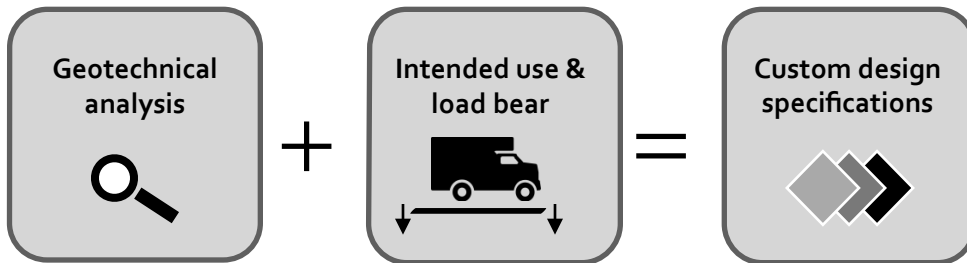
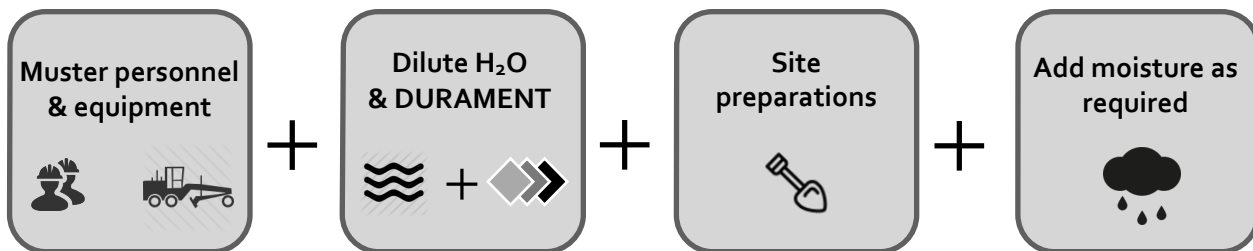


Application Procedures

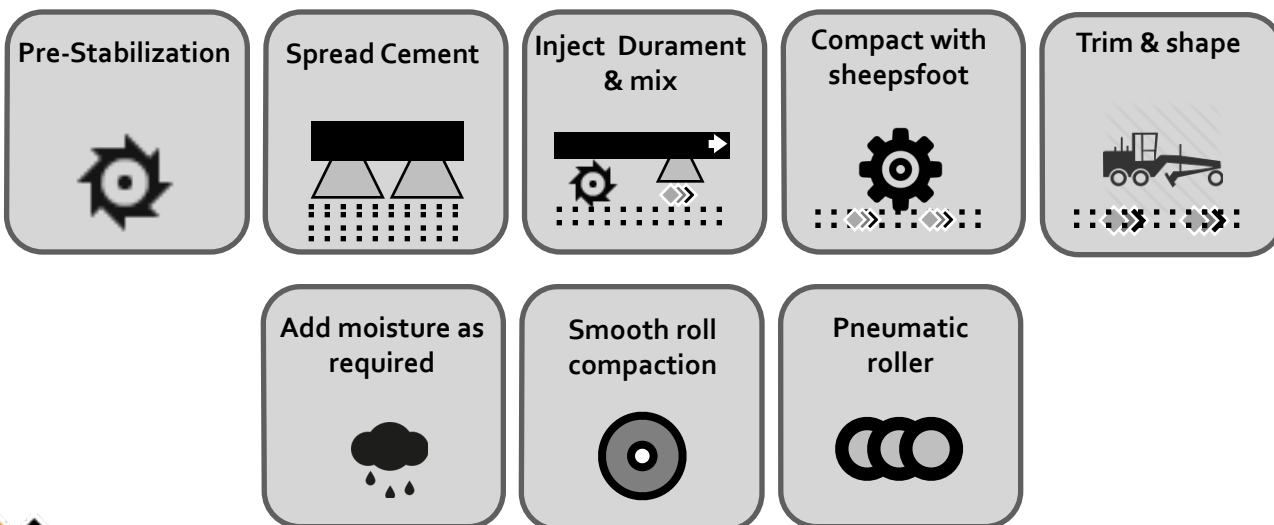
FORMULATION



PRE-WORKS



APPLICATION



FORMULATION: Methodology for the design formulation and application of **DURAMENT™** RS follows established cement-stabilization guidelines.

DURAMENT™ RS is added into the construction water on site.

Geotechnical analysis



Objective: To enhance the California Bearing Ratio and further increase the Ultimate Tensile Strength, flexibility and the resistance to moisture permeation by means of soil stabilization with **DURAMENT™** RS Polymer, water and Portland General Purpose Cement.

DURAMENT™ RS polymer-creating cement additive is designed to work in conjunction with Portland General Purpose Cement in a wide range of soil and sub-grade types to make a strong and flexible base for roads enhancing quality and durability of the final pavement.

