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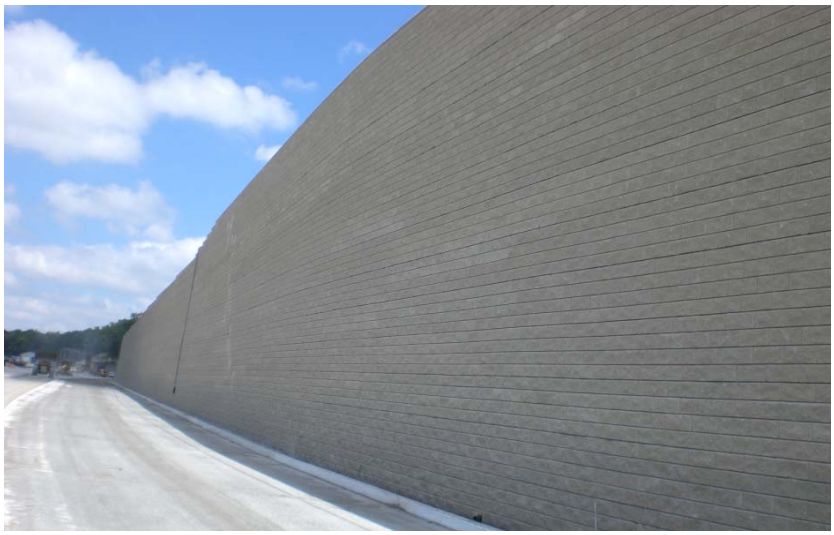
Project Summary

# CSX Intermodal Facility


When CSX Intermodal Facility in downtown Worcester, MA needed to expand their property for new rail lines, multiple issues were encountered. With a local roadway at the top of the nearby hillside as well as utilities directly behind the proposed wall, this project presented numerous challenges to both the design and construction of the wall. With the wall construction as phase 1 of the estimated $100 million project, time was a huge consideration to keep the project on track. Incorporating the Allan Block segmental retaining wall system along with multiple reinforcement types would be investigated and applied to achieve the space necessary for the expansion.

**Plan**

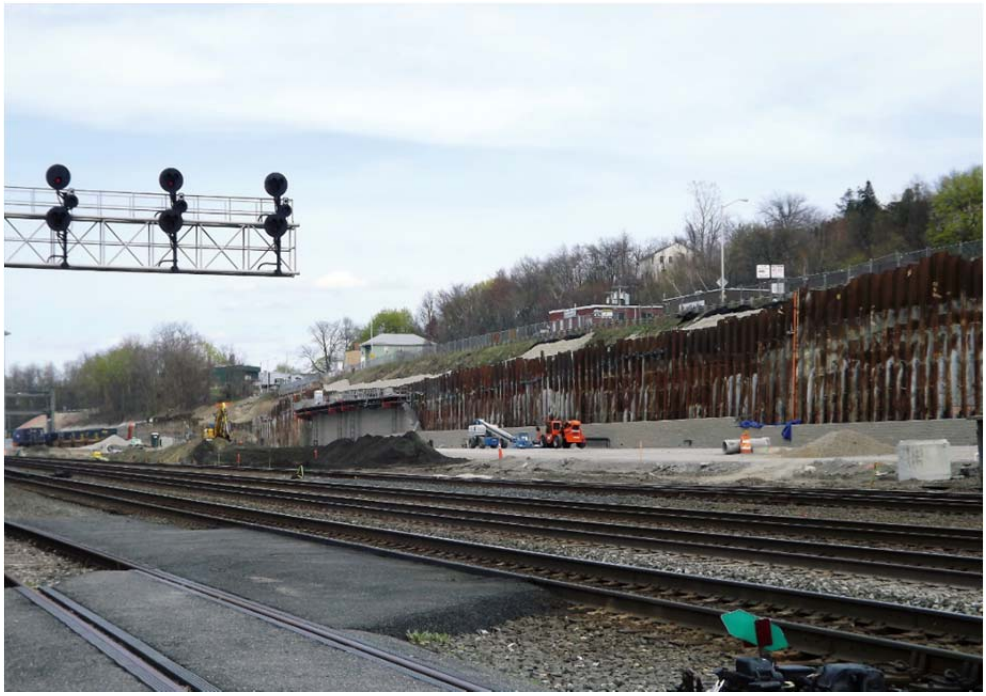
The CSX Intermodal Facility is located in downtown Worcester, MA where space is limited for expansion. When CSX wanted to expand their Worcester facility into the main hub for the entire New England area, the additional land needed to be obtained with retaining walls. Initially, the plan was to use shotcrete and soil nails for the majority of the project and only a small portion of the walls would utilize geogrid reinforced segmental retaining wall (SRW) block. Problems with the site soils and the aesthetics of the proposed wall did not allow the initial design to proceed. To solve the aesthetics challenge, the overall plan was changed from having 15,000-20,000 $ft^2$ (1,400-1,800 $m^2$) of geogrid reinforced Allan Block wall to using SRW to face the entire wall including the geogrid and non geogrid reinforced areas. The resulting design used SRW to cover all 110,000 $ft^2$ (10,200 $m^2$) of wall which satisfied the owner's aesthetic requirements. Not only did the project encounter multiple design methods for



