NATIONAL COOPERATIVE TRANSIT RESEARCH & DEVELOPMENT PROGRAM

1 Synthesis of Transit Practice

Cleaning Transit Buses: Equipment and Procedures

TRANSPORTATION RESEARCH BOARD
National Research Council

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PETER E. WARD

ATE Management and Service Co., Inc.
Cincinnati, Ohio

Topic Panel

ADRIAN G. CLARY, *Transportation Research Board*
RICHARD GOLEMBIEWSKI, *Detroit Department of Transportation*
J. S. LOE, *Phoenix Transit System*
ROBERT VAN BROCKLIN, *Peninsula Transportation District Commission*
HARVEL WILLIAMS, *Metropolitan Transit Authority*

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Administrators, engineers, and many others in the transit industry are faced with a multitude of complex problems that range between local, regional, and national in their prevalence. How they might be solved is open to a variety of approaches; however, it is an established fact that a highly effective approach to problems of widespread commonality is one in which operating agencies join cooperatively to support, both in financial and other participatory respects, systematic research that is well designed, practically oriented, and carried out by highly competent researchers. As problems grow rapidly in number and escalate in complexity, the value of an orderly, high-quality cooperative endeavor likewise escalates.

Recognizing this in light of the many needs of the transit industry at large, the Urban Mass Transportation Administration, U.S. Department of Transportation, got under way in 1980 the National Cooperative Transit Research & Development Program (NCTRP). This is an objective national program that provides a mechanism by which UMTA's principal client groups across the nation can join cooperatively in an attempt to solve near-term public transportation problems through applied research, development, test, and evaluation. The client groups thereby have a channel through which they can directly influence a portion of UMTA's annual activities in transit technology development and deployment. Although present funding of the NCTRP is entirely from UMTA's Section 6 funds, the planning leading to inception of the Program envisioned that UMTA's client groups would join ultimately in providing additional support, thereby enabling the Program to address a large number of problems each year.

The NCTRP operates by means of agreements between UMTA as the sponsor and (1) the National Academy of Sciences, a private, nonprofit institution, as the Primary Technical Contractor (PTC) responsible for administrative and technical services, (2) the American Public Transit Association, responsible for operation of a Technical Steering Group (TSG) comprised of representatives of transit operators, local government officials, State DOT officials, and officials from UMTA's Office of Technology Development and Deployment, and (3) the Urban Consortium for Technology Initiatives/Public Technology, Inc., responsible for providing the local government officials for the Technical Steering Group.

Research programs for the NCTRP are developed annually by the Technical Steering Group, which identifies key problems, ranks them in order of priority, and establishes programs of projects for UMTA approval. Once approved, they are referred to the National Academy of Sciences for acceptance and administration through the Transportation Research Board.

Research projects addressing the problems referred from UMTA are defined by panels of experts established by the Board to provide technical guidance and counsel in the problem areas. The projects are advertised widely for proposals, and qualified agencies are selected on the basis of research plans offering the greatest probabilities of success. The research is carried out by these agencies under contract to the Academy, and administration and surveillance of the contract work are the responsibilities of the Academy and Board.

The needs for transit research are many, and the National Cooperative Transit Research & Development Program is a mechanism for deriving timely solutions for transportation problems of mutual concern to many responsible groups. In doing so, the Program operates complementary to, rather than as a substitute for or duplicate of, other transit research programs.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to the transit industry. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire transit community, the Urban Mass Transportation Administration of the U.S. Department of Transportation has, through the mechanism of the National Cooperative Transit Research & Development Program, authorized the Transportation Research Board to undertake a series of studies to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on measures found to be successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be useful to transit administrators, maintenance managers, and others concerned with bus cleaning operations. Detailed information is presented on procedures, equipment, and materials used in cleaning transit buses.

Administrators, engineers, and researchers are continually faced with problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated, and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to the available methods of solving or alleviating the problem. In an effort to correct this situation, NCTRP Project 60-1, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common transit problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCTRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific problems or sets of closely related problems.

Transit buses must be clean to be attractive to passengers. Practices used in

cleaning bus interiors and exteriors vary greatly among transit agencies. This report of the Transportation Research Board includes information on equipment and procedures currently used for cleaning buses.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of public transportation agencies. A topic panel of experts in the subject area was established to guide the researcher in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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NOTICE

The project that is the subject of this report was a part of the National Cooperative Transit Research & Development Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council, acting in behalf of the National Academy of Sciences. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the National Academy of Sciences, or the program sponsors.

Each report is reviewed and processed according to procedures established and monitored by the Report Review Committee of the National Academy of Sciences. Distribution of the report is approved by the President of the Academy upon satisfactory completion of the review process.

The National Research Council was established by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the Federal Government. The Council operates in accordance with general policies determined by the Academy under the authority of its congressional charter of 1863, which establishes the Academy as a private, nonprofit, self-governing membership corporation. The Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine. The National Academy of Engineering and the Institute of Medicine were established in 1964 and 1970, respectively, under the charter of the National Academy of Sciences.

The Transportation Research Board evolved from the 54-year-old Highway Research Board. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society.

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Adrian G. Clary, Engineer of Maintenance, Transportation Research Board, assisted the Project 60-1 Staff and the Topic Panel.

Information on current practice was provided by many transit agencies. Their cooperation and assistance were most helpful.

CLEANING TRANSIT BUSES: EQUIPMENT AND PROCEDURES

SUMMARY

Bus cleaning techniques have not changed appreciably in the last 20 years even though wage rates have increased substantially and the design of new transit buses has made cleaning more difficult. A clean bus is defined as one with all exterior and interior surfaces free of dirt and graffiti, clear and unscratched windows, and an interior that is free of dust, dirt, trash, and residue.

Exterior cleaning typically consists of running a bus through a 2- or 4-brush automated washer. The washer does in 2 min what used to be a 75-min job. Problems with washers include scratched windows, controlling speed of the bus through the washer, difficulties in cleaning the rear of the bus, breakage of bus equipment (e.g., mirrors), and difficulty in cleaning the wheels. Equipment modifications and changes in procedures in the use of brush washers offer solutions for these problems; an alternative solution is a pressure washer that uses chemical cleaning techniques instead of brushes.

Nearly every agency makes an effort to clean the interior of each bus every day because it is commonly believed that keeping a vehicle clean is the best defense against litterers and vandals. A clean interior is also important in maintaining ridership. The most common device used for interior cleaning is the cyclone cleaner, which is a large-capacity vacuum cleaner with a main orifice that fits over the door of a bus and sucks up loose trash. A high-pressure hose (or hoses) can be used to force trash from hard-to-reach areas. However, it is reported that with the use of the cyclone cleaner, a dust residue is left on seats and interior surfaces, and the cyclone does not handle bottles or large pieces of newspaper (which must be removed by hand) and is not effective on articulated or RTS buses. Alternatives to the cyclone cleaner are a large vacuum cleaner with long hoses or a plain sweep out and wipe down.

Periodic, thorough cleaning practices vary widely among transit agencies. The interval between cleanings and the amount of labor required per cleaning are affected by policy dictates, management directives, budget considerations, the interior materials used in buses (e.g., carpeted floors), and past practices. Various materials and procedures are used for the periodic cleaning of bus interiors. For example, some agencies shampoo carpeted floors and others use a dry cleaner; there are almost as many cleaning materials used as there are agencies. Graffiti removal is a problem and several different chemicals are used for this purpose. Often, however, the only way to remove graffiti is to replace the seat or panel. Some agencies are experimenting with an impervious coating material that can be removed by a cleaner along with graffiti.

The prime factor in maintaining a clean vehicle fleet is a transit board policy that establishes vehicle cleanliness standards and management commitment to carry out the policy. Below the managerial level, effective bus cleaning is more the result of good supervision than of specific materials or techniques. Constraints on the effectiveness of cleaning policies include availability of funds, union work rules, and high job turnover.

There is a need for applied research on major bus cleaning problems; in particular, development of graffiti-proof materials and/or solvents to remove graffiti is needed.

CHAPTER ONE

INTRODUCTION

The urban transit industry has been extremely cyclical in the last 30 years; it has been a profit-making industry, then unprofitable, then prosperous under public subsidy, and is now experiencing a reversal of that prosperity under increasing federal and local pressure to reduce the influence of government financing. Throughout this period, three aspects of the urban transit industry have had a negative influence on the bus cleaning capabilities of transit systems:

- Exterior bus cleaning techniques, with the exception of the introduction of the automated bus washer, have not changed appreciably in the last 30 years.
- Labor rates for transit workers have increased at a rate that exceeds the consumer price index for the same period.
- The design of new transit buses, influenced more by government regulation than by efficiency of operation and ease of maintenance and cleaning, has tended to intensify the problem of cleaning buses.

The relative importance of each of the above factors in the various transit systems has resulted in a diversity of approaches to vehicle cleaning.

One transit system manager describes his agency's approach to vehicle cleaning as follows: "While the cleaning program is done by the Equipment Department, it is a significant part of our on-going marketing effort." This approach and other approaches to vehicle cleaning are examined in this synthesis. Proven cleaning techniques that may be applicable to a number of transit systems are identified. In addition, cleaning procedures for other vehicles are examined to determine if other industries or transportation modes use techniques that could be applied to the transit bus industry. Both exterior cleaning (the washing of vehicles, often on a daily basis) and interior cleaning (daily cleaning and periodic cleaning) are covered in this report.

Rising operating costs, dwindling operating subsidies, and public demands for increased service and/or more efficient service are currently forcing transit managers to look at every facet of their operations. Although cost-reduction strategies in bus cleaning will not produce savings equal to those achieved by major service reductions, measurable savings can be obtained from the application of efficient cleaning techniques with no perceivable deterioration in cleaning quality. Current practices in bus cleaning are examined in this synthesis; however, it is recognized that transit funding is currently being closely scrutinized, and thus bus cleaning techniques are discussed here within the overall context of an efficient and cost-effective maintenance operation.

DEFINITION OF A CLEAN BUS

Exterior: No graffiti; backs, sides, and fronts free of dirt, residue, and streaking; no scratched windows or tattered advertising signs; all body components (panels, doors, etc.) secure and not flapping.

Interior: No graffiti; seats free of visible dust and residue (cloth seats free of dirt or residue that would soil light-colored clothing); area between bolsters, sides, and side panels free of trash and dirt; floors and stepwells free of trash or dirt buildup; side panels, modesty panels, light panels, and overhead free of visible dirt; driver compartment and seats as clean as rest of the bus with no coffee stains or trash buildup.

CHAPTER TWO

EXTERIOR CLEANING

Typically, at the end of a day's run, transit buses are taken through a service cycle. This cycle includes some or all of the following procedures:

1. Retrieval from the parking area,
2. Revenue removal,
3. Refueling,
4. Engine oil and coolant check,
5. Tire check,
6. Walk-around inspection,
7. Interior cleaning with vacuum cleaner,
8. Exterior washing, and
9. Return to parking area.

Previous studies[1] have shown that the complete service cycle requires an average of 10 min, with about 5 min of that time spent at the refueling station. Exterior washing, the final step of the service cycle, requires 1 to 2 min.

WASHING EQUIPMENT

The automated bus washer perhaps represents the most astounding improvement in transit-related productivity in recent years. The automatic washer does in 2 min what used to be a 75-min job. Even with a price tag of over $50,000, these washers are used almost universally in the urban bus transit industry. However, the investigation conducted for this synthesis reveals that there is almost as much variance in the design and use of these washers as there are agencies using the washers.

Brush Washers

A number of different companies manufacture automatic bus washers. Most washers have a rotating brush and water-spray side washing capability. Some washers have additional front and rear wash capabilities and/or a roof washer, which is either a rotating brush or wet mop. Information on bus washers and bus washing operations obtained from interviews and observations at various transit agencies is summarized in Appendix A.

Most agencies use either a two-brush or four-brush washer (see Figure 1). The washing process includes a prewash water cycle; a detergent and agitation wash cycle in which rotating brushes, lubricated by water and detergent, clean the exterior surfaces of the vehicle; and a postwash water-rinse cycle. Depending on the size and complexity of the washing system, the various cycles may have a number of subsystems, including: (a) multiple prewash rinses; (b) special wash cycles for hard-to-clean or exceptionally dirty parts (e.g., wheel backs and undercarriages); (c) special wash components for windows; (d) multiple postwash rinses; and (e) a hot-air dry cycle.

Pressure Washing

Cleaning-equipment manufacturers have introduced automated washers without brushes (Figure 2). (A comparison of the costs of a pressure washer and a comparably priced brush washer is presented in Table 1.) Early attempts at developing and selling these pressure (or brushless) washers were not well-conceived, and they have not been well-received in the transit industry. However, there is emerging evidence that these washers are effective in cleaning buses. One test performed during the investigation conducted for this synthesis demonstrated the cleaning effectiveness of the pressure washer. It was observed that after cleaning, the bus was substantially cleaner, including such hard-to-clean areas as wheels and door frames.

Pressure washers depend on a chemical reaction, not scrubbing, to clean the bus. This reaction requires precision in the chemical mix—a capability not always found at transit systems, which may not be recognized by manufacturers nor admitted by the transit systems. The washer has three applicator arches: (a) arch 1 sprays a hydrofluoric acid solution; (b) arch 2 sprays an alkaline-based chemical; and (c) arch 3 sprays high-pressure water to rinse the bus.

Even though the pressure washer appears to be effective, several factors should be considered by individual transit systems before purchase. First, the chemical formulas used in the cleaning process are trade secrets, and the specified chemicals are expensive. However, as four suppliers make the chemicals with essentially the same formula, prices should be competitive. Formulas that are similar, but not identical, will not produce the same results. Second, experience with this technology during the last 7 years indicates that bus paints and finishes are unaffected by the chemicals. The acid wash is only on the vehicle for a short time; and the alkaline wash neutralizes the acid. The neutralizing action removes the dirt, which is then washed off by the high-pressure rinse. Safety engineers from the New York State Gas and Electric Company have certified the wash process as safe for all their vehicles, including those with fiber-glass components that must be inspected regularly for maintenance of electrical insulating properties.

[1] *Bus Maintenance Facility Handbook*, The Mitre Corporation and the Urban Mass Transportation Administration, November, 1975, p. 29.

