

APPLICATIONS FOR TRACKMOBILES and CLCX LOCOMOTIVES

Class I National Railroads

The Class I railroads are the seven largest systems in the US and Canada. They operate on thousands of miles of track and account for more than 90% of annual freight revenues handle and about 90% of the railroad employees in the US and Canada. They are as follows:

CSX	CSX Transportation,
NS	Norfolk Southern Railway
BNSF	Burlington Northern Santa Fe
UP	Union Pacific
CN	Canadian National (with Illinois Central)
CP	Canadian Pacific (with subsidiaries)
KCS	Kansas City Southern

Class I railroads have been slowly working their way out of small volume local switching services for well over thirty years. Today their revenues are mostly derived from handling long haul trains of 100 or more cars. Those are mostly made up of intermodal trains, unit trains, and multiple commodity trains that travel between major rail hubs and large facilities throughout North America.

Trackmobile Applications:

- ◆ *switching locomotives and railcars at car shops and maintenance facilities*
- ◆ *switching railcars at intermodal facilities*
- ◆ *switching railcars on railcar repair tracks at remote locations*

Locomotive Applications:

- ◆ *switching and making up trains at rail yards*
- ◆ *switching operations at ocean ports and intermodal terminal terminals*
- ◆ *indexing and progressing trains for loading or unloading*
- ◆ *short line switching operations in locations where it is done by Class I railroads*
- ◆ *controlling other locomotives in a consist through MU connections*

To operate on the mainline the minimum horsepower range for Class I railroads generally requires six-axle locomotives with 4400 HP and up. CLCX specializes in building four-axle locomotives up to 3300 HP. CLCX doesn't build locomotives for the Class I mainline locomotive market.

Class II Regional Railroads

Class II regional railroads operate in different regions of the country that have large areas that lack full coverage by Class I railroads. These railroads are sometimes owned by Class I railroads and sometimes by private or public corporations. Class II railroads often compete with and/or own barge operations for handling bulk commodities.

Trackmobile Applications:

- ◆ ***switching locomotives and railcars at car shops and maintenance facilities***
- ◆ ***switching railcars at intermodal facilities***
- ◆ ***switching railcars in small rail yards, ports, and industrial facilities***
- ◆ ***switching railcars on railcar repair tracks at remote locations***

Locomotive Applications:

- ◆ ***switching and making up trains at rail yards***
- ◆ ***switching operations at ocean ports and intermodal terminal terminals***
- ◆ ***indexing and progressing trains for loading or unloading***
- ◆ ***short line switching operations in locations where it is done by Class II railroads***
- ◆ ***controlling other locomotives in a consist through MU connections***

The application for CLCX locomotives at Class I railroads can be for both switching and main line service. Regional railroads tend to operate at lower speeds, below 65 MPH, and over shorter distances than Class I railroads. Class II railroads often operate over terrain with steep grades, sharp curves, small tunnels, and over track and bridges not well suited to larger main line locomotives. That makes four-axle locomotives with shorter turning radii a better choice than six-axle locomotives. This may be the case on parts of or all of the track system for a Class II railroad. CLCX locomotives from 1000 HP up to 3300 HP can work very well in Class II railroad applications.

Class III Short Line and Terminal Railroads

Class III railroads are small local railroads with less than 350 miles of track. There are over 550 of these short line railroads. A terminal railroad is a short line railroad that interchanges railcars and locomotives between different Class I and Class II railroads or between different types of carriers, like ship to rail. Large ocean ports and some major integrated industrial facilities are served by terminal railroads. Most major rail hubs have terminal railroads that move railcars and locomotives back and forth between the switch yards of the Class I railroads. The other short line railroads operate to interchange railcars between shippers, receivers, and the larger railroads.

Trackmobile Applications:

- ◆ ***switching and spotting railcars in small rail yards, ports, and industrial sites***
- ◆ ***contract switching services***

Locomotive Applications:

- ◆ ***local switching services***
- ◆ ***interchanging railcars and locomotives between larger railroads***
- ◆ ***switching operations at ocean ports and intermodal terminal terminals***
- ◆ ***indexing and progressing trains for loading or unloading***
- ◆ ***contract switching services***

The serving railroad to CLCX is the Pickens Railway Company. It is a typical Class III Short Line railroad. CLCX is fortunate in that it can have its locomotives tested under actual short line operating conditions on the Pickens Railroad prior to shipment. That provides quality assurance that a land locked locomotive rebuilder wouldn't normally have.