construction, but there were also local utilities that ran behind the wall. Planning for these utilities dictated soil nail or sheet piling placement during construction of the wall.

With the vast size of the project, CSX also paid for roadway and utility improvements which were part of a Neighborhood Improvement Fund paid to the city. Although these improvements were not part of the wall construction, the improvements would help the local area flourish with the new railway expansion.

By incorporating multiple soil retention methods, including geogrid, soil nails, and sheet piling along with SRW as a facing allowed for a feasible and economical design that met CSX standards for quality and reliability.



**Design**

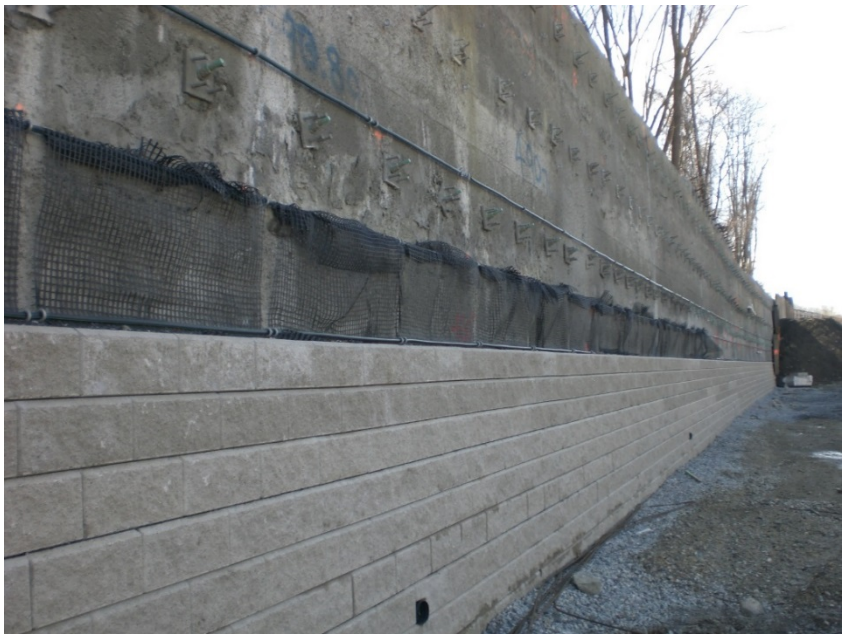
As with any project, the designer has many challenges that need to be identified and overcome. In the case of the CSX project, not only were multiple reinforcement types deemed necessary in the planning stage, but additional areas of poor soils were found once excavation began. The project manager, Terry Chappell of Vermont Lumber and Stoneworks of Nashua, NH, mentioned "if the soils were known before excavation began, the design may have been different." The discovered soils, again, altered the direction of the final design and required additional areas of non-geogrid walls. Clark Geotechnical out of Woodstock, Georgia was hired to perform all retaining wall designs because their engineers were up to the challenges of this difficult site.

