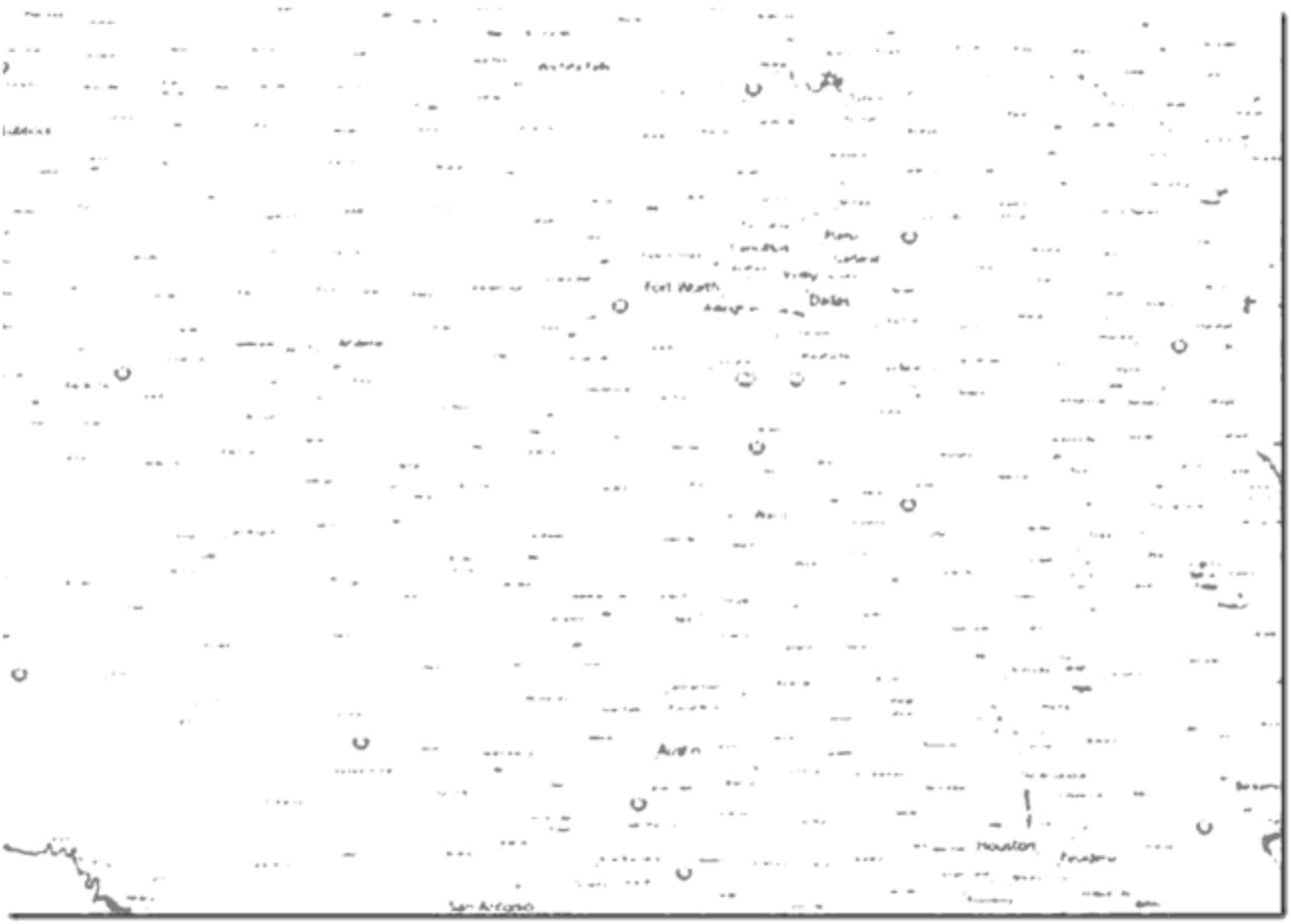
11/23/2011 BUILDING A PLATFORM FROM SCRATCH – LESSONS FROM EAST AFRICA

We love to think about what it is like to build a product from scratch—it is fun, but also very challenging. You have to decide on what platform elements to use, or maybe you're creating a platform. All those decisions and choices—so many possibilities it is sometimes very challenging to know where to start. Now imagine building a city from scratch—where do you start? There's an amazing example of building a platform upon which a city can be built in the work of GIZ to build roads in Ethiopian cities. As different as it sounds from building software, one can look at this success and see how it takes on elements of a platform and how the work we do to build platforms can learn from this work. This post is based on a trip to Ethiopia where I had an amazing opportunity to learn about this work and learn from those who are implementing it and also benefitting from it.

GIZ (or *Gee Eye Zed*) is a federal enterprise that supports the German Government in achieving its objectives in the field of international cooperation for sustainable development. GIZ has some similarities to the USAID organization in the US Department of State. The project described in this post was developed by GIZ and funded through a variety of sources. One interesting note about GIZ is that the organization was previously called GTZ where the "T" stood for technology and shows that the history of the group is rooted in providing technology support and programs.

As you're reading this, keep in mind one dimension of statistic. Our King County, WA has 1,800 miles of paved roads over about 2,300 square miles. Ethiopia is about 4,300 miles of paved roads over 426,000 square miles (about twice the size of Texas). Texas has about 300,000 miles of paved roads (and less than one third the population of Ethiopia). Moving around Ethiopia—people or goods—is extremely difficult. The climate of Ethiopia consists of very heavy rains, which makes unpaved roads unusable by carts pulled by animals (the predominant form of moving people and goods) for much of the year. Paved roads are required to withstand these climate stresses, and so many existing asphalt roads are in poor repair. Paved roads are also very expensive and require skills, expertise, tools, and materials that must all be imported. Below is a comparison of roads (from Bing Maps) surrounding Addis Ababa and Dallas, Texas.


