 2306.2 may require high-piled tire storage rooms exceeding 500 sf to have an automatic fire extinguishing system.

## **CHAPTER 25 TIRE REBUILDING AND TIRE STORAGE**

### Section 2509 Indoor Storage Arrangement

- Where tires are stored on tread, the dimension of the pile in the direction of the wheel hole shall not exceed 50 ft.
- Tires stored adjacent to or along one wall shall not extend more than 25’ from that wall.

## **CHAPTER 26: WELDING AND OTHER HOT WORK**

### Section 2601 General

- Welding and other hot work to be done only in designated area.
- Compressed gas cylinders shall comply with this chapter and Chapter 30.

### Section 2604 Fire Safety Requirements

- Partitions segregating hot work areas from other areas of the building shall be non-combustible and prevent passage of sparks, slag and heat from the hot work area

## **CHAPTER 27: HAZARDOUS MATERIALS-GENERAL PROVISIONS**

### Section 2701 General

- Flammable and combustible liquids are classified as “physical hazards.”

### Section 2703 General Requirements

- Maximum allowable quantity of hazardous materials per control area are shown in Table 2703.1.1(1). See the following excerpt.

**2009 NORTH CAROLINA STATE BUILDING CODE: FIRE PREVENTION CODE  
WITH NORTH CAROLINA AMENDMENTS (CONTINUED)**

**Table 2703.1.1(1) (Excerpt)**

**MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS  
POSING A PHYSICAL HAZARD**

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE	USE- CLOSED SYSTEMS	USE-OPEN SYSTEMS
			LIQUID GALLONS	LIQUID GALLONS	LIQUID GALLONS
Combustible Liquid	II	H-2 or H-3	120 d,e	120d	30 d
	IIIA	H-2 or H-3	330 d,e	330 d	80 d
	IIIB	N/A	13,200 e, f	13,200 f	3,300 f
Flammable Liquid	I-B	H-2 or H-3	60 d,e	60 d	15 d

**NOTES:**

- a. For use of control areas, see section 2703.8.3.
  - d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where note “e” also applies, the increase for both notes shall be applied accumulatively.
  - e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, exhausted enclosures or safety cans. Where note “d” also applies, the increase for both notes shall be applied accumulatively.
  - f. Quantities shall not be limited in a building equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
- 2703.1.3 The storage, use and handling of hazardous materials in amounts not exceeding the maximum allowable quantity per control area indicated in Table 2703.1.1(1) shall be in accordance with Sections 2701 and 2703 of Chapter 27.
  - 2703.1.4 The storage, use and handling of hazardous materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 2703.1.1(1) shall be in accordance with all applicable sections of Chapter 27.
  - Installation of above-ground and underground tanks shall comply with Chapter 34.

## **2009 NORTH CAROLINA STATE BUILDING CODE: FIRE PREVENTION CODE WITH NORTH CAROLINA AMENDMENTS (CONTINUED)**

### Section 2704 Storage

- Spill control: Storage of hazardous material liquids in individual vessels having more than 55 gal. Capacity, or in which the aggregate capacity exceeds 1,000 gal. Spill control is required for both interior and exterior locations.
- Liquid-tight sloped or recessed floor or raised or recessed sills.
- Sumps and collection systems or other engineered systems.
- Capacity of spill control device = volume of largest single container it serves plus the volume of automatic fire protection water for a 20 minute flow period. (Section 2704.2.2.3.)
- The slope of floors to drains shall be not less than 1%.
- Provide mechanical exhaust ventilation as required by this section and the International Mechanical Code.

## **CHAPTER 34 FLAMMABLE AND COMBUSTIBLE LIQUIDS**

### Section 3402 Definitions

- Liquid storage room: classified as H-3 occupancy (**only if quantity of hazardous materials exceeds that in Table 2703.1.1(1)**); room used for storage of flammable or combustible liquids in closed condition

### Section 3403 General Requirements

- Electrical equipment Class I locations: Table 3403.1.1

### Section 3404 Storage

- Design, fabrication and construction of tanks shall comply with NFPA 30 and Section 3404.

