Supplemental Material 2:
Urban Pattern: Layout Design by Hierarchical Domain Splitting

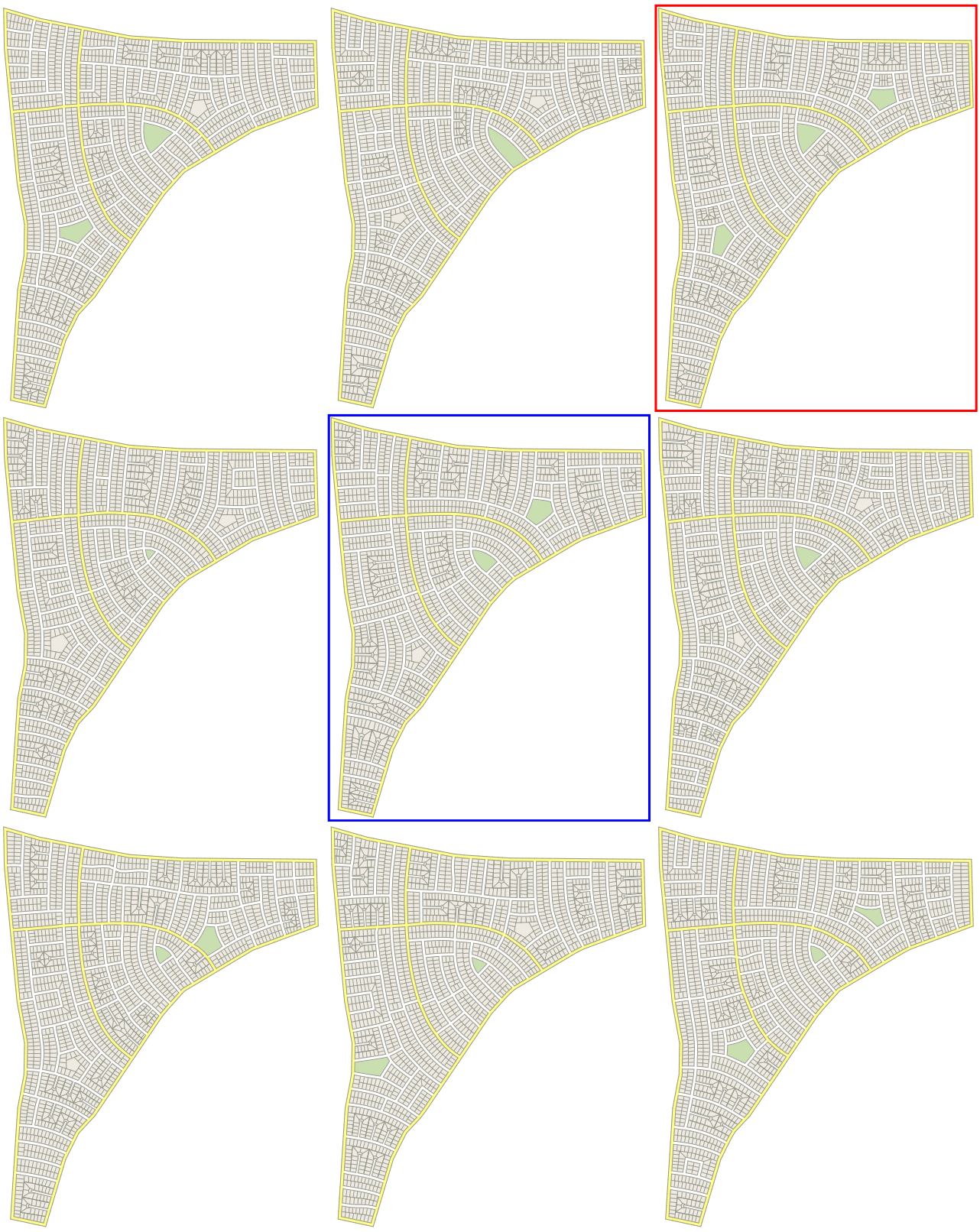

Figure 1: *Our framework can automatically generate design variations. The input constraints in this example are the region boundary and major roads (highlighted in yellowp). The layout in the red cell has the smallest parcel similarity distortion, while the one in the green cell has the shortest street network.*