Addis Ababa


Fort Worth
Dallas
Austin
Houston

Throughout recent history there have been innumerable approaches to modernizing cities and towns (as defined by Western standards) in the developing world where there exist none of the infrastructure created over the past 100 years. The infrastructure of a modern city includes water, sewage, healthcare, housing, transportation, power, communications, safety, waste disposal, and more—all the things we tend to describe as necessities or essentials to just living. Yet across the developing world, these don't exist and the approaches to bringing them have seen mixed results throughout the latter part of the 20th century.

The challenges are immense. The skills and resources required are immense. The organizational and cultural issues to overcome are immense. We are all familiar with the hundreds of billions of dollars that the developed countries of the world have provided in direct and in-kind aid and yet the situation remains much as it has been for 50 years. Upon mention of the country of Ethiopia, many of us remember the famine (caused by a combination of environmental and governmental problems) that took the lives of hundreds of thousands of people in just a couple of years. A country of over 80 million people, of whom about 80% rely on subsistence farming to live, represents the challenges of building cities from scratch. Standard statistics such as a GDP per person of about 350 routinely place Ethiopia among the poorest in the world, and those basic services described above exist in few places in the entire country.

In addition, there are cultural or societal issues involved. Certainly international organizations have come to cities and built homes, some roads, or put in water or electrical. But this infrastructure seems to decay rapidly and almost always seems "wrong" to the citizens. These attempts at providing services simply "appeared" without the involvement of citizens and absent tradeoffs among choices, just seemed wrong (no matter how well intentioned) and thus a legacy of failed projects across developing countries. A common cultural misunderstanding might be the rush to bring flush toilets (sewage) to cities that don't have enough water. Another example, might be the efforts to build housing using Western ideals of materials and floor plans without a clear understanding of usage patterns and the climate.

