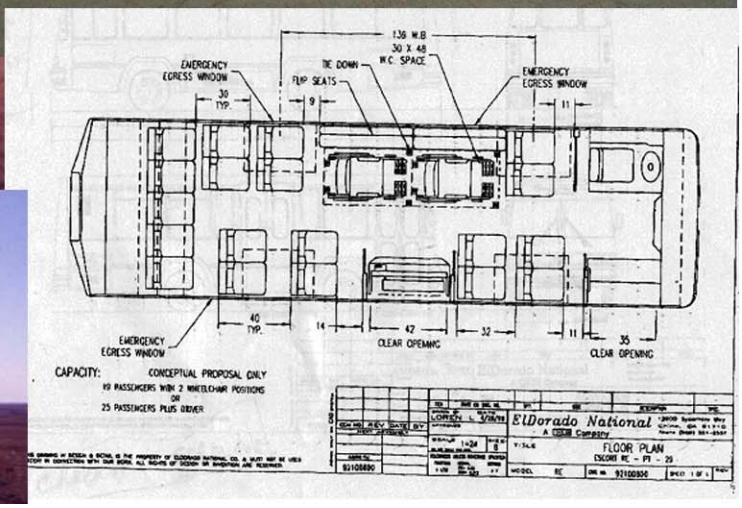
Park Facility Management Division
National Park Service
U.S. Department of the Interior

Tallgrass Prairie National Preserve
Strong City, Kansas

Tallgrass Prairie National Preserve
Vehicle Decision Document



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Report Notes and Acknowledgments

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Introduction

This document serves as technical substantiation in support of a procurement for a vehicle to be used to operate an interpretive bus tour at Tallgrass Prairie National Preserve (TAPR), located just north of Strong City, Kansas.

The preserve consists of nearly 11,000 acres, of which the National Park Trust (NPT), a private non-profit land conservancy, owns all but 32.5 acres. These 32.5 acres include the historic ranch headquarters and the Lower Fox Creek School area, ownership of which resides with the National Park Service. The National Park Service (NPS) has entered into a long-term partnership with the Trust, and is responsible for managing the preserve.

In December 2000, TAPR completed a General Management Plan/Environmental Impact Statement and Record of Decision. The preferred alternative chosen by TAPR, in consultation with the public, calls for the integrated management of the natural and cultural resources of the preserve. Two fundamental ideas form the basis for the preferred alternative. Tallgrass Prairie National Preserve's has been established to *preserve, protect and interpret for the public a remnant of the once vast tallgrass prairie ecosystem*. This remnant is extant because of a complex history of interaction between people and the land. Thus the importance also of cultural artifacts and lifestyle as an important interpretative theme has been emphasized.

The protection of the ecosystem goal to minimize development, and the preservation needs of historic structures and significant archaeological and ethnological sites, has reinforced a decision by TAPR staff to control private motorized vehicle access. An alternative transportation system will be developed using existing roads and roadbeds to provide transportation, interpretive bus tours, and access to the prairie. The existing interpretive bus tour, now operating, is but one piece of a planned future configuration of transit routes and interpretive bus tours. The precise contours of this future network await further implementation planning and are predicated on a primary visitor information and orientation center, along with a co-located administrative and maintenance complex, to be developed near the junction of Kansas Highway 177 and U.S. Highway 50, near Strong City. Co-located parking and/or one or more 'intercept parking facilities' will also determine the future contours of the planned network for the visitor transportation system. The key issue is that the quality of the visitor's experiences, now and in the future, is intimately tied to the interpretive bus tours run and operated by the National Park Service under a 'controlled access' policy. An essential component that undergirds that quality is the adequacy and suitability of the vehicle selected to conduct the interpretive bus tour.

This document is organized in sections:

- "Vehicle Requirements" articulates the core vehicle requirements. These requirements have been developed in consultation and collaboration with TAPR staff, and also have been based on a field site reconnaissance of the route, including observations derived from a simulation of the intended duty cycle for the vehicle when operating to provide future interpretive services.

- "Questions and Answers" presents a sequence of decision recommendations, organized in the following format: Q*uestion, Answer (Q&A),* and *Discussion.*

- "Findings and Next Steps" summarizes key findings, including a recommendation for the replacement vehicle, and sets forth 'next steps' with respect to procurement strategy and action items.

Vehicle Requirements

Vehicle requirements for the interpretive bus tour at TAPR have been determined based on consultation with TAPR staff, completion of a *vehicle requirements survey instrument* by TAPR staff (see Appendix), and a field site reconnaissance visit by a project team engineer. During the field site reconnaissance visit, the project team engineer inspected the route, and rode the existing vehicle along the route, with the supervisory park ranger operating the existing vehicle in accordance with the anticipated duty cycle in a prototypical mode. The discussion below is organized in sections corresponding to the General Service Administration (GSA) "How 2 Select Buses" brochure. All other issues, factors and preferences not corresponding to GSA's heading sections are articulated in the "Special Needs and Considerations" section, below.

What are the maximum number of adult or child seats, wheelchair positions, and standees to be accommodated?

TAPR staff have indicated a desired passenger capacity of 23 seats. For safety and liability reasons and due to the nature of the type of operation (i.e., an interpretive bus tour lasting approximately 90 minutes), there are no standees allowed. Given minimum passenger capacity requirements, and projected visitation growth over the next 10-15 years of up to 150,000 per year, with a likely range of 100,000-125,000 visitors[1], the proposed vehicle length is 30 feet, with a minimum number of 25 seats, the precise number dependent on interior configuration. Also, the vehicle must be fully Americans with Disabilities Act (ADA)-compliant. This means that there must be two (2) securement locations and devices[2] for mobility-devices. Because of the rarity of use of the securement positions, the proposed vehicle will have 'removable' or 'adjustable' seats (e.g., flip-up seats) at these positions.

What is the budget?

TAPR has indicated a vehicle acquisition budget of $100,000[3]. GSA, in its "How 2 select buses" brochure, appropriately cautions that "cheaper is not always better." The longer life of a premium bus might be the better value when life cycle costing (LCC) is considered. LCC analysis of vehicle options includes the acquisition cost of the vehicle and the maintenance and repair cost (including major engine re-builds) over the design life of the vehicle with the longest design life. Operational labor cost is independent of vehicle choice; therefore it is not a factor in considering a decision between two or more vehicle options. Fuel cost, however, is a function of the efficiency of the drive train (i.e., engine and transmission), choice of fuel, and weight of the vehicle. The difference in the quality of visitor experience is also a key determinant in the decision-making framework. There are a number of vehicle attributes that affect visitor experience. These include: ride quality, seating comfort, interior noise levels, heating, ventilation, and air conditioning (HVAC) system output, quality of public address (PA) system, height levels for vehicle access, aisle width, auxiliary storage facilities, and views from the vehicle. In making our vehicle recommendation, we have attempted to weigh these factors.

What is the type of bus operation?

Application

TAPR operates an interpretive bus tour on a seven (7) mile route consisting of a 3.5 mile unpaved ranch road with a turnaround at its terminus. Tour duration is 90 minutes. Three tours per day (at 11:00 AM, 1:00 PM, and 3:00 PM) are operated. Operations are run from end of April to end of October, with peak season being May/June and September/October.

The average weekday load per vehicle is between 5–10 passengers. On the weekends, the average load is on the order of 15–20 visitors. Although tours are generally on a first-come-first-served basis, visitors are allowed to make advanced tour reservations. Overload situations, that is when passenger demand exceeds the vehicle's capacity, are rare. On occasion, a large scheduled group size will consume all passenger seats on

[1] See William Byrne, Technical Memorandum, Sept. 30, 1999, Tallgrass Prairie National Preserve: Transportation Analysis for Proposed Action.
[2] See 36 CFR §1192.23, Americans with Disabilities Act (ADA) Accessibility Guidelines for Transportation Vehicles.
[3] Note: 30-foot transit buses are priced at $140,000–$240,000+, depending on design and options.

the vehicle, and additional visitor requests for a tour will have to be accommodated on the next tour[4]. Staff constraints prevent running two or more buses in convoy fashion along the route. The park expects that creation of new interpretive, educational and recreational opportunities will increase annual visitation substantially relative to the baseline.

Duty Cycle

The duty cycle consists of approximately 2 stops on the outbound leg which is 3.5 miles in length (i.e., 'geology stop' and 'overlook stop' at the turnaround), then a straight 'run' back to the starting terminus (staging area). Inter-stop distance averages one (1) mile. Average time at each stop is 20 minutes. Depending on the need for air conditioning (A/C), vehicles generally do not idle at the stops. This idling policy is in effect to reduce emissions, minimize noise disturbance, and minimize fire risk arising from hot exhaust system potentially igniting the roadside prairie grasses. Average operating speed is 10 mph with a maximum of 15 mph. These slow operating speeds are due to the condition of the roadbed, the road surface profile, and the desire to provide ample time for interpretation along the route. The vehicle however must be able to drive highway speeds, because the vehicle is taken to the Department of Motor Vehicles (DMV) for employees to obtain their commercial driver licenses (CDL) in the vehicle that they will be driving. Park managers sometimes use the vehicle for off-site park-related events. This use necessitates a maximum cruise speed for the vehicle consistent with highway driving, i.e., 65 mph.

Length of route is 7 miles roundtrip. The total vehicle miles traveled (VMT) per day is roughly 25 miles accumulated over the three tours that are operated. This mileage may be accumulated on a single vehicle, or accumulated across multiple vehicles used for the interpretive bus tour. This is dependent upon visitor count, vehicle operation and availability, or handicap accessible needs. Annual miles are less than 5000 per annum.

