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Aerial Laser Scanning for Urban Modeling

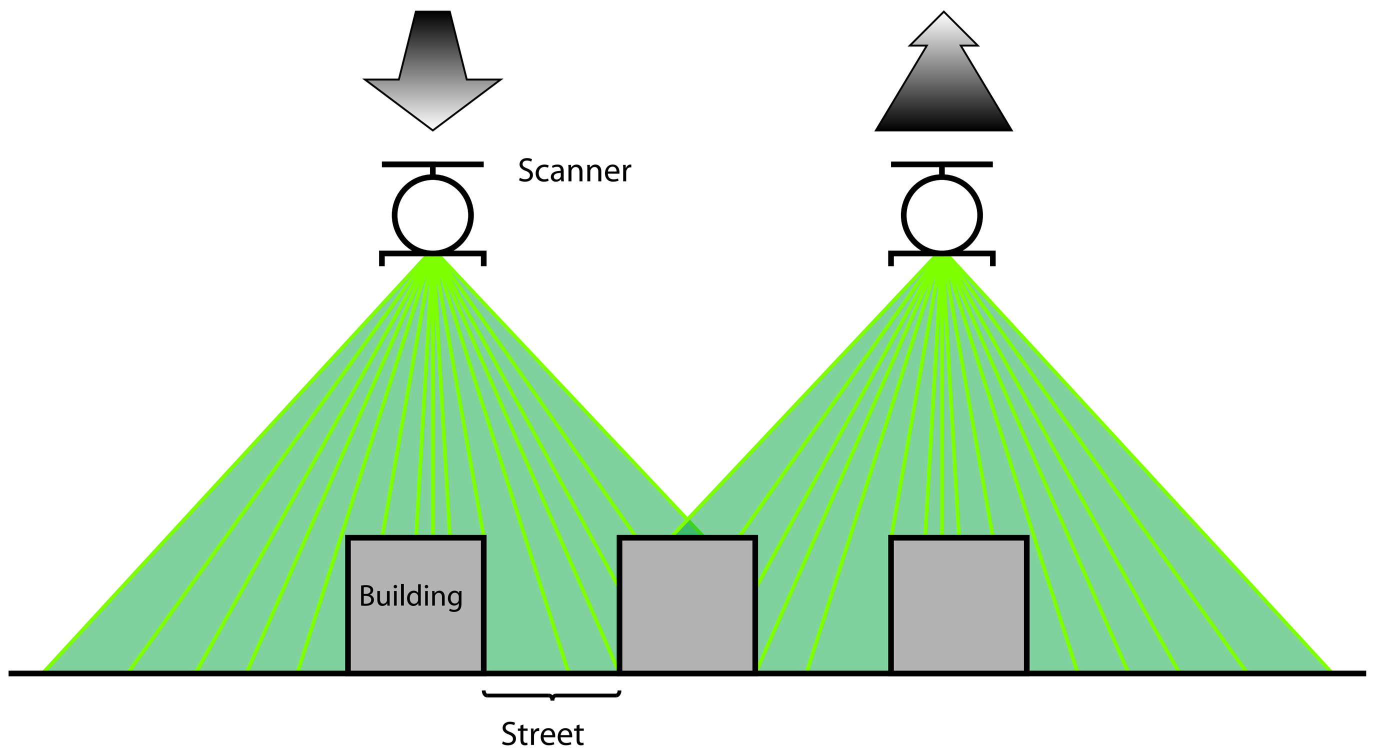
University College Dublin

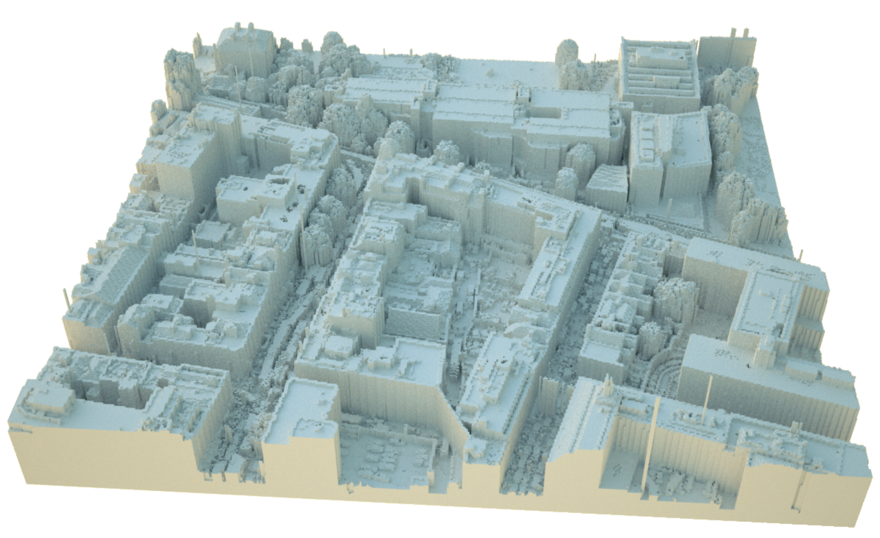
PhD Candidate: Tommy Hinks

Supervisors: Dr Hamish Carr & Dr Debra F. Laefer