In Ethiopia, there are at least 10 cities with a permanent population of over 100,000 people (census data in Ethiopia is not so great through for a variety of reasons). Visiting these cities shows little in the way of clean water, sewage, paved roads, stable structures, electricity, city planning, etc. Where do you start? How can you bring all of these modern infrastructure services to a city? Think about it—you can't do construction without roads, but you can't build roads without asphalt which require heavy machinery and petroleum, and you don't want to put all of these in without a plan for how the city should evolve. These questions and attempts at answers have stumped urban planners for decades. There's a cycle of dependencies where you can't seem to find the starting point. What's the platform upon which you build a city?

In technology, a platform is something that provides two (at least) important elements:

- It is a technology that immediately solves problems faced by a significant number of constituents
- It is a technology that is part of a self-reinforcing cycle or ecosystem that gets stronger the more people use it for what it is intended

There are many technology platforms. We're all familiar with Windows and the services it provides that turn raw hardware into a functional PC—the combination of hardware and software creates tool that begets more tools, solves more problems, and creates more economic value for an increasingly large group of people. The web is certainly a platform in the combination of protocols and formats. Excel is a platform for financially minded people. Photoshop and the formats it supports is a platform for graphics professionals. AutoCAD is a platform for architects and engineers.

There's no easy answer to building a platform for a city. Reading any book about urban planning and probably the first thing you see is a city grid of roads. The theory is with roads you have the "arteries" of a city and from there you can build the routes for water, sewage, electricity, and you know where to put houses. You can move around goods and services with ease, and you can dispose of waste with ease. People can get from homes to markets or schools. Of course we know this. So did the Romans.

Building roads, however, is a major undertaking. It takes skills and resources. The materials of modern roads are expensive and the tools to create them require roads to deliver them to the site in the first place! In other words, bootstrapping a city with roads is a great idea—on paper.

There are very few roads in Ethiopian cities outside of Addis Ababa (and at best one road connecting major cities and it is usually not continuous). Major cities of 100,000 or more people such as Harar or Dire Dawa have only moderate paved roads at best. Mid-sized cities such as Jijiga or Bishoftu have no paved roads. Imagine the city of Redmond with no roads (or plumbing or electricity).

At first glance, the country should just do what Eisenhower did and commission a highway building project. Suffice it to say the conditions (political, economic, geographic) in the US were unique and can't be matched in Ethiopia. Just the challenge of building a road with modern methods seems impossible to overcome, and certainly not possible for anything but a national highway (one is being built in Jijiga right now, but the lack of water in the city is limiting the pace of construction, which in turn means it will be even longer before water could be brought to the city, if ever). Even if you could build an asphalt road, it turns out it might not be the best investment. Built to German standards, such a road might last 20-30 years. If there are economic and trade incentives, China has shown an interest in building roads in Africa, but these are built to 5-10 year standards.

Have you ever been to a really really old western city like Rome, London, Paris, or Berlin (or downtown Seattle)? It turns out there is a technological solution to building roads that can work—cobblestone. The roads that the Romans built have lasted 1000 years. That's older than Excel 3 running on Windows 8. So there's a technology to use. But we've seen that just providing the technology doesn't seem to work. How can we turn the technology into a platform? How can this platform drive economic growth for a city in a new way? In other words, is there a solution where roads become a platform for the city, not just serve the purposes of transportation directly.

The typical relief work or charitable view of this problem would be to raise money and just build a road. What you are left with is a large group of people without increased skills or the skills to maintain the roads. It means that the city is caught in a negative cycle of having to raise money to pay for outside resources to provide technology and people to maintain the road. Plus, the amount it costs for a mile of asphalt roads (the technology in use by those charitable organizations) is relatively short-lived and extremely expensive per mile (or per mile/per year of useful life).