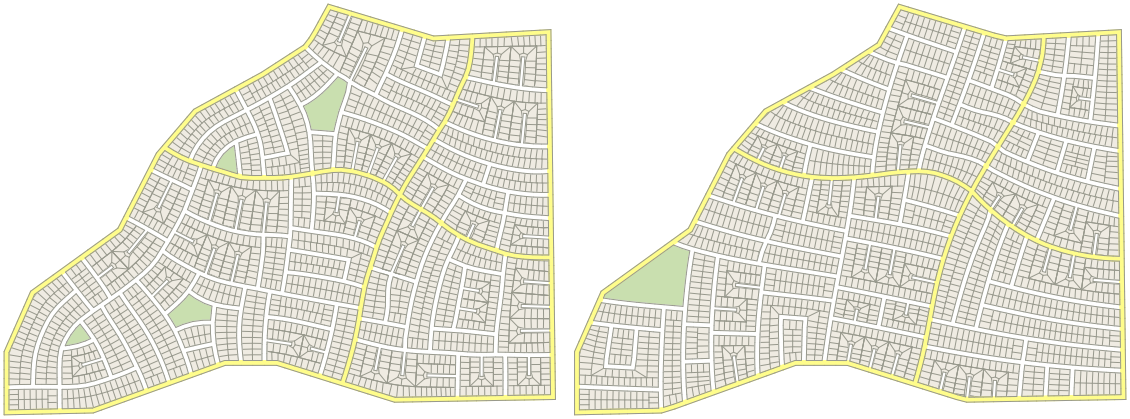

Figure 2: *By default, we generate layouts with streets meeting at right angles (left). Relaxing the boundary alignment/orthogonality constraints during the field computation (see supplemental material #1) results in less curved roads and more acute road intersection angles (right).*

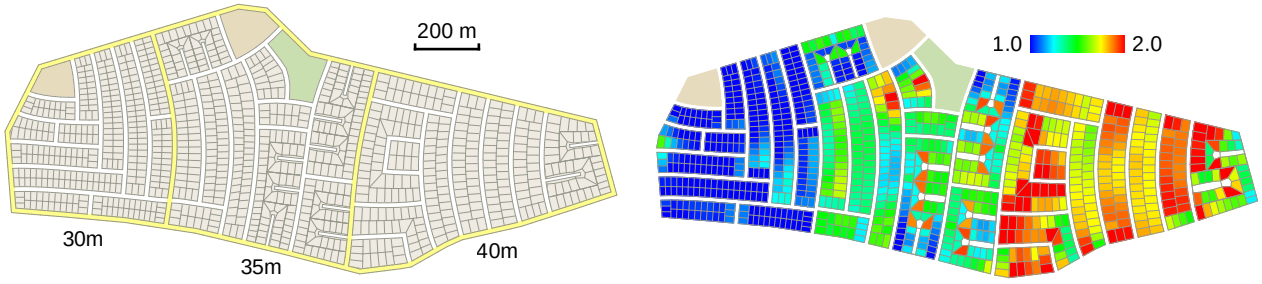

Figure 3: *The user can specify parcel sizes for different subregions. In this example we chose ideal parcel lengths of 30m, 35m and 40m while keeping the aspect ratio 5:3 (left). The area distortion is visualized as* $parcelarea/(30 * 18)$ *(right).*

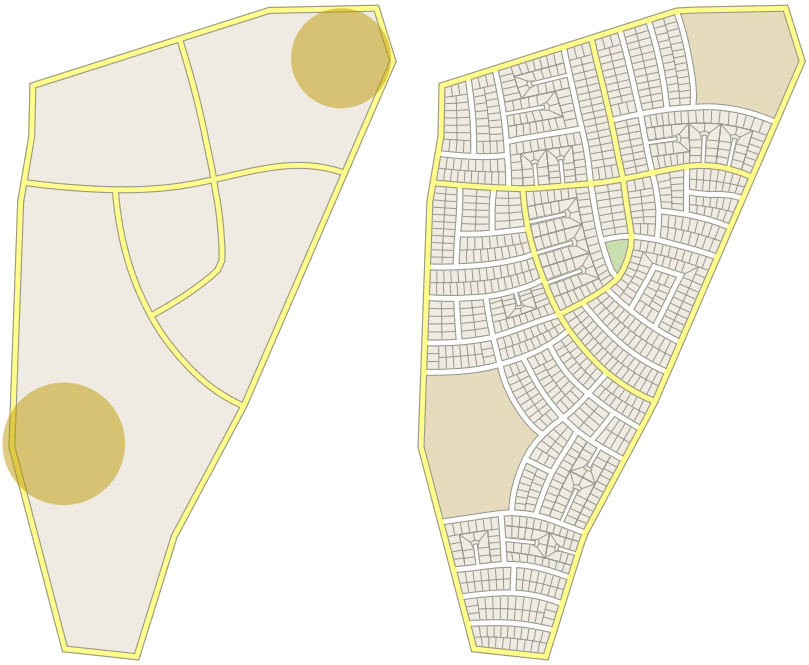

Figure 4: *Other than region boundary and major roads, our framework also allows the user to define approximate reserved regions as constraints. These regions do not allow a street to pass through them.*