## **NFPA 30A MOTOR FUEL DISPENSING FACILITIES AND REPAIR GARAGES**

### Chapter 4: Storage of Liquids

- Above-ground tanks and underground tanks shall be in accordance with Section 4.3.
- Table 4.3.2.4: minimum separation requirements for aboveground tanks
- 4.3.2.5: The 12,000 gallon tank capacity shall be increased to 20,000 gallons for a “fleet” vehicle motor fuel dispensing facility.
- 4.3.2.6: No minimum separation is required between the dispensing device and a tank in a vault, a protected tank or a fire-resistant tank for a “fleet” dispensing facility
- Above-ground tanks (except those in vaults) shall be provided with spill control per NFPA 30.
- Vaults shall be designed and constructed per 4.3.3.
- Fire-resistant tanks shall be per 4.3.4.
- Protected tanks shall be per 4.3.5.
- 4.3.7: Physical protection for all outside aboveground tanks
  - Guard posts for tanks subject to vehicular damage
    - 4” diameter minimum filled with concrete
    - 4’-0” o.c. maximum
    - 3’0” minimum deep concrete footing with 15” minimum diameter
- 4.3.9 Storage of Liquids Inside Buildings
  - Class IIIB liquids storage quantity shall not be limited.
  - Class IIIB liquids stored in and dispensed from tanks and containers that meet Chapter 9 and Chapter s 21 thru 23 of NFPA 30
  - Class IIIB tanks inside buildings shall be permitted at, below, or above grade.
  - Tanks or containers containing only crankcase drainings shall be considered Class IIIB.

### Chapter 5: Piping for Liquids

### Chapter 6: Fuel Dispensing Systems

- Provide an emergency electrical disconnect at an approved location but not less than 20’ or more than 100’ from the dispensing system it serves.

### Chapter 7: Building Construction Requirements

#### 7.4 Repair Garages

- Occupancy classification: “special purpose industrial occupancy” per NFPA 101, Life Safety Code
- Means of egress per NFPA 101, Life Safety Code

## **NFPA 30A (CONTINUED)**

- Floors are to be of non-combustible materials, liquid-tight and sloped to floor drains which are properly trapped and which discharge through an oil/water separator to the sewer or to an outside vented sump.
- Pits, below-grade work areas and subfloor work areas
  - Walls, floor, structural supports: masonry, concrete, steel or other approved non-combustible materials
  - Number, location and construction of means of egress shall conform to: “Special purpose industrial occupancies “ Chapter 40, NFPA 101, Life Safety Code.
  - Shall be exhausted continuously: minimum 1 cf/min./sq.ft. of floor area. Exhaust air taken from a point within 12” of the floor
- Automatic sprinkler protection per NFPA 13 is required in a repair garage if it exceeds 12,000 sf.
- Forced-air heating, air conditioning and ventilating systems serving repair garages shall not be inter-connected with any such systems serving other occupancies in the building. Such systems shall comply with NFPA 90A.
- Return air openings in areas of repair garages used for servicing or repair of vehicles shall be not less than 18” above the floor (measured to bottom of openings).
- Combined ventilation and heating systems shall not recirculate air from areas that are below grade level.
- Exhaust duct openings shall be located so that they effectively remove vapor accumulations at floor level from all parts of the floor area.
- Heat-producing appliances shall be installed in accordance with Section 7.6, and the requirements of NFPA 90A, NFPA 31, NFPA 54, NFPA 211. and NFPA 82 as applicable.

### **Chapter 8: Electrical Installations**

- Electrical installations shall comply with Chapter 8 and NFPA 70.
- Electrical equipment classified areas for motor fuel dispensing facilities are shown in Table 8.3.1.

### **Chapter 9: Operational Requirements**

- The bulk delivery vehicle shall be located so that all parts of the vehicle are on the premises when delivery is made to a tank
- The number of tanks or containers of Class IIIB liquids (not exceeding 120 gallons) fitted with a dispensing pump for dispensing at one time and located inside, shall not be limited
- Portable fire extinguishers: located within 100 ft of each pump, storage tank fill pipe opening and lubrication service room (North Carolina Fire Code says 75 feet). Comply with NFPA10.
- Crankcase drainings and waste liquids shall not be dumped into streams, sewers or on the ground. They shall be stored in approved tanks or containers in accordance with Chapters 4 and 5 until removed from premises.
- The contents of oil separators and traps of floor drainage systems shall be collected often enough to keep oil out of the sewer.