Enter GIZ, the German development group. GIZ created a plan to build cobblestone roads in Ethiopian cities. The impetus was not just the desire to improve transportation in a cost effective manner, but to create an economic engine for cities. Cobblestone roads can be created with local labor (there is a large supply) and local materials (Ethiopia is rich in raw materials for cobblestone, but has none of the materials for asphalt) and even local tooling. GIZ provides a few of the reasons that cobblestone provides the basis for a platform in building roads. Cobblestone paving:

- is labor-intensive, creating jobs and opportunities for construction entrepreneurs
- uses natural and local materials and does not require imported machinery

- boosts the local economy with investment going to local economic development
- does not depend on imported oil, as asphalt does
- is cost-effective compared to concrete or asphalt roads
- empowers cities to develop their own infrastructure and construction sectors
- makes towns and cities more beautiful, benefiting residents and encouraging tourism
- is easy to maintain and has a much longer lifespan than asphalt roads

When you see these reasons you can see how cobblestone roads provide a true platform for the city. An asphalt road requires capital that is hard to come by along with tools and materials that are prohibitive. All of these factors make western-style roads essentially an expensive "import" effort. Cobblestone roads represent a domestic product. And the second test of a platform is the economic engine that gets built along with the roads. This cycle is the magic of this project.

Kai is a member of the GIZ team working with the city governments to build cobblestone roads. After working in Ethiopia for a year or so he partnered with some friends to open a beauty salon (when you meet Kai in person, this is even stranger than it sounds) in Mekele (pop. 200,000+). They chose a location where they could afford the rent based on their available capital and expected revenue. Over time, it turns out their street went from unpaved to cobblestone. Their business increased. They could hire people to serve more customers. It is a classic story of the power of pavement and how it can serve as a platform for the city. In fact, things for the city near the roads improved so much that the owners of the buildings are able to raise their rent. The city can increase occupation taxes. Businesses can afford this because things are improving for everyone. The positive feedback loop began with a stone about 4" square.

The positive cycle of a platform doesn't stop there. Those trained to build the roads will continue to have more roads to build. They will continue to get paid. That means they will buy more goods and services. That will create more businesses. Those businesses will use the new skills in the city to use masonry. The city will grow. And it will grow based on wholly domestic inputs.

Perhaps a sense of the "economic flywheel", which is not unlike the positive reinforcing function of any platform, can be visualized by something as pictured below. You can see how various attributes build on each other to provide growth and stability:

By our definition above we can see how the cobblestone road is a platform for a city. GIZ working with partners is bringing this to more cities and will look to scale this as it makes sense (for example in neighboring Somaliland). You might contrast this with a "modern" approach using asphalt. In this case, "Step 1" involves importing equipment, skills, labor, and materials to build the road. A worse case would be to take up a foreign entity on the offer to build the road. They would use their own labor (particularly China) and upon completing the project would take the equipment and skills with them. This leaves behind a decaying road with the need of large scale (and ongoing) capital and materials import expenses.

A big part of what GIZ brings to the project is the engineering expertise combined with the training required to scale out cobblestone road building. There are detailed documents and training for how to choose materials, how to build tools, how to study the soil to develop the right sub-pavement, and so on. These are all critical to the success of roads. If you've ever seen a cobblestone road falling apart it is simply because the well-understood engineering needs where not met. Cobblestone is not new to Ethiopia, in fact in Dire Dawa we saw some earlier attempts at cobblestone where the cobblestones themselves where not square on all sides ("who needs a flat edge on the parts you can't see", they thought) and so the roads are falling apart. Cobblestone, when done well, is a smooth surface that works equally well for all the common "wheels" in the cities from 4x4 to push/pull carts (bicycles are not too common in the high altitude, muddy, hills of Ethipoia).

As part of learning about this project, we had a chance to see some new roads being built to support a Merkato (market) in Bishoftu (pop. 165,000+). The city is about an hour away from Addis Ababa, and traveling to it is itself a

lesson in lacking of roads between major cities (40km takes about an hour). In the case of this one site, the work to build the market along with the roads is progressing in parallel after a collaborative effort to locate the market and develop the local labor and materials sourcing for the project. The following are a few pictures of the process of developing a cobblestone road:

First, you start with a source for stones. This is a pile of stones in the process of being broken into 4" square cobblestones.