Industrial Switching Operations

Industrial facilities and ports are the majority of the users of Trackmobiles and CLCX locomotives. They include: steel mills, aluminum mills, auto manufacturing, mobile equipment manufacturing, paper mills, chip mills, lumber mills, plywood mills, chemical plants, cement plants and terminals, aggregate mining and terminals, coal mining and terminals, bulk material transfer terminals, food processing, grain elevators, feed mills, flour mills, petroleum refining, steel fabricators, appliance manufacturers, fiberglass and glass manufacturing, plastic pellet manufacturers, plastic parts and blow molding manufacturing, ethanol plants, pharmaceutical plants, coal-fired power plants, soy bean processing, corn processing plants, beer producers, soft drink producers, intermodal operations, solid waste landfills, warehousing, re-packagers, scrap yards handling metals, brick manufacturing, concrete pipe manufacturing, steel military facilities, and any many other facilities; too numerous to mention.

Trackmobile Applications:

- ◆ *switching and spotting railcars in all of the above listed facilities and ports*
- ◆ *contract switching services*

Locomotive Applications:

- ◆ *switching and spotting railcars in all of the above listed facilities and ports*
- ◆ *contract switching services*
- ◆ *indexing and progressing trains for loading or unloading*
- ◆ *controlling other locomotives in a consist through MU connections*

Ocean Ports and Non-Attainment Sites

Many ocean ports and urban rail served facilities are located in US EPA designated non-attainment areas for atmospheric pollution. The US EPA and State Air Control Boards regulate diesel engine exhaust emissions. Although the States can't impose more stringent exhaust emissions than required by the US EPA they can impose some regulations on how and during what hours locomotives and Trackmobile can be used. They can impose regulations on noise, oil leakage, and other things that can affect the operation of locomotives and Trackmobiles in their areas of control.

The primary pollutants being controlled are NOx "nitro-oxides" and PM "diesel particulate matter". Other controlled pollutants include HC "hydrocarbons", CO "carbon monoxide", aldehydes, and smoke. Stack opacity is controlled to prevent white smoke when starting diesel engines that have been allowed to cool off before restarting. Locomotives placed into service in those areas will need to have low or ultra-low emissions engines. They generally have to have lower emissions than locomotives used in attainment areas and/or main line service. Trackmobiles and CLCX Process Locomotives are well suited for those type switching operations.

All current production Trackmobiles have Tier-3 engines that are US EPA emissions certified for off-road use. Soon they will be going to Tier-4 engines. This is currently the best technology commercially available for large scale producers. The standard engines used are manufactured by Cummins.

CLCX Process Locomotives currently use Tier-2 large engines above 750 BHP and Tier-3 engines below 750 BHP. All of these engines are US EPA emissions certified for off-road use. This is in compliance with current US EPA regulations for locomotive switcher service up to 2300 BHP. Beginning in 2011 CLCX locomotives will go to Tier-3 and/or Tier-4i or better on the larger engines and Tier-4 on the smaller engines. These will be available from the engine manufacturers. The standard engines used on CLCX Process Locomotives are manufactured by Detroit Diesel – MTU and Cummins.

Trackmobile Applications:

- ◆ *switching, spotting, and indexing railcars*
- ◆ *contract switching services*

Locomotive Applications:

- ◆ *switching and spotting railcars*
- ◆ *contract switching services*
- ◆ *indexing and progressing trains for loading or unloading*
- ◆ *controlling other locomotives in a consist through MU connections*

Military Operations and Other Government Run Facilities

Military operations generally require 100% reliability. This is often accomplished through the use of multiple back-up units of all types of equipment including locomotives and Trackmobiles. The switching operations are similar to private industry at industrial facilities and ports. The big difference is in reliability and the frequent use of much of the equipment. A locomotive may go for years at a military site with only a few hundred hours of operation. On the other hand they may be used 24/7 for months or years at a time during periods of war or natural disaster. Military facilities generally want high reliability, very low emissions, and low pricing.

