



# BOX CLEVER

## RICK HARRISON REVEALS HOW HE COMBINED GEOSPATIAL TECHNOLOGY WITH THE XBOX TO HELP IMPROVE HOUSING FOR THOSE ON LOW INCOMES

Housing affordability is a critical issue in most US cities, but more important than striving for 'cheap' housing is increasing living standards for those on lower incomes.

Henry Luo, Mitch He and Aaron Yang, principals of A1 Development, purchased a topographically challenging 25.5ha site in northwest Omaha in the US. The team included Short Elliott & Hendrickson (SEH), civil engineers, Design Basics, architects, and Rick Harrison Site Design Studio.

A typical process when planning a site is to create a quick and dirty 2D conceptual layout. Houses close to each other demand expensive earthwork and retaining walls. Home floor plan layout is an afterthought and not part of this initial process. Communication between the land planner, engineer and architect is non-existent. This 'typical' process fails to take into consideration elements that enhance liveability, affordability and environmental

impacts. An analytical, precision geospatial design technology could provide a superior toolset at these initial stages of layout.

Our world is built on land surveying coordinate geometry, which began being automated in the 1970s. It has evolved into the cumbersome 'point number' based geometry that is used on top of a CAD or GIS software to define land ownerships, easements, conflicts, and positioning of our built environment.

GIS represents owned or built perimeters as 'shapes' which are made up of straight lines. In surveying terms, owned land are parcels that contain both lines and true curves. Both CAD and GIS separate data structures for calculating coordinate geometry, which assigns each location a point number, north, east, elevation, and a description of that element. This is tied or 'hooked' to a location on the CAD or GIS software. Topographic data is derived from another data structure,

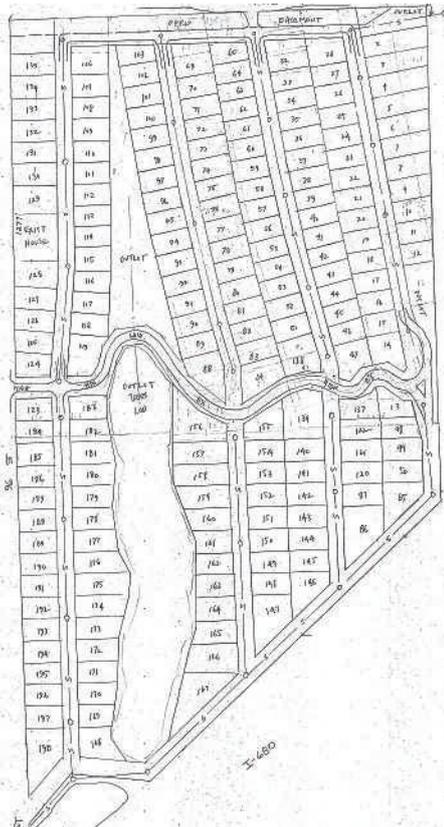
Lake Cunningham Village as seen in the LandMentor virtual window

typically excessive data along LiDAR-produced contour lines. Since most GIS depict properties with straight lines and not true curves, it's impossible to replicate actual real-world legal parcels using the mapping data.

We are conditioned to communicate with linework on drawings that are almost identical to the deliverables presented 50 and – in many cases – hundreds of years in the past. That linework represents different surfaces. We must imagine how they might look in order to use them to convey property or build something.

### A new paradigm

To create a new paradigm for the consulting industry, we needed to look at a new core technology to emulate the natural and built environment by replicating precise 'surfaces'. The topography, both existing and proposed, is another surface that can be accurately replicated with a small fraction of the excessive LiDAR-generated data today.



Initial site plan

A surface-based core software system that uses a more advanced form of land surveying coordinate geometry that also eliminates point number management is better suited for geospatial applications. This core system builds the maps and presentations from geometry that remembers point locations



Natural terrain shown at 1m contour interval (red=low, green=high)

in 3D space, 'fusing' edges (straight or true curves) to form exact surface areas. It dissolves the complexity of data and enables software to be written in an easier form to use.

LandMentor takes this one step further, introducing animated prompts with

patented user interfaces that eliminate commands. Having an intuitive surveying, engineering, and advanced land planning system as easy as a smartphone opens up its use to both architects and planners. They are educated in the basics of engineering and surveying by reading the educational materials included in the system.

To achieve instant access to a 3D visual environment, the data (natural and designed) is passed to a video gaming environment. Buildings, landscaping, cars, people and other objects are 'dropped' onto the topographical surface and automatically set at the proper elevations. Typically, these 3D models come from SketchUp, but they can be a wide variety of 3D sources.