In one of the areas of the CSX project, a roadway above and utilities behind the wall did not allow a conventional MSE wall to be used. Although soil nails with shotcrete could usually be used in these applications, poor foundation soils were found which would not allow for the proper bearing capacity requirements of the design. Chad Clark of Clark Geotechnical mentioned, "The initial borings missed the site soils which led to unforeseen soils during excavation." In this case, Clark Geotechnical decided to incorporate sheet piling with a soil nail tie back system. The tie backs allow the sheet pile wall to be taller and would not disturb the roadway or utilities on site. Although this method of construction is typically more expensive, it was the most viable option because the poor soils on site did not allow other

retaining wall applications to be used. Secondary testing of the site soils showed a standard penetration test with a "zero blow count." The blow count in the test gives an approximated density of the in-situ soils. Soils that give lower blow counts are typically poor soils for construction.

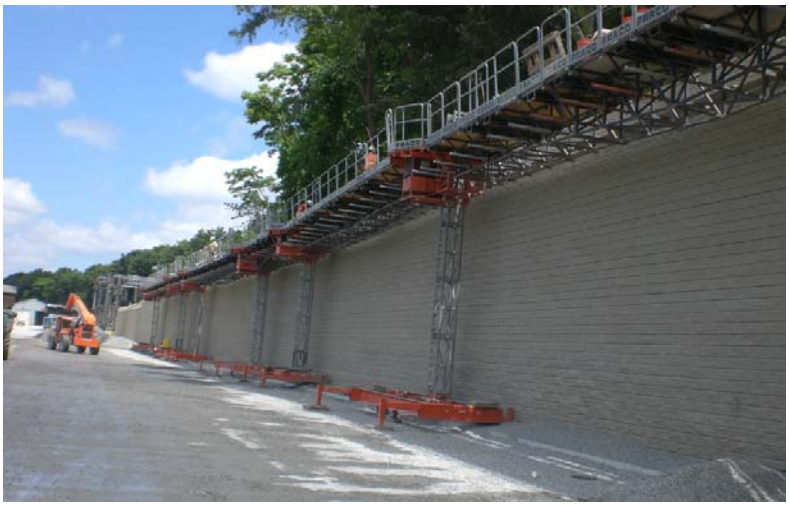
Although unsuitable soils were found during excavation, soil nails with shotcrete could still be used in a large portion of the nearly 1 mile (1.6 km) long retaining wall, primarily where conditions above the wall made excavation impossible and the wall height did not exceed the bearing on the foundation soil.

Clark Geotechnical had designed many retaining walls prior to this project, but none with such variety of design options. Typical construction for a SRW wall would be in a geogrid reinforced application, but for the CSX project, Clark Geotechnical had to come up with a wall connection detail in the non-geogrid areas that provided a seamless appearance from geogrid to shotcrete to sheet pile areas. They knew that using Allan Block as a facing to non-geogrid reinforced walls was common, but due to the tight time schedule, they came up with an alternate detail to the commonly used spreader bar option. First, they called for an additional coating of shotcrete to be placed over the sheet pile walls to provide a more uniform working surface. Then, they had steel eyehooks anchored to the walls at designed intervals and through the eyehooks they threaded commercial grade 7 wire cable which was tensioned to provide a connection point for the geogrid. Terry noted, "The tensioned cable was more feasible, easier installation, and no welding which made sense as the alternative." Eyehooks and cable assemblies were installed at all geogrid layers from the bottom to the top of wall section. When the cables were installed, the retaining walls were constructed with geogrid layers coming out of the back of the walls which wrapped around the cable and then returned back into the wall at the next course up. The hollow cores of the Allan Block units and the void between the wall and the shotcrete were filled with a clean washed gravel to provide easily compactable material for the installers and additional drainage for any incidental water in the area. Clark Geotechnical and CSX chose Allan Block, due to the very tight site constraints. The nearly vertical Allan Block units and innovative alternate cable connection method made the end product appear seamless from end to end of this nearly mile long, very diverse structure.