The operation is a *scenic* interpretive bus tour. Comfortable seating and large windows (side, front and back) are critical vehicle attributes.

Seating Type

Seats should be high back, contoured and vinyl-upholstered, and have armrests. There should be a minimum of a 6" clear space between a person's knees and the back of the next seat.

Interior Seating Configuration

TAPR staff has expressed a desire to have a forward seating configuration. This facilitates views by the visitor of the resources of the park from either side of the vehicle. Perimeter seating would preclude this possibility.

Type of Windows

Windows should be as large as possible, while still preserving the structural integrity and crashworthiness of the side panels. Body frame construction and rollover protection capability should be designed to minimize the use of obstructive side pillars. The windows should be lightly tinted (to maximize views from the bus, and to not distort the colors of the actual landscape). To improve air circulation, and lessen the dependency on A/C, a roof air vent and windows that slide open are desirable. At least one window on each side should also have a quick-release emergency exit capability (with appropriate markings) in accordance with federal motor vehicle safety standards (FMVSS).

Type, Number, and Location of Doors

Because of the nature of the interpretive service operated by TAPR staff, fast loading and unloading of the vehicle is not a requirement. On an ordinal scale from 1 to 5 (1 being 'least desirable,' 5 being 'most desirable'), TAPR staff indicated a preference for multiple doors with an ordinal ranking of 3. Therefore, one front door would be adequate. The door width should not be less than 34" to allow unrestricted use by ADA-compliant mobility devices. To reduce potential injury to visitors waiting to board, the front door should not be of the

[4] It is unknown whether these visitors wait for the next tour (2 hours later), or are 'lost' to the tour operation.

swing type, but similar to a transit accordion-style door type. This door type requires no additional clearance outside the vehicle envelope. It would be desirable, however, for the vehicle to have a multiple-door option since future acquisitions of the vehicle could be used to provide additional transit services, including more traditional shuttle-type operations. For this application, faster loading and unloading is a critical requirement requiring more than one channel for access/egress to the vehicle. If a rear door is included, use of the back door should be controlled by the driver in non-emergency situations. Ideally, a secondary door would have a lock and alarm system to prevent non-authorized use. This is not the case for the interpretive bus tour.

Amount and Location of Baggage and Equipment Storage

Limited overhead baggage racks would be desirable. This location would achieve a better linear distribution of visitors loading and unloading personal belongings (e.g., strollers). Front or rear racks would not be desirable since they could become a bottleneck and obstruct the internal passenger flow within the vehicle, and to/from the doorway. Bicycle racks are not required or desired.

What are the environmental and operating conditions?

What are the average and maximum road speeds required?

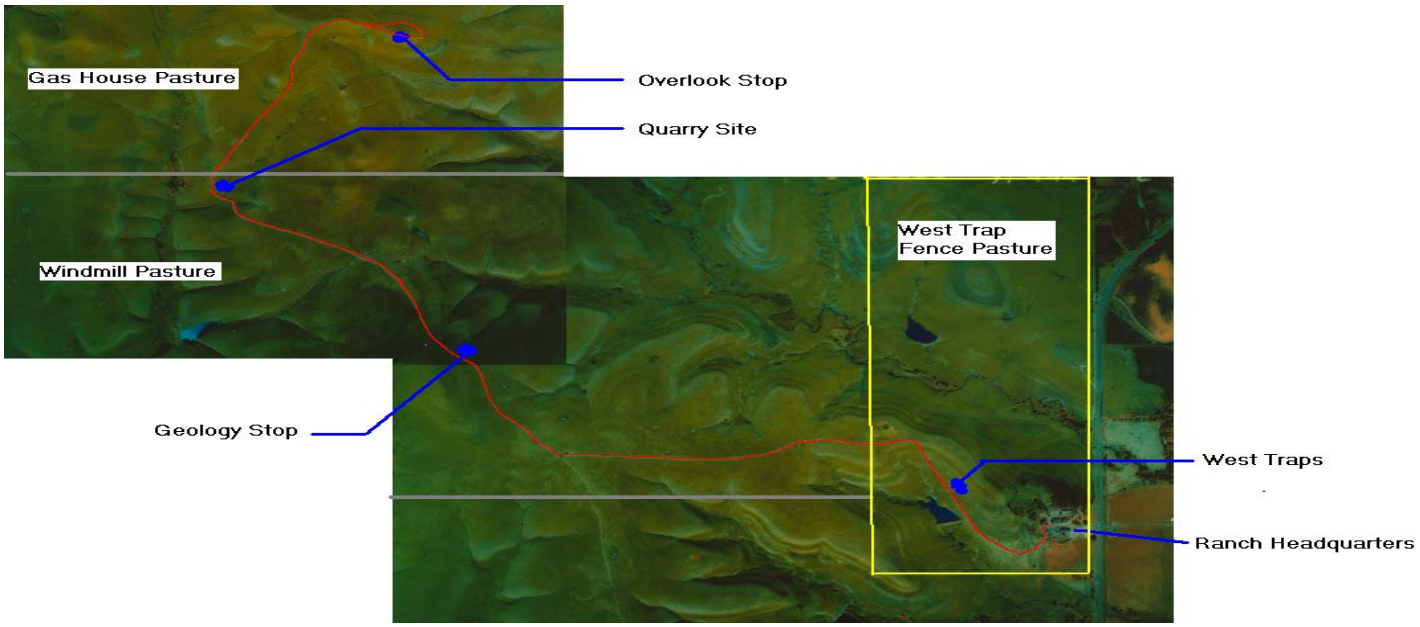
Average speed for the interpretive bus tour is 10–15 mph. Because of the low average speed, low-range gearing (capable of being switched to high-range for highway use) is a necessary requirement to prevent premature failure of the vehicle transmission. Minimum highway speed for the vehicle is 55 mph. Because of intermittent highway use, the proposed vehicle should perform well on safety and structural integrity Altoona tests, and must pass all pertinent federal motor vehicle safety standards (FMVSS) because of its use on public roads.

Are the roads flat, hilly or mountainous? What are the maximum grades?

There are two areas on the route with extreme grades. *West Traps Pasture* has a 19% grade (maximum on the route) with a grade length of 250 ft. *Overlook Stop* has a 17% grade, also over 250 ft.

Figure 1, below, illustrates the route and identifies the location of the two steepest portions of the route.

Figure 1
Tallgrass Prairie Interpretive Bus Route



These extreme grades, in conjunction with a crushed stone surface, suggest a number of core attributes for the proposed vehicle. These core attributes include axle ratios suitable for mountainous terrain, a limited slip differential on a heavy-duty transmission, and a high horsepower/torque engine. TAPR staff have expressed a desire for automatic transmission. During the field reconnaissance and simulated interpretive bus tour, a slight 'negative super-elevation'[5] was detected during the steepest incline. Handholds that visitors could grab, attached to the vehicle in appropriate places (e.g., interior side panels, and/or to the seat backs), which may offer a more comfortable ride, are recommended. Anti-sway bars added to the chassis/suspension system may allow for a less stiff suspension system to compensate for this particular movement.

Are the road surfaces smooth, gravel, dirt, mud or snow, or are there severe off-road conditions?

The proposed vehicle will be operating in a primitive road application. The road used by the interpretive bus tour consists of a compacted, graded crush gravel surface ('semi-improved'). Road surface, surface profile and crown is however uneven. At the intersection with other paths are cattle guards that the tour vehicle must traverse. The tour vehicle must also traverse small, rocky streambeds. At the most severe vertical transition, ground clearance measured at the rear overhang bumper for the existing vehicle (as a function of its wheelbase) is only 10.6 inches. The route is a non-exclusive, single-lane with two way directional flow of traffic. If necessary, other vehicles pull off to the side and let the tour vehicle pass. Width of the road is 10 ft. There are no shoulders on the tour road. Traffic is quite light. The tour vehicle, jeeps and pedestrians share or will be sharing the road. The Park is starting a backcountry hiking permit process this summer and pedestrians will be using the existing ranch roads for their paths. TAPR staff are not sure whether the existing vehicle gross vehicle weight rating (GVWR) (~12,000–14,000 lbs.) has had a detrimental affect on the roadbed. The maximum gross vehicle weight limit given the existing condition of the roadbed is not known, and is a factor requiring further evaluation during the field-tests for qualified vehicles (see **Findings and Next Steps**). The condition of the road and roadbed appears to be primarily affected by weather. Poor drainage patterns damage the road and roadbed and lead to ruts, excessive run-off, and loose gravel. Mud is also a concern.

Core requirements dictated by road conditions include: isolation of engine/transmission noise and vibration; high-quality suspension system; extremely rugged chassis and body frame; body noise insulation within side

[5]Superelevation refers to the 'banking' of a horizontal curve, measured in ft. per foot of road surface.

panels; high traction tires and perhaps a specialized tread pattern that is particularly effective in shedding water under the tire-roadbed contact surface.

Figures 2 and 3, below, provide photographic illustrations of the route.

Figure 2
Interpretive Route (photo from vehicle)

Figure 3
Interpretive Route (external photo)

Are there physical size limitations?

As noted, the width of the road is 10 ft. The proposed vehicle should not exceed 8 ft. (96 inches). At the most severe vertical transition, ground clearance measured at the rear overhang bumper of the *existing* vehicle was 10.6 inches. Ground clearance –front, midsection, and aft - is a function of the wheelbase, and approach, break-over, and departure angles respectively of the vehicle. There are no overly restrictive horizontal curves. A 30-ft. length transit bus has a required turning radius of 30-32' depending on wheelbase. This turning radius is not incompatible with the geometry of the terminus of the route at which the interpretive bus tour vehicle reverses direction.

