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Design Considerations for Soft Soil Mobility
(Vehicle Cone Index (VCI)/Rating Cone Index (RCI) Measurement)

Note: This document is meant to provide contractors with lessons learned to maximize soft soil mobility. Final design choices ultimately rest with the contractor.

- Choose largest tire practical for vehicle weight, class, and the ability to operate at low tire pressure settings (largest deflection) considering the off road, soft soil mission requirements. However, the largest tire may not offer the largest contact area at max deflection.
- Maximize tire deflection for load and speed over each terrain type and condition. Specifically, Mud/Sand/Snow & Emergency tire pressure settings should provide as much tire deflection as possible consistent with the wheel load and the tire manufacturer's recommendation.
- Tire and runflat design should consider Mud/Sand/Snow inflation operation and dynamic contact.
- Tire selection should also balance footprint area for mobility, spring rate, and available range of inflations for terrain conditions.
- Ground clearance should be maximized for all underbody components including underbelly protection, skid plates, knuckles, control arms, transfer case, and differentials. Clearances less than 25 % of the tire diameter have been found to increase drag and reduce performance during soft soil operations.
- As near to equal axle weight distribution as possible should be considered to maximize mobility. Testing suggests equal weight distributions will evenly distribute sinkage and resulting motion resistance between axles.
- Any low points should be designed with ground/obstacle contact in mind to minimize drag.
- Gear ranges need to consider tire size and relevant speeds for high mobility operation mud, sand, and grade climbing. Likewise, the Central Tire Inflation System (CTIS) may need to be recalibrated to provide the correct deflection if the vehicle is retrofitted with different tires and/or loads.
- Four wheel drive system should have positive engagement either directed by the operator or activated by the M/S/S & Emergency CTIS setting. However, while a fully locked up drive system may be reasonable for a short term Emergency situation, it is not practical for M/S/S setting which could involve multiple turning and long term operations. The default mode of the system also needs to consider the mission profile.
- An advanced traction control system and/or intelligent CTIS may reduce problems observed by uneven weight distribution and excessive sinkage of the rear axle as observed during immobilization.
- Four wheel drive system needs to provide mobility in all aspects of mission terrain. Some four wheel drive system are tuned toward specific terrain conditions like gravel roads or sand roads, these systems may not provide the best mobility in M/S/S which should be considered prior to system integration.
- Approach / departure / break over angles need to consider removable equipment, i.e. winches, pintle, ladder, spare tire, etc.
- Routing of air/electrical lines need to consider debris (mud / sand) accumulation and ground protrusions.
- Suspension design should consider the full range of vehicle weight and weight growth throughout life of the vehicle system.
- High deflection/low tire pressure was shown to reduce the amount of force required to extract the vehicle after immobization.