**Build**

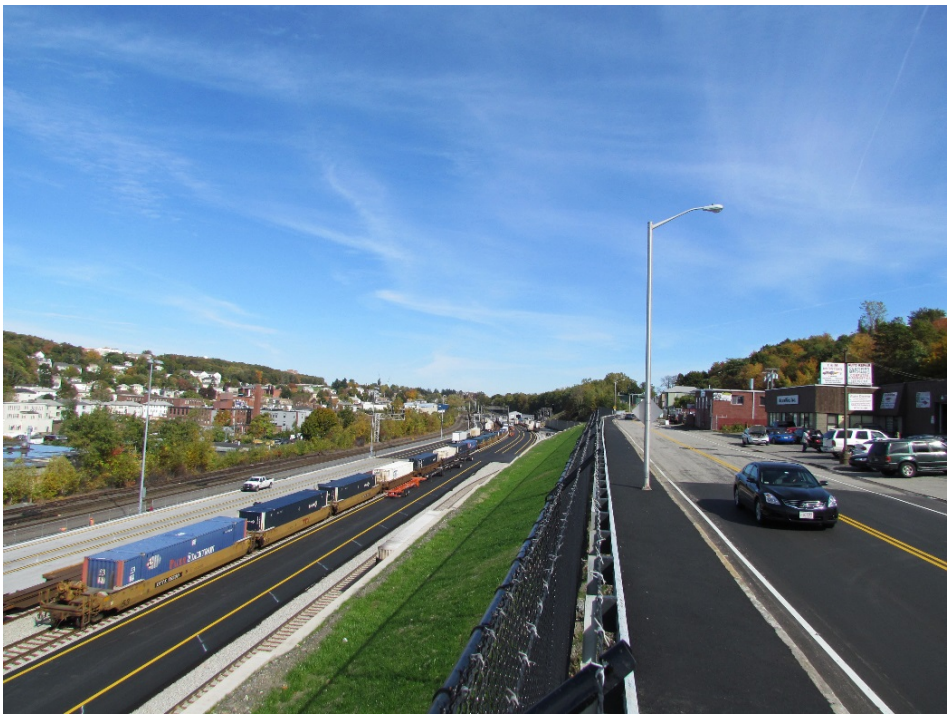
Vermont Lumber and Stone Works (VLS) who was already a certified wall contractor through the nationally recognized Allan Block contractor training course, was awarded the project. As with any railroad project, timing plays a major role in its success and this project was no different. Since the walls were only phase 1 of the railway expansion, the retaining walls had to be constructed first before any rail expansion could start. To make things even more difficult, the entire wall project had to be constructed while the railways remained open for CSX. With virtually no access from behind the wall for most of the project length, VLS utilized a mobile hydraulic lift to safely move material during construction.



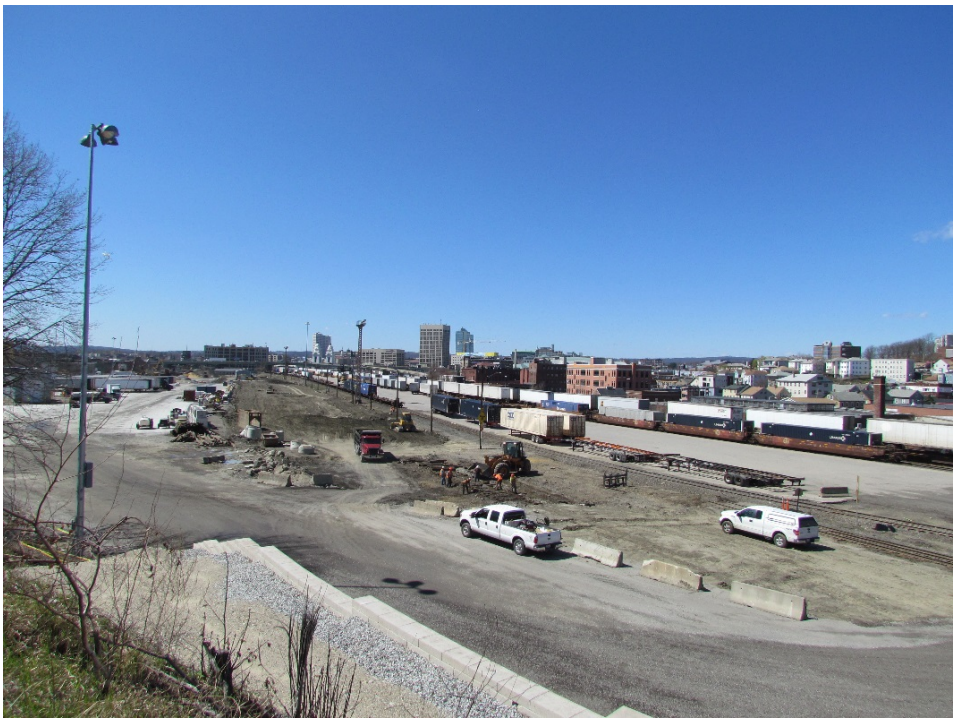
"This project had unforeseen circumstances from the start to the end, we just had to adapt as we moved forward," explained Chappell. Using their well-trained installers, the innovative hydraulic lift system, and their well-earned experience they installed an average of 1200 Allan Block units per day, even through the non-geogrid reinforced areas. A total of seven walls were installed on the site which varied from different types depending on the area of the overall site. The final walls were nearly 1 mile in length (1.6 km) with heights up to 35 ft (10 m) which accounted for over 110,000 $ft^2$ (10,200 $m^2$) of wall. With the wall construction completing in 2012, CSX now has the space available to expand their rail yard to become the main hub for the New England region. Four new tracks were installed after the wall completed which amounted to a total of 28,700 TF for the expansion hub. In addition to the wall and track, the project also included parking and pavement areas, a new gate and crew building, maintenance facility, automatic gate system, a fueling system, and a new bridge for local traffic to cross over the facility.