What are the lowest/highest operational temperatures?

The interpretive bus tour is operated during warm weather only (end of April to end of October). Cold starts are not an issue. However, summer temperatures can run over 100 degrees Fahrenheit. Air conditioning (A/C) is a critical core requirement. Operable windows are preferred as a backup in the event of AC

malfunctioning and for autumn scheduled interpretive bus tour experiences. An operable roof vent to take advantage of natural ventilation (and reduce the load on the A/C system) is a desirable requirement as well. A white roof would reduce the thermal heat absorption and also lessen the load on the A/C system. Some tours have been cancelled due to high temperatures. The A/C should have two control zones—fore and aft of the passenger 'cabin.' A/C should be specified to the maximum BTU limit available. Because of slow operating speeds (10–15 mph) over the route, and long idling at stops during extremely hot weather events, the proposed vehicle should have a heavy duty engine cooling system to operate the auxiliary power unit (APU). The ability to run the A/C independently from the engine speed and load is desirable. Also, due to low engine speeds, and outdoor garaging of the vehicle, the coolant should be specified with these ambient temperature conditions in mind.

Are there special needs and considerations?

Alternative Fuel Types; Additional Fuel Capacity

TAPR staff have expressed a strong desire for an alternative fueled vehicle, in keeping with National Park Service (NPS) policy to use alternative fuels as a component of a sustainable alternative transportation system. See **Questions and Answers (Q&A)** for a discussion and recommendation of a viable alternative fuel choice, given the site location, sources of supply, site-specific infrastructure needs (e.g., fuel storage tank and dispensing system), and capability of TAPR staff to operate and maintain a vehicle running on an alternative fuel. Sufficient fuel capacity for a 300-mile range, given energy density of the alternative fuel and effective fuel efficiency, is desirable. Fast fill on-site dispensing system with compatible vehicle hook-up is also desirable.

The existing vehicles use diesel. The source of the diesel is a truck stop on US Highway 50, 3 ½ miles from the ranch headquarters area. Fueling is once per week, and is done at the beginning of the day before the bus tours start. Refueling is undertaken when the tank is ½ full. Refueling time is satisfactory. The existing vehicle's fuel efficiency is 6 mpg.

Does the bus manufacturer being considered have dealer, warranty or maintenance facilities close to your facility?

This is a critical consideration since the park has no staff capability or infrastructure to maintain the vehicle. A partnership agreement with Wichita Transit (~ 75 miles from the park) is one possibility worth exploring, particularly after all warranties run out.

During the operating season, interpretive bus tours are operated seven (7) days per week. It is therefore imperative that most preventative maintenance replacements and checks are done during the off-season. Because of a lack of 'downtime,' the park places a high premium on the reliability and robustness of the vehicle. Unreliability and lack of ruggedness of the *existing* vehicle has been a major issue. Unscheduled maintenance would have to be accomplished at an automotive garage within the vicinity of the park (particularly if a tow is required). For this reason, the proposed vehicle should not have complex systems that require specialized diagnostic and repair tooling that are unlikely to be available at the maintenance facilities used to maintain and repair the vehicle. The precise arrangement for maintenance of the proposed vehicle has yet to be worked out.

The vehicle should have front and aft marked tow points.

Special Options

Exhaust tailpipe and the catalytic converter temperature of the proposed vehicle are critical concerns. There is a lot of "tall grass", which can be quite dry. The park's operating rules limit the amount of idling at stops—fire safety concerns as well as fuel and emission considerations. Fear of fire is always present. Relocation of the exhaust pipe to the middle of the undercarriage would avoid exhausting hot air adjacent to the prairie grasses.

An automatic hands-free head-set for the public address (PA) system is needed since the interpreter is also the driver. The audio system for the public address system must be high quality and easily discernable by the

visitor. The PA system need only project sound within the bus and does not need to project outside the vehicle.

An automatic transmission is needed. This is based on strong TAPR staff preferences and the fact that the driver is also the interpretive guide, and a manual transmission with clutch would increase the driving task workload.

Delivery Times

The park needs delivery of the vehicle in time for the 2005 season, i.e., April 2005.

Questions and Answers (Q&A)

This section addresses a sequence of significant decisions that Tallgrass Prairie National Preserve (TAPR) must address in support of its vehicle procurement. This section is organized in a free form, question and answer (Q&A) format. When appropriate, a *Discussion* sub section is added to provide analytical support and serve as a foundation for the decision.

Q. What are TAPR's core (critical) vehicle requirements for its interpretive bus tour operation?

A. Unreliability and lack of ruggedness of the *existing* vehicle as expressed and documented by TAPR staff in the *vehicle requirements survey instrument*, the site reconnaissance visit, including operation under a simulated duty cycle characteristic of the interpretive bus tour, all confirm the need for a medium/heavy-duty *bus* chassis. A high quality suspension system, limited-slip differential, high traction treads on tires, and low gearing for high engine load and low speed operation are also critical core requirements. The proposed vehicle must be well insulated from noise and vibration since the sole purpose of the operation is to provide a high quality visitor experience via an interpretive bus tour of the park. The vehicle must be ADA-compliant, and have a passenger seating capacity not less than 23 seats. The vehicle also must be capable of operating at highway speeds, and the driver's workstation ergonomics must be optimized for both comfort and safety. Alternative fuel, if not strictly a core requirement, is a strongly expressed desire by the TAPR staff to the extent that the recommended alternative fuel option is feasible and economically sustainable. The exhaust pipe should be routed to the midpoint of the rear bumper. If the exhaust pipe must be routed to the roofline, special consideration needs to be paid to isolate noise and vibration from the exhaust pipe to reduce the potential for amplification by the bus body.

To enhance the quality of the visitor's experience, in addition to a high quality suspension system, the vehicle must have:

- Low interior sound level (< 65 dBA)
- Comfortable seating
- Large windows that open
- Air conditioning and roof vent
- Automatic on/off public address system with high quality head-set (i.e., high signal-to-noise ratio)

Q. What are TAPR's other needs/requirements ("nice to have" attributes)?

A. Other needs/requirements ("nice to have" attributes) expressed by TAPR staff include: visual look and appeal of vehicle, multiple doors for access/egress.

Q. What are TAPR's order preferences for "nice to have" requirements?

A. TAPR staff prefer an enhanced visual look and appeal of the vehicle to a configuration with multiple doors for access/egress.

Discussion: Based on the ordinal ranking in the TAPR staff response to the *vehicle requirements survey instrument*.

Q. Are bicycle racks needed?

A. TAPR staff have expressed a desire not to include bicycle racks on the vehicle used for the interpretative bus tour. In fact, TAPR staff prefer that bicycles not traverse the same route.

Q. What are TAPR's plans for enhancements and development of other transportation service operations, including future establishment of a visitor transportation system on the preserve, and what additional 'core' requirements do these plans impose?

A. Three distinct types of transport services[6] are either operating or are planned. The first is the current interpretive bus tour service. The existing route now in use may in the future be reconfigured, with perhaps a future departure point at the planned visitor orientation center in the south (~ 2 miles south of the current terminus). Interpretive bus tours may also be extended to the eastern "day use" area of the park. This report identifies the core (or critical) vehicle requirements supra.

The second concept of operation of transport services is a potential 'general' visitor shuttle between the south (the planned orientation center, visitor parking, and possibly Strong City/Cottonwood Falls) and the north (the existing historical facilities). This vehicle would travel only on paved services and for a short distance (several miles), and at standard paved-road speed (i.e., 45-55 mph), meaning that visitors would be aboard only for a short time. This service would obviate the need for additional parking in the sensitive historical or natural areas and communities. The service itself need not be a part of the visitor experience as such (*as in the case of the current interpretive bus tour*). This service is somewhat in the future, as it depends on developments not yet underway. It could always be implemented incrementally, with vehicles on hand or temporarily obtained, much as with the current interpretative tour service.

The third potential transport service element at TAPR is to provide recreational transport to the eastern "day use" zone of the park, bringing hikers, fishers, picnickers, etc. to trailheads, fishing locations, etc., obviating the need for visitors to hike to those locations directly. (Vehicles and parking are both prohibited in this area.) Public vehicles for this service, ideally, would combine the characteristics of vehicles for the two services above—they would be heavy-duty and rugged, able to handle steep, unimproved roads, but they need not be an integral part of the visitor experience. Vinyl-upholstered interiors, which make sense for a touring vehicle in which the visitor will spend 90 minutes, getting on and off several times, are not necessary for a vehicle on this service, which could, in the late afternoons, be transporting visitors with dirty hiking boots and satchels full of fish.

It is clear that the most stringent vehicle requirements are dictated by the current interpretive bus tour. There are no additional requirements needed for the other two planned services (with the possible exception of additional luggage rack space for the vehicle(s) used to transport recreationalists to the eastern zone at TAPR).

Q. Could a single vehicle type satisfy the 'core' vehicle requirements for each type of operation, or is a 'mixed fleet' situation unavoidable?

A. Additional vehicle purchases of the vehicle recommended for the current interpretive bus tour could satisfy vehicle needs/requirements for the 'general' visitor shuttle system and the 'day-use recreation' shuttle system. It would be desirable to alter the interior seating and luggage configuration for these other operations, however. In the case of the 'general' visitor shuttle system, the interior configuration would have more seats. In the case of the 'day-user recreation' shuttle system, the interior configuration would have more storage racks and fewer vinyl seats.