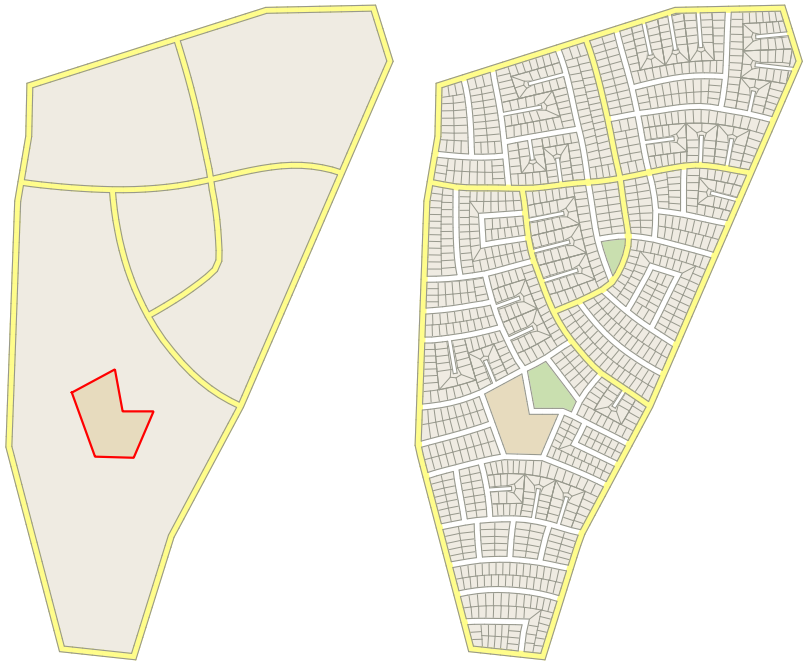

Figure 5: *The user can prescribe polygonal region(s) inside.*

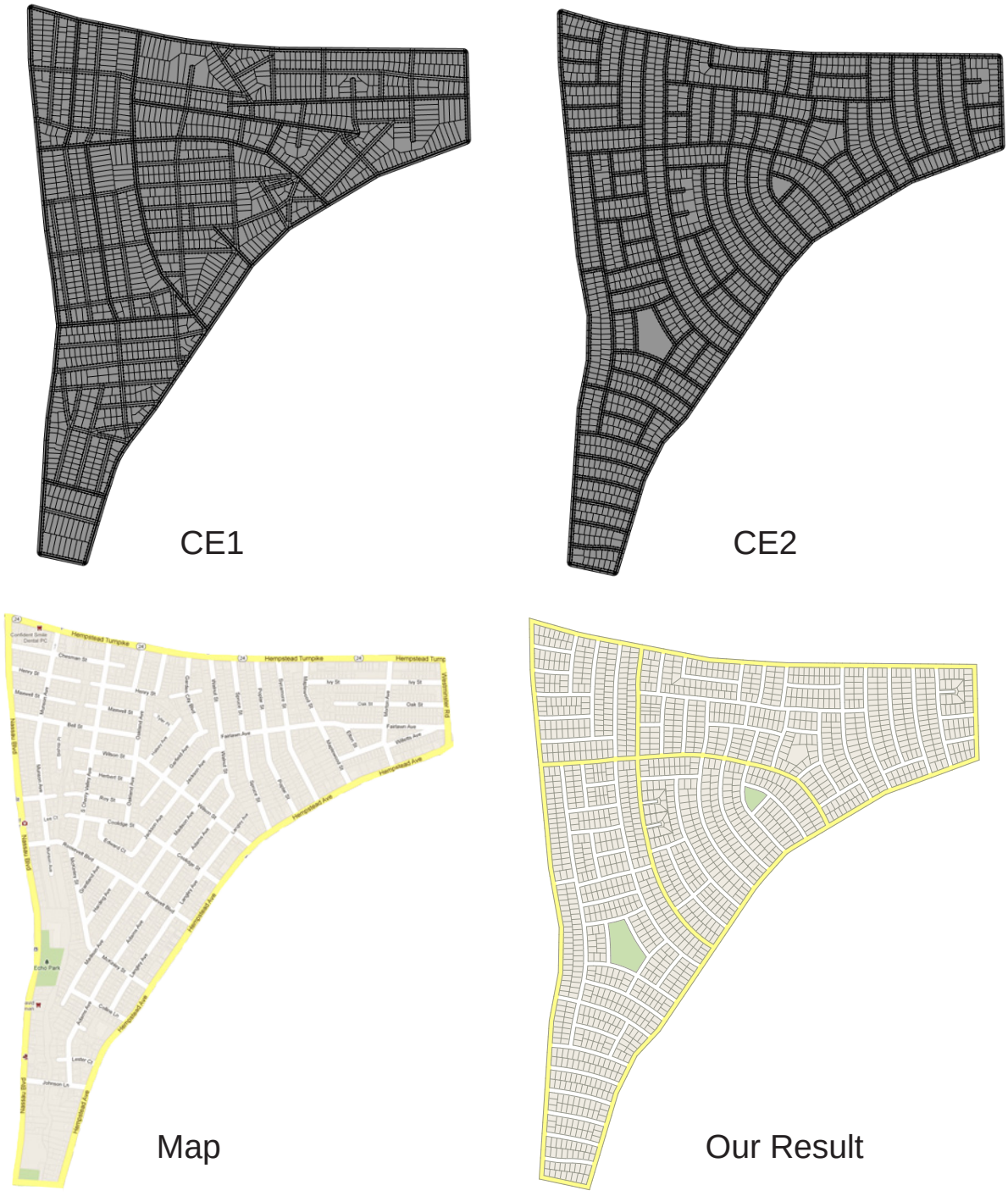

Figure 6: *A comparison of our results to CityEngine (CE1), our street network and CityEngine parcels (CE2), and a real world layout (Map) for Hempstead.*