### **NFPA 30A (CONTINUED)**

- Repairing of motor vehicles shall be restricted to areas specifically provided for such purposes
- Operations involving open flame or electric arcs shall be restricted to areas specifically provided for such purposes and shall comply with NFPA 51B.
- Electric arc welding shall comply with NFPA 70.
- Gas fusion welding and storage of cylinders shall comply with NFPA 51.
- Spray painting shall comply with NFPA 33.
- Storage and handling of flammable and combustible liquids shall comply with NFPA 30.
- Clear aisle space for access to and use of fire-fighting equipment shall be maintained.
- Provide metal lockers for employees' clothes.
- Metal receptacles with self-closing covers shall be provided for storage or disposal of oil-soaked waste or cloths.
- Covered metal receptacles for combustible rubbish shall be provided and their contents shall be removed daily.
- Vapor processing and vapor recovery systems shall comply with Chapter 10.

#### **Annex "B" – Classifications of Flammable and Combustible Liquids:**

Gasoline	IB
Diesel Fuel	II
Antifreeze, brake fluid, chassis grease,	IIIB
Crankcase drainings, gear lubricant,	IIIB
Lubricating oils, power steering fluid,	IIIB
Transmission fluid	IIIB
Windshield washer fluid (Methanol/water mixture):	
100% Methanol	IB
50% Methanol/50% water	IB
29% Methanol/71% water	II
20% Methanol/80% water	II
5% Methanol/95% water	IIIB

## **NFPA 33: SPRAY APPLICATION USING FLAMMABLE OR COMBUSTIBLE MATERIALS**

### Chapter 5: Construction and Design of Spray Areas, Spray Rooms, and Spray Booths

- Aluminum shall not be used for structural support members or the walls or ceiling of a spray booth enclosure nor for any interior components.
- Aluminum shall not be used for ventilation ductwork associated with a spray booth.
- Enclosed spray booths shall be provided with means of egress that meet the requirements of NFPA 101, Life Safety Code.
- Spray booths shall be separated from other operations by 3 ft. min. distance or by wall or floor/ceiling assembly having 1 hour fire rating minimum.
- Spray booths shall be installed so that all parts of the booth are readily accessible for cleaning.
- A clear space of 3 feet shall be maintained on all sides of the spray booth. This clear space shall be kept free of any storage or combustible construction.
  - Exception: Spray booth can be closer than 3 feet or directly against interior wall or floor/ceiling assembly with minimum 1-hour fire rating if spray booth can be maintained and cleaned.

### Chapter 6: Electrical and Other Sources of Ignition

- Electrical wiring and utilization equipment shall meet applicable requirements of Articles 500, 501, 502 and 516 of NFPA 70, North Carolina Electrical Code and this chapter.

### Chapter 7: Ventilation

- Ventilation and exhaust systems shall meet applicable requirements of NFPA 91 and this chapter.
- Mechanical ventilation shall be kept in operation at all times while spray operations are being conducted and for a sufficient time afterward to allow vapors to be exhausted.
- An adequate supply of clean make-up air should be provided, the in-take for which shall be located so that air exhausted from spray operations is not recirculated.
- Exhausted air from spray operations shall be carried by ducts directly to the outside, without penetrating any fire walls.
- Exhaust discharge shall be directed away from any fresh air intakes.
- Exhaust duct discharge point shall be minimum 6 feet from any exterior wall or roof.

### Chapter 8: Storage, Handling, and Distribution of Flammable and Combustible Liquids

- Storage, handling, and mixing of flammable and combustible liquids shall meet all applicable requirements of NFPA 30 and, at process areas, shall also meet the requirements of this chapter.

### **NFPA 33** (CONTINUED)

- Dispensing or transfer of liquids from containers, mixing of liquids and filling of containers shall be done only in a mixing room or spray area.
- The mixing room shall be constructed per the requirements of Section 5.1.
- Mixing room: maximum 150 sf.
- The mixing room shall be designed to contain a spill of the contents of the room.
- Continuous mechanical ventilation shall be provided in the mixing room (1 cf/min./sq.ft. (minimum) of floor area or 150 cu.ft. per minute, whichever is greater).
- Mixing rooms shall be electrically classified the same as spray booths.
- Mixing room shall have an approved automatic fire protection system (per requirements of Chapter 9).
- The mixing room shall have a portable fire extinguisher per NFPA 10.
- Maximum quantities of liquid allowed in spray booth and mixing room per Chapter 8.