Aerial Laser Scanning (ALS)

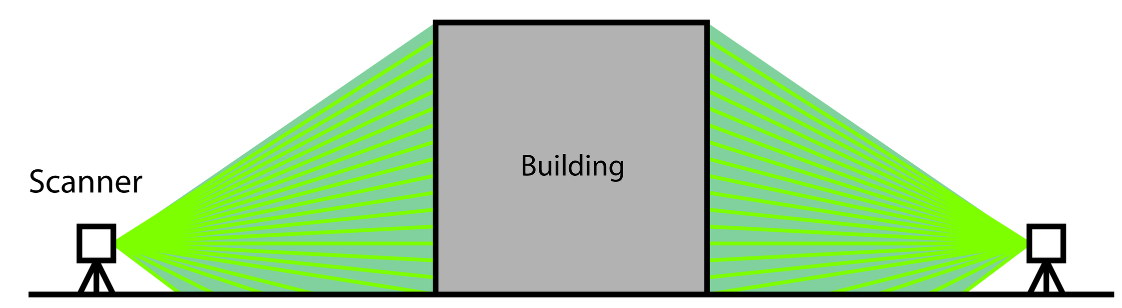
+ 1 day = 1 city
+ High quality on building roofs
– Low quality on building walls





Terrestrial Laser Scanning (TLS)

– 1 day = 1 building
– Low quality on building roofs
+ High quality on building walls