Figure 7: *Visualization of good (blue) and undesirable (red) parcels. An undesirable parcel has* $p_{angle} > 15$ *or* $p_{area} > 1.2$*. The number of undesirable parcels: CE1(177),CE2(40), Map(236) and our result(27).*

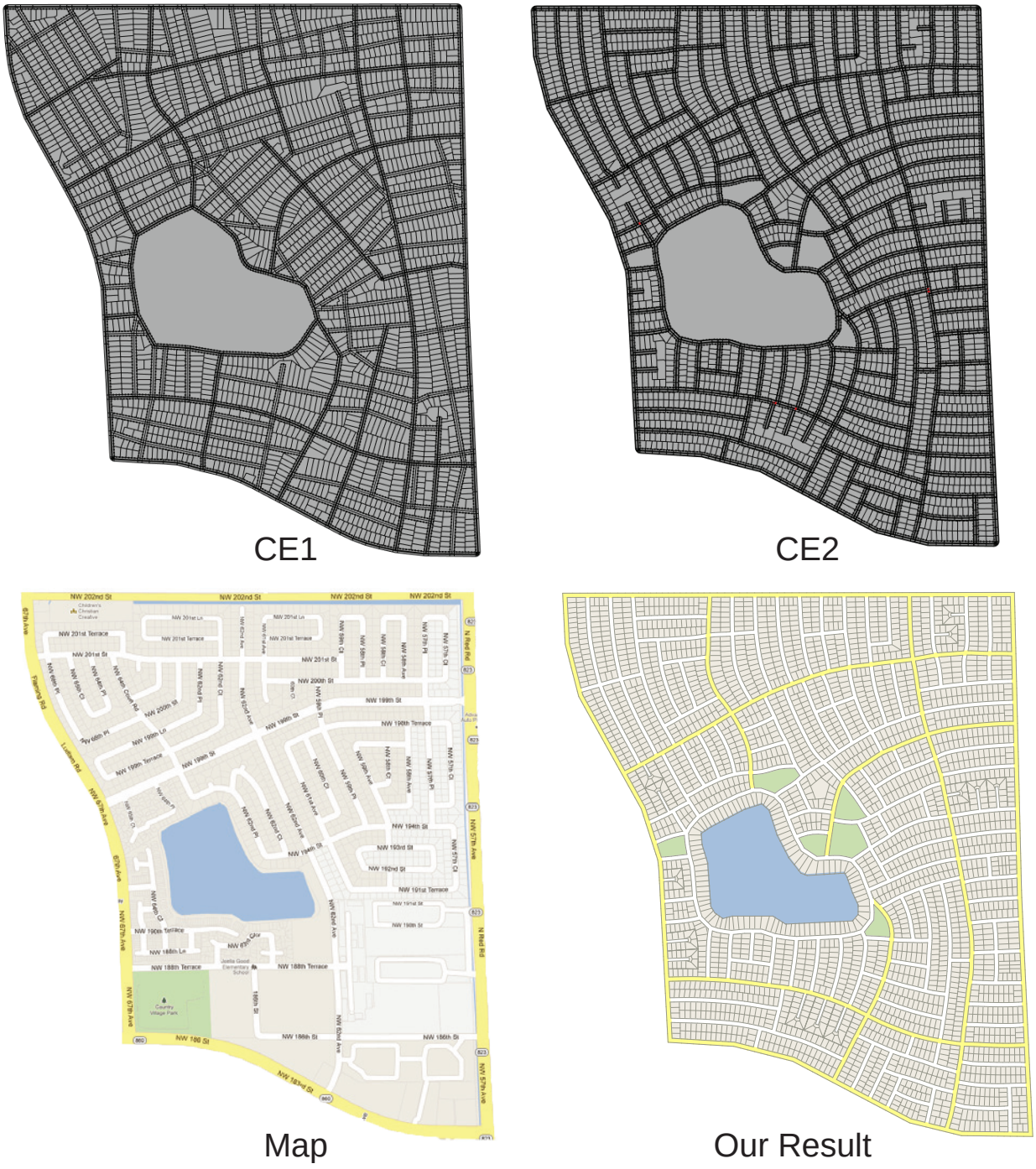

Figure 8: *A comparison of our results to CityEngine (CE1), our street network and CityEngine parcels (CE2), and a real world layout (Map) for Villagepark.*

Figure 9: *Visualization of good (blue) and undesirable (red) parcels. An undesirable parcel has $p_{angle} > 15$ or $p_{area} > 1.2$. The number of undesirable parcels: CE1(235),CE2(114),Map(154) and our result(73). For the Map result, we only analyze the subregion with single family houses.*

Figure 10: *Street and parcel layouts generated by our framework based on different type of fields. (a) Chen et al. [2008] tensor fields with recomputation after every split; (b) Chen et al. tensor field without recomputation; (c) D-field without recomputation; (d) D-field with recomputation; (e) D-field with recomputation under major road constraints (in yellow). We can observe from (a) and (b) that the previous solution by Chen et al. has the tendency to generate streamlines that connect streets even though they are approximately orthogonal. We see that this leads to block shapes that are hard to match with our current template library. This effect is visible in the top left and top right corner of the generated layout in (b).*

