AUTODESK RECAP PHOTO USER MANUAL

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Overview

ReCap Photo is used to create 3D models by importing photographths. Generally, the final goal of ReCap processing is a point cloud or mesh ready for CAD and BIM tools. There are two methods to create 3D models:

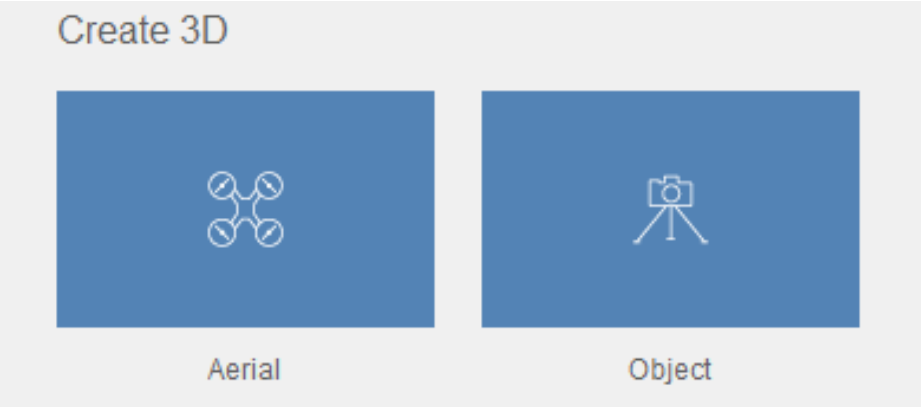


Figura 1 Selection screen to create the 3D model

Method 1_Aerial Project: processes photographs taken from drones to create 3D representations of current conditions of sites, objects, and more. In this mode it's possible to load up to 1000 photos (max 100 photos whit education license) processed on the cloud, the 3D models obtained can be geolocated through multiple coordinate systems integrating the 3D models whit Ground Control Points. The reconstruction process requires at least 20 photos imported for each project.

Method 2_Object Project: processes photographs taken from camera to create 3D objects. In this mode it's possible to load up to 300 photos (max 100 photos whit educational license) processed on the cloud. The reconstruction process requires at least 20 photos imported for each project.

1_General workflow Aerial Project

Before starting any operation, it is necessary identify what photos will be used for 3D reconstruction.

Processing of images with ReCap Photo includes the following main steps:

- loading photos into ReCap;
- inspecting loaded images, removing unnecessary images;
- definiting coordinate system;
- loading Ground Control Point;
- identifying GCP on minimum 4 photos;
- creating 3D model;
- downloading and analyzing 3D model;
- exporting report;

ADD PHOTOS

The first step is to add the photos via the command **ADD PHOTOS** (the icon is present on the left of the screen) ReCap accepts the following image formats: *.jpg *.jpeg. Photos in any other format will not be shown in the Add photos dialog box. It's important that the photos we will use into ReCap photo have the geotag (gps information associated whit each photo), otherwise the 3D model will be not geolocated or scaled correctly (ReCap photo can leverage this information to scale and geospatially locate the 3D model). So ReCap photo aerial project require the GPS data in the photo metadata to create a 3D model.

Figura 2 Add photos command

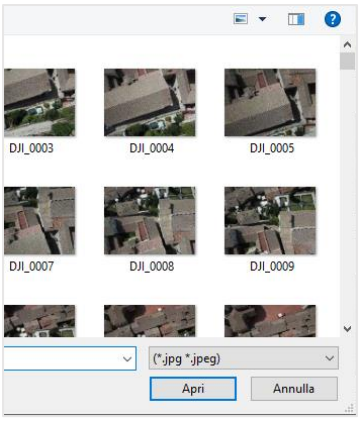


Figura 3 Add photos dialog box

Once the photos are uploaded if is necessary it's possible check and remove unnecessary images by clicking on the red cross, while clicking on the blue check the photo is not removed from the working set but at the same time the photo isn't used for 3D reconstruction.

Figura 4 Screen of loaded photo

COORDINATE SYSTEM AND GCP

The second step is set up the coordinate system by clicking **GROUND CONTROL POINT** (the icon is present on the left of the screen), from dialog box we can search between many coordinate systems.