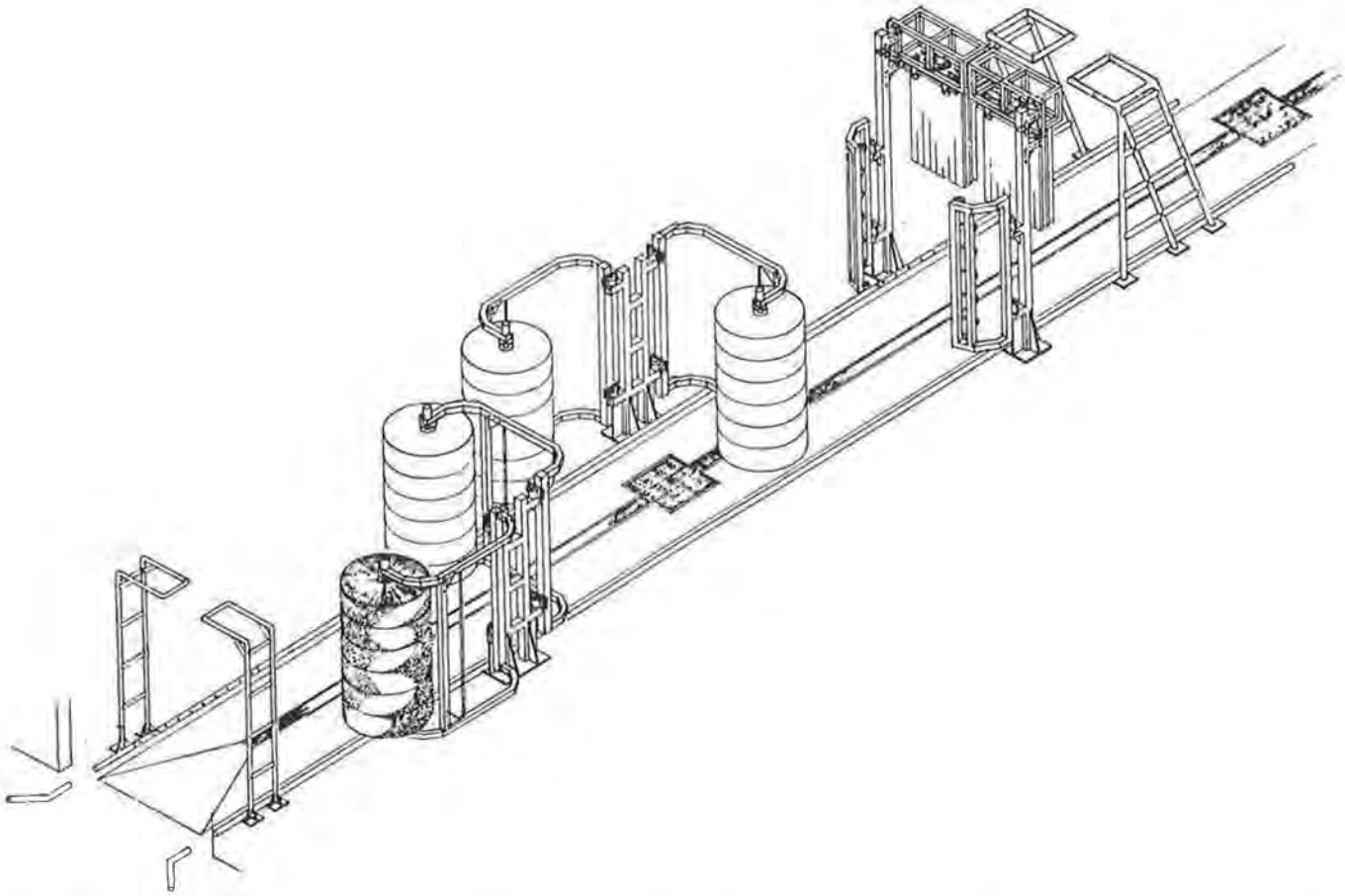


FIGURE 1 Schematic diagram of a typical brush-washing system. (*Courtesy of Automated Washing Systems International, Inc.*)

It appears that the state of the art in exterior washing systems is a pressure wash system, although some brush washers produce excellent results with little hazing of windows. As with any large mechanical equipment, bus washing systems require careful supervision and close adherence to manufacturer specifications.

PROBLEMS WITH AUTOMATED WASHERS

Although the automated washers have been a boon to transit operators, various problems have been reported.

Maintenance

Experience over the last several years has indicated that the bus washers require maintenance. Even though many of the smaller transit systems are able to maintain their washing systems on a part-time basis, the bus cleaning systems of the larger transit systems often require full-time maintenance (which may include maintenance of the cyclone cleaner). Estimates of the amount of labor required for maintenance range from 2 to 7.5 man-hr per bus per year, reflecting variation in the complexities of washing systems and the emphasis placed on bus cleaning by the various transit systems.

As shown in Figure 1, the automated washing units with brushes are fairly complex systems. Often, these units are subjected to a number of simultaneous stresses; (a) the electrical systems are subjected to power surges caused by constant on/off operation and to moisture; (b) the hydraulic systems are frequently abused by careless transit employees; and (c) the mechanical systems are affected by environmental factors, including chemical mixtures and extreme temperature variations.

Scratching of Bus Windows

About the time that automated bus washers were coming into widespread use, increasing vandalism in the nation's larger cities led manufacturers to offer plastic windows in lieu of laminated safety glass on buses. Over time, these plastic windows (Lucite, Lexan, etc.) became scratched or hazed to the point of causing customer complaints and concern by transit managers. The automated bus washer became known as the primary cause of hazed windows, although window manufacturers were also targeted for blame. As window manufacturers sought to improve their products, bus washing equipment was also carefully scrutinized. Both manufacturers and agencies tinkered with brushes, detergents, water flow, etc., and proposed changes in brush-

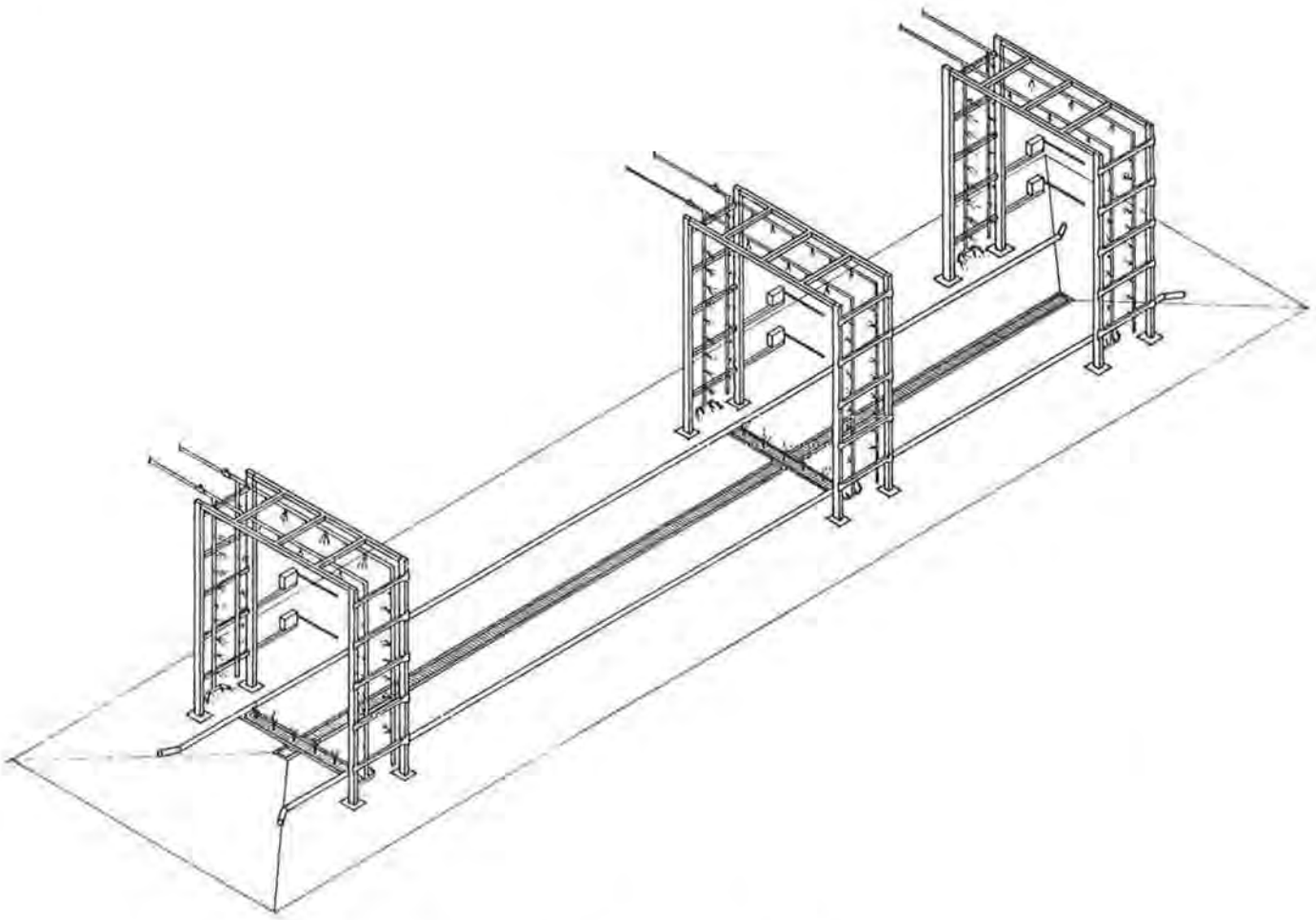


FIGURE 2 Schematic diagram of a typical pressure (brushless) washing system. (*Courtesy of Automated Washing Systems International, Inc.*)

washing equipment (use of brushless washers) and procedures in an effort to ease the hazing problem and still clean buses thoroughly.

Both window and washer manufacturers stress the importance of proper lubrication of the window surface before the brushes are operated. Adding a prewash arch 25 to 40 ft (8 to 12 m) in front of the brushes is one suggested approach; multiple prewash arches have also been used. Washing equipment manufacturers have added special spray nozzles and foam applicators aimed at the window line to provide extra lubrication, and have experimented with changes in the composition of the brushes, recommending polypropylene or nylon film brushes or changing to Tampico brushes, which are softer. Each of these efforts has been directed at reducing the friction (which causes the hazing) created by dirt particles being agitated between the brushes and windows. There is also some evidence that wax, which is transferred from the brushes to the windows (via abrasion and the heat created by friction), also adds to the problem of haze.

Other attempts at reducing friction include the use of high lubricity detergents and the use of different types of detergents depending on the wash cycle. Some agencies have adjusted brushes to minimize the overlap between the bus and the brush filament, whereas others have made a special effort to clean the grit from the brushes between washing periods.

Hard-to-Clean Areas

The back ends and wheel rims of buses are probably the most difficult areas to clean. That these areas get so dirty is probably a reflection of the lack of aerodynamic design on a typical urban transit bus. The back ends of buses seem to almost "suck up" road dirt and grit, a problem that is worse in rainy or inclement weather. Both transit operators and washing equipment manufacturers have attempted to find solutions to this problem. One manufacturer's solution has been to add brushes that actually wrap around the rear of the bus, an equipment change that can even include sequential overlapping by two brushes. One transit agency added a special nozzle and soap activator to be aimed at the rear of the bus and triggered by a rear wheel wand. Generally, however, agencies have tended to revert to washing the back ends by hand on a weekly (or more frequent) basis. Variations to this practice include manual spraying or application

of a mild degreaser to the rear of the bus before it enters the wash rack.

Whereas a number of transit agencies have indicated satisfaction with the cleaning results of the back ends of buses (even though this satisfaction may be due to a more labor-intensive cleaning process), there is almost universal dissatisfaction with the washer subsystems designed to clean wheels. Manufacturers offer special wheel-washing equipment; however, few transit properties order the wheel-washing equipment or continue to use the equipment after installation. One agency that uses the system's wheel washers and has made minor adjustments in the design of the system reports that the brushes must be replaced every 6 to 8 weeks. In general, wheels are steam-cleaned either during the service cycle (which requires a steam jenny near the service lane) or on a less frequent basis, such as when the tires are changed or the bus painted. Some agencies use polyurethane-based paint (such as Imron) to improve the durability of the painted surface of the wheels and thus dirt resistance.

Human Factors

Even though the introduction of the automated bus washer reduced the amount of manual labor involved in cleaning bus exteriors, human factors still play a significant role in well-executed bus cleaning (exterior and interior). It should be noted that the transit system personnel who actually perform the bus cleaning tend to be the lowest paid employees. The bus cleaning job is highly repetitive, dirty (exterior cleaning is part of the overall service cycle, which often includes interior vacuuming, fueling, and checking oil and coolant levels), and is characterized by a finite number of units to be cleaned each evening. The possibility exists that the work may be finished too quickly, well before the end of the normal 8-hr shift; thus training and close supervision of the cleaning force (who are often called hostlers) are extremely important.

The speed of the bus through the automated washing system, which is critical to the effectiveness of the cleaning, is solely under the control of the bus hostler. If the bus goes through the washer too fast, the amount of lubrication used in the wash cycle is usually reduced, thus aggravating the problem of friction as previously discussed. If the bus goes through the washer too slowly, premature window hazing and paint wear occur. The recommended procedure is to drive the bus through the washer at 1 to 2 mph (0.6 to 1.2 km/h). Because this slow speed tends to make the cleaning job even more tedious, some agencies have experimented with using timing systems linked to the wands that trigger each segment of the washing cycle. One equipment manufac-

TABLE 1
COMPARISON OF LIFE-CYCLE COSTS OF BUS WASHERS[a]

		Brush Washer		Pressure Washer
Purchase price		$ 87,800[b]		$ 38,900
Detergent cost	(@$0.123/wash[c])	31,900	(@$0.50/wash[d])	130,000
Water cost @ $0.0007/gal	(@23.4 million gal)	16,400	(@23.1 million gal)	16,200
Electrical consumption @$0.052/kWh	(@51.4 kWh[e])	2,700	(@14.3 kWh)	700
Replacement brushes[f]		10,400		None
Maint. cost @ $10/hr (including parts)[g]		40,000		4,400
TOTAL Life Cycle Cost		$189,200		190,200

[a]Based on a 100-bus fleet with each bus washed 5 days per week, 52 weeks per year for 10 yr. This is the equivalent of 260,000 washes.

[b]Includes $80,000 for basic washer and $7,800 for window foam applicator.

[c]Transit agency estimate based on $2.25/gal and 100:1 dilution ratio.

[d]Manufacturer's estimate.

[e]Manufacturer's equivalent estimate based on 1 hr constant load per day @ 15.2 amps. Note that the estimate does not reflect power surges.

[f]Brushes to be replaced every 75,000 washes (transit agency count).

[g]Manufacturer's and transit agency estimates. Brush washer = 4,000 man-hour over 10 yr. Pressure washer = 150 man-hour over 10 yr.

[h]The life-cycle cost of the brush washer does not include damage to vehicles to which the use of brush washers may contribute, including: (a) occasional breakage of mirrors, lights, etc., and (b) hazing that requires replacement of acrylic windows. Typical replacement costs are $4,000 per bus (based on $400 per window for 10 windows). Acrylic windows have a reported life of 6 yr; thus an annual amortized cost would be $66,700/yr over 10 yr.

turer offers traffic lights that aid the hostler in getting the bus through the washer at the appropriate speed. At one agency, an alarm system that is audible in the foreman's office has been installed to signal when buses are going through the system too quickly. Another agency reports that a time clock has been installed adjacent to the entrance and exit of the wash bay with the requirement that each bus be punched in and out of the wash cycle. These cases demonstrate that efforts are being made to assist the cleaning-area supervisor in controlling the human factors of the exterior washing program.