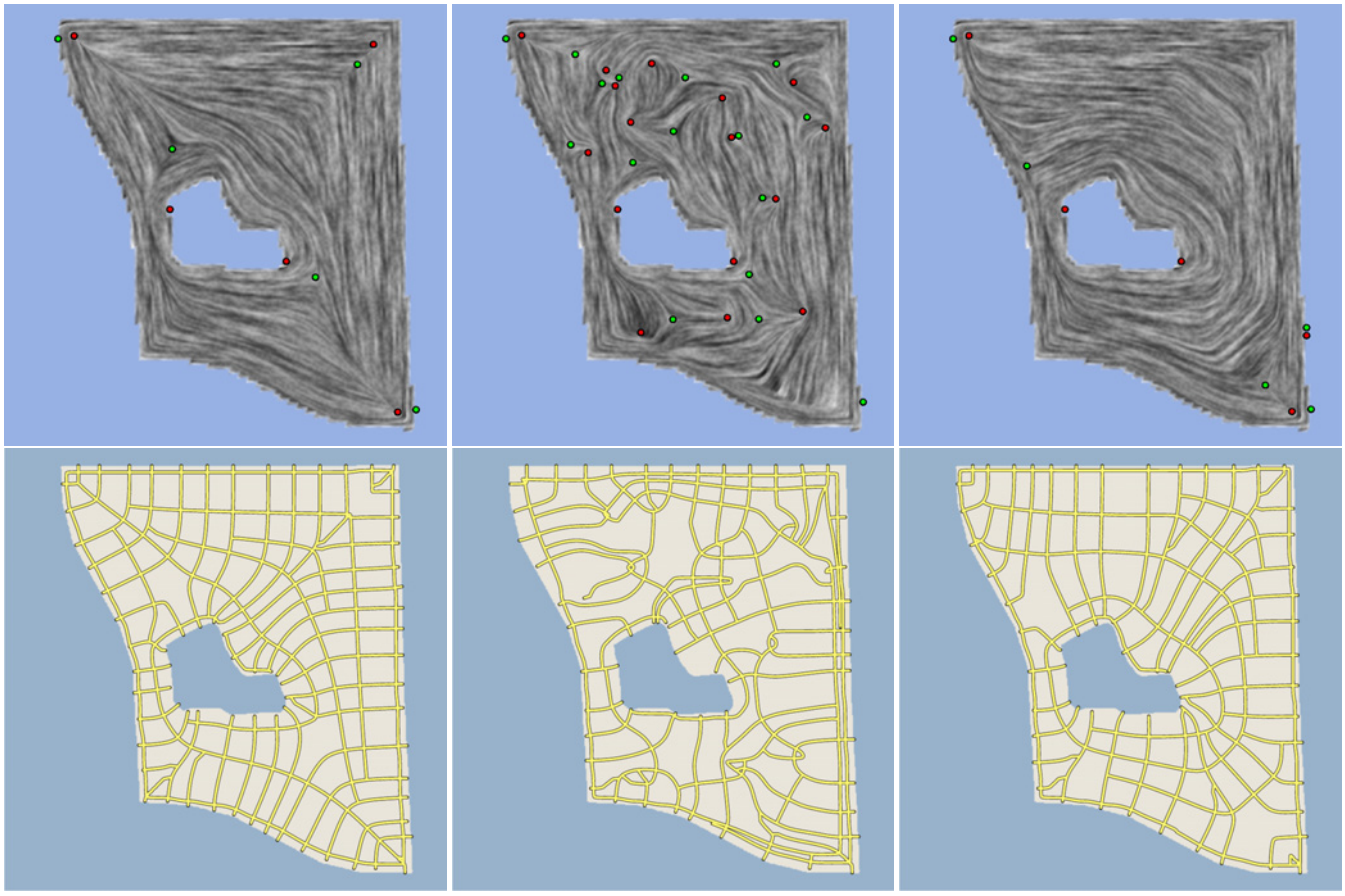

Figure 11: *We show an informal comparison with previous work from Chen et al. [2008] on the Village Park example. We show three results of their method that we generated ourselves with the executable provided by one of the authors. Left: An automatic solution without user edits. Middle: A fancy solution with many singularities. Right: A more moderate editing result. For each result we show the generated fields on top and the street layout on the bottom. The algorithm is able to generate many nicely shaped blocks, but the number of undesirable block shapes is significantly larger than in our results. The results of Chen et al. are well suited for synthesizing virtual worlds, but they cannot be used for planning future developments.*