Discussion: This would avoid a 'mixed fleet' situation which can complicate both operations and maintenance (e.g., additional spare parts inventory, and training needs for mechanics). It would also allow TAPR to present a single common 'branding' of its transport service. However, the capital cost of the vehicle needed for the interpretive bus tour (and the planned 'day-use recreation' shuttle system which also requires a similar medium/heavy duty *bus* chassis because of the same rugged unpaved roads and grades) may be substantially greater than a vehicle that would be functional to service the 'general' visitor shuttle system.

Q. What are the available options for vehicles that can satisfy the 'core' vehicle requirements for the interpretive bus tour operation?

A. There are many suppliers that can offer all the described options listed in this document for conventional as well as alternate fueled buses. Some options may be costly while others are considered standard equipment, which may be included in the vehicle base price.

[6] See General Management Plan/Environmental Impact Statement, Tallgrass Prairie National Preserve, September 2000; also, Record of Decision, Final General Management Plan/Final Environmental Impact Statement, Tallgrass Prairie National Preserve, Kansas, December 2000 and BRW, Tallgrass Prairie National Preserve—Transportation Analysis for Proposed Action, technical memorandum, September 1999.

The following vehicle features are recommended for TAPR[7]:

Chassis, Powertrain & Mechanical Components

- Five-speed electronic transmission
- S-Cam airbrakes with slack adjusters
- Engine mounted air compressor
- Electronic throttle
- Air dryer
- Heavy duty axle package
- Four bag per axle air ride suspension
- Tilt and telescopic steering column
- Steel belted radial tires
- Rear mounted engine and heavy duty radiator
- Front and rear mud flaps
- Front and rear tow hooks
- Documentation of FTA-Altoona testing for 5-Years/150,000 miles

Electrical Features

- 200-amp alternator
- Manual reset circuit breakers
- Fast idle control
- Color and number coded electrical wiring
- Reverse alarm
- Engine hour meter
- Armored clearance lights
- Side mount turn signals
- Additional microphone jack
- PA system with head-set and four loudspeakers
- Complete electrical schematic provided inside the electrical power source panel for on-site troubleshooting.
- Taillights are mounted in rubber gaskets, permanently sealed and completely impervious to dirt/moisture with a minimum 5-year life.

Body Features

- rubber floor with ribbed isle
- ¾–inch exterior grade plywood floor, sealed and undercoated
- Driver stanchion
- Two stainless steel overhead hand rails
- Roof hatch
- Right hand entry handrail
- Slightly-tinted large touring style windows that open
- Intermittent windshield wipers
- Driver's passenger view mirror
- Automatic air actuated entry door with mechanical override
- Keyed exterior door switch
- Vinyl padded headliner and vinyl seats

HVAC

- Driver area, dash a/c, heat and defrost
- Two rear heaters (35,000 BTU minimum)
- Two speed minimum driver's fan
- Passenger area a/c system rated for 34,000 BTU/hr, minimum
- Ozone-friendly refrigerant

[7] For additional guidance on vehicle procurement, see W. Chernicoff, Transit Vehicles for National Parks: Selection Factors and Technologies, prepared for the Vehicle Design Conference, Estes Park, Colorado, March 2002, updated March 2003; and R.Gill, M. Gentile, B. Mickela, W. Chernicoff and D. Spiller, Best Practice Vehicle Procurement Guide, August 2003.

- Tropical-climate package (or equivalent)

Safety Features
- First aid kit
- Fire extinguisher
- Roadside flares
- Reflector kit

Paratransit Features
- Fully automatic wheelchair lift
- ADA securement system with lap belt and shoulder harness
- Interior and exterior lift lights
- Exterior entry door light
- Overhead handrail
- Modesty panel and stanchion at wheelchair lift
- Wheelchair securement storage box
- ADA signage
- Interlock

Recommended Additional Features
- Rear engine run box
- Exhaust and muffler wrap
- Kneeling front suspension
- Spare tire and wheel assembly
- Hubodometer
- LED exterior lights
- 2-way radio antenna conduit pre-wire
- 2-way radio pre-wire
- Side mounted mechanical drive fan cooling radiator
- High-back bucket seating with grab handles
- Solid glass "tour style" passenger windows for unobstructed viewing that open
- Entry door interlock
- Titanium tinting on passenger windows
- Euroview upper window above windshield
- Overhead stainless steel parcel racks
- Attractive paint scheme that blends into the prairie
- Motorized exterior mirrors
- Fire detection and suppression system

Q. Which vehicle is recommended (and why?)

A. The vehicle recommended for TAPR should be durable, but not as massive as a heavy-duty (12-year 'design-life') vehicle. This is important because a heavier vehicle, which is not recommended for TAPR, will only be less efficient to operate and on average more costly to repair and maintain.

The vehicle recommended for TAPR is the Escort RE 29-foot transit bus, manufactured by ElDorado National, or equivalent. This model is offered in diesel, propane and natural gas.

An ElDorado National, Escort RE 29-foot transit bus equipped with most of the TAPR recommended options listed above is priced around $135K while the same vehicle equipped for propane fueling (with a propane dedicated engine, not an after-market kit) is priced around $155K.

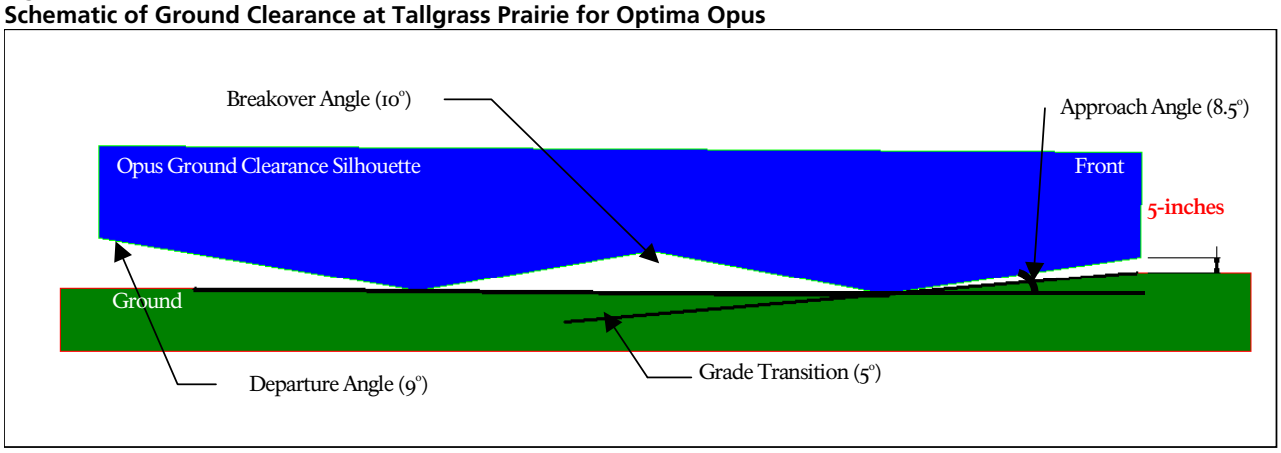
The Escort RE 29-foot transit bus is an Altoona-tested 7-year'design-life' vehicle, with a tested 200,000-mile life cycle (see illustration below).

The project team also briefly assessed the Optima Opus low-floor 30' transit bus. There are five such buses at Wichita Transit System. Several issues, however, make it problematic for application at TAPR. The cost is substantially greater (~$235,000), the GVWR is substantially greater (30,000 lbs. versus 22,000 lbs.), and the

ground clearance at the most restricted vertical transition on the interpretive bus tour route is less (5" at the front bumper for the Optima Opus versus 6" at the front bumper for the ElDorado Escort RE).

The Opus, crossing a grade transition of concern (see below), approaches a ground-clearance of 5-inches at the front of the bus. The current vehicle (Bluebird) has a minimum clearance of approximately 6-inches located at the rear of the bus at the same location.

Figure 4
Schematic of Ground Clearance at Tallgrass Prairie for Optima Opus



Although 5-inches may seem reasonably safe for any vehicle over the road, other factors such as the unevenness of the terrain and loose surface aggregate may be more problematic for the low-floor models.

The ElDorado Escort-RE 29-foot transit bus ground-clearance at the same location is 6-inches. This is the same clearance as the current vehicle, which has proven to traverse the terrain at TAPR. With the higher ground clearance, greater breakover angle, shorter wheelbase and smaller turning radius, the Escort-RE is more suitable than the low-floor Opus bus for TAPR.