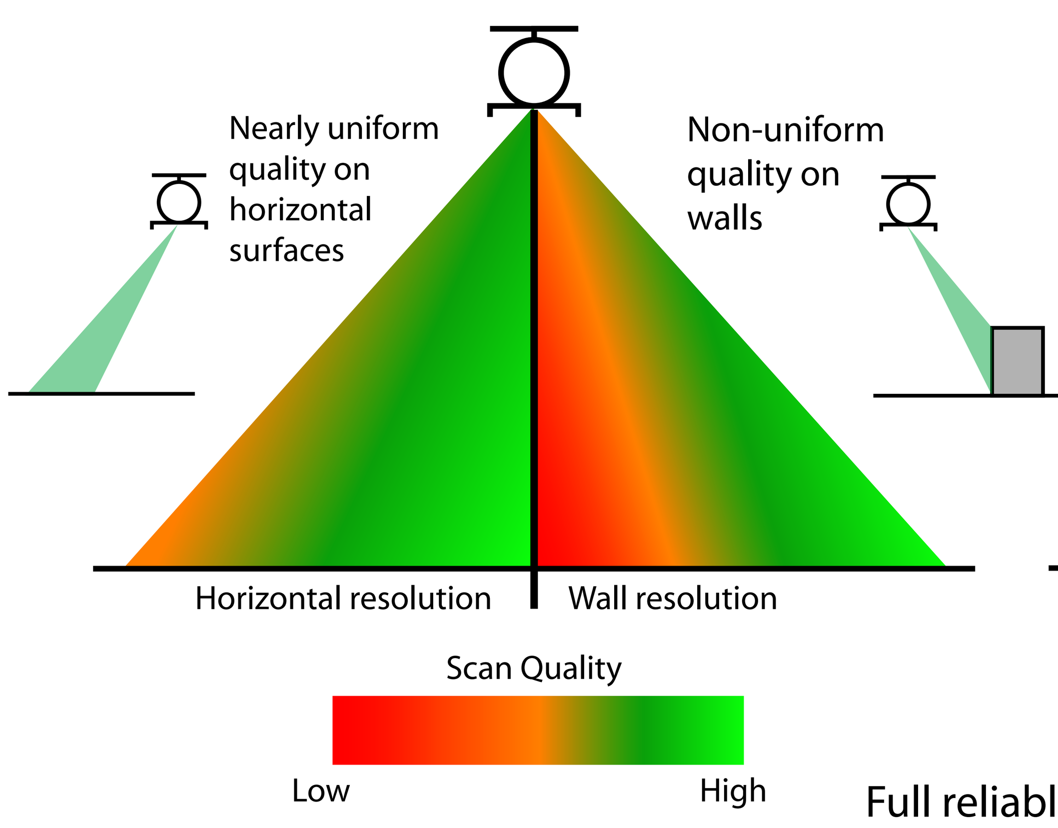


Q: How do we achieve high quality building models from ALS?

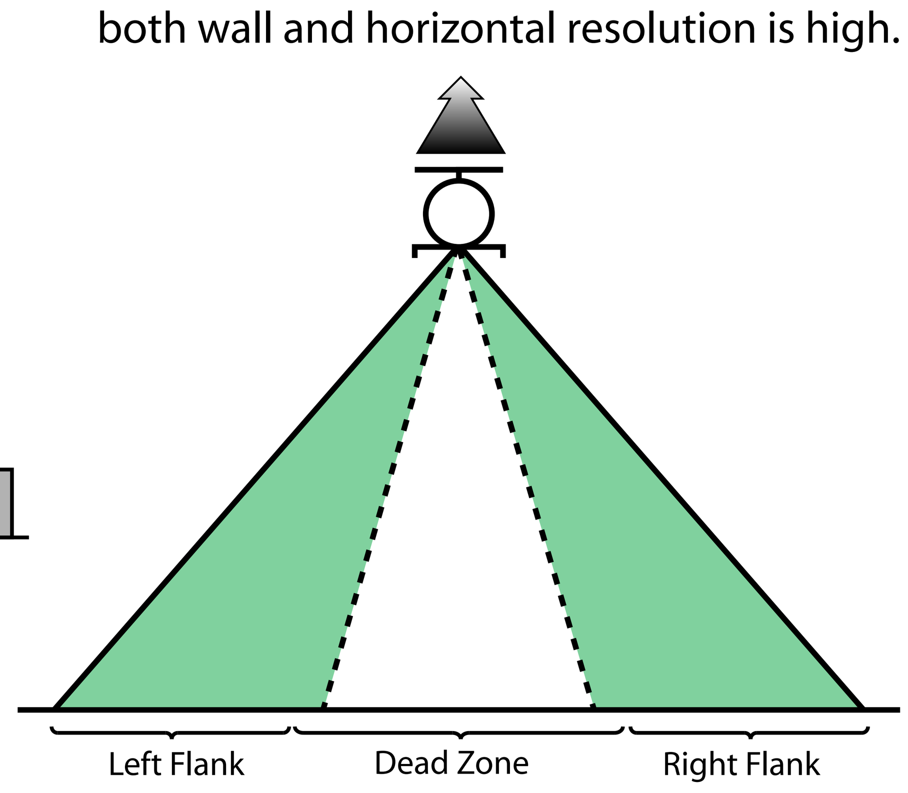
A: We consider the geometric properties of ALS and optimize our scanning:
- Intelligent use of overlap
- Scan quality analysis
- Adhering to street patterns