The GP cement, water and **DURAMENT™** RS ratio-to-weight per m³ of earth-material is determined by various factors that must first be established to enable a proper formulation to be designed.

Intended use & load bear



These factors include the plasticity index of the soil to be stabilized, optimum moisture content, compaction of the substrate, the current CBR (California Bearing Ratio), projected traffic including maximum axle load weight, volume of projected traffic and the required lifetime of the road pavement.

The volume of cement appropriate to the different soil types and plasticity index is formulated specific to the project, dependant upon these factors.

For example, where highly plastic clays are encountered, a specified stratum of low plasticity material may be introduced into the clay prior stabilization with cement and **DURAMENT™** RS. This low plasticity material may, for example, consist of laterite, limestone, sand or fly ash. Further, should specifications require a high degree of water resiliency, additional polymer may be called for.

Custom design specifications



Water used with **DURAMENT™** RS may be clean fresh water, brackish water or seawater, provided that it is clean and does not contain any organic contamination. Local standards and/or construction documents may require or specify the quality of water that must be used, adherence to such standards is recommended.

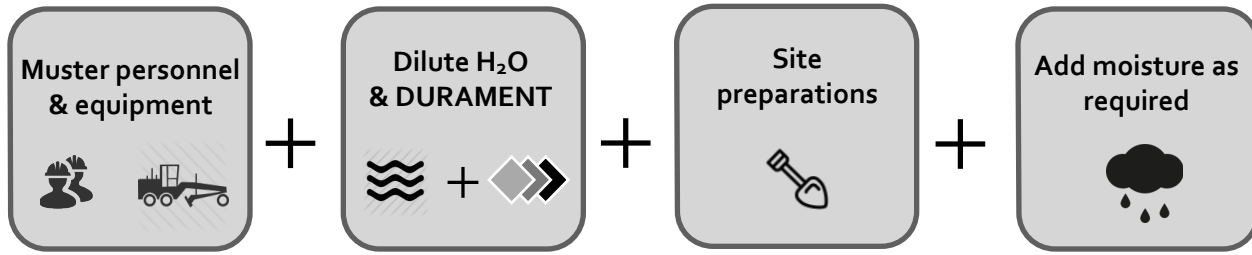
Quality Control Before Use: **DURAMENT™** RS additive should be in sealed containers as delivered from the manufacturer with MSDA attached and must be protected from contaminants prior to use.

Portland General Purpose Cement used in the soil stabilization process must meet local standards of quality.

It is suggested that before construction begins, laboratory tests establish the cement content, compaction, and water requirements of the soil material to be used. During construction, tests are conducted by geotechnical engineers to ensure that construction specifications are met. Testing ensures that the mixture will have strength and long-term durability. No guesswork is involved.



PRE-WORKS: Thorough planning of pre-works assures best outcome.



Muster Personnel and Equipment:

Experienced personnel providing proper oversight to ensure engineering standards and specifications, are strictly met; including dilution rates, OMC, polymer flow rates, cement distribution rates, mixing, depth, and compaction.

Fully qualified and experience equipment operators are essential.

Equipment required (all in good working condition) typically will include:

Grader:

1 x Road Grader (Cat 12 equivalent or larger) with Rippers and Tynes.....<http://www.cat.com>

NOTE: Blade must be sharpened for cutting the final grade.

Stabilizer / Reclaimer:

1 x Soil Stabilizer preferably with a microprocessor controlled injection system to ensure **DURAMENT™** RS is injected simultaneously with mixing. (pass width generally 2.0 to 2.7 metres)

- Wirtgen Stabilizer<http://www.wirtgenamerica.com>
- Heavy Duty Rotary Hoe (eg. RM 300..... <http://www.cat.com>
- Bomag soil stabilizer with water system<http://www.bomag.com>

NOTE: For continued forward progression in the process, a second stabilizer is suggested. The first to pre-stabilize the area and the second to follow behind the cement spreader to mix together the cement/soil and **DURAMENT™** RS

Water Tanker:

2 x Water Tanker Trucks with horizontal rear mounted spray-bar with all fully operational flow rated nozzles.

NOTE: If unable to obtain a Stabilizer fitted to disperse liquid into the mixing chamber, it is imperative that a water tanker be fitted with a spray bar to measure rate of flow.

Cement Spreader:

1 x cement spreader suitable for use in soil stabilization. Spreading and even distribution of the binding agent is governed electronically to ensure proper volume of cement is laid down per square meter.

<http://www.wirtgeamerica.com>

Compaction Rollers:

Pneumatic roller such as a CW34 with a modular ballast system.

<http://www.cat.com>

20 tonne padfoot roller or equivalent with tractor for pulling or self-propelled.

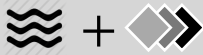
<http://www.cat.com>

Smooth drum roller - **NOTE:** Steel drum tends to stick to the final mixture where clay is involved.