SUGGESTED CHANGES TO IMPROVE BUS CLEANING WITH BRUSH WASHERS

A summary of suggested equipment modifications and procedural changes to overcome problems associated with the use of brush washers and improve exterior cleaning is presented below.

Scratched Windows

Equipment Modifications

- Prewash arch can be added, ideally at 25 to 40 ft (8–12 m), before wash bay; or two prewash arches, separated by 6 to 10 ft (2–3 m) can be used.
- Water should be free of solids and have a minimum flow of 150 to 200 gal (9–13 L/s) of water.
- Polypropylene or nylon filament brushes or Tampico brushes can be used.
- A soft roller wheel guide can be used to reduce brush pressure.
- A spray line at window area can be added to provide lubrication directly at brush/coach interface.
- Alternatively, a pressure washer can be used.

Procedural Changes

- Require slow but constant speed through washer [1 to 2 mph (0.6–1.2 km/h)].
- Use a solvent-based, dissolving type of detergent with prewash.
- Use a highly lubricating detergent with wash.
- Use warm water [90° to 110° F (30°-45°C)] with detergent.
- Adjust brushes so that only one set of brushes washes side of bus, and no more that 2 to 5 in. (50–125 mm) of filament overlaps the side.
- Ensure that pressure of brush does not exceed 1 to 2 psi (7–14 kPa).
- Use a rinse spray to clean grit from brushes.
- Use a high pressure/high volume final rinse with a minimum delivery of 150 to 200 gal/min (9–13 L/s).
- When soap is not used in washer, increase amount of water and adjust brushes to 20 psi (140 kPa).

Controlling Speed of Buses Through Washer

Equipment Modifications

- Traffic lights can be installed in wash system.
- An audible alarm can be set up in foreman's office to signal when buses are going through the system too quickly.
- Wands can be placed on overhead instead of at side to prevent tampering.

Procedural Changes

- Provide training for hostlers.
- Closely supervise hostler force.
- Establish a standard operating procedure to be used by employees.

Difficulty in Cleaning Rear of Bus

Equipment Modifications

- Wrap-around brushes or two overlapping brushes can be used.
- A special nozzle and soap activator triggered by left rear wheel wand can be added.
- Brush pressure of 25 psi (170 kPa) is recommended (greater pressure will cause brushes to wear out more quickly).

Procedural Changes

- Wash rear of bus by hand.
- Spray a mild degreaser on rear before bus enters wash rack.

Broken Equipment (e.g., Mirrors and Windshield Wipers)

Equipment Modification

- Softer brushes or tie-back, wrap-around brushes should be used.

Procedural Change

- Fold all mirrors into bus before washing.

Dirty Wheels

Equipment Modifications

- Wheel washers can be used; brushes should be replaced every 6 to 8 weeks and carriage length can be reduced.

- Wheels should be steam-cleaned during service cycle (requires steam jenny near service lane).
- Use of spray bar is recommended.

Procedural Changes

- Use Imron paint on wheels.
- Steam-clean wheels when tires are changed or bus painted.

Greasy Brushes

Procedural Change

- Install rubber grease shields over brushes.

Drainage

Equipment Modifications

- Floors can be grooved to direct runoff to catch basin.
- Roof blankets can be replaced with brushes.

Dull Paint Finish

Procedural Change

- Use Imron or polyurethane-based paint on exposed surfaces.

Electrical Problems

Equipment Modification

- Solid-state controls should be specified.

Bruised Rear Tires

Equipment Modification

- A stainless-steel plate can be installed at washer entry.

Striping on Rear of Bus

Equipment Modification

- Washer should be realigned, and pressure changed to prevent bouncing.

CHAPTER THREE

INTERIOR CLEANING

DAILY CLEANING

Whether or not the exterior of each bus is washed every day, nearly all agencies make an effort to clean the interiors of their buses each day. The methods employed for daily cleaning vary widely and depend on geographical and climatic conditions as well as on local policy and past practice. Close supervision, including frequent inspection of bus interiors by supervisors and management, is a prerequisite for maintaining a clean fleet.

The purpose of the daily cleaning is to keep the bus at a predetermined level of cleanliness. During the course of a day's service, urban transit buses accumulate trash (Figure 3). There is a widely held theory among transit managers that keeping a vehicle clean (as defined in Chapter 1) is the best defense against potential litterers and vandals; it is believed (and unfortunately has been demonstrated all too vividly at both large and small transit systems) that litter and trash (as well as graffiti, etc.) beget more litter and trash.

The exterior cleaning of a transit vehicle is an important part of a system's public-awareness program; nonriders will feel more positively about transit service when buses appear to be well-maintained. However, it is through the interior cleaning that the transit system demonstrates its commitment to its regular customers—the riders. According to substantial market research conducted by several transit systems, a clean vehicle interior and on-time performance are significant determinants of transit ridership, particularly among those riders who have the option of switching to another mode of transportation for their trip. Agencies that commit management attention and maintenance dollars to interior cleaning are more likely to realize increased demand for transit service. Therefore, a policy directive that commits management to an effective interior cleaning program may be one of the best marketing moves that can be made by a system.

Some agencies do approach the daily cleaning problem as part of the marketing effort. Probably the most effective effort in this regard is the policy of an eastern rail line. Management requires each train operator to pick up trash during the layover at the end of each trip. As the operator must walk the length of the train for other purposes, this practice is not inconvenient. On long trains during the rush hour, a helper is stationed at each of the lines to assist the train operator. As

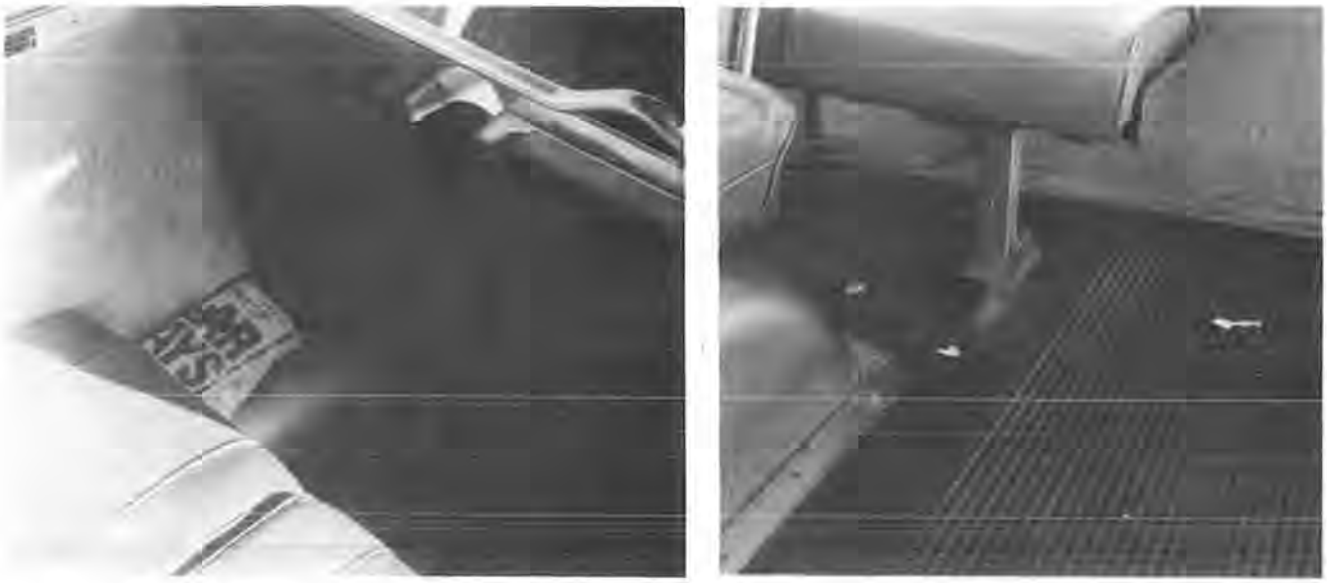


FIGURE 3 Examples of trash accumulation on an urban transit bus.

a result of this practice, the trains are clean and the service is extremely popular and highly regarded by its passengers.

Although all transit agencies dedicate resources to the daily cleaning process, few rigorously define that process. Exceptions include the Toronto Transit Commission and OC Transpo of Ottawa, Ontario.[1] At OC Transpo, the cleaning cycle is part of the "countdown" process, so called because the countdown is a precisely defined sequence of servicing and cleaning events. A written standard operating procedure lists the time allotted for each task. Different tasks are included for each night of servicing, with special emphasis on window cleaning, wiping dashes, and cleaning the operator's area. A biweekly sanitizing spray is included. The countdown schedule is presented in detail in Appendix B.

Despite the importance of interior cleaning to overall system effectiveness, there has been no substantial improvement in the productivity of interior cleaning in the past 20 yr (since the introduction of the cyclone cleaner as discussed below). Most transit agencies currently clean vehicle interiors much as they did in 1960.

Cyclone Cleaner

In the last several years, a large number of transit systems have purchased Buck cyclone cleaners. These cleaners are large-capacity vacuum cleaners with a main orifice that fits over the door of a bus. While the vacuum sucks up loose trash, an integrated high-pressure air hose can be used to force trash out of hard-to-reach areas. Initially, it was expected that the cyclone cleaner would result in productivity improvements comparable to those resulting from the use of the automatic bus washer. However, according to information obtained from interviews with transit maintenance managers, much of the early enthusiasm for these cyclone cleaners has waned, primarily because the cleaners leave a dust residue on the seats and other surfaces of the coach interior. This residue is particularly perceptible on padded vinyl seats. To solve this problem, managers have either stopped using the vacuum, modified the vacuum procedure, or added a supplementary interior wipe down.

During visits to the transit agencies in preparation of this synthesis, several comments on the design of the cyclone cleaner were expressed. It was noted that the vacuum will not handle large pieces of newspaper or other trash (bottles, etc.), which then have to be picked up by hand. (The accumulation of this type of trash suggests that a sweep out may be necessary; thus it may be possible to eliminate the use of the cyclone.) Some agency personnel also reported that a cyclone cleaner with only one air hose is not effective with RTS-II buses.

The new-model cyclones have an adaptable shroud for the various model buses. The newer models also have an integral trash compactor, which cuts down on loose trash and pickup. Several agencies reported that the new cyclone cleaner does not have an inspection plate on the blast gate, which inhibits maintainability. The blast gate itself is a three-vane gate, which also inhibits maintainability; a one-vane gate would be easier to clean.

Vacuuming practices vary among the transit agencies. Two air hoses are used by several agencies. At one agency, the high-pressure air hoses are used to move trash to the door; then the vacuum is briefly turned on to dispose of the trash. Those agencies with carpeted interiors and cloth seats

[1]Canadian transit systems, functioning in a financial and operating environment somewhat different from U.S. systems, have tended to approach problem solving in transit operations in a more quantitative manner. For example, Canadian agencies tend to use industrial engineering techniques to examine their operations. Although the results of their work may not be necessarily applicable to U.S. agencies, their solutions are instructive (see Appendix B).

still use the Buck cyclone, as the residue problem is not as perceptible. Several agencies include a separate wipe down in addition to the vacuuming procedure. At one agency, the interior is wiped daily. At another agency, a schedule is followed: on Mondays, the dashboard is wiped; on Tuesdays, the sills and overhead are wiped; and on Wednesdays, the seat is wiped.

It is likely that the debate on the usefulness of the cyclone cleaner will continue. The cleaner no doubt will have its adherents; what it lacks in thoroughness, it may make up in speed. Other types of vacuum cleaners and/or sweep out and seat wipe down can be just as effective and speedy, but these methods are more dependent on close supervision.

Other Cleaning Procedures

Various procedures are used by those agencies that have abandoned the Buck cyclone cleaner. Some have opted for a large vacuum cleaner with long, flexible hoses. This approach generally requires two men to wield hoses on the bus, in order to keep within the amount of time to be spent at the cleaning station as specified in the service cycle. Generally, this method does lower the dust level, but some sweeping or extra trash pickup may also be required.

Other agencies have resorted to a plain sweep out and wipe down. This approach may require closer supervision. However, if properly monitored, it can be most economical; e.g., the bus need not be in the service cycle to be swept out. At some agencies a worker is assigned to sweep buses after the service cycle has been completed and the buses are lined up for the next pullout. The drawback to this procedure is that trash may tend to blow around the parking lot, necessitating another cleanup job.

One large midwestern agency has experimented with both flexible vacuum hoses and cyclone cleaners and has abandoned the use of both methods. Currently, a worker sweeps the bus and wipes the seats; the agency has designed and manufactured a dust pan that fits in the front stepwell to catch the accumulated trash. The dustpan design is shown in Figure 4.

FIGURE 4 Custom-designed dustpan for trash removal. This pan fits in the front stepwell to catch trash swept from the bus.

Bus Design Considerations

Articulated buses are not readily adaptable to the use of the cyclone cleaner; the extra interior space of the vehicle is too great for most existing cyclone cleaners. In addition, most agencies using RTS advanced-design buses have experienced problems with the cyclone cleaner—either because of the door size or because of the lack of ventilation at the rear of the coach.

Buses have crevices and other spaces that collect dirt and that are difficult to clean (see Figure 5). For example, trash that collects between the seat cushion and side can only be removed if the seat is removed. Agencies report that cantilevered seats facilitate sweeping out and also the collection of large trash items by the Buck cyclone cleaner (see Figure 6).

FIGURE 5 Typical difficult-to-clean interior space on an urban transit bus.

PERIODIC CLEANING

Periodic cleaning practices also vary among the transit agencies. The primary purpose of periodic cleaning is to ensure that within a specified time interval each coach will be

FIGURE 6 Cantilevered seat design on an urban transit bus.

held out from service for a thorough cleaning. At most agencies, this cleaning also provides an opportunity to inspect the coach interior for broken or slashed seats that previously may have escaped notice. Some agencies combine the periodic cleaning with a scheduled mechanical inspection.

Based on information from the agencies visited in preparation of this synthesis, it can generally be assumed that the number of man-hours spent on the periodic cleaning varies directly with the interval between cleanings. However, a limited sample was subjected to a regression analysis to determine the statistical significance of the findings. Based on the data, the correlation coefficient was 0.201, which shows little relationship between the variables. Thus the lack of correlation suggests that factors other than those examined account for the number of man-hours per bus cleaning and intervals between cleanings. It is known that management directives, policy-board dictates, budget considerations, and past experience all determine periodic cleaning practices.

For example, the decision by an agency to purchase cloth seats and carpeted floors has an effect on the number of man-hours required to clean a bus, and substantially increases the cost of cleaning the vehicle. During the early and middle 1970's, a number of transit systems opted for cloth seats and carpeted floors and even side walls. Often the decision to equip these buses was made by policy makers and not by managers. Carpeted floors and cloth seats require substantially more care than do vinyl or fiber-glass seats and rubber flooring. One agency reported that the cleaning of buses with cloth interiors requires more than twice the man-hours reported by another agency for the same cleaning intervals; other agencies also reported increased man-hours for cleaning buses with fabric interiors.