#### Chapter 9: Protection

- An approved automatic fire protection system per applicable requirements of this chapter and NFPA 13 shall be provided for spray booths (extra hazard occupancies).

**NFPA 51/NFPA 51B**: Welding and cutting shall comply with applicable requirements of these standards.

## **2008 NORTH CAROLINA STATE ELECTRICAL CODE**

### Article 511: Commercial Garages, Repair and Storage

- Proper electrical equipment, wiring and devices are required in Class I locations.
- Battery chargers and their control equipment, and batteries being charged, shall not be located within locations classified in 511.3.

## **OSHA General Industry Standards 2010**

### 1910.22 General Requirements

- permanent aisles and passageways shall be appropriately marked
- covers and/or guardrails shall be provided to protect personnel from the hazards of open pits, etc.
- storage areas with structural floor: approved design floor loads must be shown on a plate securely affixed in a conspicuous place

### 1910.23 Guarding floor and wall openings and holes

- protection using railings and toe boards described in detail

### 1910.23 Fixed Industrial Stairs

- locations where required and design details described

### 1910.106 Flammable and Combustible Liquids

- Requirements for the storage and usage of Class IA, IB, IIA, IIB, IIIA and IIIB flammable/combustible liquids are discussed in detail.
- Fuel dispensing station requirements

### 1910.107 Spray finishing using flammable and combustible materials

- spray booth requirements

### 1910.157 Portable fire extinguishers (for use by employees)

- Class A fires: location of fire extinguishers: employee travel distance = 75 ft. maximum
- Class B fires: location of fire extinguishers: employee travel distance = 50 ft maximum

### 1910.177 Servicing multi-piece and single-piece rim wheels

- Tire inflation cage required
- Requirements related to the process of tire inflation/deflation; mounting/demounting

### 1910.251 through 1910.255 Welding, cutting and brazing

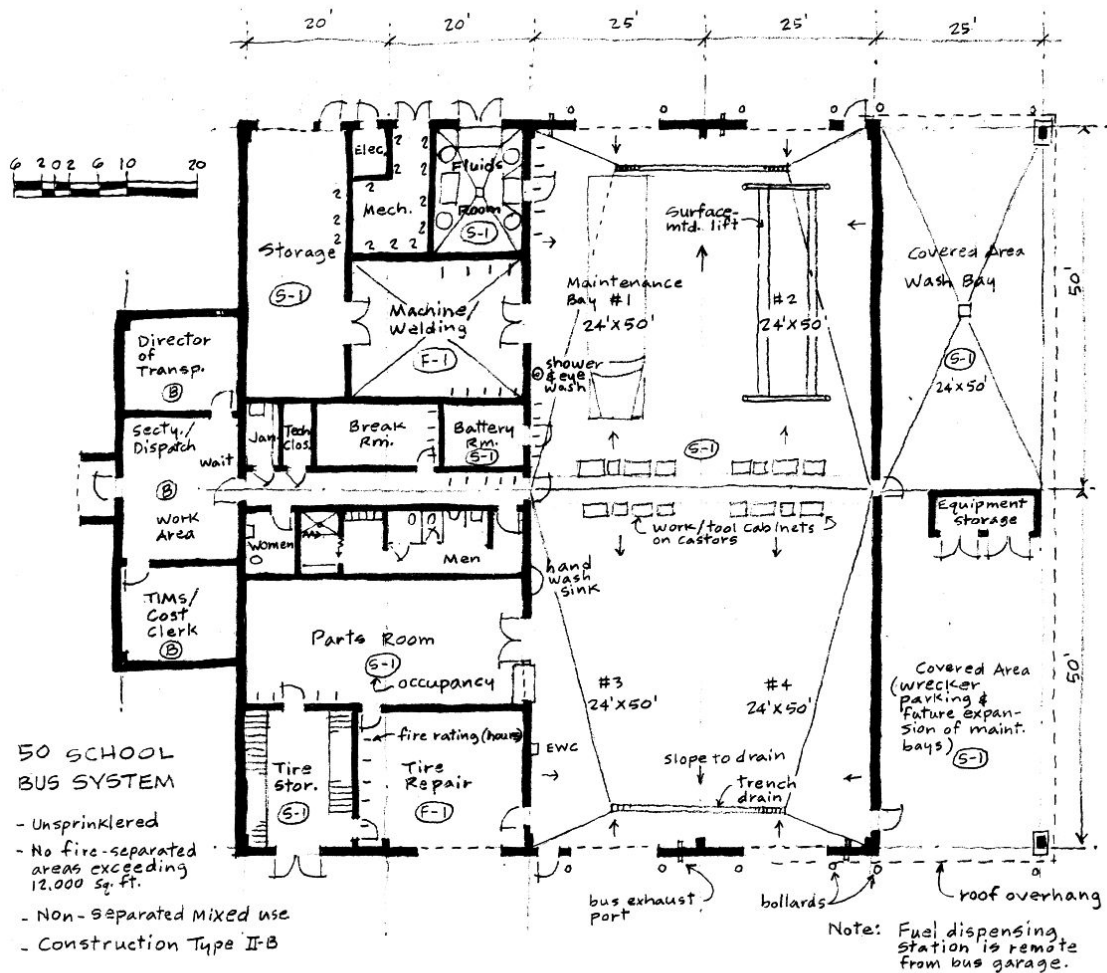
### 1910.306 Specific Purpose Equipment and Installations