Once in the video gaming interface, most people already know how to use the system. To make it somewhat industry standard, LandMentor's Xbox360 controller-use is similar to Enscape software's. To gain an immersive experience that correctly emulates the proposed built world, simply plug in a Mixed Reality (Microsoft-based) headset – no other software needed.

To report the impact (environmentally and economically), LandMentor instantly charts these impacts, which enables stakeholders and designers to quantify with uncanny precision if what's being proposed is actually efficient – or not. This is another industry first.

All this adds up to a new era of consulting with geospatial technology.

**A better way to design**

The consultants developed a game plan in which the shape of the lots as well as the spaces surrounding every home are coordinated with the home shape, window and wall locations, so that inside space coordinates with outside space. The trick is to accomplish this attention to detail with production housing.

To eliminate costly retaining walls, we used large areas of landscaped slopes and designed architecture that would embrace the terrain with walkouts and lookouts as well as introducing side walkouts and lookouts. This increases the value of the home while reducing grading issues.

The LandMentor terrain indicates low areas in red, then transitions to green (high ground).

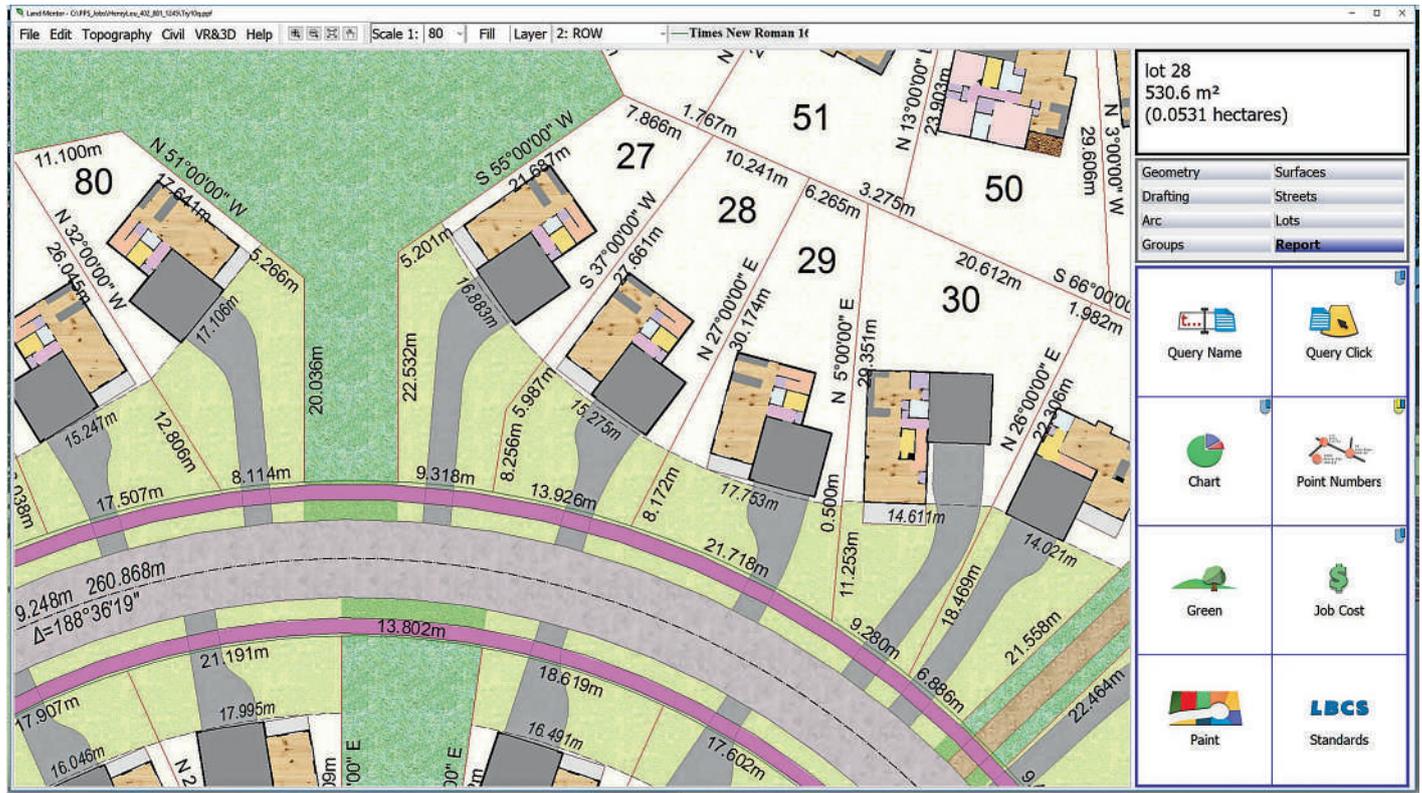
Severe slopes along the east side of the site allows homes to view Lake Cunningham to the northeast of the tract.