Carpeted Floors

Substantially more time is required for periodic cleaning of buses with carpeted floors than for buses with tile or rubber flooring. Shampoo is used to clean the carpets; two of the agencies visited use liquid shampoos (one uses Spartan and the other uses Top Secret by Puritan). Both agencies report satisfactory performance from these shampoos. A third agency had switched from a liquid shampoo to a dry-extraction carpet cleaner called Host. The dry cleaner was judged to be effective and was somewhat easier to work with than the liquid shampoo. The carpets at this agency have been in service for 10 yr and are just now beginning to show wear (less wear than carpeted floors cleaned with liquid shampoo). The three agencies operate under similar climatic conditions.

Windows

Many agencies specify a special window cleaning for bus interior windows. Two of the agencies visited (one large and one small) performed weekly window cleanings. The large agency reported that about 20 min per bus was spent on cleaning interior windows; the small agency reported a total of about 30 min per bus. Other agencies surveyed reported the time spent close to 20 min per bus, or roughly 16 to 20 buses per shift. Several agencies have experimented with using CETA workers to clean windows; at other agencies, window cleaning is a full-time job included in the bargaining unit.

Noncarpeted Floors and Interior Side Panels

There appears to be divergent opinion in the transit industry regarding the use of pressurized water on bus interiors. Pressurized water systems consist of either a garden-variety hose and nozzle or a "power wash" hose with wand and trigger. The latter type can incorporate a detergent into the water stream. Adherents of the pressurized water system claim that the speed and effectiveness of the system offset any problems that might result from the use of the pressur-

ized water over the long run. Detractors of this method of interior cleaning contend that the use of pressurized water causes considerable damage to the bus that is both difficult and expensive to repair. Of the agencies surveyed, opinion was equally divided on the use of pressurized water systems.

Pressurized Water Systems

Transit agencies that use a pressurized water system for cleaning the bus interior generally make provisions for protecting the components that are susceptible to water damage. At the least, this involves taking care not to aim the spray at the driver's area and instrumentation panel. Often more extensive precautions are taken. For example, some agencies use a cover to protect the fare box; at other agencies the driver's area is covered as well. At one agency, special care is taken to cover the driver's seat, as the foam cushion is easily penetrated by water. Most agencies give careful attention to the cleaning procedure in the driver's area because of the exposed wiring and instrumentation. Often the driver's area is washed by hand, whether or not a pressurized water system is used.

The pressurized water wash procedure is essentially straightforward and similar to the nonpressurized approach. Details of this procedure, provided by OC Transpo, Ottawa, Ontario, are presented in Appendix B.

Nonpressurized Methods

If the pressurized water method is not used, generally a damp mop is used to clean the floor and rags for the side panels. No system surveyed used a wet mop or pressurized water above the bottom of the windows. Areas above the bottom of the windows are cleaned with a damp rag and, if necessary, with a spray cleaner.

Careful attention is given to minimizing the amount of water left standing in a bus; a damp mop is used for this purpose. Buses are sometimes parked on an incline, near a drain basin, to keep the standing water at a minimum. The most elaborate arrangement observed was the design of a special bay for interior cleaning in the bus washing building. The bay is graded and inclined so that the water will run out the front door of the bus. At two agencies in the North, forced-air heaters are used to dry the interior of the bus after the washing cycle.

Seats

The seats are usually cleaned at the same time the rest of the coach interior is cleaned, using the same methods and materials, particularly if the seats are padded vinyl, fiber glass, or fiber glass with padded inserts. Although cloth seats may be cleaned at this time, different methods and materials are often required.

Cleaning Materials

The transit agencies surveyed tended to use the same type of cleaning material for a variety of interior cleaning jobs; i.e., an all-purpose substance instead of a specific cleaner for the seats, floors, sides, etc. At many agencies, an all-purpose spray cleaner is used above the bottom of the windows. The cleaning materials used for graffiti, chewing gum, and other special problems are discussed elsewhere in this chapter.

TABLE 2
INTERIOR CLEANING CHEMICALS USED BY TRANSIT SYSTEMS

Toronto-Rail	Big Blue Cleaner and TTC Soil Solvent
Toronto-Bus	Big Ben Industrial Cleaner
Detroit	501 Carwash
Ottawa	1120 Soap by Carleton Chemical or 2053 by Stripolene
Atlanta	Intex
Washington-Rail	Top Secret
Washington-Bus	Powermite
Baltimore	Plaudit by Turco
Lindenwold	J Cleaner by Johnson
Providence	Skyrite
Manchester	Skyrite
Raleigh	Handi-Clean
Portland	Spartan Custom Car Wash

There are almost as many cleaning materials in use as the number of transit properties surveyed. The materials used by these agencies are listed in Table 2. A common characteristic of most of these materials is that they are locally manufactured and/or marketed. Many of the agencies reported long relationships with the same supplier, who was often well-positioned to also be the lowest bidder.

Seat manufacturers provide cleaning instructions for their products (see Appendix C). However, as usually noted by the manufacturers, such products may not necessarily be the most appropriate material to use for cleaning. For example, a seat manufacturer may recommend using a household detergent, which, although effective, may have drawbacks. The detergent may be expensive to purchase in the quantity needed for commercial use. Also, the detergent may contain phosphates. Although phosphates are excellent for cleaning, some communities or states ban the use of phosphates (e.g., New York) or severely limit their use because of the effects on water quality. (Detergent manufacturers are sensitive to such laws, and many have switched, particularly in the production of detergents for industrial use, from phosphate-based detergents to butyl-based compounds.)

Manufacturers that produce butyl-based compounds emphasize that such cleaning materials can be widely used by a transit system. The same compound can be used for a variety of cleaning jobs merely by changing the dilution ratio. Butyl-based compounds [which cost approximately $3.25 per gal ($0.86/L) of concentrate] can be used for interior and exterior cleaning and also for steam cleaning. They appear to be effective and safe for rubber, brass, plastics, and even for acrylic windows.

Removal of Graffiti

During the past few years, particularly in the larger cities, the removal of graffiti has been the most difficult cleaning problem for transit managers. However, the graffiti problems of most of the transit agencies are minimal in comparison to that of the subway system in New York, where the interiors and exteriors of subway cars are covered by graffiti. The removal of graffiti is a mangerial and a technological challenge. Several procedures for removing or reducing graffiti were observed or reported by the transit agencies surveyed.

Use of Chemicals

A major seat manufacturer reports that no single chemical removes all types of inks, and recommends a multistep process (see Appendix C). Several manufacturers offer graffiti removers, including: Spray 'n Wipe by CMS; SKC-NF Formula 8 by Magnaflux; Mar Hyde M-2; Top Secret by Puritan; Graffiti Eater by Sunshine Chemical; and Graffiti by Neleco. Two of these chemicals were reported by transit managers to be effective in removing graffiti.

Graffiti by Neleco (Dedham, Massachusetts) was judged to be effective, especially for graffiti marked on hard surfaces such as stainless steel or melamine. It appears to be less effective on painted surfaces or on soft plastics. The chemical is sprayed on to dissolve the graffiti and then is wiped off. Graffiti Eater by Sunshine Chemical was judged to be effective in removing graffiti from almost all surfaces. However, disadvantages of using this chemical include: (a) the cost is $55 per pint ($116/L); and (b) two compounds must be mixed together and used within 24 hr. Thus the use of this expensive, somewhat unstable substance requires extra effort, which may preclude its use by some agencies in favor of more cost-effective methods.

Other Procedures for Removing Graffiti

Often, replacing the seat cushion or recovering the seat with new vinyl is the only way of removing graffiti. A major eastern agency reports that at one division alone 25 seats per week are replaced to get rid of graffiti.

At some transit agencies vinyl seats are retinted using Color Hit by Advance Color Corporation. This spray paint can be applied quickly and dries fast; however, it works best on small areas where the tinting is less visible. Larger areas are better handled by replacing the seat.

Recently, transit agencies have been experimenting with coating graffiti-prone surfaces with Ultra-Shield, a "liquid-emulsion" that forms an impervious coating when applied to surfaces. If the surface if then marred by graffiti, a companion solvent can be used to remove the coating (and the graffiti), and the surface can be recoated. This is a time-consuming process but worthy of investigation. The material is reported not to affect vinyl surfaces or to be discernible to transit patrons.

Prevention of Graffiti

Many transit managers hold to the theory that a little graffiti begets more graffiti. Thus some agencies make a special effort to remove evidence of graffiti as soon as it is spotted. The policy of one rail system is to remove the car from service as soon as possible after graffiti is spotted; the car is then cleaned or the offending seat removed.

One approach used by an agency to prevent graffiti is the attempt to identify graffiti artists. This measure requires highly motivated drivers and supervisors. Once identified, the alleged culprits, who are usually juveniles, are interviewed with their parents and local law enforcement officials. Parents and juveniles are offered the choice of a police record or paying the full cost of cleanup or replacement. Other agencies are experimenting with youth education programs to inform youngsters of the cost of their actions.

Most bus companies manage to control their graffiti problems. One manager indicated that graffiti was not a problem. In the cities where graffiti is a significant problem (one system reported a geometric increase in graffiti and vandalism), the approach to the removal of graffiti encompasses all the techniques discussed here; no one technique appears equally effective at the various agencies. It should be noted that, to keep vehicles free of graffiti, top management commitment backed by maintenance expenditures is necessary at all transit agencies.

Removal of Chewing Gum

As much a headache for maintenance managers as graffiti, chewing gum has defied numerous chemical cleaning approaches. The most common method is to scrape off the gum, using a putty knife. At many agencies, ice water or freon is used to solidify the gum before it is scraped off. Pop-Up by Hysan, a commercially available solidifier containing fluorocarbons, is used at some transit agencies.

Fumigation

Many transit agencies, especially those in humid climates, schedule a periodic fumigation for each vehicle in the fleet (Figure 7). Usually outside contractors are used for this work, which minimizes the exposure of agency employees to the fumigating chemicals. Buses are periodically fumigated every 30 to 45 days with return visits scheduled as needed.

BUS DESIGN FEATURES AFFECTING INTERIOR CLEANING

Some of the observations by the transit agencies on the effects of bus design features on interior bus cleaning procedures are listed below. A summary of the interviews conducted with the transit agencies with respect to interior cleaning practices is presented in Appendix A.

- In all models of buses, there are crevices and corners that are difficult and/or time-consuming to clean. The rear interiors of buses appear to cause the most problems.
- The side-wall air conditioning system on AM General buses collects dirt and is difficult to clean.
- As dust collects inside lenses, interior lighting can become dirty. (In general, the insides of lenses are cleaned only when lights are replaced.) Bus dome lights are susceptible to

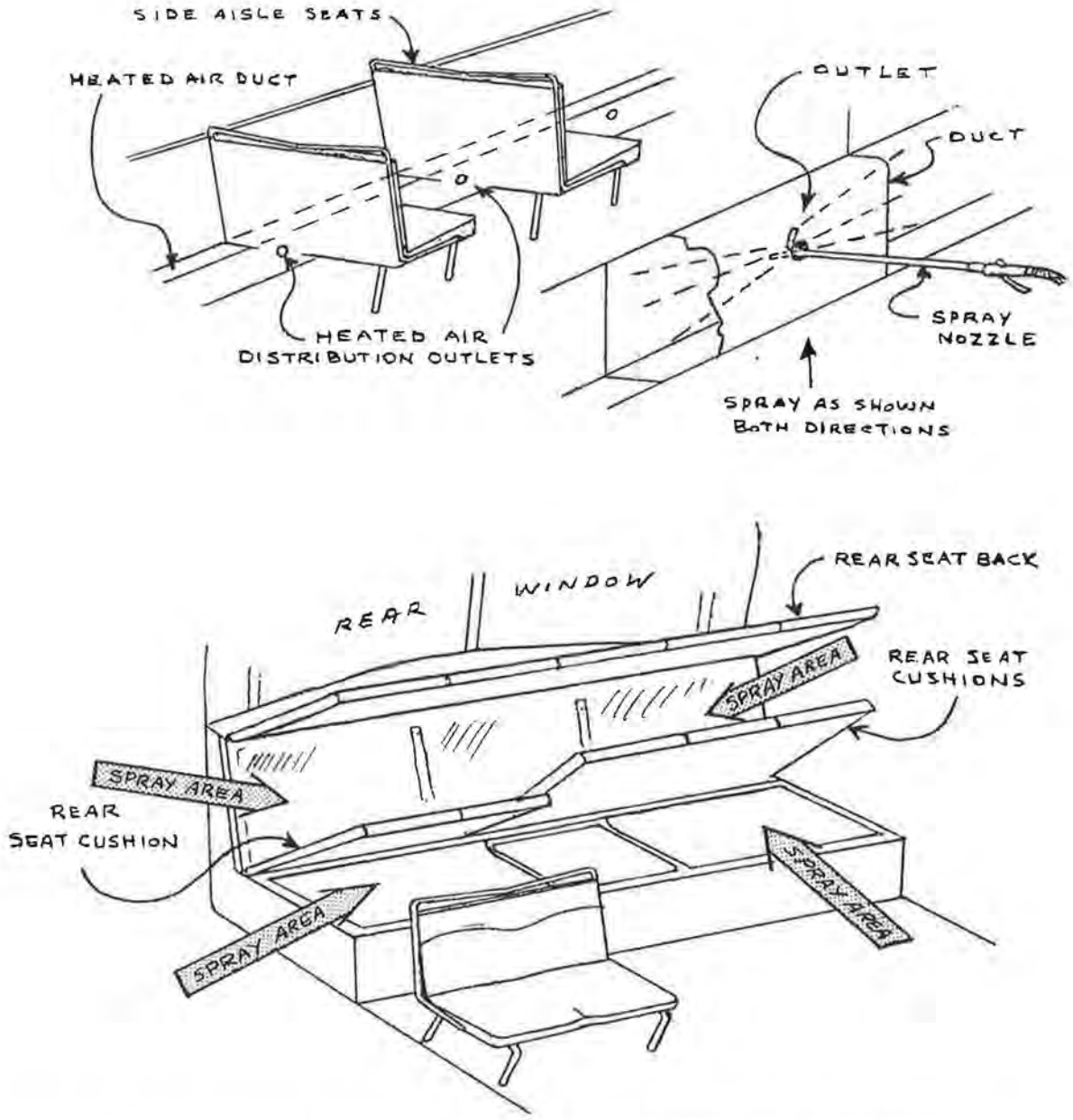


FIGURE 7 Partial illustrated instructions for fumigation procedure (Detroit Department of Transportation).

infiltration by dust blown by the air conditioning system, which can create a severe cleaning problem.