Although the project encountered multiple design considerations and the construction of the wall took special installation requirements, the railway expansion site was a huge success. With proper design and construction of the CSX Intermodal Facility, the finished railway expansion now stands in the downtown location to service the New England area.

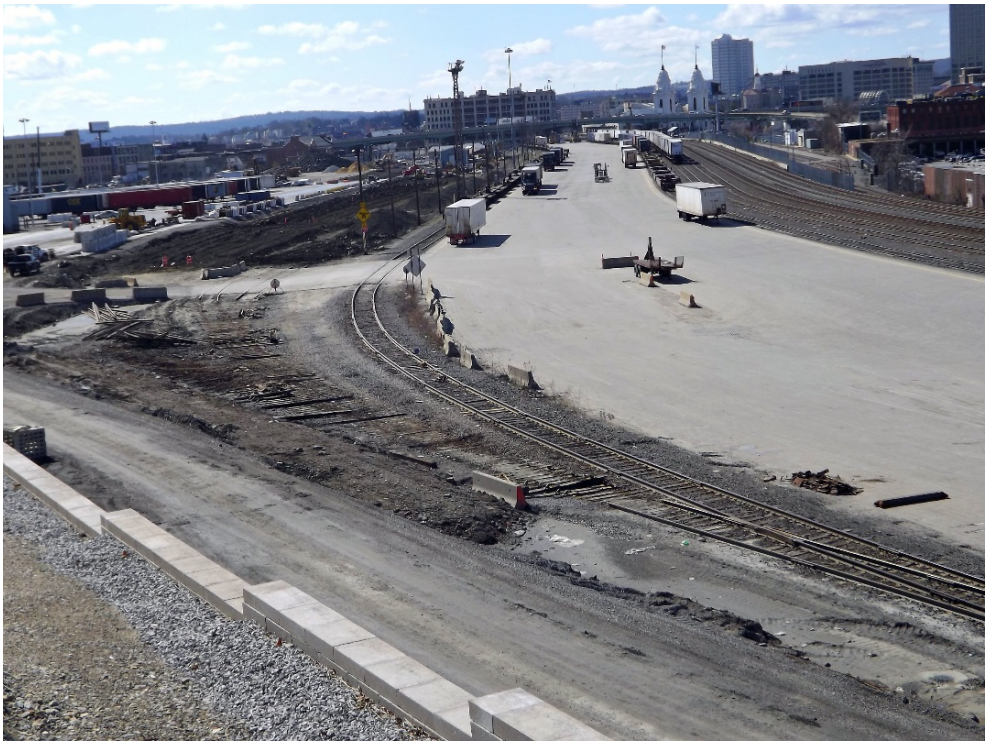
Expansion near complete



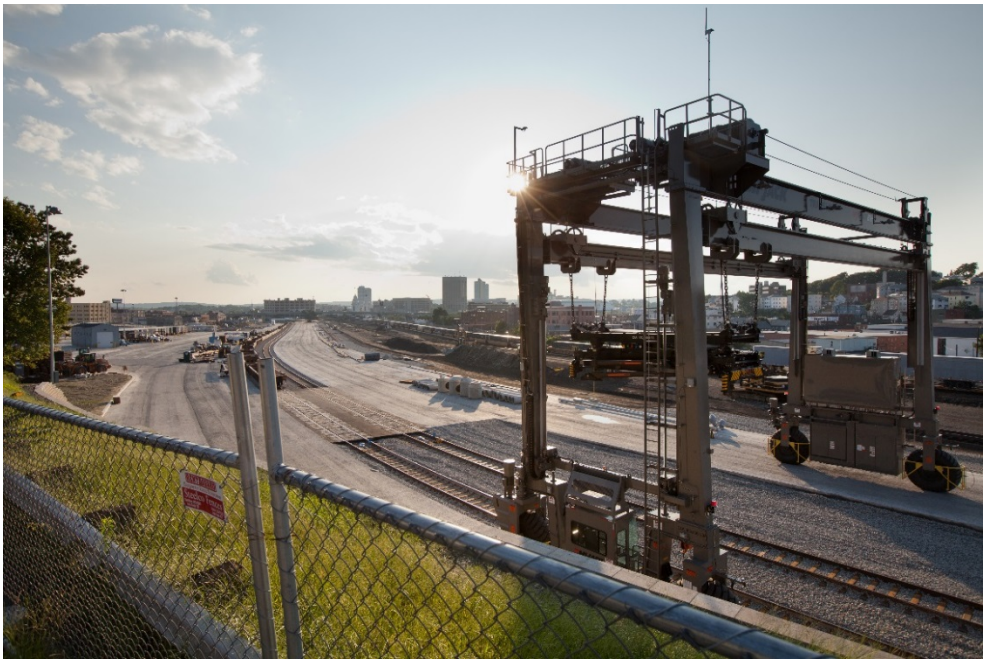
Roadway improvement above



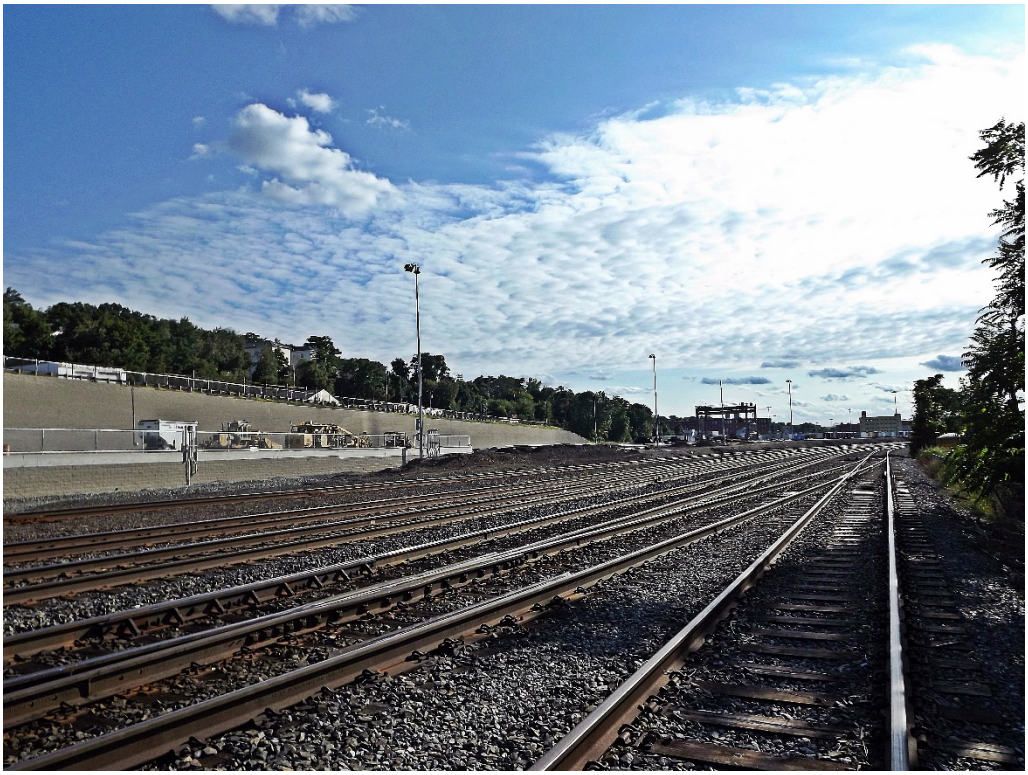
Railway Expansion Begins



Expansion dirt work



Railway expansion completed



Completed