The survey for the road is conducted and mapped out just like you would see in a paving project here:

While all steps are critical, the most critical step is securing the edges of the road properly. In this step the worker is digging the supporting trench that will serve as the wall of the road:

The road bed is critical to the durability and stability of the road. Here is a section from the GIZ overview manual for local workers that explains the basic structure of a road:

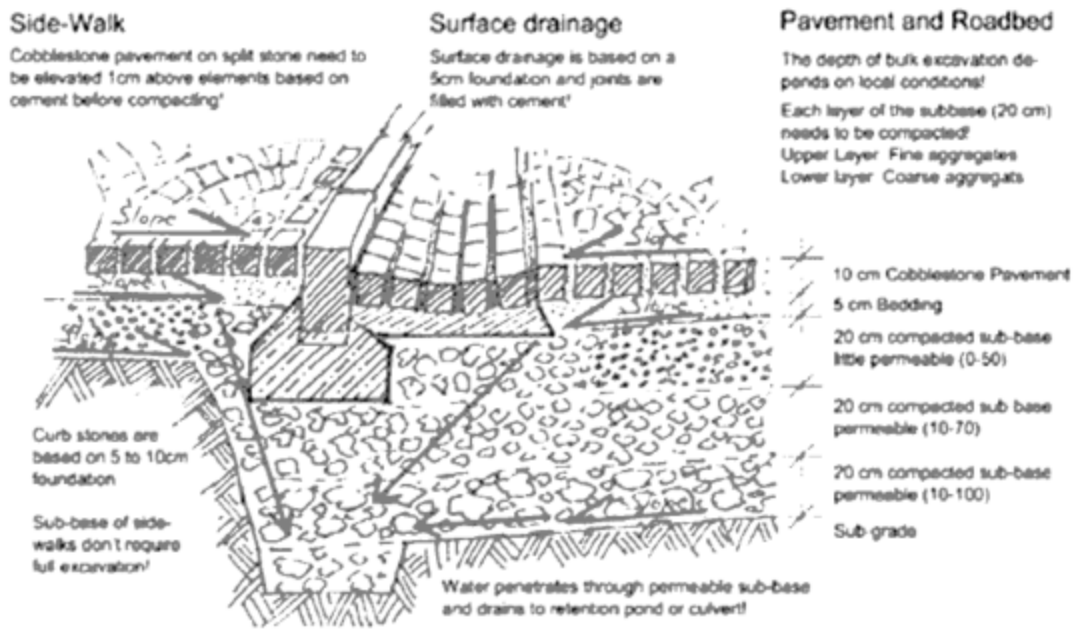
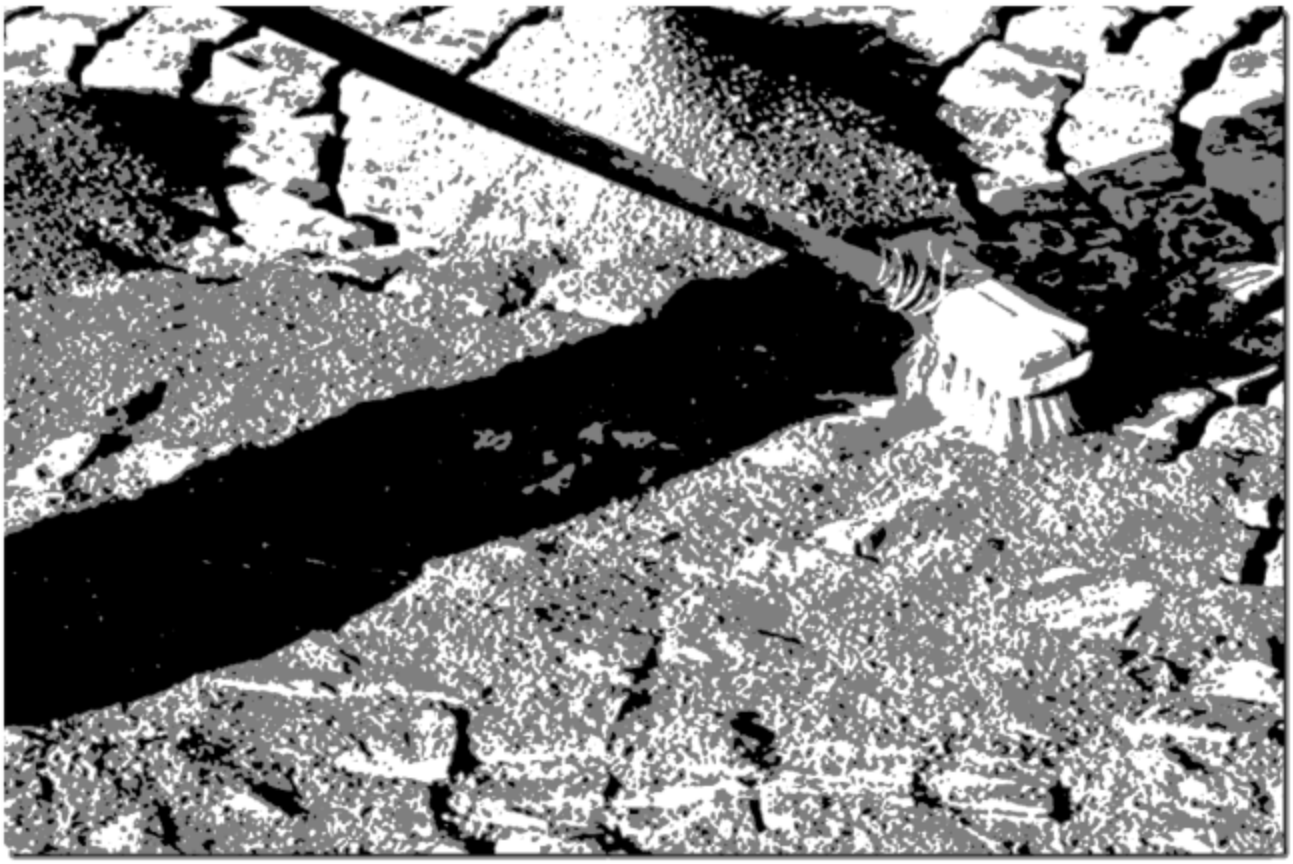