Figure 5
Schematic of Ground Clearance at Tallgrass Prairie for Escort-RE

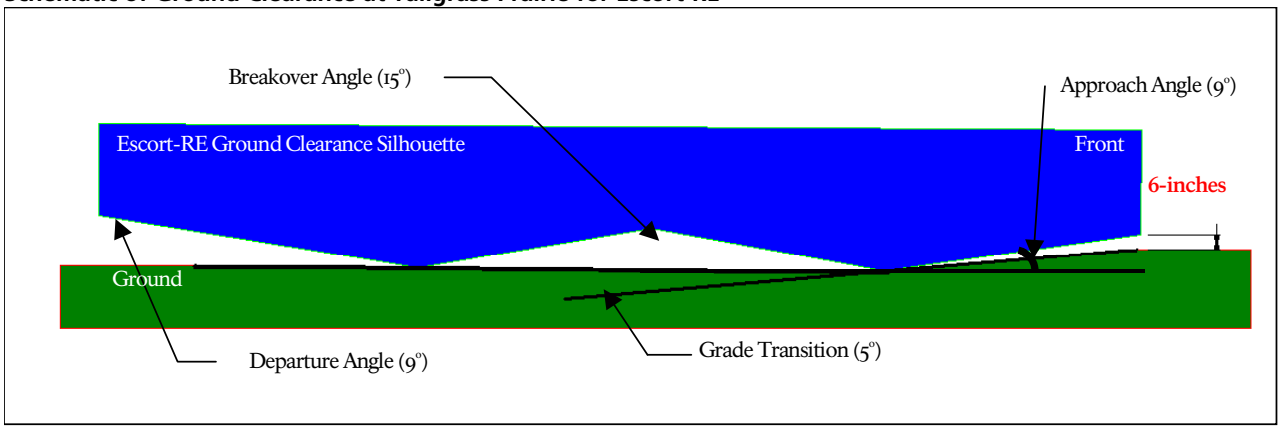
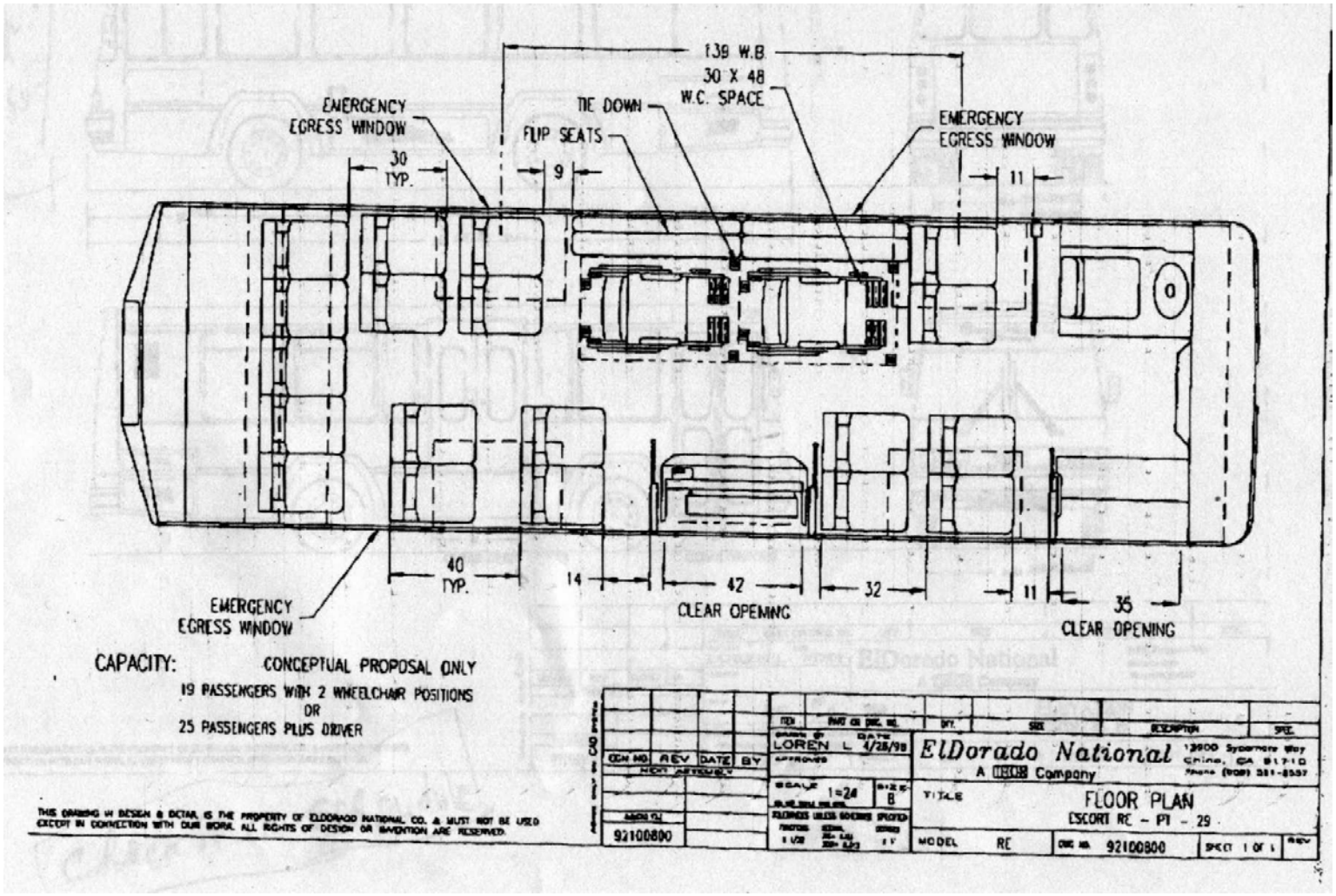


Figure 6
Escort-RE 29' Transit Bus

Figure 7
Escort RE Recommended Seating Arrangement



The above schematic is illustrative of a prototypical interior configuration. At TAPR it would be desirable to place the wheelchair securement locations to the left of the rear door. This would allow more forward seating closer to the front. While multiple doors are not strictly a 'core' requirement, we strongly recommend it because it provides more flexibility in configuring the seating arrangements, including the wheelchair securement locations. Rear doors, if included, should be controlled by the driver and secured when not needed.

Q. *What alternative fuel option is recommended at TAPR?*

A. Biodiesel (B50 blend) is recommended as the "least-cost, least-risk" strategy at TAPR. Because the current biodiesel fuel suppliers are located in St. Mary, Topeka and Wichita (~60-70 miles from TAPR), it is recommended that TAPR proceed with a 500-gallon fuel storage and dispensing system on-site. After the initial fill of the tank, 200+ gallon deliveries would be no more than once per month. This assumes a conservative 3 mpg fuel efficiency, and is based on the cumulative vehicle mileage per vehicle per week of ~150 miles. Fueling of the vehicle from the on-site fuel dispensing system would be approximately twice per week, assuming the desire to maintain at least a half-tank level on the vehicle at all times.

Discussion: 'Core' requirements at TAPR dictate the need for a medium/heavy duty 30-foot bus. The standard propulsion system for this type and size of vehicle is conventional diesel (Compression ignition engine). However, there are a number of reasons why the National Park Service in general, and TAPR in particular, should seriously consider other propulsion systems using alternative fuels. Conventional diesel has serious public health effects, including increased risk of lung cancer and other respiratory illnesses from fine particulates and oxides of nitrogen[8]. Incomplete combustion of petroleum diesel produces exhaust laden with particulates and chemical compounds that contribute to regional haze, acid rain and global warming[9]. In Kansas, heavy-duty vehicle contribution to NO_x and PM annual emission loads is 38% and 62% respectively[10]. An additional reason for opting for alternative propulsion systems that are non-petroleum based is to reduce supply and price instabilities and geopolitical vulnerability. Imported petroleum accounted for 54% of net petroleum consumption for the US transportation sector in 2001, while the Energy Information Administration (EIA) in its 2003 Energy Outlook projects net petroleum imports to account for 68 percent of US demand (across all economic sectors) in 2025[11].

In addition to consultation with project team alternative fuel and propulsion experts at the U.S. Department of Transportation Volpe Center, contact was made with alternative fuel experts at Argonne National Labs[12], the Department of Energy's National Renewable Energy Lab (NREL)[13], University of California at Davis[14], and Oakridge National Labs[15]. There was unanimity that only biodiesel and liquefied petroleum gas (LPG or propane) were viable options at Tallgrass Prairie National Preserve, with most favoring biodiesel. Key factors influencing this recommendation include remote site location and fuel availability, duty cycle of intended application, operating on an off-road 'semi-improved' road surface, and no economy-of-scale due to a single vehicle fleet. Additional considerations were cost, safety and complexity of on-site fuel storage and dispensing systems, and cost and complexity of vehicle operation and maintenance. An additional factor unique to TAPR, having to do with fire risk, is that a modern, turbo-charged diesel engine will have a

[8] See Environmental and Energy Study Institute, Fact Sheet on Clean Buses; also, South Coast Air Quality Management District (SCAQMD), Multiple Air Toxics Exposure Study II, draft report, 1999; and State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (STAAPA/ALAPCO), Cancer Risk from Diesel Particulate: National and Metropolitan Area Estimates for the United States, March 2000 at http://www.4cleanair.com; Cal/EPA Office of Environmental Health Hazard Assessment and the American Lung Association of California, Health Effects of Diesel Exhaust.

[9] NPS monitors haze, ground-level ozone and acid precipitation in the National Park System via the Interagency Monitoring of Protected Visual Environments (IMPROVE-visibility data), the NPS Gaseous Air Pollutant Monitoring Network (ozone data), and the National Atmospheric Deposition Program (NADP-acid precipitation data) respectively; See Appalachian Voices, National Parks Conservation Association and Our Children's Earth, Code Red: America's Five Most Polluted National Parks, September 2002; also, Clean Air Task Force, Out of Sight: Haze in our National Parks, August 2000.

[10] See Kansas Division of Environment, 2001-2002 Kansas Air Quality Report.

[11] Cited in Environmental and Energy Study Institute, Op. Cit., p. 2.

[12] Michael Wang, Danilo Santini, and Christopher Saricks.

[13] K. Shaine Tyson, and Robert McCormick.

[14] Daniel Sperling.

[15] David Greene.

significantly lower exhaust gas temperature than a spark-ignited (i.e., gasoline or propane) engine[16]. Biodiesel should not have any significant effect on exhaust temperature[17], requires no major diesel engine redesign or modification for B20 or B50 mixes and only minor hose, fuel filter and gasket changes for compatibility with B100, but will result in a significant reduction in regulated and unregulated emissions[18]. Biodiesel is in our judgement the "least-cost, least-risk" strategy for TAPR. Visitors will detect a better 'smell' as well.