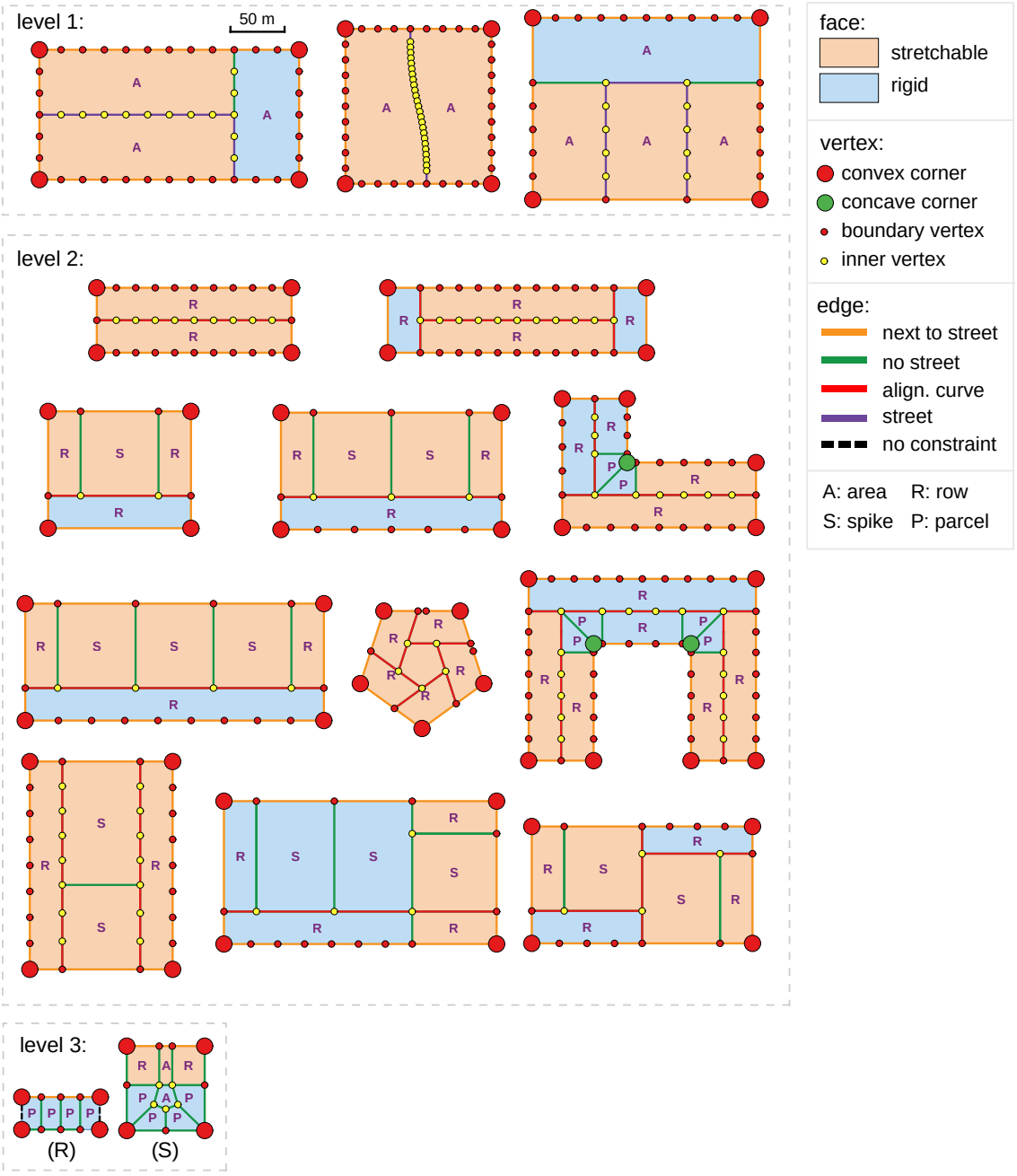

Figure 12: *The templates used to generate single family houses for the results in the paper.*