## **APPENDIX**

## FLOOR PLANS

The following floor plans serve to supplement and clarify written descriptions and are not intended for direct replication for a specific project. Actual school bus garage designs will relate to the present and anticipated needs, as determined by the owner.

### Small School System (50 buses)



[illegible]

250 SCHOOL BUS SYSTEM

Scale: 0 20 10 20

Notes:

- Fully sprinklered (including roof overhang @ right end)
- Fire area over 12,000 sq ft
- Non-Separated mixed use

## Number of North Carolina School Buses Per County (2010)

Number of Active Route Buses	Number of North Carolina Counties*
25 and below	8
26-50	16
51-100	28
101-150	19
151-200	9
201-250	10
251-300	3
313	1 (Johnston)
321	1 (Union)
371	1 (Forsyth)
467	1 (Cumberland)
629	1 (Guilford)
905	1 (Wake)
1155	1 (Mecklenburg)

One North Carolina school system has as few as 12 buses and one as many as 1155

*\*Counties having more than one LEA are counted as one in the above chart.*

### **OTHER VEHICLES:**

- Activity buses
- One service truck/20-25 buses is the general rule.
  - fuel trucks
  - wreckers
  - tire trucks
  - pick-ups
  - vans

### **BUSES**

Seating Capacity	Overall Length	Turning Radius
41-42	25'-6" – 26'-6"	22'-9" – 27'-8"
53-54	30'-4"	28'-6" – 30'-9"
65-66	35'-2" – 35'-6"	33'-5" – 35'-1"
71-72	37'-6" – 39'-11"	36'-7" – 39'-0"
75 (rear engine bus)	36'-6" – 37'-8"	35'-2" – 39'-2"
All buses: maximum width = 8'-0" (9'-6" max, tip-to-tip of mirrors)		
Tallest Bus: 10'-8" high		

**\*\*SCHOOL BUS GARAGE**

**SHOP EQUIPMENT**

It is recommended that all school bus garages be equipped with the following minimum equipment. Additional equipment may be required for your operation.

QUANTITY	TYPE OF EQUIPMENT
1	Headlight aligner, complete set
1	High pressure washer
1	Ignition tester, electronic
2	Impact wrenches ½” and ¾” or 1”
8	Jack safety stands, heavy duty
3	Jacks, hydraulic or air (minimum 10 ton)
1	Key machine
1	Kunrl machine (valve guide repair)
1	Masking paper dispenser
1	Metal cutting shears
1	Metal lathe (engine lathe)
1	Micrometers and calipers, inside and outside, complete set
1	Milliampere meter (0-150)
1	Paint gun (5 gallon pot with agitator)
2	Paint respirators (OSHA approved)
1	Pin hole grinder
1	Power hacksaw
1	Press, 40 ton
2	Pressure gauges, 1 air and 1 hydraulic
1	Pressurized brake bleeder
1	Radiator temperature gauge
1	Radio system, two way (1 base station, 1 radio station, 1 radio on each service vehicle)
1	Rear axle nut sockets, complete set
1	Ridge reamer
1	Rivet gun, air operated
1	Sander, disc type, heavy duty
1	Sander, orbital
1	Socket set, heavy duty metric and standard
1	Steering wheel puller
1	Tap and die set
1	Timing light, electronic
1	Tire balancer
2	Tire changers, 1 truck and 1 car
1	Tire inflation cage
1	Tire matching gauge