TAPR staff should be aware that the US Environmental Protection Agency is lowering federal exhaust emission standards for heavy-duty diesel bus engines and is requiring the use (by 2006) of ultra-low sulfur diesel (ULSD) fuel (< 15 ppm). New emission standards will go into effect in 2004 and 2007 as illustrated in Table 1, below[19]. ULSD fuel will facilitate effective use of active catalysts (e.g., selective catalytic reduction (SCR), exhaust gas re-circulation (EGR)) and sophisticated after-treatment devices (e.g., NO_x adsorbers, and diesel particulate traps (DPT)), technologies that perform poorly with use of high-sulfur content diesel. Thus the medium/heavy duty bus for the interpretive bus tour will be cleaner even without use of biodiesel (or propane).

Table 1
Federal Exhaust Emission Standards for Diesel Bus Engines (g/bhp-hr)

Years	HC (NMHC)	CO	NOx	NOx + NMHC	PM
Current–2003	1.3 (1.2*)	15.5	4.0	N/A	0.05
2004–2006	(0.5)	15.5	[2.0]	2.4 [2.5]	0.05
2007–2010	(0.14)	15.5	0.20	N/A	0.01

( ) Non-methane hydrocarbon emission standard
[ ] Optional requirement
NO_x standard was obtained by substracting maximum NMHC emissions allowed from the composite NO_x+NMHC emission standard.
* Only for heavy-duty engines using natural gas.

For completeness, summarized below are the limiting factors that preclude viability of other alternative fuel/propulsion systems at TAPR.

Methanol, ethanol: Both alcohol-based fuels are best suited to light-duty spark-ignition engines (high octane values but low cetane values preclude high compression ratio; also poor lubrication qualities degrade the operation of high-pressure pumps in compression-ignition engines); modified diesel-fuel engines and fuel system re-design for heavy-duty application are possible, but expensive[20]. No bus manufacturers are marketing methanol transit buses[21]. Lower energy density requires a larger fuel tank in order to sustain an equivalent range and fueling frequency. Fuel supply is also questionable[22].

[16] Personal communications, Robert McCormick, PhD., Center for Transportation Technologies and Systems, National Renewable Energy Lab.
[17] Ibid.
[18] See, e.g., BioBus: Biodiesel Demonstration and Assessment with the Societe de Transport de Montreal (STM), Final Report, May 2003 which found total mass of particulate matter (PM) reduced by 25–30% depending on mechanical versus electronic fuel injection with vegetable-based B20, carbon monoxide (CO) emissions reduced by 20–30%, total hydrocarbons (THC) emissions reduced by 20%, and nitogen oxides (NO_x) reduced by 3–5% for a higher cetane-rated blend. For non-regulated emissions, sulphates (SO_4) were reduced by 15%, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and carbonyl compunds were either unchanged or slightly reduced (PAHs) by 10-20%. Fine particulate matter below 2.5µm ($PM_{2.5}$) were reduced due to lower mass of elemental carbon particles due to a lower sulpher content in the fuel blend. See also National Biodiesel Board, Regulated Fleet Use of Biodiesel: Frequently Asked Questions.
[19] Source: Battelle, Technical Assessment of Advanced Transit Bus Propulsion Systems, August 2002, prepared for Dallas Area Rapid Transit (DART).
[20] See DOE/EIA, Alternatives to Traditional Transportation Fuels: An Overview, June 1994, chapter 8.
[21] See Merced County Association of Governments (MCAG) Alternative Fuels Study 2002.
[22] DOE's Alternative Fuel Locator database indicates two E85 fueling stations within 75 miles of Strong City.

CNG: Infrastructure for fuel storage and dispensing is complex and costly[23]. Costs would not be amortized over a sizable fleet. Training costs for operating and maintenance staff would be high. CNG buses are also substantially more expensive to acquire.

LNG: There is no LNG fueling station in Kansas[24]. The interpretive bus tours are operated during high ambient temperature; sufficiently insulating the fuel lines to keep the fuel liquid would be difficult. The vehicle's tank would absorb heat leading to substantial venting to relieve the pressure. As with CNG infrastructure for fuel storage and dispensing, the designs are complex and the costs are high. Training for operational and maintenance staff would be high. Site location of the storage and fuel dispensing system at TAPR near the terminus of the route at the ranch headquarters may be difficult since LNG storage and dispensing systems are subject to requirements for minimum separation from other land uses under provisions of the NFPA and Uniform Fire Code[25].

Battery-electric, hydrogen-fuel cell vehicle: Fundamentally, both electric propulsion technologies are not yet "commercial-grade", although a number of transit systems have demo projects operating[26]. Battery-electric could be a promising technology at TAPR since electric motors can be designed for high torque, low-speed operation (consistent with operating requirements for the interpretive bus tour). The limiting factor is the extreme grade (> 19% and > 17%) on two segments of the route. Excessive weight (exceeding GVWR for the roadbed) is also a potential issue. A large stack of battery packs (which are quite heavy) would be necessary to supply enough specific power (i.e., the ratio of power delivered by a battery to its weight, expressed in watts per kilogram (W/kg)) for the application. Vehicle acquisition cost for fuel cell propulsion is prohibitive for TAPR. Reliability of the vehicle is an issue; some electric vehicle fleets have experienced intermittent electrical problems that can't be traced to a defect in the design or components[27].

Hybrid-electric: A hybrid-electric vehicle (HEV) combines an electric propulsion system (electric motor or motors driving the wheels) with another power plant such as a conventional internal combustion engine (diesel, gasoline, propane or natural gas), turbine, or fuel cell stack in order to take advantage of each. While the HEV vehicle is at a more advanced state than the battery electric and hydrogen-fuel cell vehicle, it too is not yet "commercial-grade". A significant issue with HEVs is the relatively complicated control process needed to operate all of the electrical systems and optimize use of the energy storage device and power plant[28]. HEV design and integration are still in an early development stage. The integration process can be costly and can only be finalized with demonstration/prototype vehicles in the field for actual service experience[29].

Instructive in this regard is the experience of Santa Clara, California[30]. While deemed 'successful' in meeting project objectives, there were nonetheless delays in delivery of the vehicles, problematic construction of the front cowls and windshields, system design problems, and problems with energy integration between the Capstone micro turbines, batteries, and the PEI battery management integration software. Both the vehicle manufacturer and the system integrator contractor (which was absolutely critical to 'success' of the project) filed for Chapter 11 bankruptcy. So too did the operator (i.e., 'concessionaire'). High complexity, cost and unreliability all argue against use of HEV vehicles at TAPR

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[23] See, e.g., TCRP Report 38, Guidebook for Evaluating, Selecting, and Implementing Fuel Choices for Transit Bus Applications, chapter 3.
[24] See DOE's Alternative Fuel Locator database at http://afcdmap.nrel.gov/locator/locateresults.asp
[25] TCRP Report 38, chapter 4.
[26] See Leslie Eudy, Challenges and Experiences with Electric Propulsion Transit Buses in the United States, DOE/GO-102003-1791, November 2003.
[27] L. Eudy, op. cit., p. 10.
[28] Control system design would include regenerative braking management—the propulsion system applies a load on the drive axle (like a mechanical brake retarder) during braking to convert kinetic energy into electrical energy that is fed back into the battery storage device, and, depending on design, a charge-sustaining subsystem; see Battelle, Technical Assessment of Advanced Transit Bus Propulsion Systems, prepared for Dallas Area Rapid Transit System, August 2002.
[29] Battelle, Technical Assessment of Advanced Transit Bus Propulsion Systems, op.cit., p. 23-25; also, Electric Hybrid Bus (BEE) Project in Santa Clara, Implementation of an Electric Hybrid Transit Bus Operation by a Municipal Electric Utility, 2003.
[30] Electric Hybrid Bus (BEE) Project in Santa Clara, Implementation of an Electric Hybrid Transit Bus Operation by a Municipal Electric Utility, 2003, pp. 1-7.

Q. Under Federal Property Management procedures[31] which require—except under unique waiver conditions—that federal civil agencies purchase motor vehicles through the General Services Administration (GSA), what is the sequence of acquisition steps, what is the corresponding required documentation at each step, and what is the timeline for each step?

A. Federal agencies are required to use GSA for vehicle procurement. Standard, commercial vehicles can be procured using GSA AutoChoice. If the vehicle desired is not available through AutoChoice, the park can do a special procurement through GSA, use GSA's Express Desk, or request a waiver (leaving the park to purchase the vehicle on its own if the waiver is approved).

TAPR and Volpe Center staff have, as documented in this report, worked to determine the most appropriate vehicle for the park. However, GSA does not currently have a contract for a transit-type bus as has been recommended.

Therefore, TAPR may choose to use GSA's Express Desk or may request a waiver to purchase the vehicle on its own. Both processes require justification for not using AutoChoice. This vehicle decision document serves as justification for requesting a waiver. Using Express Desk adds an additional 5% to the cost of the vehicle, similar to a special procurement, but means that the park does not have to directly handle the procurement, compared to a waiver, which would leave the responsibility of the procurement to the park.