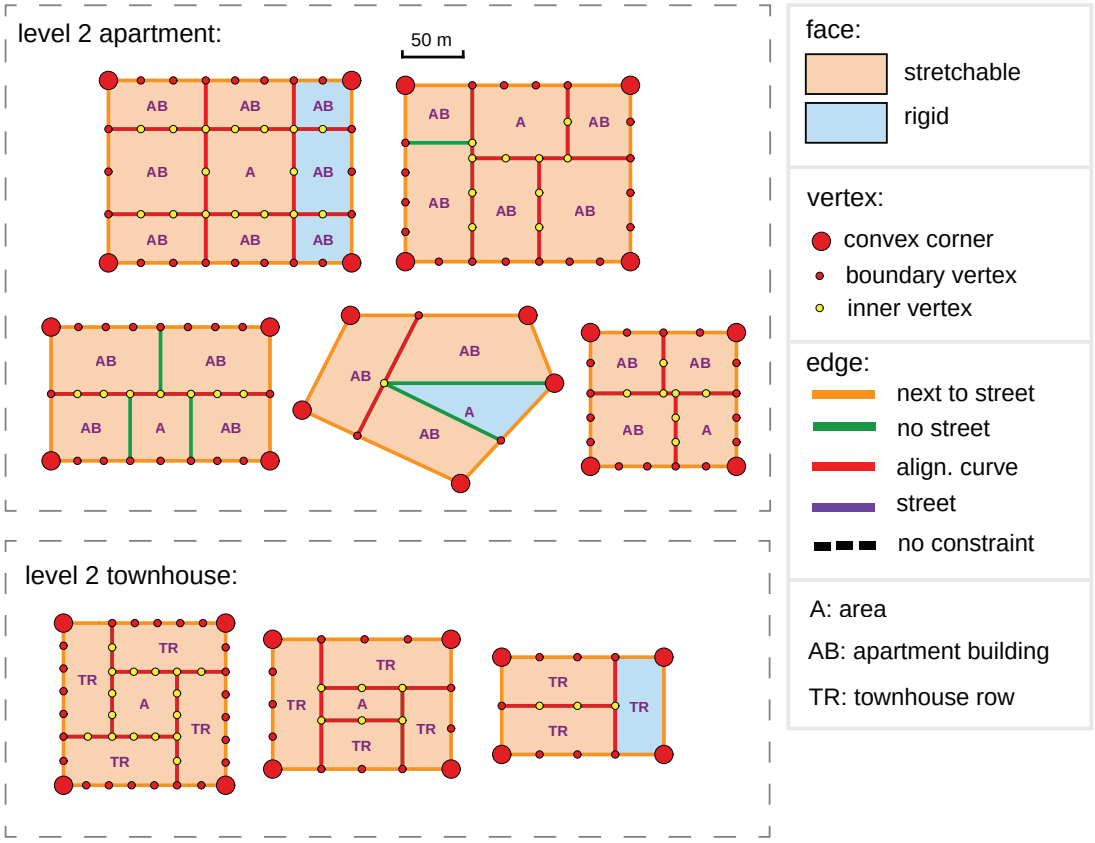

Figure 13: *The templates used to generate townhouse and apartment layouts in the paper.*