QUANTITY	TYPE OF EQUIPMENT
3	Torque wrenches, 3/8" drive, 1/2" drive and 3/4" or 1" drive
1	Transmission gear lube gun
1	Transmission jack
1	Transmission stand
*	Tread depth gauge, 1 for each man
1	Tune up equipment, complete set (volt/amp tester, ohm meter, timing light, compression tester, rpm gauge, vacuum gauge, combustion analyzer) or preferably
1	Engine analyzer
1	Pro-link 9,000 or equal (electronic test unit)
1	Brake drum and rotor gauge

***\*Each mechanic shall have a battery terminal puller and battery terminal spreader***

***\*\*As recommended in the publication "N.C. Bus Fleet: North Carolina Transportation Fleet Manual" by the North Carolina Department of Public Instruction, School Support Division, Transportation Services Section***

**N.C. DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES (NCDENR)**

School bus maintenance facilities may need the environmental permits as follows. Please note that this list is very general and thus a specific facility may only need a portion of the permits included here.

The current NCDENR Environmental Handbook can be found at the following link:

<http://portal.ncdenr.org/web/csc/permits/category> (click on “permits”)

The following chart illustrates the changes to the permit information previously published in the 2003 version of “School Bus Maintenance Facility Planner”

***NC DENR Permits Then and Now***

PREVIOUS PERMIT TITLE LISTED IN DPI GUIDANCE FROM 2003	PERMIT TITLE LISTING UNDER THE CURRENT NCDENR ENVIRONMENTAL PERMITS HANDBOOK
1. Division of Land Resources – Land Quality Section	Erosion and Sedimentation Control
2. Division of Water Quality-Water Quality Section (DWQ-WQS)	NPDES Permits (National Pollutant Discharge Elimination System)  NPDES Permits (National Pollutant Discharge Elimination System)-Stormwater Permits  System Wide Wastewater Collection System Permit  Wastewater Treatment Systems Operator Certification
Wastewater Discharged to Publically Owned Treatment Works	System Wide Wastewater Collection System Permit
Gravity Sewer Line	Authorizations to Construct (ATC)  Authorizations to Construct (ATC)-Fast Track Dechlorination  System Wide Wastewater Collection System Permit  Alternate Sewer Extensions
Stormwater Discharge to Surface Waters (NPDES)	NPDES Permits (National Pollutant Discharge Elimination System)-Stormwater Permits
Disturbance (dredge/fill activities) to waters/wetlands	401 Water Quality Certification  Section 404 (Federal)  Isolated Wetlands / Non 404 Jurisdiction Permits
Development in Water Supply Watershed	Buffer Authorizations
3. Division of Water Quality-Groundwater Section	Well Contractors Certification  Well Construction Permit  Geothermal Cooling and Heating  Residuals Management

PREVIOUS PERMIT TITLE LISTED IN DPI GUIDANCE FROM 2003	PERMIT TITLE LISTING UNDER THE CURRENT NCDENR ENVIRONMENTAL PERMITS HANDBOOK
3. Division of Water Quality-Groundwater Section	Wastewater Irrigation Systems Reclaimed Water Systems Monitoring Wells and Recovery Wells In-Situ Groundwater Remediation High-Rate Infiltration Systems Closed Loop Recycle Systems Groundwater Remediation: Non-Discharge Groundwater Remediation Systems (Other than those that use Injection Wells)
4. Division of Water Resources	Interbasin Transfer Certification Water Withdrawal and Transfer Registration
5a. Division of Environmental Health-Public Water Supply Section	Location and Protection of Public Water Supply Sources Public Water Supply Operating Permit Water Supply System Plans and Specifications Approval
5b. Division of Environmental Health-Onsite Wastewater Section	On-site Water Protection Section/Local Health Departments Subsurface Wastewater Disposal Permit
(No Entry)	Water Impoundment Permit (Public Health Pest Management Section)
6. Division of Air Quality	Greenfield Air Permit (Non-Prevention of Significant Deterioration / New Source Review)