The park should contact Russell Miller[32], GSA Automotive's Engineering Director, to discuss these options. If the park chooses to request a waiver, a written waiver request should be submitted to:

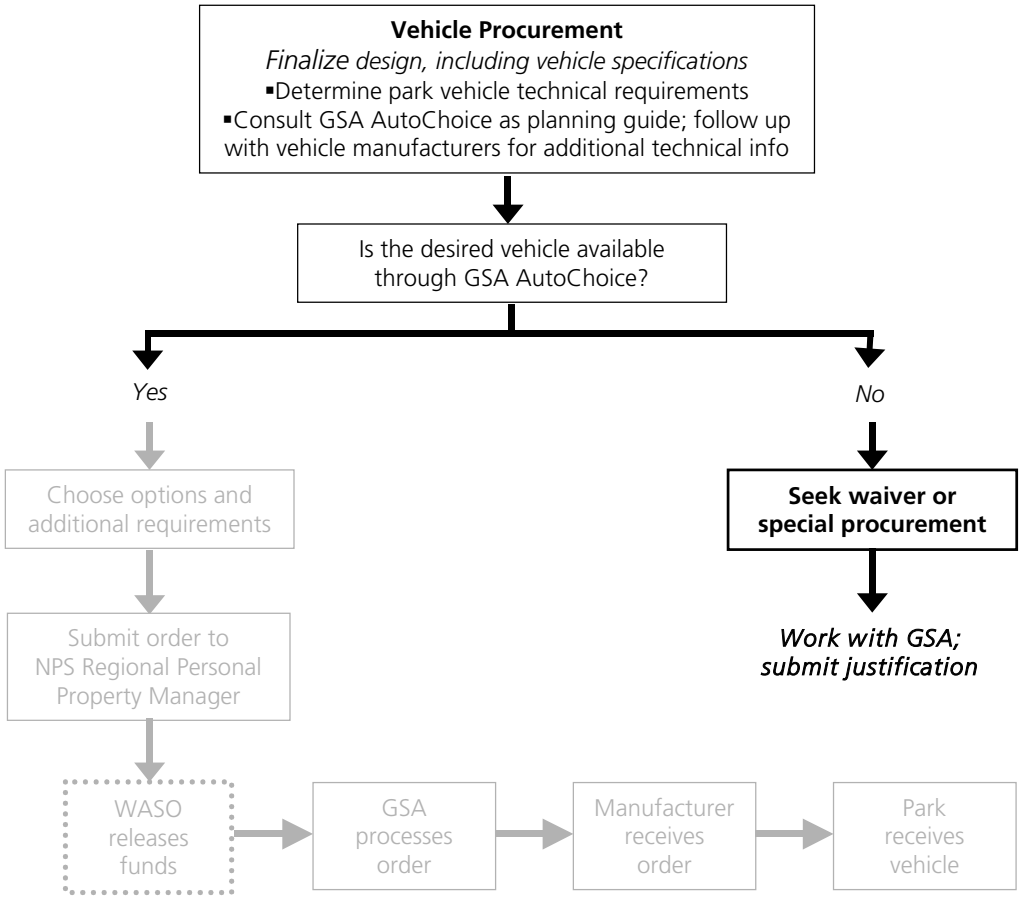
General Services Administration
Federal Supply Service
Attn.: Director of GSA Automotive
1941 Jefferson Davis Highway, Room 600
Arlington, VA 22202

If and once the waiver is approved, TAPR will need to complete its own procurement process. Options include finding an agency with "add on" options to a current contract for the necessary vehicle or publishing a request for proposal for a vehicle meeting the park's specifications. The American Public Transit Association (APTA) and the Federal Transit Administration have published *Standard Bus Procurement Guidelines*[33] and a *Best Practices Procurement Manual*[34] to assist transit agencies with procuring new vehicles.

See the flowchart below for a graphical representation of this process.

[31] See Title 41, chapter 101, part 101-26, section 101-26.501-1.
[32] Telephone: (703) 305-6815; e-mail: Russell.Miller@gsa.gov.
[33] Standard Bus Procurement Guidelines. American Public Transit Association, 1997.
[34] Best Practices Procurement Manual. Federal Transit Administration. Last updated June 2003. http://www.fta.dot.gov/9386_ENG_HTML.htm

Figure 8
Vehicle Procurement Flowchart



Findings and Next Steps

Key findings of this investigation include the following:

- Rejection of a class of vehicles—cut-away vans or body-on-chassis—as not being suitable at TAPR due to the ruggedness of the terrain and the relatively short (e.g., 3-5 year) 'design life' of these vehicles[35].

- Rejection of "school bus"-type vehicles, although durable and rugged, due to the limiting window arrangements and excessive noise created from the front-end mounted diesel engine.

- Recommendation by the project team for procurement of a 30-foot transit *bus* such as the ElDorado Escort RE 29-foot transit bus fitted with a diesel engine.

  Measurements taken during the site visit indicate the possibility of consideration of a low-floor (30-ft max) transit bus such as the Optima Opus. Some sections of the interpretive bus tour path may be problematic to navigate due to the low clearance of a low-floor transit bus; to operate on the path with a low-floor bus, it may require lessening (i.e., smoothing) the grade transition approaching the cattle guards. Changing the existing transition grades at these segments, however, may be quite problematic because of the sensitive historical and cultural landscape.

  The project team's vehicle recommendation is based on engineering judgment informed by the park's responses to the *vehicle requirements survey instrument*, the site reconnaissance field visit, and simulated operation of the intended duty cycle for the interpretive bus tour. The recommendation is also informed by a qualitative value engineering and life cycle cost (LCC) assessment that balances 'core requirements' and costs.

- Recommendation by the project team of biodiesel as an alternative fuel option for the recommended vehicle.

- Recommendation by the project team that TAPR proceed with an on-site storage and dispensing system but for biodiesel fuel (original PMIS request was for an on-site storage and dispensing system for propane).

Next steps include:

- Send out a special notice to the public via *www.FEDBIZOPPS.gov* announcing the invitation of *qualified* vehicles (i.e., 30-foot transit buses) to be operated at TAPR for field-evaluation purposes.

- Arrange for a field test at TAPR of the specifically-identified vehicle (the ElDorado Escort RE 29-foot transit bus), the Optima Opus low-floor 30-foot transit bus (a vehicle which has been tentatively rejected based on a qualitative value engineering assessment and concern with respect to vehicle clearance on the route), and other *qualifying* vehicles proposed and offered by respondents to the special notice.

- Make final vehicle selection based on field tests, park staff response to field tests, and reassessment of *qualified* test vehicles.

- Make contact with GSA regarding special procurement, Express Desk, or waiver; decide which option to pursue.

[35] There are a few cutaway vehicles that have been Altoona-tested for a design life of 7 years (e.g., Startrans, ElDorado's 240 Aerotech and 320 Aero Elite Ford); these are also considered unsuitable at TAPR due to (a) insufficient passenger capacity; (b) wider than acceptable physical envelope (i.e., > 96"); and (c) not visually and aesthetically acceptable in a park setting.

Appendix: Tallgrass Prairie National Preserve Vehicle Requirements Survey Instrument

Vehicle-Related Questions

1. With respect to the current vehicle used for the Tallgrass Prairie National Preserve (TAPR) interpretive bus tour, what characteristics of the vehicle and visitor experiences – systems and performance - would you like **retained** in any future vehicle purchase?

   Answer: Forward facing seats, big windows for viewing and ability to open for air circulation, at least 23 seats, and automatic rather than standard transmission.

2. What characteristics of the vehicle –systems and performance – would you **like to change** in any future purchase of a vehicle?

   Answer: Vehicle noise inside and out, knocking of the diesel engine,

3. What is the horsepower rating of the existing vehicle's engine, and do you consider it: (a) under-powered; (b) adequately powered; or (c) over-powered?

   Answer: It is adequate for our tour road, but a little under powered for the highway road. Seems like you really have to put your foot into the floor to get going down the road.

4. What is the current type of fuel used? At what fueling station (location) is the current vehicle fueled? What is the fuel range in mileage of the existing vehicle? Is this considered adequate? How many times per week is the vehicle fueled? Is fueling done at the beginning or end of the operating day? What is the time to refuel? Is the refueling time considered: (a) satisfactory; (b) too slow?

   Answer: Both vehicles used in providing the interpretive bus tour operate on diesel; source of current diesel fuel is truck stop on U.S. Highway 50, 3 ½ miles from ranch headquarters area; fueling is approximately once per week;

   Vehicle is usually fueled once a week. Fueling is done at the beginning of the day before the tours start. We refuel when the tank gets to ½ full. Refueling time is satisfactory. They get around 6 miles per gallon.

5. On a scale from 1-5 (**1 being least desirable, 5 being most desirable**) please rank the following (re: future/new vehicle):

(a) ride quality/suspension system	1	2	3	4	5
(b) driver workstation ergonomics	1	2	3	4	5
(c) ease of maintainability	1	2	3	4	5
(d) cost of operation and maintenance	1	2	3	4	5
(e) reliability	1	2	3	4	5
(f) large side windows	1	2	3	4	5
(g) ability to open windows	1	2	3	4	5
(h) large roof windows	1	2	3	4	5
(i) alternative fuel	1	2	3	4	5

(j) seating capacity> 20 passengers	1	2	3	4	5
(k) low interior/exterior noise level	1	2	3	4	5
(l) visual look and appeal of vehicle	1	2	3	4	5
(m) low-floor for disabled access	1	2	3	4	5
(n) bike racks on vehicle	1	2	3	4	5
(o) heating/AC	1	2	3	4	5
(p) multiple doors for access/egress	1	2	3	4	5
(q) public address system	1	2	3	4	5

Other: please list, with preference rating using same scale:

Ability for access to a mechanic that can repair vehicle. 5

6. What is the year, make and model of current vehicles?

   Answer: (1) 1995, Chevrolet commercial-frame P-chassis, 'Bluebird' Bus; (2) 1990, Ford Bus, Class 016-

7. What is the turning radius of the current vehicles? Answer: Nothing more than normal.

8. What is the height and width of the current vehicles: (a) physical envelope of 'outside vehicle' dimensions; (b) physical envelope usable by patrons for the interior of the vehicle?