Dilute DURAMENT™ RS with Water:

Dilute H₂O
& DURAMENT



- Standard Health and Safety conditions should be observed, and use of protective gloves and goggles is recommended for personnel unloading DURAMENT™ RS. MSDS should be observed.

To dilute the concentrated DURAMENT™ RS with H₂O first added to the water-tanker the specified volume of H₂O leaving a sufficient volume of room to next add the DURAMENT™ RS.

Dilution ratios of DURAMENT™ RS and H₂O are according to design specifications contained in the construction documents. Care should be taken to ensure that the correct volume of DURAMENT™ RS is added to the the water-tanker.

The pump delivery hose should be either introduced into the top of the water-tanker delivery port, or extracted from the DURAMENT™ RS container by means of suction pump attached to water-tanker.

Recirculating devices within the tanker can be used to ensure a thorough mixing. A special mixing site is not required. This dilution process can be done at any convenient place on or adjacent to the work area where the water-tanker can be positioned conveniently beside the bulk DURAMENT™ RS polymer supply.

Site Preparations:

Site
preparations



- Remove all organic material. Ensure substrate meets or exceeds design specifications for intended use. If existing substrate does not meet design criteria, do not proceed until specifications are met.

Test the stabilizer equipment to determine the machines ability to manage the in-situ material. At this time, personnel should determine if a single pass with the stabilizer should be performed prior to proceeding with laying the Portland cement. If unable to produce a uniform soil consistency, do not proceed with soil stabilization process until a resolution is determined.

Where high plasticity indexed clays are encountered in the soil to be stabilized, consider applying a stratum of low plasticity material at approximately >4% of density per m³. Always adhere to design specifications as provided in construction documents and local building standards.

Optimum Moisture Content:

Add moisture as
required



- Add moisture as needed. Recommended Optimum Water Content (OMC) is 5%. If the soil is over OMC a mud may be created. If the soil is below OMC, the soil will not compact properly.

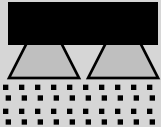
Application:

Pre-Stabilization



- To achieve a uniform soil consistency, a single pass with the stabilizer prior to the addition of Portland Cement may be required (determined in the pre-works). Adjust the Stabilizer to depth and proceed to create a uniform and consistent sub-grade. If required, the material may now be graded, levelled and trimmed prior laying Portland Cement, or left to aerate for a period of time. If a stratum of low plasticity material is laid over the area, pre-stabilization will ensure it is mixed well into the soil.

Spread Cement



- Commence spreading general purpose Portland cement the length and width of the area to to be stabilized. Cement is applied directly to the ground. The weight of the cement to applied per meter square should be according to design specifications. Personnel should inspect to ensure that specifications are being adhered to.

Inject Durament & mix



- With the water-tanker coupled to the stabilizer, begin mixing the soil and cement while at the same time injecting a specified amount of **DURAMENT™** RS into the mixing chamber. The water-tanker leads the precession and is followed by the stabilizer. A thorough and homogeneous mixing of cement, **DURAMENT™** RS and in-situ material is critical to the success of the stabilization process. On site personnel will determine if a second pass with the stabilizer is required.

The objective is to reach a perfectly uniform soil consistency with an OMC of 5%. Additional water may be required during mixing to maintain OMC and accordingly a stand-by water truck loaded with water only should be readily available.

The mixture remains in a workable condition for a time to enable compaction, trimming and rolling. However as an exothermic reaction is generated there does exist a limited period of time, therefore the length of the section under construction should take into consideration such things as the available expertise, quality of the equipment used, weather and temperature.

Compact with sheepsfoot



- Initial compaction with a sheepsfoot compactor should immediately follow completion of the stabilization and mixing process. Several passes will normally be required until the pads begins to ride on top of the soil and are no longer sinking into the material. Continue with the compaction process until the desired compaction percentages are met or exceeded.

Trim & shape



- Initial compaction is followed by the grader to reshape the top course and if necessary, to remove excess material.

Depending upon the intended use and specifications, the grader may at this time trim to a finish level and fall. It is important to ensure that the blades are sharp to prevent the blade from hopping.



Add moisture as required



- A light watering as may be required. Caution, some clayey soils may stick to the smooth drum roller. Perform a test patch first before wetting the entire surface to determine if soil sticks to smooth roller drum.

Smooth roll compaction



- Proper compaction is essential. Smooth roll to desired compaction percentages. If additional moisture causes the soil sticks to smooth drum, it may be necessary to either (1) stop adding moisture and compact with smooth roller to achieve the specified compaction percentages, then later use the grader to swipe off top rough course, or (2) use the Pneumatic roller in stead of the steel drum smooth roller, or (3) do not add moisture and compact with smooth drum roller and or pneumatic roller to achieve specified compaction percentages.


Pneumatic roller



- Final compaction with a multi-wheel pneumatic roller.



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