- The fabric interior of the bellows on articulated buses rapidly collects dirt and easily smudges. It is difficult to keep clean, as road dust can enter the compartment.
- Snap-in vinyl-padded seats hide dust and debris along the side walls. Often the debris is decayed food matter or food wrappings that will attract roaches. Employees require constant supervision in the cleaning of these areas.
- Bus interiors are easier to clean if seats are cantilevered or perimeter-style seats used.
- Passengers complain that the Flxible manufactured seats installed on Model 870 buses, which have a plastic composition texture, have a dirty appearance. Managers have complained that this textured vinyl is difficult to clean.
- Fiber-glass seats are easier to clean than vinyl or fabric seats.
- The fire-retardant fabric on bus interiors appears to "soak up" dirt.
- Vinyl-clad or melamine modesty panels, which tend to absorb graffiti, cause more maintenance problems than does stainless steel. Many agencies would welcome a return to stainless steel.
- The Flxible Model 870 bus interior cannot be washed with a pressurized water system, as water leaks into the radio compartment.

CHAPTER FOUR

CONCLUSIONS

As previously discussed, there have been limited improvements in the cleaning practices of the transit industry over the last two decades. It is evident that the prime factor in establishing and maintaining a clean vehicle fleet is the formulation of transit board policy that establishes vehicle cleanliness standards and is strongly supported by the commitment of transit management to carry out the board's policy. As there is no uniform procedure for bus cleaning in the transit industry, local policy, effectively managed, appears to represent the best approach to vehicle cleanliness. Below the managerial level, effective bus cleaning is more the result of careful supervision than of specific cleaning materials or methods. However, sound policy, managerial commitment, and effective supervision must be accompanied by substantial financial commitment to maintaining a clean bus fleet.

Agencies that have made the effort to keep vehicles clean generally find that both passengers and nonpassengers respond positively. However, those agencies that for various reasons do not make a commitment to vehicle cleanliness find that cleaning standards can slip quickly and that recapturing past standards becomes increasingly difficult over time, especially in this era of fiscal constraint.

It should be stressed that conditions affecting vehicle cleanliness and the level of commitment to cleanliness may vary greatly from agency to agency, even within the same geographical area. For example, agencies that largely serve suburban commuters face different problems than neighboring transit systems serving industrialized inner-city neighborhoods; and agencies in the Northeast, which face severe weather and extensive use of road chemicals, have different needs than agencies in the Southwest, which operate in relatively benign climates.

The cleanliness of local transit vehicles often reflects community pride; communities that recognize the value of overall urban cleanliness and effective public transit place more value on vehicle cleanliness. The exterior cleanliness of transit vehicles is an important indication to nonriders that the transit service is worthy of their support. A clean interior indicates to transit users that the system cares enough about them to maintain a standard of cleanliness.

There are constraints on the effectiveness of local cleaning policies and execution of such policies. In addition to the availability of funds, there are institutional constraints. Union work rules can affect the ability of transit managers and supervisors to devise productive cleaning techniques. There has been little improvement in the overall productivity of transit vehicle cleaning; however, union-negotiated work rules that affect cleaning practices tend not to be targets for renegotiation by management at contract times. Vehicle cleaning jobs are often the lowest paying jobs and tend to be entry level positions for all new maintenance department employees, which results in high job turnover. This in turn adds to the problem of providing effective supervision.

Transit managers generally agree that recent changes in bus design have had a negative effect on vehicle cleanliness; e.g., the addition of wheelchair lifts, with their highly susceptible electrical and hydraulic systems, and the use of acrylic windows. Furthermore, it has been suggested that the low-bid philosophy prevents vehicle manufacturers from modifying vehicle interiors and exteriors to facilitate both maintenance and cleaning.

It should be noted that despite federal involvement in vehicle design, little or no interest has been expressed by the federal government in the improvement of vehicle maintainability and cleanability. There has been a clear lack of applied research on major industry cleaning problems, including the increasing incidence of graffiti on urban transit vehicles. A modest federal effort (possibly conducted by the National Bureau of Standards, or even a nongovernment agency such as Underwriter's Laboratories) to develop graffiti-proof materials and/or anti-graffiti solvents would be welcomed by the industry. The Urban Mass Transportation Administration, through the Transportation Systems Center, has conducted a continuing investigation of the suitability of transit interiors, focusing on interior flammability standards; a complementary effort in cleaning materials would benefit the industry.

In summary, transit vehicle cleaning is both reflective of and influenced by local needs. Where transit boards and management consider vehicle cleanliness to be important to the overall provision of service, transit vehicles are well cleaned and maintained. Where more pressing needs take precedence, vehicle cleanliness tends to come under the category of deferred maintenance. There is no doubt, however, that both transit riders and nonriders respond positively to effective and efficient vehicle cleaning. The execution of local standards, backed by the resourceful use of available funds, is a transit system's best hope for clean vehicles.

APPENDIX A

SUMMARY OF INFORMATION OBTAINED FROM INTERVIEWS AND OBSERVATIONS AT TRANSIT SYSTEMS

PART I — EXTERIOR CLEANING

Agency/ Garage	Buses	Servicing Lanes	Washers	Frequency	Detergent Name	Brush Replacement	Comments
Washington (WMATA)/ Bladensburg	400	4	4 (R&W)	Every bus daily	None	Unknown	Front and rear cleaned by hand once per week; requires 4 extra employees. Roof cleaning--3 blankets and 1 mop.
DDOT/ Shoemaker	265	5	3 (Fleet Wash)	Every bus daily	501 Carwash (ABSO Clean Chemical) Inc.)	No problem at 22 months, except for oily brushes	Light system used (green = O.K.; red = stop, brushes off; yellow = too fast). Driver speed a problem. Blanket on roof. Windshield wiper arms torn off by front brushes on ADB's. Lack of soap caused scratching on Lexan. Prerinse at 5-10 ft (soap and cold water). Some preventive maintenance on washer. Undercarriage wash causes problem with electrical system in winter. Lighting system sensors turn off brushes. ADB window design sucks up dirt from street.
Ottawa OC Transpo/ St. Laurent	340	1	1 (Washtronic)	Every bus daily	Resolve (Dustband, Inc.) (used daily in winter and weekly in summer)	Unknown	Detailed standard operating procedures used. About 8 min per bus. Light system used (red = too fast, bell rings at foreman's station; green = too slow; yellow = OK). Mirrors pulled against bus before entering washer.
Transit Authority of Northern Kentucky (TANK)		1	1	Daily	None	2-3 yr	Front and rear washed by hand 3 times per week. Sides washed by hand quarterly. Hostler must pull back mirror. Very old wash rack.
Toronto (TTC)/ Wilson	260	2	2 (R&W)	Every bus daily	Big Ben Industrial Cleaner	Every 3-4 yr	Speed-through washer important. Occasional problem with windshield washer nozzle being ripped off. Undercarriage wash used. Watch for rough edges on advertising signs. Grooved floor eases drainage problems. Washers checked and serviced monthly. Front and rear pressure = 25 psi; extra pressure could cause rear bumpers to wear out brushes. Glass windows. Prerinse and final rinse water unheated. Standard procedures manual used.

Agency/ Garage	Buses	Servicing Lanes	Washers	Frequency	Detergent Name	Brush Replacement	Comments
Atlanta (MARTA)/ Brady Ave.		3	2 (R&W)	Daily (if necessary, twice daily	Niagra National	Every 75,000 buses	Water recycling. 2 washers (consecutive) in each lane. Wheel washers (not used on articulated buses). Wheel washers are maintenance problem. Speed of drive-through is critical. Wheel washer brushes replaced every 6-8 weeks. Soap activator by left rear wheel wand. Grease shield over brushes.
Baltimore (MTA)/Bush	265	4	4 (R&W)	Daily	None—environmental restriction		Washers modified to use Costanza brush. 13 workers plus foreman on 1 shift, 5 days per week; 4 workers Saturday and Sunday. 20-ft prewash. Wheel washers installed but not used. Rear brushes set at 27 psi when soap is not used; for good rear clean, set at 35 psi with soap. Side brushes at 20 psi; windows not affected. R&W roof blankets replaced with Costanza brushes. Mirrors damaged if not folded in. Sloping rears of RTS not cleaned by side brush. Roof vents may cause roof brush to skip.
Providence		2	1 (Power Wash)		Skyrite Cleaner-Polisher (Winfield Brooks Co.)	Unknown	Wheels cleaned by hand and steam. Front and rear cleaned by hand. Wrap-around brushes shut off to avoid damage to mirrors and windshield washers. Bus washers will not clean rear of RTS. Tampico brushes have not yet harmed Lexan. Imron paint cleans better and lasts longer. Front and rear brushes shut off; brushes used on side only.
Manchester		1	1 (Mr. Scrub)		Skyrite	After 5 yr	Wheels cleaned by hand and steam. Brush will not clean rear. No Lexan windows. Brush used as roof cleaner. Bus washer does not damage mirrors. Bus washer has electrical problems.
Raleigh		1	1 (Hannah HF-150)	Every 2 days (every day if raining)	Handi-Clean		Moderate speed through washer. Washer does sides, tops, fronts, and rears. Wheel cleaners not offered; steam jenny used instead. Prewash used to protect Lexan windows. Rear slant on RTS causes problems.

Agency/ Garage	Buses	Servicing Lanes	Washers	Frequency	Detergent Name	Brush Replacement	Comments
Phoenix		2	1 (R&W)				Spray bar for wheel cleaning. Imron paint used on wheels. Stainless steel plate used to slide bus easily onto washer lane for proper alignment for cleaning. Overhead wands instead of side wands used to prevent hostlers from tying back wands. Lights used to control speed. Washer is solid state; no relays.
Portland		2	2 (Hannah)	Daily	Spartan Car Creme (alkaline-based detergent)	Every 2-3 yr	Wheels steam-cleaned as part of 12,000-mi inspection. Washer improperly aligned, causing striping effect and stripping of paint off rear (washer was bouncing across rear). Culligan Filtration with water recycling used; sump pump cleanout contracted out. Mild degreaser sprayed on rear before wash to reduce dirt buildup. Would prefer rivetless exterior, flush doors, front and rear more flush. Brush fibers need improvement. Traffic light at entry and exit.
AC Transit/ Emeryville		3	1 (Fleet Wash) (14-yr old)	Every other day (odds/ evens, all on weekend	ZEP (Johnson)	3-4 times per year	Brushes checked frequently. Time through rack very important. GMC EIP kit difficult to clean. Problems with wheel cleaning. SAR windows (Allamac) do not appear to scratch. Would prefer 2 overlapping brushes at front and rear rather than single brush (single brush takes too long).

PART II—INTERIOR CLEANING

Agency	DAILY		PERIODIC									
				Seats		Sides		Floor				
	Method	Comments	Interval/ Man-Hours	Method	Material	Method	Material	Method	Material	Graffiti	Chewing Gum	Comments
Washington (WMATA) - Rail	Vacuum; panels wiped daily with Top Secret; seats wiped down	Carpeted.	45-60 days/ 8 per car	Spray; then wipe	Top Secret (Puritan)	Spray; then wipe	Top Secret (Puritan)	Shampoo; spot remover used for carpets	Top Secret (Puritan)	Top Secret (Puritan)	Freeze spray	
Washington (WMATA) - Bus	Cyclone	2 air hoses.	90 days/ 4.6	Wipe, scrub, and rinse with rags	Powermite	Wipe, scrub, and rinse with rags	Powermite	Wipe, scrub, and rinse with rags	Power-mite	Powermite, or recover seat	Scrape	No hoses. Fumigation every 45 days. Grained vinyl seats difficult to clean.
DDOT	Cyclone	2 air hoses. Dust accumulates in heater/ defroster core, destination sign, crevices, etc. Cyclone does not take up bottles, glasses, heavy papers. Paper jam once caused fire.	90 days/2	Power wash plus wipe-down for vinyl		Power wash plus towel wipe-down above sash	501 Car Wash	Power wash			Gum softener	Farebox covered with plastic cover. Bus fumigated every 30 days (Diazinon). Disinfectant used. Driver area cleaned by hand. Fiber-glass seats easy to clean. Lights get dirty, but only cleaned when replaced. Would prefer stronger, less toxic soap (J Cleaner by Johnson). Cantilever and perimeter seats promote cleaning.
Ottawa OC Transpo	Dust Bane Vacuum Cleaner	Seat wipe for sightseeing tours only (student labor). Special Countdown program (see Appendix B).	90 days/2	Power wash	Stanchions cleaned with Resolve	Power wash	1120 Soap (Carleton Chemical) or 2053 Stripo-lene	Power wash	All Purpose Wash materials (True Chom); rug shampoo; spray with Fibregard	Paint vinyl--MarHyde M-2 (ace-tone base)	Scrape; freeze spray	Winter partial, summer, fall Farebox and driver area covered.

	DAILY		PERIODIC									
				Seats		Sides		Floor				
Agency	Method	Comments	Interval/ Man-Hours	Method	Material	Method	Material	Method	Material	Graffiti	Chewing Gum	Comments
Transit Authority of Northern Kentucky (TANK)	Cyclone; seats wiped down as necessary	Must blow air at seats. Buses have carpets.	30 days/6	Hand wash	Spartan Custom Car Wash	Hand wash	Spartan Custom Car Wash	Shampoo	Spartan Custom Car Wash	Vinyl re-tinted with spray paint		Interior completely hand washed. Driver seat must be covered so that foam cushion is not penetrated. Would prefer not to have carpets.
Toronto (TTC) - Rail	Sweep out; graffiti cleaned off seats.	3 cars per hour.	20-30 days (or 5000 km)/3	Wipe		Brush, mop, sponge	Big Blue Cleaner	Clean— no wax	TTC Soil Solvent		Chlorothane scrape	More intense cleaning performed every 2-3 months (2 workers for 2 cars for 8 hr).
Toronto (TTC) - Bus	Cyclone	2 air hoses.	90 days/3	Power wash	Soap	Sponge, soap, scrub, rinse	Big Ben Industrial Cleaner	Power wash		Spray 'n Wipe (CMS)	Scraping	Fareboxes are removed by driver. Driver seat, etc., is covered. Careful attention to use of power wash in driver area. Forced-air heaters used to dry bus in winter months (hung from ceiling).
Atlanta (MARTA)	Cyclone; sweep out (even between peaks)	Wands used before turning on vacuum.	1600 mi/1.6	Wash		Wash below sash; hand wipe above sash				Soap used for most graffiti; for felt markers, seats replaced (current rate = 25 seats per week)	Scrape with putty knife	Windows every 800 mi (1 worker full time for 20 buses per day). Cannot flood 870 floor because water leaks into radio compartment. Fumigation on contract every 30-60 days. 870 seat back always looks dirty due to material composition design. 870 A/C blows dust into dome lights and creates cleaning problems. Intex is best soap.