The method of 'coving' reduces street length, which also reduces right-of-way dedicated to the city, resulting in more useable land. Increased distances between homes allows transitioning slopes without retaining walls. The average demonstrated street length reduction of 'coved neighbourhoods' compared to conventional (suburban style) layout is 25%. Combined

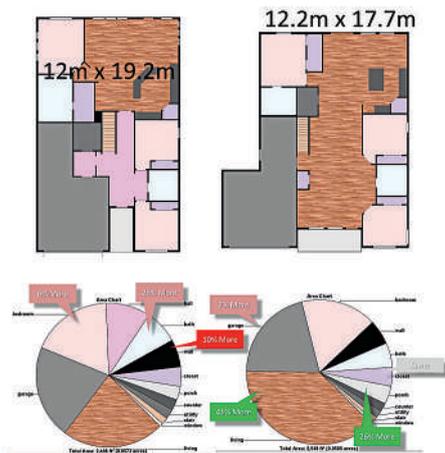


Interior and exterior spaces merge – an abundance of windows

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LandMentor's patented user interface merges planning, engineering and architecture



with less earthwork and retaining walls, this translates into significant savings. Those savings are used for better architectural and landscaping elements – a superior home at competitive pricing. With the unique geometrics of curving, less is more.

By coordinating open spaces around the homes with the floor plan design, the team increased premium views from 'living spaces' within the homes – something typically reserved for a custom home on a large lot. To achieve density targets without creating a 'garage-grove project', we used architectural shaping.

This embraces a coved lot's nonrectangular shape to make the house wider at the front or rear than could typically fit on a grid-like subdivision. We determined a minimum angle between lot lines, so that we could have consistent and replicable floorplans. A home wider at the front has

more curb appeal and a fuller front porch. A home that is wider at front or rear can reduce hallway, making rooms within a target size larger and more usable. Architectural shaping makes a home 'feel' larger than it actually is, adding value for the first buyer and those that will purchase at each resale.

Architectural blending is a method that can be applied to both single and multifamily housing. It coordinates what goes on inside the home with the site plan's open spaces and viewsheds surrounding that home. It pays attention to locations of windows, walls and living spaces. A person inside the home will have views expand as much as possible,

## ALL THIS ADDS UP TO A NEW ERA OF CONSULTING WITH GEOSPATIAL TECHNOLOGY

looking out into the open spaces adjacent to that home. In this neighbourhood, because of the extreme topography, these views are often 'regional' when a home overlooks space over other groups of homes or ravines.

The market responds to a home that has better curb appeal, but also just 'feels' better and larger – even if it's not. The abundance of windows overlooking surrounding space enhances this open feel.

### Efficiency and function

The ability to instantly and effortlessly create spatial reports of manmade elements of a proposed plan also applies to providing an analysis of the efficiency of a floor plan. By eliminating excessive hallways, construction

costs go down with a significant increase in living spaces – maintaining the same overall size. Without a geospatial analysis, it would be difficult to measure waste and then discover design alternatives.

The same analysis is applied to make sure the proposed plan is as efficient as possible, also extending to analysis and reporting of the required earthwork. Homes situated on the inside of a curve get wider at the front – on the outside wider at the rear.

The horizontal and vertical sculpting of the streetscape eliminates the monotony typical of today's growth. The angled relationship of the homes provides an increased depth of views when inside looking out, and the varied setback provides an

increased sense of scale. All this creates a neighbourhood that hides the higher density we achieved.

At each stage of design, the LandMentor technology offers instant access to 3D both on the screen and using VR headsets. You can witness the final built site as if being there – at the initial concept stage.

Lake Cunningham Village represents an entirely new way to deliver low-income housing with the elements typically provided to only those on the upper end of the social ladder. That will enhance the sense of pride for homeowners in this neighbourhood. No losers – only winners, all made feasible by harnessing geospatial technology in an entirely new way.

**Rick Harrison is president of Rick Harrison Site Design Studio and Neighborhood Innovations ([www.rhsdplanning.com](http://www.rhsdplanning.com))**



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