Geometric Analysis

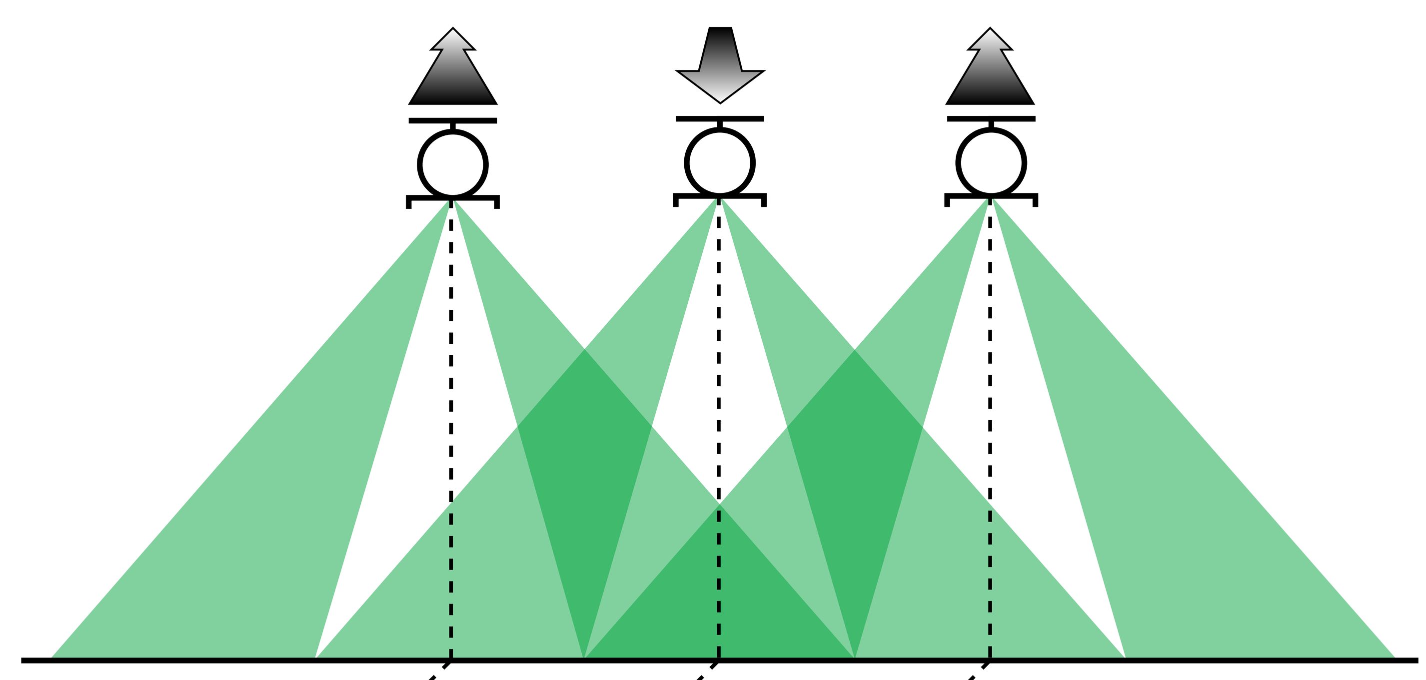
There are areas directly beneath the scanner where scan quality on walls is very low. Horizontal surface scan quality is uniformly acceptably high.