Figure 1: Section-cut of a cobblestone road with sidewalk, surface and sub-grade drainage with impermeable soil condition and a bulk excavation of 75cm.

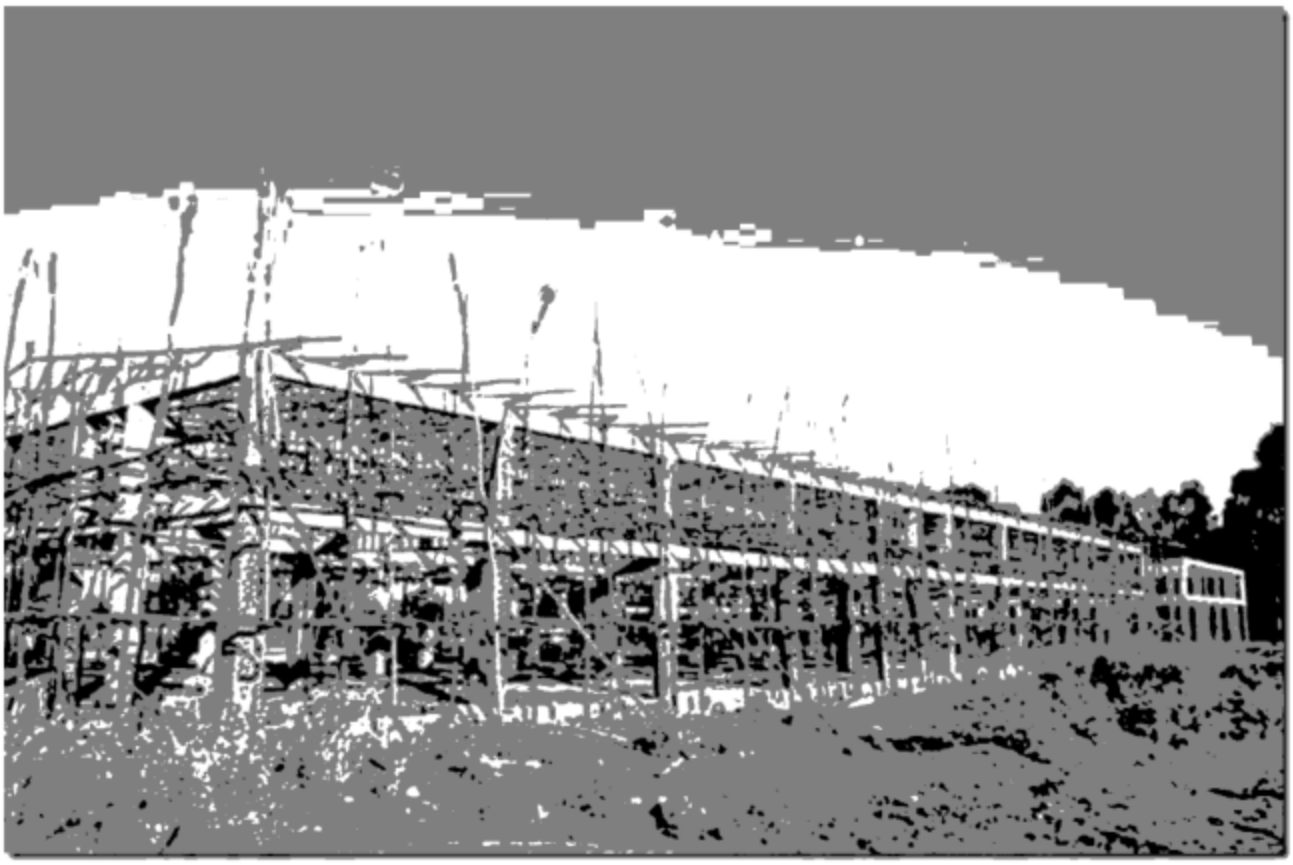
The stones, while a standard 4" square are not machined so each stone needs to be chiseled as it is placed in the location. Here the worker is fitting a stone into the road:

Once the stones are set, the fill between cobblestones is put in place. First the stones are secured using smaller stones as stabilizers (if you have put down pavers, we use little plastic plus signs between machined tiles):

Here you can see the pouring of material and the sweeping of the material over the stones:



As mentioned, this project also involves building a market. The following is the scaffolding of the market (from locally grown eucalyptus trees, which were of course imported from Australia years ago when there was a wood shortage—a pretty funky story).



Here you can see a more finished building where the local mud-based cement and bricks are used for the walls with the scaffolding removed:

The Mayor of Bishuftu hosted the GIZ group along with some other African mayors and funding groups to talk about the program and the profound impact it has had on the city.

I wanted to include one last picture that sort of made me laugh. How many times have you driven past a construction site and seen guys leaning on shovels doing nothing while you had to sit through traffic? Oh and also notice the women hard at work in the back. Perhaps, this appears to be a universal “experience”:

The role of platforms in our technological society should be obvious. Creating a platform and seeing the impact one has is something we live with every day in our software. The opportunity to see a platform created at the basic level of a whole city is awe-inspiring. It doesn't necessarily take high technology to create a platform and see the positive virtual cycle. The work of GIZ is a great success and amazing lesson.

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