Long Term Durability of Load Bearing Runway and Taxiway Base

When aircraft loads are applied to a soil sub grade, the soil will be less prone to deform or rut if the shear strength of the soil exceeds the applied loads.

The strength of the soil is a function of such characteristics as its angle of internal friction, its cohesion, and its degree of compaction.

Most runways and taxiways are built with one or more layers of high quality fill materials placed and compacted. The fill materials allow the area to support the loads that the sub grade soil, by itself would not be capable of supporting.

The function of the layers of base material is to distribute and spread the imposed loads over a large area, reducing the pressure applied to this sub grade. The base material is able to distribute the loads because the individual aggregate particles if they are properly graded will lock together. Applied loads are transmitted through the base material both as vertical and horizontal forces.

If these horizontal forces under heavy load push the base material sideways this can result in early failure.
Even a really good quality graded stone base, with the proper internal strength can move laterally if the loads are frequent or heavy enough.

To prevent lateral movement at the bottom or even within the base layer, high modulus geo textiles and grids have been used for several years. Because of their strength, resistance to elongation, these fabrics and grids are more capable of restraining the lateral movement of the base materials with which they are combined.

Although they are a proven tool in many stabilisation applications, these fabrics and grids are only truly effective at the boundary where they contact the base soils. Prevention of lateral movement of the base materials above and even below this boundary/contact area still depends totally on the strength and quality of the soils/fill materials at this point.

The vertical and horizontal confinement of the entire depth of the base layer is only possible with a bound stabilisation of the layer and this has major implications for the bases long term performance. Cement and to a lesser degree Lime has been fulfilling the requirement of the construction industry for stabilising materials to form a bound layer, and have proven to provide long term strength and durability. Cement not specifically designed for the treatment of soils and can only perform to full effect with granular or cohesive soils.

Where loadings of the construction platform are expected to be high or frequent. Lime alone is not an option, Cement in combination with Lime or on its own can be used in designs of up to 5% by volume. The risk of cracking will rise exponentially beyond this mix design, unless RoadCem is added to modify and improve the hydration process.

RoadCem will allow cementitious stabilisation of all types of soils and materials, with reduced risk of cracking even in Design mixes of 10% by volume and more to cope with the heavy or long-term loadings required for airport facilities.

For extreme loadings mixes of up to 15% have been used successfully without any cracking.

300 tonne concrete bridge section being trucked along a 400mm deep +10,000 Mpa RoadCem soil concrete road.

RoadCem manufactured in Holland by PowerCem Technologies has been available worldwide for over ten years.

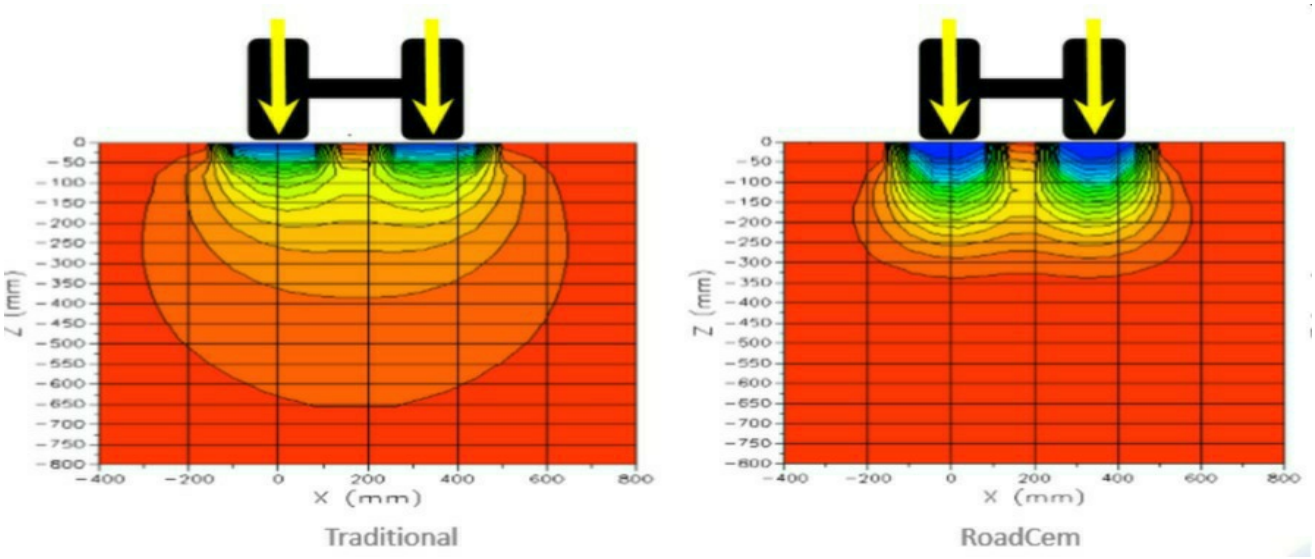
One of the earliest applications was at Moerdijk Harbour, close to headquarters, where a stabilised soil hard standing for containers and plant was constructed in-situ from local soils and dredged harbour sand and silt.