Agency	DAILY		PERIODIC									
				Seats		Sides		Floor				
	Method	Comments	Interval/ Man-Hours	Method	Material	Method	Material	Method	Material	Graffiti	Chewing Gum	Comments
Baltimore (MTA)	Cyclone; seats wiped	1 air hose not effective for RTS. Need an adaptor for RTS. Cantilevered seats make little difference with vacuum - but help with sweeping.	55 days/8	Soap; wipe off with rags	Plaudit (Turco)	Soap; wipe off	Plaudit plus Glyst for window plastic	Soap; wipe off with rags		Graffiti Remover (Neleco)		No hoses. No floor wax (RCA floors). Graffiti remover less effective on painted surfaces or soft plastics. Fumigation as required. Problems with cleaning crevices (could be eliminated by new design).
Providence	Sweep out		120 days/8	Sponge and water	Skyrite	Sponge and water	Skyrite Window Cleaner	Mop	Skyrite	Skyrite	Scrape	Annual fumigation. Windows cleaned weekly.
Manchester	Sweep out; seats wiped		24,000 mi/5	Sponge and water	Skyrite	Sponge and water; towel used for windows	Skyrite			Vinyl re-tinted with spray paint or cover replaced		Windows cleaned weekly (30 min per bus). Farebox covered with Duncan farebox cover. No fumigation.
Raleigh	Vacuum; seats wiped	One hose through each door.	30 days/8	Brush and water		Brush and water	Handi-Clean used on overheads to remove grease			(No graffiti)	Ice water	
Phoenix	Cyclone	Special shroud designed for Buck cyclone. Plate on ground for lining up bus for cyclone. Blast gate on top of cyclone needs inspection plate. 1-vane preferred over 3-vane blast gate. Integral trash compactor used.	35 days/2-3			Mop and water		Mop and water		Seat changed		Periodic cleaning performed by contractor. Fire-retardant fabric on RTS-II "soaks up" dirt. Interior side-wall HVAC system on AMG collects dirt. Paper and dirt buildup behind panels in driver area.

Agency	DAILY		PERIODIC									
				Seats		Sides		Floor				
	Method	Comments	Interval/ Man-Hours	Method	Material	Method	Material	Method	Material	Graffiti	Chewing Gum	Comments
Lindenwold Rail	Trash picked up by operator after every run (helper on long trains); each car wet-mopped nightly	Windows cleaned daily.	/16	Wipe down; clean with cotton terry-cloth towels	J Cleaner	Wipe down	J Cleaner	Strip and rewax	Nonskid wax	Graffiti Eater (Sunshine Chemical) ($55/pint); must be mixed and then used in 24 hr		To remove graffiti, car is removed from service and cleaned. Driver inspection at end of each run. Strong disinfectant used. Seat cushions removed.
Portland	Vacuum; sweep out	Carpets. Mon. - dash boards; Tues. - sills and overhead; Wed. - seats wiped.	12,000 mi/ 90 days or as necessary (random sample)/4-6	Rag and water	Spartan Custom Car Wash	Rag and water	Spartan Custom Car Wash	Shampoo	Host dry extraction carpet cleaner		Pop Up (Hysan)	Periodic cleaning is part of Level C inspection. Carpeting has lasted for 10 yr. Dissatisfied with PVC or vinyl-clad or melamine modesty panels (would prefer corrugated stainless steel).
Evergreen			As needed/5	Wipe	Scotchgard					Degreaser or Acetone	Freon	
AC Transit	Sweep out; ledges dusted every other night	Cleaning with Buck cyclone takes too long; not effective for specific problems.	5000 mi/2-3	Wipe		Hose used below; spray bottle above; windows cleaned at 2500 mi; ceilings cleaned at 2000 mi				Vinyl re-tinted with spray paint or Graffiti Remover (Neleco) used		Inside bellows of articulated buses are dirt collectors (easily smudged). Fumigation at 10,000 mi with Roach-Proof plus spray (West Chemicals) at 5000 mi. Snap-in seats hide dust (workers reluctant to pull out and clean). Floors will eventually rot due to heavy use of hose. Inside cleaning performed while mechanic works outside. Articulated buses difficult to hose down.

APPENDIX B

EXAMPLES OF CLEANING JOB STANDARDS (OC TRANSPO, OTTAWA, ONTARIO, CANADA)

COUNT DOWN SCHEDULE

GARAGE ST. LAURENT

S. FORM # 266

GROUP #1
L ODD NUMBERED BUSES
TH NUMBERS ENDING
- 3 - 5 - 7 - 9

GROUP #2
ALL EVEN NUMBERED BUSES
WITH NUMBERS ENDING
2 - 4 - 6 - 8 - 0

LEGEND
C.D. #1 FULL SERVICE GROUP #1
C.D. #2 FULL SERVICE GROUP #2
T.O. WEEKLY TORQUE OIL CHECK
TR. G. - SANITIZING

:DAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
te 15-3-81 Full C.D. ograms: DASHES	Date 16-3-81 2 C.D. Programs: WIND/S T.O.	Date 17-3-81 1 C.D. Programs: DASHES T.O.	Date 18-3-81 2 C.D. Programs: TR.G OPP. SEAT	Date 19-3-81 1 C.D. Programs: WIND/S	Date 20-3-81 2 C.D. Programs: DASHES	Date 21-3-81 Full C.D. Programs: WIND/S
te 22-3-81 Full C.D. ograms: ASHES	Date 23-3-81 1 C.D. Programs: WIND/S T.O.	Date 24-3-81 2 C.D. Programs: DASH T.O.	Date 25-3-81 1 C.D. Programs: W.S.W	Date 26-3-81 2 C.D. Programs: OPP SEAT	Date 27-3-81 1 C.D. Programs: WIND/S	Date 28-3-81 Full C.D. Programs: DASHES
te 29-3-81 Full C.D. ograms: IND/S	Date 30-3-81 2 C.D. Programs: DASH T.O.	Date 31-3-81 1 C.D. Programs: WIND/S T.O.	Date 1-4-81 2 C.D. Programs: T-R-G OPP SEAT	Date 2-4-81 1 C.D. Programs: DASH	Date 3-4-81 2 C.D. Programs: WIND/S	Date 4-4-81 Full C.D. Programs: DASH
te 5-4-81 Full C.D. ograms: IND/S	Date 6-4-81 1 C.D. Programs: DASHES T.O.	Date 7-4-81 2 C.D. Programs: WIND/S T.O	Date 8-4-81 1 C.D. Programs: W.S.W.	Date 9-4-81 2 C.D. Programs: OPP. SEAT	Date 10-4-81 1 C.D. Programs: WIND/S	Date 11-4-81 Full C.D. Programs: DASHES
te 12-4-81 Full C.D. ograms: IND/S	Date 13-4-81 2 C.D. Programs: DASHES T.O.	Date 14-4-81 1 C.D. Programs: WIND/S T.O.	Date 15-4-81 2 C.D. Programs: T.R.G OPP SEAT	Date 16-4-81 1 C.D. Programs: DASHES	Date 17-4-81 Full C.D. Programs: WIND/S	Date 18-4-81 Full C.D. Programs: DASHES
te 19-4-81 Full C.D. ograms: IND/S	Date 20-4-81 Full C.D. Programs: DASHES	Date 21-4-81 2 C.D. Programs: WIND/S T.O.	Date 22-4-81 1 C.D. Programs: W.S.W T.O.	Date 23-4-81 2 C.D. Programs: OPP. SEAT	Date 24-4-81 1 C.D. Programs: WIND/S	Date 25-4-81 Full C.D. Programs: DASHES
te 26-4-81 Full C.D. ograms: IND/S	Date 27-4-81 2 C.D. Programs: DASHES T.O.	Date 28-4-81 1 C.D. Programs: WIND/S T.O.	Date 29-4-81 2 C.D. Programs: TRG OPP/SEAT	Date 30-4-81 1 C.D. Programs: DASHES	Date 1-5-81 2 C.D. Programs: WIND/S	Date 2-5-81 Full C.D. Programs: DASHES
te 3-5-81 Full C.D. ograms: IND/S	Date 4-5-81 1 C.D. Programs: DASHES T.O.	Date 5-5-81 2 C.D. Programs: WIND/S T.O.	Date 6-5-81 1 C.D. Programs: W.S.W	Date 7-5-81 2 C.D. Programs: OPP. SEAT	Date 8-5-81 1 C.D. Programs: WIND/S	Date 9-5-81 Full C.D. Programs: DASHES
te 10-5-81 Full C.D. ograms: IND/S	Date 11-5-81 2 C.D. Programs: DASHES T.O.	Date 12-5-81 1 C.D. Programs: WIND/S T.O.	Date 13-5-81 2 C.D. Programs: TR.G OPP SEAT	Date 14-5-81 1 C.D. Programs: DASHES	Date 15-5-81 2 C.D. Programs: WIND/S	Date 16-5-81 Full C.D. Programs: DASHES
te 17-5-81 Full C.D. rograms: IND/S	Date 18-5-81 Full C.D. Programs: DASHES	Date 19-5-81 1 C.D. Programs: WIND/S T.O.	Date 20-5-81 2 C.D. Programs: W.S.W. T.O.	Date 21-5-81 1 C.D. Programs: OPP. SEAT	Date 22-5-81 2 C.D. Programs: WIND/S	Date 23-5-81 Full C.D. Programs: DASHES

JOB SPECIFICATION & PROCEDURE

REFERENCE NO.: 104-29A

DATE OF ISSUE: 4/79

VOLUME NO.: XB

W.S.T. A.W. 3/79

A. NAME: Count Down Jockey

B. SUPERCEDES: Jockey, May, 1972

C. LOCATION: St. Laurent, Pinecrest & Merivale Garages

D. GRADE OF OPERATOR: Garage Attendant

E. AUTHORITY: Buses will be passed through Count Down according to schedule issued from Job Planner's Office.

Main Account No.	4205	
Sub Account No.	001	
Location Code	10	St. Laurent
	30	Pinecrest
	40	Merivale

F. EQUIPMENT:

1. Aerofog Generator - for sanitizing agent
2. Spray pumps for cleaning materials
3. Gloves
4. Automatic bus washer
5. Vacuum with attachments

JOB SPECIFICATION & PROCEDURE

G. MATERIALS:

1. Glass cleaning solvent Glyst (9 parts water to 1 part glyst)
2. Dash cleaning solvent, Resolve (1 part water to 1 part resolve)
3. Tri-Gly (Sanitizing agent)
4. Terry towels
5. Windshield washer fluid

H. REFERENCES:

Count Down St. Laurent, 1963 - Ref. No. 104-01-A
Daily Servicing and Cleaning , 1972 - Ref. No. 104-05-A

J. SAFETY:

1. All normal safety precautions must be observed.
2. Posted speed limits must be observed.
3. Do not move bus without adequate air pressure (minimum 80 P.S.I.). Observe gauge as buzzer may be defective.
4. Do not dirve a bus that will not supply adequate air pressure or that can not be operated safely.
5. Place gear shift in neutral and apply parking brake before leaving operator's seat.
6. "Toot" horn to signal fueler, back vac man and torque oil man and wait until they have stepped aside before moving from Station "O" to Station "I".
7. When necessary to back up bus, use extreme caution.
8. Jockeys must not smoke in fueling area.

JOB SPECIFICATION & PROCEDURE

K. EQUIPMENT MAINTENANCE:

1. Do not use more than 1/3 throttle to pump up air pressure.
2. Lights should not be left on for an extended length of time when engine is not running. All lights should be switched off for easier starting of engine.
3. Aerofog must be handled with care. Aerofog control knob on generator should be set slightly below medium position on dial. Generator should be switched on for 8 - 10 seconds facing the rear of bus.

L. ESSENTIAL DATA:

1. At station "O" pick up large debris that will not go through vacuum hose.
2. Vacuum is to be done as efficiently as possible with minimum motion and effort. Clean front steps upon entery, clean centre aisle and under right side seats. (Jockey's left) while moving towards rear of bus. Upon reaching half-way point back up towards front cleaning under left seats (Jockey's right) while doing so. Clean operators platform and around pedals.
3. Special attention must be given to seat cushions and back rest during debris pick-up, since a duster is not involved in Count Down operation. Dirty seats must be reported as a defect.
4. Windows that are hard to open or close and broken glass must be reported as defects.

JOB SPECIFICATION & PROCEDURE

L. ESSENTIAL DATA: (cont'd.)

5. Report defective windshield wipers and blades.
6. Warning Devices: Report faulty low air pressure buzzer. Tell-tale: Report indicator lights that are not working. Example: Low oil, low air, exit door, and turn signals.
7. Report loose floor coverings, loose stanchions, loose or broken seats or any other abnormal condition.
8. Report buses that are difficult to place in gear.
9. Report buses that have extremely long parking brake lever travel or that parking brake will not hold.
10. Loose mirrors, broken mirror glass, bent or loose mirror arms must be reported as defects.
11. Report as defects excessive air pressure drop when brakes applied. Normal pressure drop - 5 - 7 lbs.
12. Filling of windshield washer reservoir is done on sanitation nights only.

M. STANDARD METHOD:

1. At station "O" stop bus, place transmission in neutral and apply hand brake. Walk to rear of bus picking up paper too large for vacuum cleaner and closing windows and vents. Deposit papers and contents of garbage pail in large trash container to the left of the operator's window.
2. On signal from fueller advance to station "1". Place transmission in neutral and activate interlock, at this point the fueller will open the rear door and insert rear door holding fixture, shut off motor.
3. Exit from bus, by front door, pick up front vacuum hose. Vacuum front section of bus as described in Essential Data.

M. STANDARD METHOD (con'd.):

4. Exit from bus and hang up vacuum hose on hook. Pull right mirror into body.

5. When Fueler has finished and removes rear door holding tool and door closes, start engine and advance to station "2".

6. At station "2" place transmission in neutral and apply hand brake.

7. From operator's side window pick up spray bottles and terry cloth. Depending on program for the night, spray and clean either the dash area or inside of front windshield glass. Replace spray bottles and terry cloth on stand. Pull left mirror into body.

8. On sanitization nights place transmission in neutral and apply hand brake. Exit from bus using front door. Pick up aerofog generator and place it in the centre aisle of the bus facing the rear. Turn on generator for 8 - 10 seconds. Switch off generator and place it on stand out side of bus. Fill windshield washer reservoir from large tank.

9. At the bus wash drive slowly until bus activates wand, as washing cycle starts, drive through automatic bus washer at an even speed so as to keep the speed indicator light on amber.

JOB SPECIFICATION & PROCEDURE

M. STANDARD METHOD (cont'd.):

10. When bus has passed out of bus wash, stop and straighten left rear view mirror. Drive to parking area. Place transmission in neutral and apply hand brake. Switch off lights and motor.

11. Exit from bus, straighten right hand mirror arm. Walk to number two bus in unserviced lane. Enter number two bus making sure transmission is in neutral and parking brake is applied. Start bus and wait until oil pressure indicator light has gone out, turn on exterior lights and exit bus.

12. Walk to number one bus in unserviced lane. Enter bus and pump air pressure to required limit when necessary. Place transmission in forward gear and release parking brake.

13. Drive to station "O" observing speed limits and using caution at door openings and pedestrian cross-over areas.

N. QUALITY CONTROL CRITERIA:

1. All buses passed through Count Down must be clean inside and out. All exterior glass shall be clean as well as exterior panels.