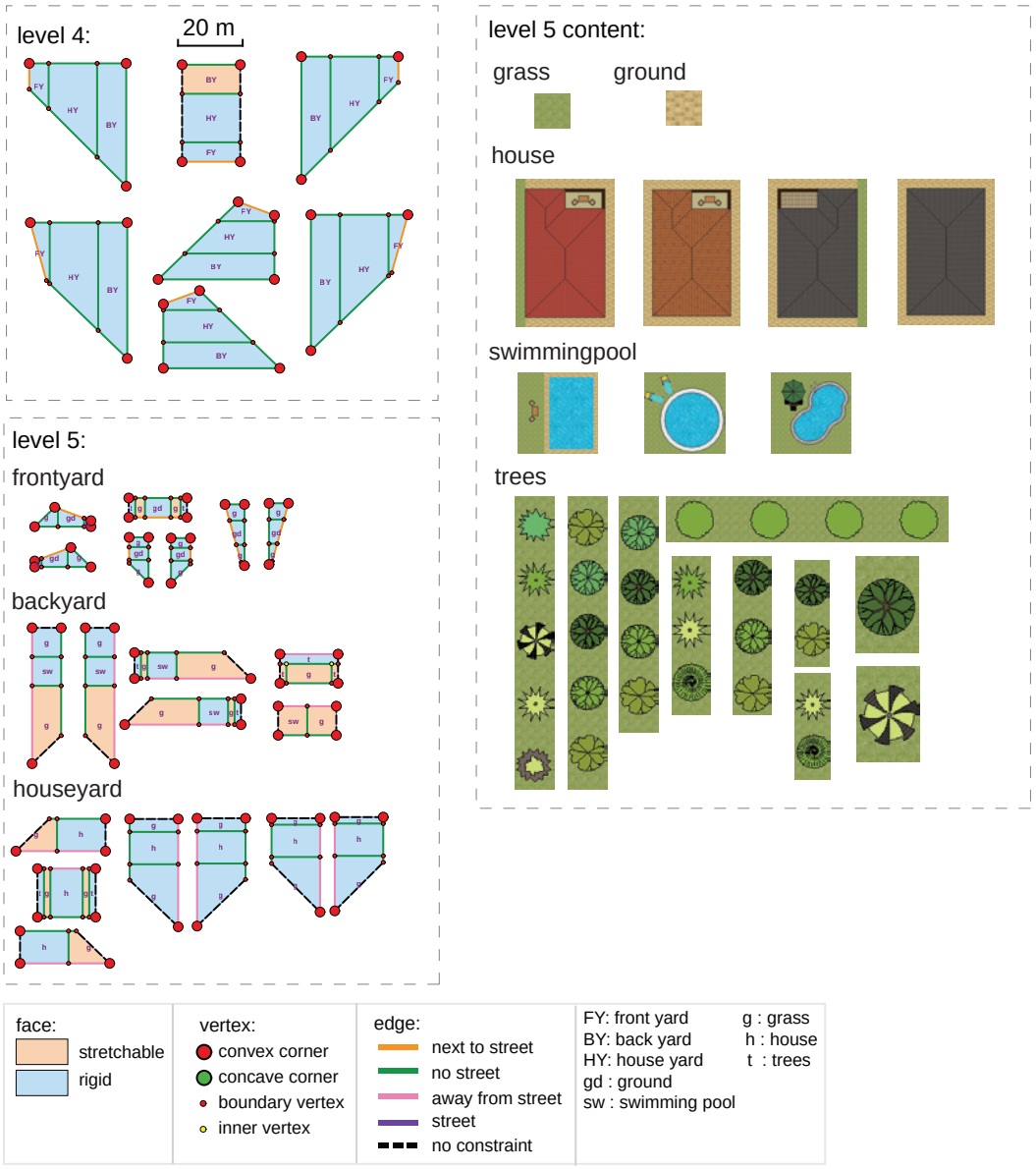

Figure 14: *The templates used to generate garden layouts in the paper.*

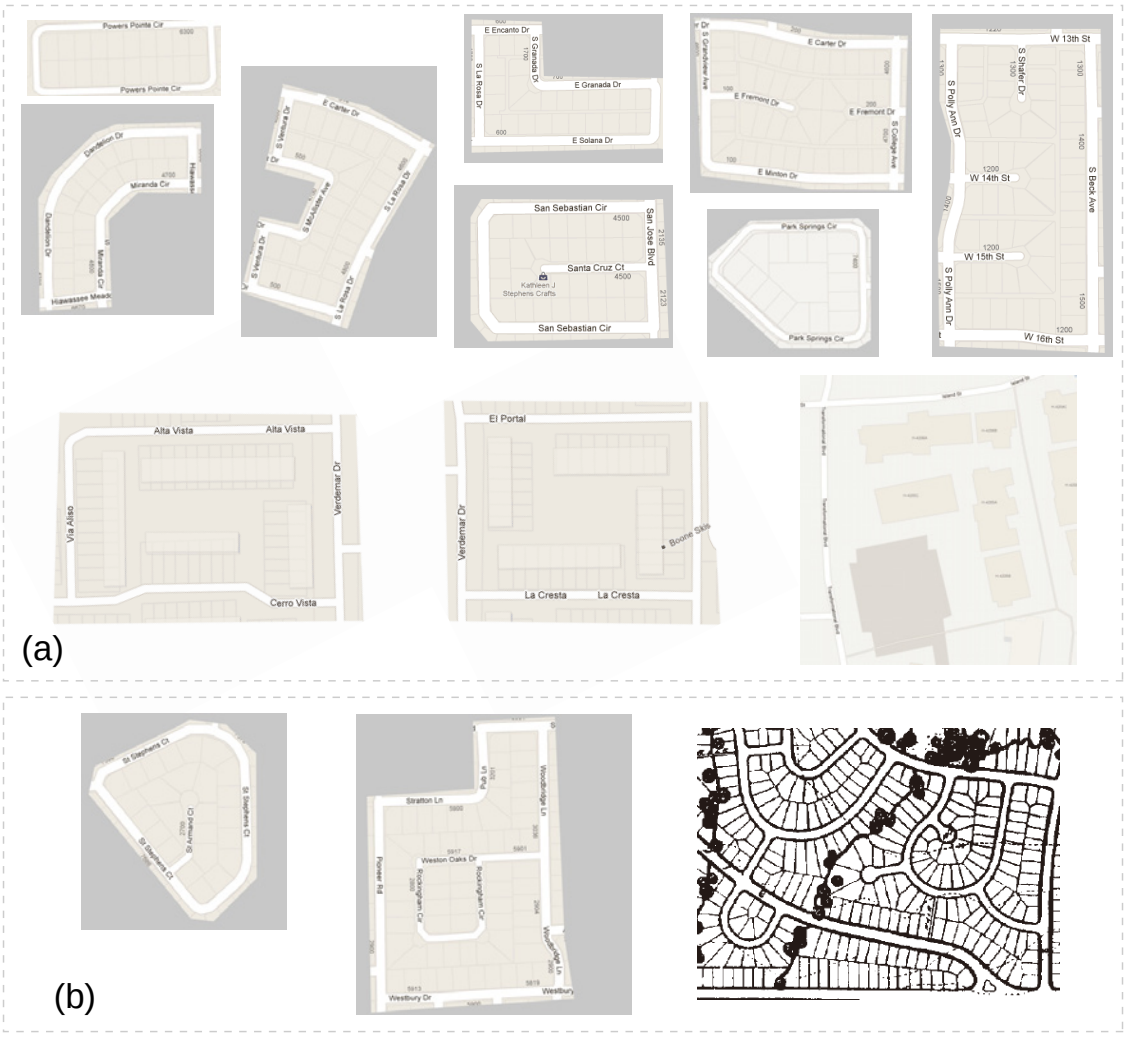

Figure 15: *(a) Our parcel template designs are inspired by several real world layouts from Google maps. (b) For a commercial application of our system, a larger range of templates will be needed. Here we show some of the additional templates that can be considered. These templates are copied from Google maps and a textbook about urban planning. For example, there are several patterns featuring small loops.*

References

CHEN, G., ESCH, G., WONKA, P., MÜLLER, P., AND ZHANG, E. 2008. Interactive procedural street modeling. *ACM Trans. on Graph. 27*, 3, 103:1–9.