Used without protective surface since 2008 the platform has proved extremely durable and any repairs caused by accidental impact have been easy to repair.

Bound platforms provide a far safer operating surface for cranes, rigs and heavy plant, especially when constructed in-situ at site level. Allowing easy plant access and set up.

RoadCem is a product specifically designed to engineer superior tensile strength and impermeability in to soils, providing superior long-term durability. Allowing the platform to be used un-surfaced and virtually maintenance free for the duration of the works.

The high modulus of elasticity and dynamic absorption properties created by RoadCem reduce the impact of loadings, allowing thinner stabilised layers to be used without compromise in strength or durability.



As the achievable mechanical properties of RoadCem soil concrete stabilisation are therefore far more predictable and measurable.

Using multi-linear elastic BISAR Software modelling our design engineers Rodgers Leask Consulting Engineers of Derby can calculate final strength and loading capacity with confidence.

Allowing the thickness of RoadCem stabilised layers to be safely reduced, saving cost construction time and environmental impact.

RoadCem is now the first choice stabilisation technology for Runways and taxiways in Mexico following the successful roll out of the technology at Guadaljara Mexico's second largest airport in Jalasco.

Some of the most extreme testing of construction platform designs can be found in the construction of runways and Taxiways.
The most commonly used testing software FAARFIELD when used recently for comparison of conventional granular base and a RoadCem stabilised soil base, produced the following amazing results:

León, Guanajuato. 4 October 2011.

PowerCem Mexico
Governor Vicente Eguía No.7
Col. San Miguel Chapultepec
Del Miguel Hidalgo
11850 Mexico, DF

Attn. Ernesto Gerardo Orozco Escoto (Engineer)
Project Manager

Dear Mr Orozco,

We wish to inform you below of the results obtained in the Office on Geotechnical Study Analysis/Soil Mechanics Analysis on Behaviour of Pavements by the Simulators FAARFIELD and COMFAA, in addition to the analysis and recommendations for the foundation for "Airport Terminal T2 of Guadalajara, Jalisco", which will be built in Guadalajara, Jalisco, Mexico.

I have nothing further to report at the moment, but for any clarifications with regard to this report, please do not hesitate to contact me.

BEST REGARDS,

Alfonso Rafael Ayala Pérez
(Engineer)

c.c.p. File.

PART 8

Conclusions

CONVENTIONAL STRUCTURE

Pavement designed with granular materials has a useful life of 39.3 years with a CDF = 0.51.

Pavement designed with granular materials has a PCN - 64 / R / B / X / T

STRUCTURE WITH SYNTHETIC ZEOLITES

Pavement designed with materials modified with synthetic zeolites (RoadCem of PowerCem) have a lifetime of 2,309.6 years with a CDF = 0.01.

Pavement designed with materials modified with synthetic zeolites (RoadCem of PowerCem) has a PCN - 64 / R / A / W / T

Pavement designed with synthetic zeolites significantly extends the useful life of the structure, in addition to having the ability to receive larger aircraft.

Brno město – Czech Republic

Airport taxiway

Due to the increase in air traffic and the size of the airliners utilizing the airport, one of the taxiways at the Brno Airport had to be widened.
RoadCem made it possible that the supply and removal of construction materials was kept to a minimum and the amount of traffic caused by construction needs was drastically limited.
This allowed for faster less disruptive construction time.
The utilization of the in-situ material not only resulted in time-savings, but a cost-saving of 25% in comparison with traditional construction methods.
The increase in durability with high elastic modulus and crack free impact resistance will also reduce maintenance for a long term life span.

Project : Airport taxiway
Country : Czech Republic
Location : Brno
Product : RoadCem

Weeze Airport - Germany

Airport

With Low cost airlines using the facility and annual passengers rising to over £2 million, new taxiways and apron were needed at Weeze Airport in Germany.
RoadCem technology was chosen because of speed of installation and also to minimize vehicle movements to and from the this busy hub.
Using a high strength mix of RoadCem and cement and incorporating existing crushed concrete materials together with the in-situ site soils.
The increase in durability with high elastic modulus and crack free impact resistance will also reduce maintenance for a long term life span.
Core samples indicated values in excess of 6,000 MPa after 28 days.

Project : Airport taxiway and apron
Country : Germany
Location : Weeze
Product : RoadCem

Bogota Airport - Colombia

Airport

The El Dororado International Airport is located 9 miles West of the city of Bogota, and serves the entire metropolitan area in Bogota and the country for allInternational flights. It receives flights from North and South America and the main citiesin Europe. Furthermore, it is the most important cargo airport in Latin America,and has one of the longest anywhere in the World.

In this airport, PowerCem Technologies participated in the construction of the new upgraded taxi strips in May 2000. Using these new strengthened taxi ways were the McDonnell Douglas MD-83 with 72,4376 Tonne (160,000 pounds) in weight, with 200,000 repetitions designed into the strips service life.

Project: Air Strip Rehabilitation
Country: Colombia
Location: Bogota, Colombia
Product: RoadCem