P. PROCEDURE:

JOB SPECIFICATION & PROCEDURE

REFERENCE NO.: 104-29 A
VOLUME: XB
DATE OF ISSUE: 4/79
W.S.T. A.W. 3/79

NAME OF JOB: Jockey
LOCATION: St. Laurent, Pinecrest and Merivale

ITEM	IMPORTANT STEPS	KEY POINTS	S.M.S.
1	Station Zero	Includes: Place transmission in neutral, apply hand brake. Pick up large debris. Empty garbage container. Close windows and vents.	1.63
2	Station One	Includes: Driving to station one. Applying hand brake, activate interlock. Vacuum front section. ENF Wait	.50
		Replace vacuum. (Full)	2.55
		Vac. Frq. 1/10 (Partial)	1.10
3	Station Two	Includes: Driving to Station "2" Completing scheduled program.	1.01
		Sanitization night & W/S fluid.	1.06
4.	Drive to Parking Area	Includes: Drive to bus wash. Drive through bus wash, drive to serviced parking lane. Exit from clean bus. Walk to number two bus in unserviced lane. Start bus, exit bus and walk to number one bus, enter and drive to station "0".	3.79

This is to certify that I have received a copy of this Job Specification and Procedure and fully understand the requirements and procedure described therein.

DATE _____ EMP. NO. _____ SIGNATURE _____

Standard Time:

Jockey with dash or windshield	Full Count Down	8.98
Jockey with sanitization	Full Count Down	9.03
Jockey with dash or windshield	Partial Count Down	8.03
Jockey with Sanitization	Partial Count Down	8.08

JOB SPECIFICATION & PROCEDURE

REFERENCE NO.:	104-30 A
VOLUME NO.:	XB
DATE OF ISSUE:	4/79
W.S.T.	A.W. 2/79

A. NAME: Rear Vacuum Man

B. SUPERCEDES: Rear Vacuum Man, May 1972

C. LOCATION: St. Laurent, Pinecrest and Merivale Garages

D. GRADE OF OPERATOR: Garage Attendant

E. AUTHORITY: Rear Vacuum Man will complete his procedure on each bus requiring a full servicing.

Main Account No.	4205	
Sub Account No.	001	
Location Code	10	St. Laurent
	30	Pinecrest
	40	Merivale

F. EQUIPMENT:

1. Vacuum cleaner with attachments
2. Canvas gloves

G. MATERIALS: N/A

H. REFERENCES:

Rear Vacuum Man, May 1972
Daily Servicing & Cleaning Report , May 1972

JOB SPECIFICATION & PROCEDURE

J. SAFETY:

1. No smoking in fueling area.
2. Stand aside when bus is approaching and wait until bus has completely stopped before reaching for rear door, to pull open.
3. Normal garage safety procedures must be adhered to.

K. EQUIPMENT MAINTENANCE:

1. Vacuum pick up nozzle must be properly adjusted.
2. Hose must be hooked to stantion bar to keep from kinking when operator enters rear door.
3. Hose must be of proper size and length 9 ft. of 2" hose joined to 15' of 1-1/2" hose.

L. ESSENTIAL DATA:

1. Papers, sticks or debris large enough to clog hose must be picked up by hand.
2. When cleaning ribbed section of flooring, the ribbed pattern must be followed to clean out dirt lodged in grooves.
3. Attachments and equipment for vacuum cleaners must be handled properly to avoid unnecessary damage and placed on equipment board at end of shift. Defective tools or equipment must be reported so that corrective action may be taken.

JOB SPECIFICATION & PROCEDURE

L. ESSENTIAL DATA (cont'd.):

4. For vacuum operation to be completed efficiently and with minimum effort, the following pattern is recommended. Clean steps prior to entering bus. Upon entry clean aisle and right side of bus (Jockeys left) while proceeding towards rear. Clean left side of bus while backing up towards rear door.
5. Special attention must be given to seat cushion and back rests as there is no duster involved in Count Down operation. Report dirty seats, loose or broken seats, loose floor covering or stanchions or any other abnormal conditions as defects.
6. On partial cleaning rear vac man performs as a jockey.

M. STANDARD METHOD:

1. Pick up vacumm hose and enter bus by rear door.
2. Close any windows left open.
3. Exit bus and hang hose and wand on hook.
4. Report any defects noted to Fare Box man.

N. QUALITY CONTROL:

All loose debris, paper, granular dirt and dust is to be removed.

P. PROCEDURE:

ITEM	IMPORTANT STEPS	KEY POINTS	S.M.S.
1	Observing defects	Includes: Observing approaching bus for defects.	.21
2	Vacuum Rear Section	Includes: Entering bus, vacuuming rear section, observing any defects. Exiting from bus by rear door.	1.75
3	Replace Vacuum Hose	Includes: Hanging hose back on hook. Observe rear door action.	.22

AUXILIARY ALLOWANCE:

Dump debris in garbage container (F 1/3)	.08

STANDARD TIME:

One large transit bus	2.26

JOB SPECIFICATION & PROCEDURE

REFERENCE NO.:	104-30 A
VOLUME NO.:	XB
DATE OF ISSUE:	4/79
W.S.T.	A.W.

NAME OF JOB: Rear Vacuum Man

LOCATION: St. Laurent, Pinecrest, & Merivale

This is to certify that I have received a copy of the Job Specification and Procedure and fully understand the requirements and procedure described therein.

DATE_____EMP.NO._____SIGNATURE_____

JOB SPECIFICATION & PROCEDURE

REFERENCE NUMBER: 104-22 A

DATE: JUNE 78

VOLUME: 10B

W.S.T. A.W. 4/78

A. NAME: Interior Cleaning (Graco Pump)
(3 buses per shift)

B. SUPERCEDES: Interior Cleaning Procedure, March 1969

C. LOCATION: St. Laurent & Champagne & Merivale

D. GRADE OF OPERATOR: Garage Attendant

E. AUTHORITY: Booking and scheduling of buses for interior cleaning must be done by Job Planner and recorded on planning board. Three buses should be booked daily so Bus Starter can select the first bus coming in; one bus kept if possible.

Main Account No.	4205	
Sub Account	003	
Location Code	10	St. Laurent
	20	Champagne

F. EQUIPMENT:

1. Graco 10 to 1 high pressure air powered pump with single nozzle.
2. Protective covers for -
   a) Gradustat
   b) Farebox
   c) Speakers (3)
   d) Heater Air Intake Ducts 5300 class
   e) Power pack
   f) Dash and Rear Destination signs
   g) Operator's seat
   h) Shift tower

i) P.A. sets
j) Passenger counter
k) Radio speakers
l) Chimes
m) Stop lamp switch over

3. Rubber suit of clothing
4. Short handle brush
5. Drip pan (for oil bath)
6. Oil can with SAE 40 oil
7. Drying fan for Champagne
8. Fuel oil heater for St. Laurent

G. MATERIALS:

1. Bus wash powder #1126 Cartier Chemicals
2. Water
3. Terry Towels
4. Spray bottle of resolve and glyst.

H. REFERENCES: Nil

J. SAFETY:

1. Remove ramps for rear wheels once bus is off (do not drive over ramps with front wheels).
2. Speed limit around garage is 15 Kph.
3. Interior heater should only be run for 45 min. (with door shut and rear windows open). Do not leave heater runnings during break or lunch periods. Do not work in bus with heater running.

JOB SPECIFICATION & PROCEDURE

K. EQUIPMENT MAINTENANCE:

1. Use clean water only.
2. Weekly check and clean screen in soap inlet pipe.
3. Fill lubricator with #10 compressor oil when required.
4. Graco Pump Lubricator must us two (2) ounces of oil for 25 buses.
5. Concentration of soap is 3/4 oz. of bus wash powder per gallon of water (28 oz. bag obtained from stock room). Dissolve 28 oz. bag of bus wash powder in pail of hot water then pour into 45 gal. drum.
6. Handle all equipment with care.
7. Shut off air supply to pump after each day.
8. Keep barrel covers in place to keep out dirt.
9. Spray gun and nozzle and protective covers to be stored in locker at conclusion of shift.

L. ESSENTIAL DATA:

1. G.M. Buses - Do not spray excessively with soap and water on panel joints in rear section of bus, since water can get into the engine breathers and engine, causing damage to engine.
2. Direct and prolonged spray should be avoided on lights, bell cord switches, electric motors. Do not use spray in front area forward of white line.
3. All protective covers must be installed correctly.
4. Interior of bus should be kept humid. If bus has had the opportunity to dry after being soap sprayed, bus will have to be re-soaped again before it can be rinsed. Thus, if there is any risk of a bus drying up during break period or noon hour, attendant should arrange with supervisor to take his break or lunch a few minutes later rather than go through a whole cycle of respraying.

4. NOTE: Keeping doors closed will keep up the humidity. Seats and lower half of sides must be rinsed last for best results. This rinses away any splashing created when floors were being rinsed.
5. The amount of soap spray and water should be kept to a minimum. It should be quite easy to soap spray 3 buses with one 45 gallon drum of soap mixture and attendants should try to do so.
6. Special attention must be given to the on board passenger data collecting equipment, overspray should be kept to a minimum and protective covers must be installed.
7. Radio equipped buses - radio must be removed when doing interior cleaning.

M. STANDARD METHOD:

1. Obtain bus - Walk to parking area, enter bus, start engine and wait for air pressure to build up to safe operating level. Drive to interior wash station.
2. Set bus on Ramps - Stop bus and apply hand brake. Position ramps in front at outer rear wheels. Open garage door in front of bus (safety measure). Back bus up 10 - 12' and stop, place bus in forward gear and drive onto ramps, stopping when rear wheels are in center of ramps. Put bus in neutral and apply hand brake.
   Ramps not used at Champagne.
3. Remove Sign clips and Signs - Walk to right front seat and remove sign clips, progressing down right side and back up left side. Place clips on right front seat. Remove signs from right side starting at front and going to rear. Keep signs in order; from rear left advance to front removing signs and keeping them in order.

JOB SPECIFICATION & PROCEDURE

4. Place signs out of bus - Pick up sign clips from right front seat. Walk to storage area,close garage door when passing, place signs in safe dry area, return to bus.
5. Lift seats - Enter bus, start at right side and lift seats to upright position working down right side and up left side.
6. Pick up loose paper - Take vehicle garbage container and pick up all loose paper including that trapped between seat side wall and rail. Work down right side and up left side. Exit bus and empty garbage container, fill with water and let soak.
7. Remove Oil Bath Filters - Walk to rear of bus, remove oil bath filter base. Place to one side and cover with cover provided. Install drip pan.
8. Obtain Protective Covers - Pick up protective covers from locker and enter bus. Install covers on steering wheel, operator's seat, fare box, chimes cover, gear shift tower, heater air intake, front and rear destination signs, stop light switch, radio mike and P.A. speakers.

NOTE: Remove radio at this time if bus so equipped.

9. Obtain Graco Gun - Walk to locker, pick up gun, turn on soap solution, enter bus. Spray soap solution on seats only, left and right, from front to rear. Working from rear to front, spray rear window, ceiling section, transom glass and walls. Avoid spraying on lamps and speakers. Care must be taken not to let overspray enter operator's compartment. Exit bus.

10. Turn Drums to Clear Water - Turn taps from soap solution to clear water. Place gun to one side. Pick up brush and enter bus, walk to rear. Agitate rear window and back panel - side windows, transom glass and wall panels. Work from rear to front stoping at white line. Agitate back cushion, replace and agitate seat cushions, work up right side and down left.
Exit bus, replace brush in locker, pick up Graco gun and enter bus.
11. Rinse Interior - Standing in front compartment facing rear, rinse ceiling, wall panels, and seats with clear water. Work from front to rear. When at rear, rinse rear window and rear seat. Rinse floor and seat legs working from rear to front. Make sure that all dirt and sand is forced to the front of the bus and out the door. Wash front step area, paying close attention to portions normally hidden such as behind front doors and wheel wells.
12. Store Gun - Exit bus, walk to locker, place gun in locker, walk to drums, turn taps to fill drums. Pick up hand cleaning equipment from locker and place in bus. If working on second and third bus go to previous bus and turn off heater. Return to drums and turn off taps. Empty vehicle garbage container and hand clean. Enter bus and place container in proper holder.
13. Remove Protective Covers - Remove all protective covers from equipment previously covered. Place all covers in largest cover, exit bus. Place covers in locker. Pick up oil can from locker, oil accelerator and brake pedals. Also oil operator's seat pedestal and lock.

JOB SPECIFICATION & PROCEDURE

14. Hand Clean Front - Pick up spray bottle of resolve, and rag, hand clean ceiling panels, destination sign cover, sun visor, switch panel and instrument panel, dash, front door moulding and fare box.
15. Hand Clean Glass- Pick up spray bottle with glyst and hand clean operator's window, windshields, door glass, rear view mirror and destination sign glass. Install radio if bus so equipped.
16. Install Oil Bath Filters - Walk to rear of bus and remove drip pan. Place to one side, install oil bath base. Close engine door, walk to front of bus.
17. Remove Hand Cleaning Materials - Pick up used rags and bottles, exit bus, place materials in locker. Open garage door, pick up signs and clips from storage area. Place signs on front right seat. Start bus, release hand brake, put bus in forward gear and drive to drying area. Place bus in neutral, apply hand brake, stop motor.
18. Install Heater - Exit bus, pick up heater (help needed). Install heater facing rear of bus, open both rear windows and driver's vent. Start heater, set on mark for fuel setting. Exit bus and close door.
18A. At Champagne - Install fan facing rear, open rear windows and driver's vent, turn on fan - close door.
19. For second or third buses, start at step one on next bus.
20. Shut off Heater or Fan - Walk to bus, open front door, shut off heater or fan. Remove heater or fan from bus (help needed). Place heater or fan to one side, enter bus and pick up signs. Place signs in holders starting at right front. Down right side and up left side (signs must be placed in correct order). Pick up clips, install clips at junction of signs and start and finish.

21. Wipe Off Interior - With rag, wipe spots off seats and stanchion bars. Start engine, release hand brake, place in gear, drive to parking area and stop bus.

P. PROCEDURE:

ITEM	IMPORTANT STEP	KEY POINTS	SMS
1.	Prepare bus #1	Includes: Get bus from parking area ramps, remove advertising clips and signs, obtain protective covers and install, lift seat and pick up loose papers on set ledge. Bring Graco gun.	17.78
2.	Wash Interior	Includes: Spray with soap solution and agitate seats, ceiling, walls, and seat backpans. Rinse down with clean water. Note: Switch off heater of previous bus if on number 2 or 3 at this point.	56.87
3.	Hand Clean Front Compartment	Includes: Remove protective covers. Obtaining cleaning materials hand wash front section, clean glass. Place signs on seats of bus. Oil pedals and pedestal.	28.67

ITEM	IMPORTANT STEP	KEY POINTS	SMS
4.	Move Bus #1 to Drying Area	Drive bus off ramps to drying area, intall and start heater or fan, open rear windows and driver's vent, and shut door.	3.31
5.	Obtain and Prepare Bus #2	Repeat items 1-2-3	103.32
6.	Go to Bus #1 for Final Cleaning	Includes: Removal of heater or fan - replacing signs and sign clips - rewiping of seats and return bus to parking area.	13.68
7.	Move Bus #2 to Drying Area	Repeat key points of Item #4.	3.31
8.	Obtain and Prepare Bus #3	Repeat key points in Item #5.	13.68
9.	Go to Bus #2 for Final Cleaning	Repeat key points in Item #4.	103.32
10.	Move Bus #3 to Drying Area	Repeat key point in Item #4.	3.31
11.	Move to Interior Wash Area	Pick up hoses and place in locker, refill drums for next day, clean floor and put cleaning equipment away.	5.00
12.	Enter Bus #3 for Final Cleaning	Includes: Replacing signs and clips, wiping seats and stanchion bars, removing heater, driving bus to parking area.	13.68

REFERENCE NUMBER: 104-22
DATE: April 1978
VOLUME: 10
W.S.T.: A.W.