   Answer: Blue Bird bus measures 8 feet wide, 24 feet in length, and 9 feet tall.
   Ford bus measures 8 feet wide, 25 feet in length, and 9 feet tall.

9. What is the seating capacity of the current vehicles?

   Answer: Ford vehicle has a seating capacity of 23 passengers
   Chevy Bluebird bus has a seating capacity of 18 passengers

10. What is the Gross Vehicle Weight Rating (GVWR) of the current vehicles? Has the weight of the current vehicle in operation on the interpretative tour resulted in any damage or additional maintenance operations to the existing pavement and/or roadbed of the loop road?

    Answer: Ford vehicle has a GVWR of 12000 lbs.(couldn't find the GVWR of the Blue Bird);
    Not really sure if the weight of the vehicles have an effect on the road or not. The weather plays the biggest role with drainage patterns across the ranch roads, causing ruts, run-off, and damage.

11. What is the *break-over angle* (see definition on last page) of the current vehicle (**ground clearance height** and **wheel base** dimensions are acceptable, if *break-over angle* is not available)?

    Answer:Blue Bird – Ground clearance is 8 inches & wheel base is 13 feet (measurement between the hubs)
    White Ford – Ground clearance is 12 inches and wheel base is 15 feet.

12. Do drivers have a CDL license? If so, what class? Up to what size of vehicle?

    Answer: Yes. Class C with passenger endorsement for vehicle of 26,000 lbs. or less to meet state requirements.

13. Have you had any safety-related issues with operation of the existing vehicle? Please discuss details.

    Answer: No. The driver's seatbelt malfunctions occasionally.

14. Have you had any maintenance-related issues with operation of the existing vehicle? Please discuss details.

    Answer: Possible overheating due to the slow traveling speed.
    Poor AC operation due to the slow traveling speed on the tour road.

15. Do you have other safety-related issues that would impact the decision to procure a future vehicle? Please discuss details.

    Answer: Exhaust tailpipe and catalytic converter temperature of vehicle is a critical concern, which could be a deciding factor in the choice of fuel. (Note: there is a lot of 'tall grass', which can be quite dry; operating rules limit the amount of idling at stops – fire safety concerns as well as fuel and emission considerations; fear of fire is always present)

    We need to have a good way to secure the wheelchair(s) inside the bus, so bumps in the road do not dislodge the chair.

Route-Related Questions

16. If engineering drawings and/or a photolog of the loop road used for the interpretative tour at TAPR exist, please forward a copy. Heather provided these to Barry on 3/12/04.

17. If a base USGS topographical survey map for the TAPR interpretative tour route is available (hardcopy or electronic file), please mark on it the **location** and **length** of the following, using these annotated symbols:

(a)	poor drainage	D
(c)	poor friction (including side slippage)	F
(d)	poor vehicle clearance (i.e., bottom of vehicle scrapes surface)	C
(e)	sharp vertical transitions (i.e., front or rear overhang of vehicle scrapes surface)	SV
(f)	tight vehicle turns (along route, and at stops)	T
(g)	sight or stopping distance problems	S
(h)	up grades exceeding 5%	UG
(i)	down grades exceeding 5%	DG
(j)	vehicle turnouts	V
(k)	load-limiting structures (e.g., culverts, bridges), with load limit	L(10 tons)

..... Barry took these measurements when he came to visit.

18. Approximately how many minutes is a round trip of the TAPR interpretive bus tour service? Please describe the following elements of the interpretative service:

length of route (in miles); the number of stops along the route, excluding the initial staging area or terminus; average dwell time for interpretation at each of the stops along the route; average operating speed over the route; maximum required operating speed for vehicle

Answer: Length of route is 7 miles roundtrip; duty cycle consists of approximately 2 stops on the outbound leg, then a straight 'run' back to the starting terminus (staging area); average time at each stop is 20 minutes or less; average operating speed is 10 mph with a maximum of 15; the vehicle needs to be able to drive highway speeds, because the buses are taken to the DMV for employees to obtain their CDLs in the vehicle they will be operating.

19. What is the policy with regard to standees?

    Answer: Our tours are on a first-come first served basis. Visitors are allowed to make advance tour reservations. Sometimes a big tour will fill an entire bus time slot, so visitors will either have to wait until the next tour time, or come back another day. This doesn't happen very often. Also, visitors are seated. We do not allow any visitors standing for safety reasons. All passengers must be seated.

20. Is the route single lane, with one-way directional flow of traffic? Single lane, with two-directional flow of traffic but with turnouts for vehicle meets? Two-lane, two-directional flow of traffic?

    Answer: Route is single lane with two way directional flow. If necessary, other vehicles pull off to the side and let the bus pass.

21. What is the minimum cross-sectional width of the road, and at what location (milepost from initial terminus of route)? Do shoulders exist along the loop road?

    Answer: Width of the tour road is 10' wide. There are no shoulders on the tour road.

22. What material is the wearing course of the road? (e.g., untreated soil, stabilized soil, course aggregate, macadam, bituminous asphalt, portland cement concrete)

    Answer: road consists of a compacted, graded crush gravel surface ('semi-improved')

23. What is the average daily traffic (ADT) on the loop road used for the TAPR interpretive bus tour?

    Answer: Three tours per day for 191 days this year. Other traffic consists of employees and researchers on errands or research into different pastures. There isn't a lot of traffic on the road. This is roughly around 4011 miles.

24. Do other vehicles share the loop road with the scheduled interpretative tour vehicle? If this is the case, what is the vehicle mix (i.e., percent autos, vans, RVs, buses, bicycles, horses, and pedestrian/hikers)?

    Answer: Buses, Jeeps, and potentially pedestrians will be sharing the tour road. We are starting a backcountry hiking permit process this summer and pedestrians will be using the existing ranch roads for their paths.

There are relatively few vehicles using these roads. Personnel mainly consist of NPS staff, leasee, researches, etc.

Other Questions

25. Approximately how frequent, and during what days and seasons, are there passenger overload events in which passengers must wait for the next vehicle run? What is a reasonable estimate of visitor demand that is NOT met (i.e., 'turned away')?

    Answer: With two buses and a van in operation and with proper scheduling, the event of visitors being turned away doesn't happen very often. The only occurrance is when we have a scheduled group that uses the maximum number of seats on the tour. When this occurs, we are unable to put any other visitors with the group. These visitors either wait for the next tour (2 hours later) or come back. We normally don't have the staff to run two buses out at the same time.

26. Based on anecdotal and informal information from the driver/tour guide's daily driving activity, on a scale of 1 to 5 (1 being least satisfied and 5 being most satisfied), are visitors satisfied with existing TAPR interpretive bus tour service?

    1 2 3 4 5

    Answer: Our Visitor Survey cards support this rating. Last year 94% of our visitors were satisfied with their experience to the preserve.

27. Based on same anecdotal and informal information, discuss major issues or problems that visitors have with the TAPR interpretative tour service and the existing vehicle.

    Answer: Noise – They can't hear the ranger because of noise from the rattle of the handicap lift. Also, loud diesel engine noise is distracting and somewhat of an embarrassment. The vehicles sound like they aren't going to make it all the way on the tour.

    Air conditioning in the hot summer months. The air conditioners have a difficult time keeping up with the heat, especially because we do not operate the vehicles at high speeds. We need to have front and rear AC units. During the hottest days (over 100 degrees) we have canceled a few tours for visitor safety relating to heat.

28. What is the average passenger load (number of passengers) per vehicle run during weekday, peak season? During weekend peak season?

    Answer: The average load during the week per vehicle is between 5-10. On the weekends, the range is between 15 – 20 visitors. Our peak season is May/June and September/October. We are a developing park and future numbers should increase, especially when a Visitor Center is built.

29. What are the hours per day and number of days of operation per annum? How many tours are run per day? What is the vehicle-miles-traveled (VMT) per vehicle per day?

Answer: Currently our regular bus tour schedule starts the last Saturday in April and ends the last Sunday in October; schedule is 7 days per week, 3 tours per day at 11:00 AM, 1:00 PM and 3:00 PM; VMT total vehicle per day is approximately 21 miles. The total amount of miles for bus tours is 21 miles. This may be shared between three vehicles or one vehicle may do all 21 miles. This is dependent upon visitor count , vehicle operation and availability, or handicap accessible needs.

30. Is there a reservation system for the vehicle and service?

    Answer: Yes. People may call in advance to reserve a seat on the bus. Or groups of 15 or more may call and reserve a Combo Tour, which is a combination of a headquarters and bus tour. These tours are 2 hours in length.

31. What is the fare/fee charged for a single interpretive bus tour?

    Answer: Bus tours are $5.00 per adult, $3.00 for children 5-18, and 4 and under are free.

32. Who does the maintenance of the vehicle? Can you provide the monthly maintenance cost per vehicle? Can you provide data for the average time between engine rebuild for the existing vehicle?

    Answer: This is performed by local garages as needed.

33. Is the vehicle garaged indoors or outdoors?

    Answer: Currently garage vehicles outside; this may change if and when new complex is developed (As envisioned in GMP which will include new Visitor Center, and Administrative and Maintenance Complex)

Definition of Vehicle "Breakover Angle"

The angle determined by the vehicle wheelbase and the clearance height under the vehicle. This angle determines the ability of the vehicle to traverse a humped road surface.