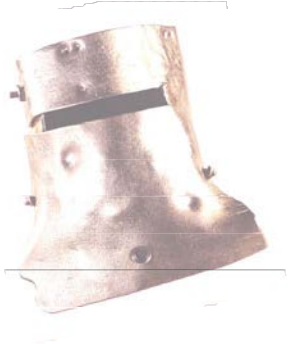

Kelcrete

(Qld) Pty Ltd

Not Fragile

Slipform Kerblayers

Understanding the Slipform Process of Concrete Kerbing

Introduction

My name is Shaun Kelly and my family have been established in this industry since 1973. We are a third generational kerbing business and over this time we have witnessed the deterioration of the kerb construction process. Hence the reason why we changed our focus away from dry extrusion kerb to wet pour slipform kerbing. I hope the following paper explains and gives a better understanding of the slipform product and construction process.

Slipform kerb is a very different process of constructing kerb to the old dry extrusion method of construction. Slipform kerb is about structural strength. It is a product which can stand up to aggressive treatment from vehicles and machinery and a life span of 60+ years. Slipform does not use slurry, just concrete. This alleviates any possible problems from third parties.

The Challenge of Change

Slipform kerbing means change in the way people think of kerbing. The way they design for kerbing in projects. The way they prepare their construction projects and the way concrete is batched and delivered.

In Australia we are very used to the dry extrusion kerbing process. This type of kerbing has been established since 1967 when the first machine was introduced to the construction industry.
The problem is the dry extrusion process is structurally floored. It fails to meet AS 1379 standard and the AS 2876 kerbing standard has been withdrawn. I would say the failure rates would have a lot to do with this action being taken. It should also be noted concrete supply companies refuse to guarantee concrete strength with dry extrusion kerbing.

The one thing that challenges people the most is change. Change takes people away from things they know, things they have done, day in and day out without much thought. It takes them from their comfort zone. The challenge of change means people have to change themselves in the way they think, look and do things. Even when change is for the better this can be a large hurdle in itself to conquer.

The Machine

Our Arrow slipform kerb machine is 3700 mm length and 2500 mm width in offset pouring mode. This is considerably larger than a standard dry extruder machine of 2700 mm length and 770 mm width. The size of machine needs to be taken into account when assessing the different outcomes by using a different methodology of kerb placement. The slipform machine is self propelled and has a fully integrated digital sensing system. The system follows a set stringline for line and height control with a quoted tolerance of +/- 3mm subject to all other outside influences e.g. concrete, base preparation and stringline setup.

The slipform paving technology is one of the most advanced forms of technology that is used around the world for the purpose of paving kerbing works in the 21st century. The success of slipform kerbing is reliant on many factors to achieve a quality finish with exact grade and line of kerb. These factors are as follows.

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The key construction factors that can influence kerb line and smoothness are:

- stringline setup and maintenance
- grade preparation
- concrete consistency
- concrete delivery
- slipform paver operation

Stringline Setup and Maintenance

The stringline is the primary guidance system for a slipform paver operation. The kerb machine's elevation sensing wand rides beneath the string and the alignment-sensing wand rides against the inside of the stringline. Accurate elevation of the stringline is essential because the sensors controlling the kerb mould adjust based on the location of the stringline. Therefore, close attention to the stringline setup and maintenance is required to achieve a smooth kerb line.

Care must be taken to avoid tripping over or disturbing the stringline. If the stringline is disturbed, it must be checked immediately and repositioned to avoid bumps or dips in the pavement. Regular visual inspection of the stringline is recommended. If problems are detected during this inspection, surveying equipment should be used to check the grade of the pegs and stringline. Stringline setup should be kept to a minimum during a project. A reduced number of stringline setups can lead to better smoothness control. (Important to keep people and machinery away from set stringlines)

Base Preparation

Based preparation is very important to the success of kerb placement. The kerb machine line is the path that wheels and track of the slipform kerb machine will follow while paving. Providing an even and stable path is essential for constructing a smooth concrete kerb. Irregularities in the kerb machine path can cause the kerb mould of the paving machine to continuously adjust its position relative to the machine frame and can cause bumps or dips on the pavement surface. Variants in base height under kerb mould can affect the kerb line and height.

Concrete Consistency

The importance of consistent concrete is **paramount** for in ensuring smooth kerb placement and must not be underestimated. Good batch-to-batch consistency of the concrete mixture improves the quality of the finished kerb because it affects how the kerb equipment performs. The main goal is to avoid alternating wet and dry concrete batches which would induce constant equipment adjustment and make it difficult to produce a smooth pavement surface. Concrete uniformity in design (mix and geometrics), logistics (concrete supply and delivery) is essential.