AUXILIARY ALLOWANCES

A.	Stores time	5.00	
B.	Refill Heater Resevoir	7.25	
C.	Fill in Job Ticket - Return to Foreman	2.00	
		14.25	- 14.2
	SMS TOTAL	380.18	
	3 Buses	6½ hrs.	

NAME OF JOB: INTERIOR CLEANING

LOCATION: St. Laurent and Champagne & Merivale

EXTRA WORK

If bus is equipped with radio - Removal and installation	2.20
If necessary to remove Oil Bath Filters	5.05

This is to certify that I have received a copy of the Job Specification and Procedure and fully understand the requirements and procedure described therein.

DATE _____ EMP. NO. _____ SIGNATURE _____

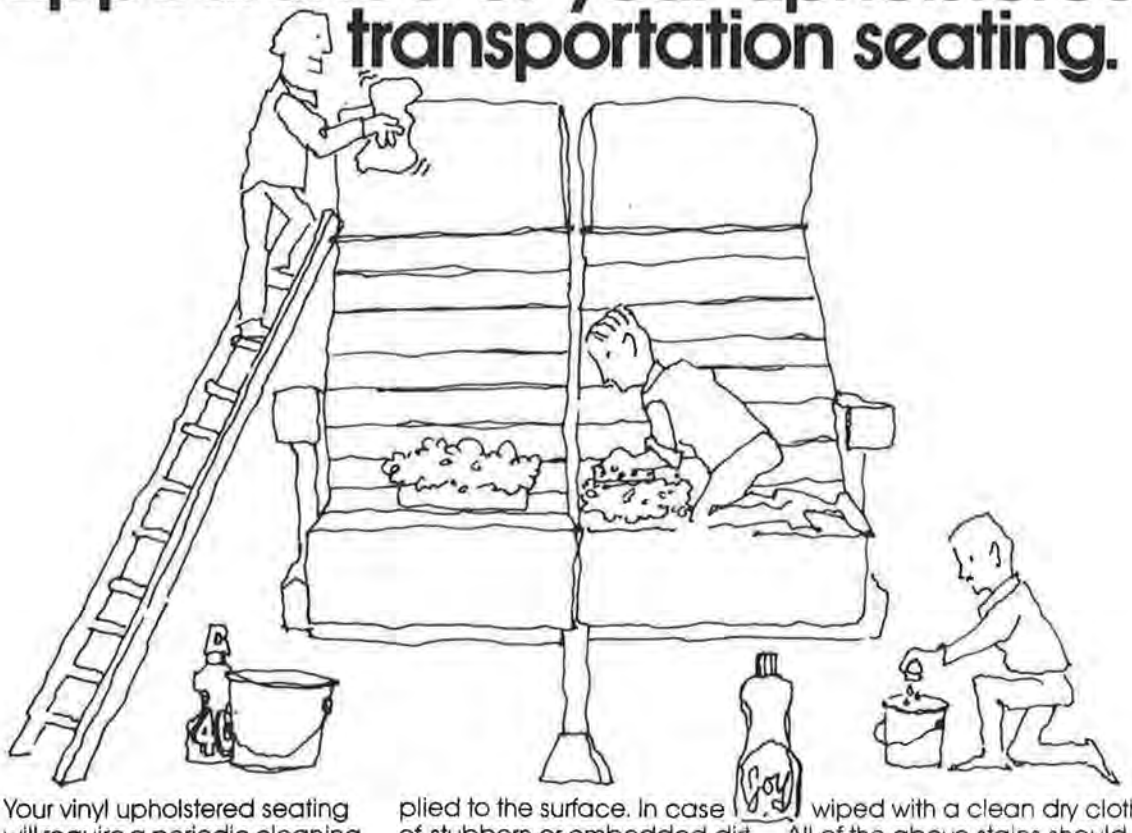
STANDARD TIMES

One bus	136.25	min.
Two buses	256.56	min.
Three buses	380.18	min.
One bus with radio	138.45	min.
Two buses with radios	260.96	min.
Three buses with radios	386.78	min.
One bus with oil bath	141.30	min.
Two buses with oil baths	266.61	min.
Three buses with oil baths	395.33	min.

APPENDIX C

EXAMPLE OF SEAT MANUFACTURER CLEANING INSTRUCTIONS

How to preserve the life and appearance of your upholstered transportation seating.



Your vinyl upholstered seating will require a periodic cleaning to retain a neat appearance. We strongly recommend the use of a mild household cleaner like No. 409.

American Seating will not accept responsibility for the normal life span of upholstered materials if harsh solvent type cleaners like Lestoil, Fantastic and others are used. These solvent cleaners cause cracking, crazing and general deterioration of the vinyl and thread materials.

The following cleaning recommendations have been tested in our laboratories and are proven to be acceptable and effective.

Proper cleaning procedures for vinyl

The use of household detergents as No. 409 Cleaner with warm water and applied with a sponge or cloth will remove most dirt. In addition, a soft bristle brush may be used after the soap has been applied to the surface. In case of stubborn or embedded dirt, a non-abrasive cleaner such as Bon-Ami can be effective. Before the surface dries, wipe with a clean dry cloth to remove residue. This procedure may have to be repeated to remove some dirt or stains.

Spot and stain removal suggestions

Ink — Can be removed sometimes by use of alcohol. Paint, Shoe Polish and Tar — Stains of this kind can best be removed by using Naphtha or Kerosene on a clean white cloth. Chewing Gum — May be removed by first carefully scraping the surface and then whatever is remaining should be removed by the use of Naphtha or Kerosene.

General information

Do not use any stronger solvents as they will attack vinyl and plastic compositions. The area cleaned using any of the above methods should be rinsed with clear water and wiped with a clean dry cloth. All of the above stains should be cleaned as quickly after they are made as possible in order to obtain the best results.

Badly stained vinyl surfaces can be rejuvenated with Color Hit, a flexible color coating made by Advance Color Corporation, 800 South Vail Avenue, P.O. Box 54870, Los Angeles, California 90054. Color Hit is an opaque water base coating available in 25 standard colors. Advance Color also makes a product called "Instant Vinyl" which is used for repairing cuts, tears, cigarette burn holes and the like in any vinyl upholstery material. Instant Vinyl is a clear, jelly-like substance which acts as a bond between the edges of the original vinyl and in effect, replaces vinyl, providing a smooth and completely flexible seam or weld.

American Seating Company
Transportation Products Division
Grand Rapids, Michigan 49504

More helpful hints for cleaning and removal of stains from woven fabrics.

Cleaning woven fabric

Remove all dust and loose dirt from fabric with a whisk broom or vacuum cleaner. Use a foam upholstery cleaner or a household detergent such as Joy, All or Tide. After diluting the cleaning fluid in accordance with the directions on the container, pour a small quantity into a flat pan and work into a thick foam with a sponge or brush. Apply only the foam to the fabric with a brush, sponge or turkish towel. Cover a small area of the fabric at a time with foam. AVOID SOAKING. Rub vigorously. Remove the foam with brush, sponge or dampened cloth. On mohair fabrics, brush the dampened surface in the direction of the pile several times with a stiff brush. When dry brush against the pile to restore the nap.

Removal of spots or stains

General Directions — Always use a clean cloth and a small amount of the recommended cleaning fluid. Avoid a ring formation by starting outside of the stained area and working in toward the center with a slow circular motion. An excellent recommended spot remover is K2r Spot Lifter made by Texise of Greenville, S. C. Follow the printed directions.

CAUTION — The fumes of such cleaning fluids as carbon tetrachloride are extremely harmful if any quantities are drawn into the lungs. Also, some solvents are inflammable. Adequate ventilation must be provided.

Chewing Gum & Tar — Moisten the gum or tar with carbon tetrachloride, kerosene or turpentine and work it off with a dull knife. Saturate a clean cloth with the solvent and rub lightly to remove the remaining spot. If kerosene is used, wash in warm soapy water afterwards.

Lipstick, Grease, Oil & Shoe Polish — Apply a small quantity of carbon tetrachloride or a commercial spot remover, such as Carbona, Dryclean, Energine & Renuzit by means of a cloth and immediately press a blotter firmly on the spot. Repeat this process using a clean portion of the blotter, until blotter no longer shows stains.

Candy, Ice Cream, Fruit Stains, Liquor & Wine, Soft Drinks — Use clear lukewarm water and a clean cloth to soften. Scrape off loose material with a dull knife. If stain remains, rub with cloth or sponge soaked in lukewarm foam cleaner. Remove foam with dampened cloth. After spot has dried, sponge soiled area with cleaning solvent and rub with a clean dry cloth.

Blood — Rub out spot with a clean cloth soaked in cool water. If spot remains, repeat the process using household ammonia and rinse with clean wet cloth. Do not use hot water or soapsuds on a blood stain. These will only set the stain.

Nausea Stains — Sponge the stained area with foam from a cleaner until the stain is removed. Remove foam with a clean damp cloth.

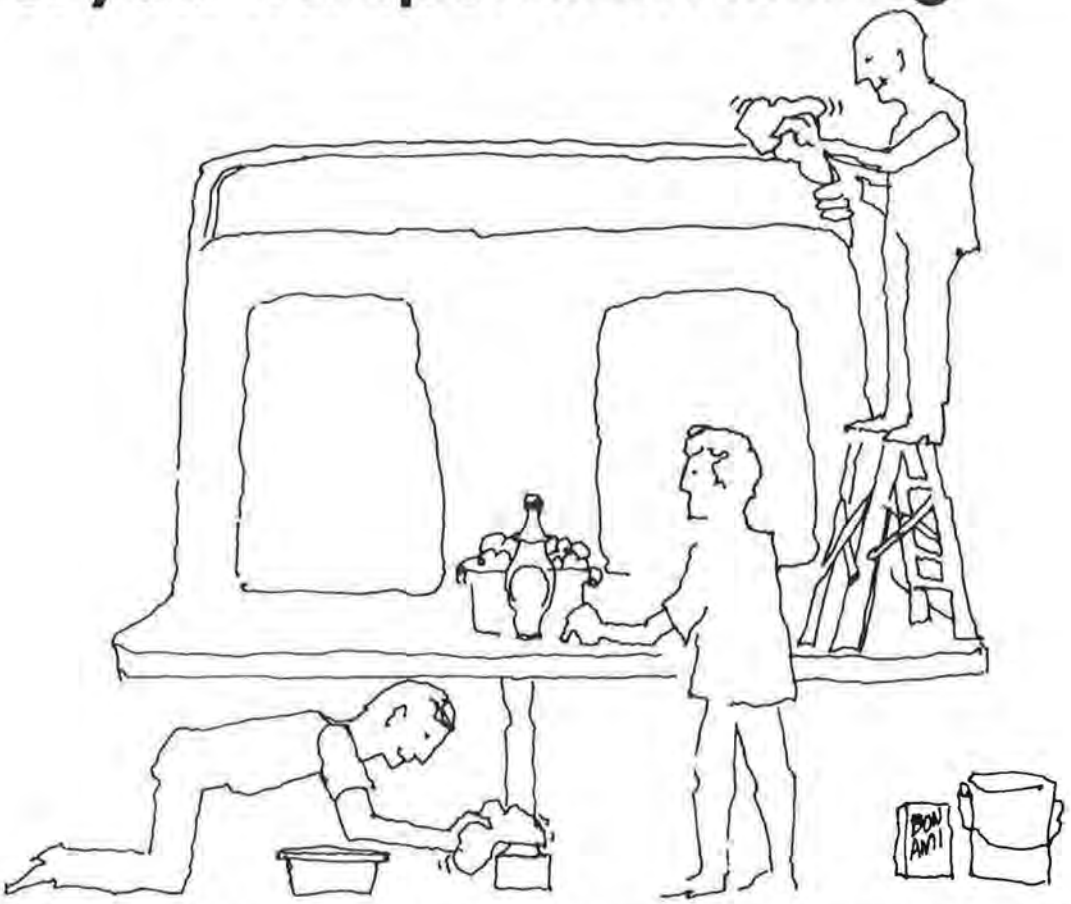
Urine Stains — Sponge stain with lukewarm foam applied with a clean cloth and rinse with cold water. Next, use a cloth to apply a mixture of one part household ammonia water and five parts of water. Allow to remain for a minute, then rinse by rubbing with a clean, wet cloth.

Ink — Because inks differ in composition, it is impossible to find removers that are equally effective for all types of ink spots. For most ink spots it is necessary to try several methods. Sponge stain repeatedly with alcohol, carbon tetrachloride, benzene, acetone or amyl acetate. Then rub glycerine (use glycerine only with alcohol) into the stain and finally rinse out with solvent. If this does not remove the stain, let the stain dry, then wet with water and rub in a synthetic detergent to help soften the stain or soak in warm suds containing 4 tablespoons of ammonia to a quart of water. Rinse with clear water and let dry.

The information contained in this bulletin is based on our best knowledge, but we can assume no liability for our statements or recommendations since conditions of use are beyond our control.

American Seating Company
Transportation Products Division
Grand Rapids, Michigan 49504

Care and cleaning recommendations for metal, fiberglass and nylon surfaces of your transportation seating.



Metal Components

To clean, wash with a solution of any household detergent such as Joy or Tide. Persistent dirt can be removed with non-abrasive cleaners such as Bon Ami. Rinse thoroughly with clear water, wipe with a clean damp cloth and allow to dry.

Fiberglass Surfaces

For standard cleaning, wash with a solution of any household detergent. Badly soiled or stained fiberglass may require the use of a non-abrasive cleaner such as Fantastik, Naphtha, Chlorothene or a commercial spot remover such as Carbona or Energine. Rinse the fiberglass surface with clear water following cleaning. Use of abrasive cleaners is discouraged because they will mar the fiberglass finish and distort the surface color.

Nylon and Energy Absorbing Molded Surfaces such as Crash Pads and Grabhandles

Persistent stains like marking pens, ball point ink, shoe polish, crayons, lipstick and air dry lacquer can best be removed with a solvent such as Chlorothene or a spot remover such as Carbona or Energine. Household detergents will remove most soils such as pencils or water base inks. Do not use abrasive cleaners as they will scratch and discolor the surface.

This information is based on our best knowledge, but we can assume no liability for our statements or recommendations since conditions of use are beyond our control.

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Transportation Products Division
Grand Rapids, Michigan 49504