Trackmobiles and CLCX locomotives are well suited for those type operations. Over the last 30 years CLCX has remanufactured locomotives and railcars for the US ARMY, US NAVY, several State owned ocean ports, NASA, and others. Likewise there are Trackmobiles operating in thousands of those facilities throughout the world. Both types of machine offer reliability in the 99+% range.

Radio Remote Controlled Operations

Trackmobiles and CLCX locomotives both offer radio remote control on all of their models. This allows one or two people to do the work of larger crews. It is very helpful for indexing, progressing, and spotting for loading and unloading operations. The FRA has approved radio remote control operations on every type of railroad, industry, port, etc. that they regulate. OSHA and MSHA use the same FRA regulations for facilities that they regulate. The FRA refers to this as "LRC" locomotive remote control. Today radio remote control of locomotives and Trackmobiles is common place throughout North America.

Radio remote control system can be one directional or two directional. CLCX most often supplies one directional systems to keep prices down. However, CLCX has built two directional remote control systems that can relay 30 or more parameters back to the operator. The systems can also be used to operate other equipment like electric track switch machines, electric sliding derailleurs, load-out conveyors, unloading conveyors, rail scales, access gates, crossing signals, etc.

Operations Using CCTV Systems

The FRA has approved the use of CCTV systems on all railroads and other operations that they regulate. OSHA and MSHA use the same FRA regulations for facilities that they regulate. Like radio remote control CCTV allows for smaller crew sizes when the locomotives are operated from the control stands in the cabs. Both Trackmobiles and CLCX locomotives offer CCTV system that can provide the operator with up to a full 360 deg. view around the machines. The CCTV systems on the CLCX locomotives can also monitor remote cameras on poles, buildings, etc. to provide the operator with remote views of the train as he operates it. The CCTV systems on the CLCX locomotives normally have up to 9 active cameras but they can have up to 20 cameras on the basic system. The system can also be set up to provide views from other locomotives when working in tandem and/or in a consist. The CCTV system can also work with portable maintenance cameras in conjunction with a CLCX Remote Maintenance system so that a factory technician can remotely diagnose problems and actually view the problems on a live video feed. This is done while the on-site technician is talking with a factory technician on a cell phone. This can work when parked or when operating moving railcars. It is highly likely that CCTV will be standard equipment on all new Trackmobiles and locomotives in the near future.

CLCX Locomotive Remote Maintenance

Remote maintenance is very useful on CLCX locomotives. Trackmobile also offers a more limited version of remote maintenance diagnostics. The purpose of remote maintenance is to reduce downtime and maintenance expense. Both Cummins and Detroit Diesel – MTU offer software for interfacing with the engine control modules. This information can be monitored with a PLC, CAN-Bus controller, and/or a PC computer. The other electrical, pneumatic, and hydraulic systems on the machines can be interfaced with as well. The key is to have the necessary software on the machine in either an on-board PC or in laptop PC that can be used by maintenance personnel when required. The reason for this is that the programs are so large that they eat up too much broadband if the software is on a remote computer. It is much faster to have all of the diagnostics software on-board and simply take control of the on-board PL or laptop through a program like PC Anywhere.

Either way a G3 or G4 wireless broadband connection is the best type of connection because it allows the remote technician to diagnose problems during normal switching operations. If it is necessary to make repairs or do diagnostics when parked then it is a good idea to use a DSL or cable service to achieve higher baud rates if G4 service is not available. This is especially the case when a live video feed is being sent to the remote factory technician.

One of the most important features of CLCX Remote Maintenance is that the remote factory technician doesn't have to be at the factory. All CLCX E&I technicians carry laptop computers with the capability to remote into any CLCX locomotive that is setup for remote maintenance. So the remote technician can be at the factory, on a field service call, or just traveling when they stop to remote into one of these locomotive systems. The only requirement is that they must have access to either wireless broadband service or to a DSL or Cable broadband connection.