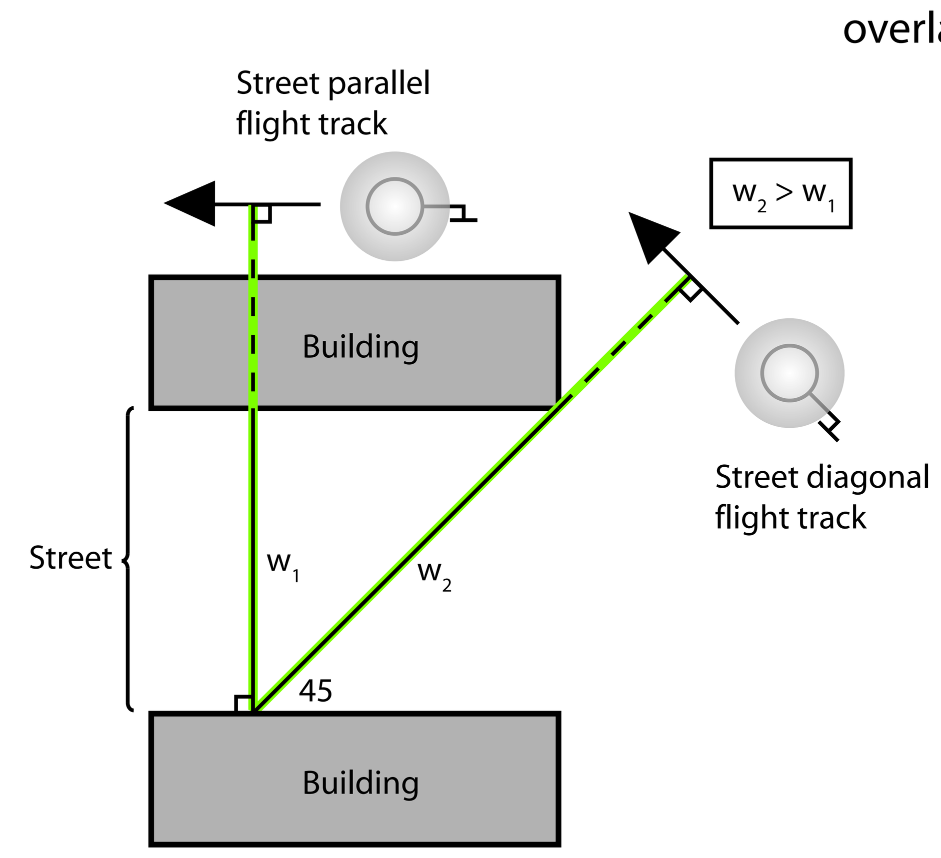
For guaranteed high quality data we can rely only on the data captured in the flanks, where both wall and horizontal resolution is high.