PREVIOUS PERMIT TITLE LISTED IN DPI GUIDANCE FROM 2003	PERMIT TITLE LISTING UNDER THE CURRENT NCDENR ENVIRONMENTAL PERMITS HANDBOOK
6. Division of Air Quality (continued)	<p>New Source Review Air Permit (Prevention of Significant Deterioration/Non-Attainment Areas/New Source Review)</p> <p>Open Burning Permit for High Hazard Counties</p> <p>Open Burning Permit for Non-High Hazard Counties</p> <p>Special Open Burning Permit-Ground Clearing for High Hazard Counties</p> <p>Non-Title V Permit Modification (Non-Prevention of Significant Deterioration/New Source Review)</p> <p>Tax Certification for Air Pollution Control Equipment</p> <p>Title V Permit Modification (Non-Prevention of Significant Deterioration/New Source Review)</p> <p>Small / Synthetic Minor Air Permit</p> <p>Transportation Facility Permit</p>
Small / Synthetic Minor Air Permit	Small / Synthetic Minor Air Permit
Emergency Generator-General Air Permit	General Air Permit
<p>7. Division of Waste Management-Hazardous Waste Section (DWM-HWS)</p> <p>Hazardous Waste Generation and/or Transport</p> <p>Hazardous Waste Treatment Storage or Disposal</p>	<p>Construction and Demolition Landfill Permit</p> <p>EPA Identification Number Requirements for Generators of Hazardous Waste (EPA Form 8700-12)</p> <p>EPA Identification Number Requirements for Transporters of Hazardous Waste (EPA Form 8700-12)</p> <p>Hazardous Waste Management Permit</p> <p>Hazardous Waste Post-Closure Permit</p> <p>Hazardous Waste Research Development and Demonstration Permit (RD &amp; D)</p> <p>Incinerator Permit</p> <p>Industrial Landfill Permit</p>

PREVIOUS PERMIT TITLE LISTED IN DPI GUIDANCE FROM 2003	PERMIT TITLE LISTING UNDER THE CURRENT NCDENR ENVIRONMENTAL PERMITS HANDBOOK
7. Division of Waste Management-Hazardous Waste Section (DWM-HWS) (Continued)	<p>Land Clearing and Inert Debris Landfill Permit</p> <p>Land Clearing Debris Treatment and Processing Notification (T &amp; PN)</p> <p>Scrap Tire Hauler Registration</p> <p>Resource Conservation Recovery Act (RCRA) Permit Information</p> <p>Septage Detention and Treatment Facility Permit (SDTF)</p> <p>Septage Land Application Site Permit (SLAS)</p> <p>Septage Management Firm (Permit to Operate A)</p> <p>Solid Waste Composting Permit (SWC)</p> <p>Solid Waste Treatment and Processing Permit (T &amp; P)</p> <p>Tax Certification of Recycling and Resource Recovery Equipment and Facilities</p> <p>Tire Monofill Permit</p> <p>Treatment and Processing Facility Permit</p> <p>Yard Waste Notification Form (YWN)</p>
8. Division of Waste Management-Underground Storage Tanks	<p>Operating Permit for Commercial Underground Storage Tanks</p> <p>Petroleum Contaminated Soil Remediation Permit (Non-Discharge)</p>
9. Division of Coastal Management	<p>CAMA General Permit (Coastal Area Management Act)</p> <p>CAMA Major Permit (Coastal Area Management Act)</p> <p>CAMA Minor Development Permit (Coastal Area Management Act)</p> <p>CAMA Federal Consistency Review (Coastal Area Management Act)</p>

## **PHOTOS**

Permission for the use of the photographs taken in the school bus garages was obtained from the respective school systems as follows:

<u>LEA</u>	<u>Remarks</u>	<u>Page Number</u>
Franklin County		6, 7, 24
Mecklenburg County		10, 12, 28, 34
Mecklenburg County	Emergency Shower	11
Mecklenburg County	Tire Inflation Cage	27
Wake County		13, 16, 19, 21
Cumberland County		15, 26, 29, 30, 31
Cumberland County	Handwashing Basin	11
Cumberland County	Tire Mounting Machine	27