Trackmobile Remote Maintenance

Trackmobile remote maintenance is different than on CLCX Process Locomotives; because Trackmobiles have CAN-Bus controls instead of PLC controls and on-board PC computers. It is currently necessary for the technician on-site to use a laptop equipped with all of the necessary software including the Cummins Insite program. Trackmobile is currently working to improve these capabilities and it is expected that new Trackmobiles will have remote maintenance capabilities in the near future. The Trackmobile factory and its dealers like AEA-Andress are working to make remote maintenance a significant asset to Trackmobile owners.

AEA-Andress and other Trackmobile service technicians will have the option of using their laptops to diagnose problems on-site or to use them to link to remote technicians at the factory or within the AEA-Andress organization to assist them in diagnosing problems.

Traction Control and Wheel Slip Applications

Most CLCX Process Locomotives have high adhesion traction control systems. Adhesion levels of up to 38% are common. This is done by controlling each of the four axles separately and independently. This is controlled by monitoring the volts and amps to each traction motor and by using ground speed radar to measure rail speed. The power to each traction motor is controlled through SCR rectifiers by the PLC program.

Trackmobiles offer automated wheel slip control systems. This is done by throttling back the engine when the speed of the rail wheels exceeds the speed detected by the ground speed radar by a set-point difference. Since there is no generator or rectifiers that can be used to control the power to the axle, it is necessary to control the engine output power.

Wheel slip systems on standard locomotives are mostly rated at 20% to 25% adhesion. Some bolt-on wheel slip systems are rated at 20% to 30%. Clearly the CLCX automatic traction control system is superior to most other wheel slip and traction control systems used on locomotives with DC traction motors. In fact the CLCX system is equivalent to most AC traction control systems used on line locomotives.

Sizing For Locomotives and Trackmobiles Applications

If a Trackmobile can do the switching for a facility without overloading it then it is almost always going to be the best choice from an operating, maintenance, and flexibility standpoint. Trackmobiles can move from track to track by using their road drive on rubber tires. When on the rail the railwheels are direct driven. The largest current production model Trackmobile, the Titan, is equivalent in tractive effort to a sixty-five (65) ton locomotive.

CLCX Process Locomotives are either 130-tons or 150-tons. CLCX standard locomotives range from 100-tons to 130-tons. It is very unlikely that there will be a reason to use a locomotive when a Trackmobile can do a job much less expensively. It is fairly easy to demonstrate a Trackmobile at a job site so that is always the best assurance that a machine is properly sized for an application.

Rules of Thumb for Equipment Sizing

- a. If it is necessary to move more than 16 loaded 143-ton railcars in one string on level ground then it is probably, but not always, best to use a locomotive.**
- b. If it is only necessary to move ten or fewer railcars in that situation then a Trackmobile is almost always the best solution.**
- c. If it is necessary to move 11 to 16 cars in that situation a large Trackmobile, like a Titan, will likely be the best solution as long as the track and weather conditions are favorable. If operating on poor track and in ice or snow much of the year then a locomotive may be the better choice.**

- d. There is no absolute rule as to which type machine would be better, it always depends on the application.

The best way to hold down maintenance costs on Trackmobiles or locomotives is not to overload them. The first thing to do is to understand the application including: the maximum number of railcars to be move in one string, the weight of each car to be moved, the amount of tractive effort and horsepower required, the required rail speeds, and the type of braking to be used. Trackmobiles use weight transfer to produce their maximum tractive effort when coupled to loaded railcars. Locomotives depend on only their own weight; and their wheel slip or traction control system to produce tractive effort.

Safety is always job #1 when operating Trackmobiles and locomotives. One very important rule is to never try to move a train so heavy that the motive power can't easily hold it using only its own brakes on the steepest grade. The brakes on the railcars have to be fully released in order to change directions of movement on grades. If the brakes on the motive power can't hold that train still on that grade then the train is too heavy for amount of motive power being used.

Grades and curves reduce the capacity of both Trackmobiles and locomotives to move long strings of railcars. A track survey should always be done prior to sizing a machine. This can be done on existing track using levels and tape measures or it can be done from blue prints using data supplied by the engineering firm that is designing the track system. For example a model Titan Trackmobile that can move up to 16 loaded cars on level grade may only be able to move two such cars on a 3% grade. The same logic applies to locomotives. For the math regarding this see the link to tractive effort calculations on either the Trackmobile or Process Locomotive home pages.