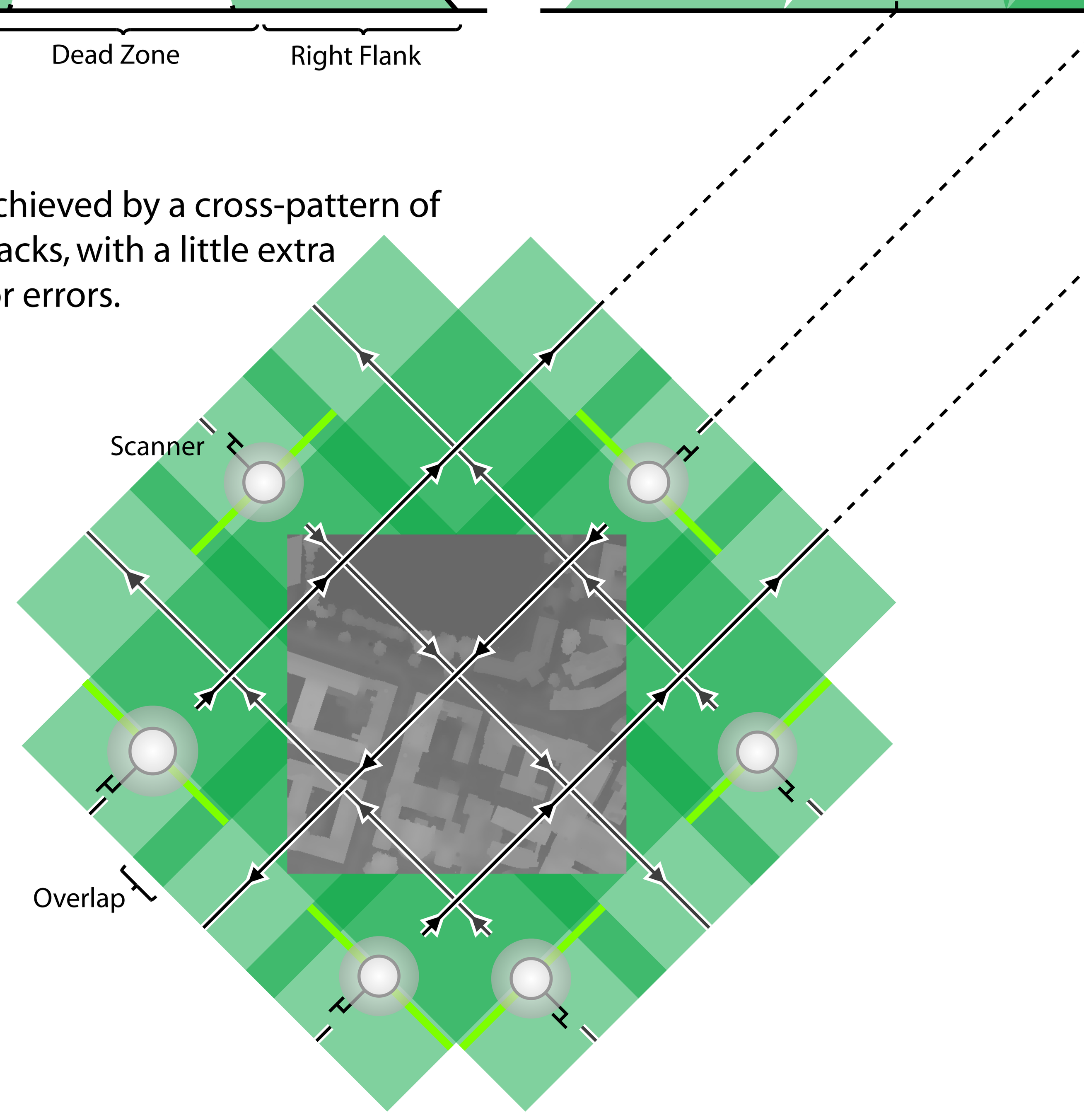
Triple overlap is used to guarantee that we never rely on data from dead zones.



Full reliable coverage is achieved by a cross-pattern of triple overlapped flight tracks, with a little extra overlap to compensate for errors.



Flight tracks are aligned as much as possible at 45 degree angles to streets in order to avoid scanning building walls directly beneath the scanner.



Analytical scan quality:

$R_H = h \sin \theta_L \sec^2 \theta_H$ [m²/point]

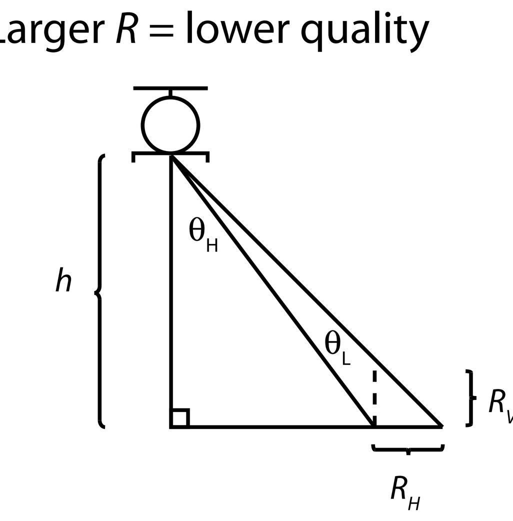
$R_V = R_H \tan (90 - \theta_H - \theta_L)$

h : scanner height

θ_L: scanner angular resolution

θ_H: angular offset to the side

Larger R = lower quality



Results

High quality ALS data of a monumental building in Dublin. Note that it is possible to pick out windows and pillars on the walls. At the same time the quality on the roof is high, so overall high quality building models can be extracted.