Concrete Delivery

Once the concrete has been mixed, uniform delivery of the concrete to the job site has a direct impact on the smoothness of the finished concrete pavement. A slowdown or stoppage in the paving process due to a lack of concrete can result in bumps or dips in the kerb lines. Other application which affects concrete delivery to the machine and cause the kerb operator to stop and start the paver are car parks, cul de sac etc. These situations a concrete truck cannot unload the concrete in one consistent movement.

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Slipform Paver Operation

A slipform paver places and forms the concrete as it moves forward. Many factors can affect the operation of the slipform equipment and influence the kerb smoothness. Controlling concrete consistency (mix control) and delivery will result in a steady operation and a smoother surface. The kerb machine cannot produce adequate results if it must stop and start often.

Adequate Paver Travel Speed

A constant machine speed is essential for producing a smooth kerb. There are no set standards for the proper paver speed. The paver speed is proper when it can be supplied with a constant supply of concrete without having to slow down or stop during the paving process. It is essential to avoid stopping the paver during the paving operation to reduce the bumps or dips in the kerb surface.

Vibration of Concrete

In slipform kerb, the concrete is placed directly into the hopper situated above the mould, vibrators mounted to the slipform machine are essential to fluidize the concrete and make it easier for the concrete to pass through the mould. In a steady paving operation, vibration of the concrete as it passes through the paver influences the surface and the resulting smoothness. Too much vibration causes pumping and fluffing at the rear of the mould and brings excess slurry to the surface. Insufficient vibration creates pulling and surface voids.

Vibration of concrete is not a cure for other problems in the concrete mix. Vibrators may identify and exacerbate a concrete mixture problem. Adjusting the frequency of vibrators will not overcome poor equipment set up or poor mixtures.

Concrete Head Pressure

Maintaining a consistent and adequate head of concrete in mould hopper of the kerb machine can improve the smoothness of the kerb line. Maintaining a consistent head of concrete will ensure consistency in the speed of paving, vibration, and consolidation. A consistent head of concrete evens the pressure in the kerb mould so that when required, adjustments to the paver can be made more accurately. If the head of concrete gets too high, it might create a pressure surge under the kerb mould that can cause the concrete to bulge and create a bump. If not enough concrete is placed in the kerb hopper the head pressure is lost from the mould causing low spots.

Finishing

If all of the above factors are correct, the paver has been operated properly, only minimal hand finishing should be required. When hand finishing the kerb surface we use hand floats on poles, the best results come when there is limited hand finishing. In many cases, the finished profile of the kerb is worsened by hand finishing. It must be remembered most kerbs are placed vertically at 300mm in height with a slump 40 mm, the more the concrete is worked or played with, the more chance of distorting the shape of the kerb.

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Contraction Joints

Kelcrete places contraction joints at no greater than 5 metre centres by inserting a steel guillotine into the kerb ¾ the depth and width of the kerb. We believe this method of crack / movement control, gives far superior results.

Expansion Joints

Kelcrete through our experience believes there is no benefit to expansion joint in kerbs set below ground as the kerbs are locked in by gravels, asphalt, soil and concrete, limiting the kerbs ability to move / expand and contract freely. Below ground kerbing is not like other concrete forms that are placed on ground level such as slabs, footpaths which can move freely.

Kerbing set below ground generally has relief points in the form of gully outlets at theses point is where expansion should be applied if it seen to be warranted. Kerbing which sits above ground such as traffic Islands etc should have expansion joints applied at DTMR standards of 20 metre centres as these kerbs can move freely.

The other negative to expansion joints in below grade kerbing is to install these the structural integrity is comprised due to the kerb having to be broken apart, an approximate gap of 75 mm is made to install the packing. The concrete is then hand packed around the board. The end result is an expansion joint is placed but we now have a weak point in the kerb structure with no real benefit to the whole life of the product. Other adverse affects are concrete spalling at the joints over time and ponding of water in low fall areas.

Conclusion

The fact is slipform kerbing is reliant on many outside factors to make the product perfect, in our experience this is very difficult to achieve all the time. This also can be seen as a positive for slipform as it does not hide behind slurry like the dry extrusion kerb. A lot of the same issues affect it but it goes unnoticed because the slurry hides many evils.

Kelcrete Qld Pty Ltd is a strong believer and supporter of sustainable design with sustainable infrastructure, innovative solutions and using new technologies that meet the objectives of less resources to build and maintain assets. We are lifting the whole of life term of the assets for current generations and needs of future generations.

Kelcrete offers slipform kerb which is totally different in the concrete used and construction methods compared to dry extruder kerb. We believe when assessing cost/value this cannot be measured just by monetary methodology. It should also be measured on the structural benefits, the durability of the product to stand up to heavy traffic areas and the whole of life term of the product so the true value is exposed.

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