Figura 5 Ground control points command

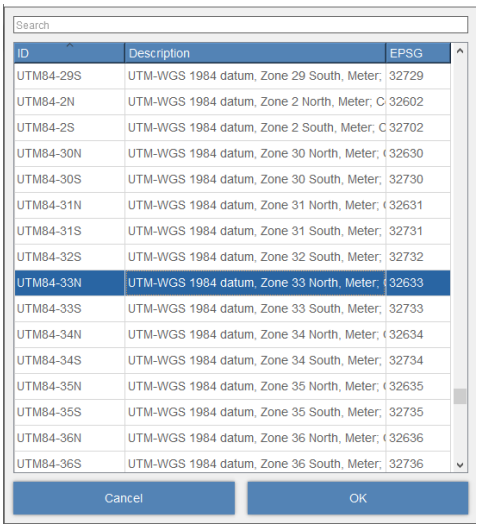


Figura 6 Selection table of the Coordinate systems

For greater model accuracy, ReCap Photo also allows you to assign control points on the ground so that the resulting 3D model is aligned with the coordinates detected. Now we must load the GCP, it's possible to import the GCP (at least three) in any coordinate system. Every GCP must be visually combined with at least four photos. If do you not add the GCP the geographical position and the scale of the 3D model are calculated from the GPS information associated whit each photo. ReCap accepts the following formats: *.xls, *.csv, *.txt. After loading the GCP we'll see the table compiled by the coordinates and next to the columns we'll see the following notice: the GCP must be identified at least four photos. So selecting the first control point we can visually combine the GCP on the photos, identifying the measured point on the images.

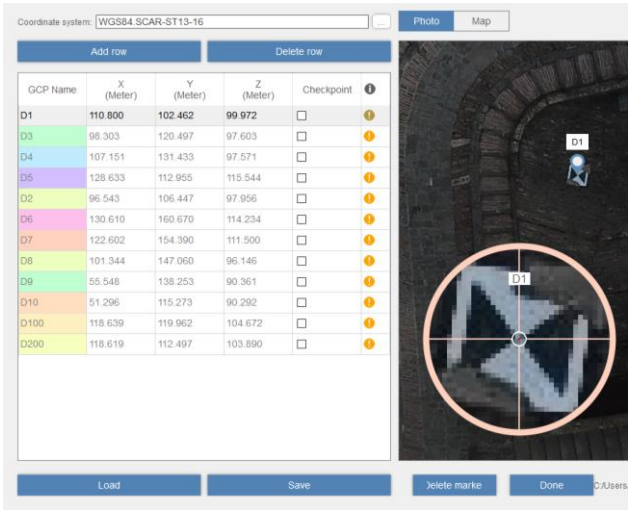


Figura 7 Identifying the measured point on the image

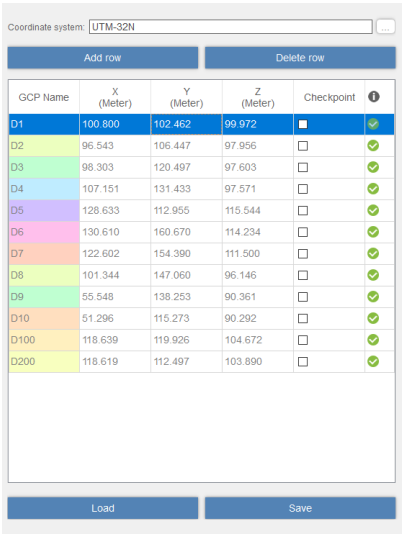


Figura 8 Table of GCP

Completed the identification of all GCP we'll see the green check at the next to the columns, now you need to set up the Checkpoints by clicking on the checkpoints box. The checkpoint setting is an important step because Checkpoints are meant to reference against the other GCPs, there needs to

be at least one regular GCP to reference against. So the GCP's should be set to Checkpoints selectively (not all), and if checking all GCPs as checkpoints in ReCap Photo, the GCP 'i' icon turns yellow and the results post-processing are inaccurate. So the photogrammetric reconstruction is based on the GCP points, the checkpoints instead are not used in the reconstruction but are used to calculate the deviations. Since these points won't affect the reconstruction, check-points' deviation in the report are more trustable to represent the model's accuracy. To check the correct position of the GCP and photos just click on **MAP** command (next to Photo command). The map shows the location of the ground control points and the location of the photos. Finally, we can click on the **DONE** command and continue the model creation process.

CREATING 3D MODEL

The third step is to create the project by clicking on the **CREATE** command (the icon is present at the bottom of the screen). Now we can select between these results: 3D photo-textured mesh, 3D point cloud, Ortho photo and elevation map. Subsequently we must set up again the coordinate system and finally we can click Start.

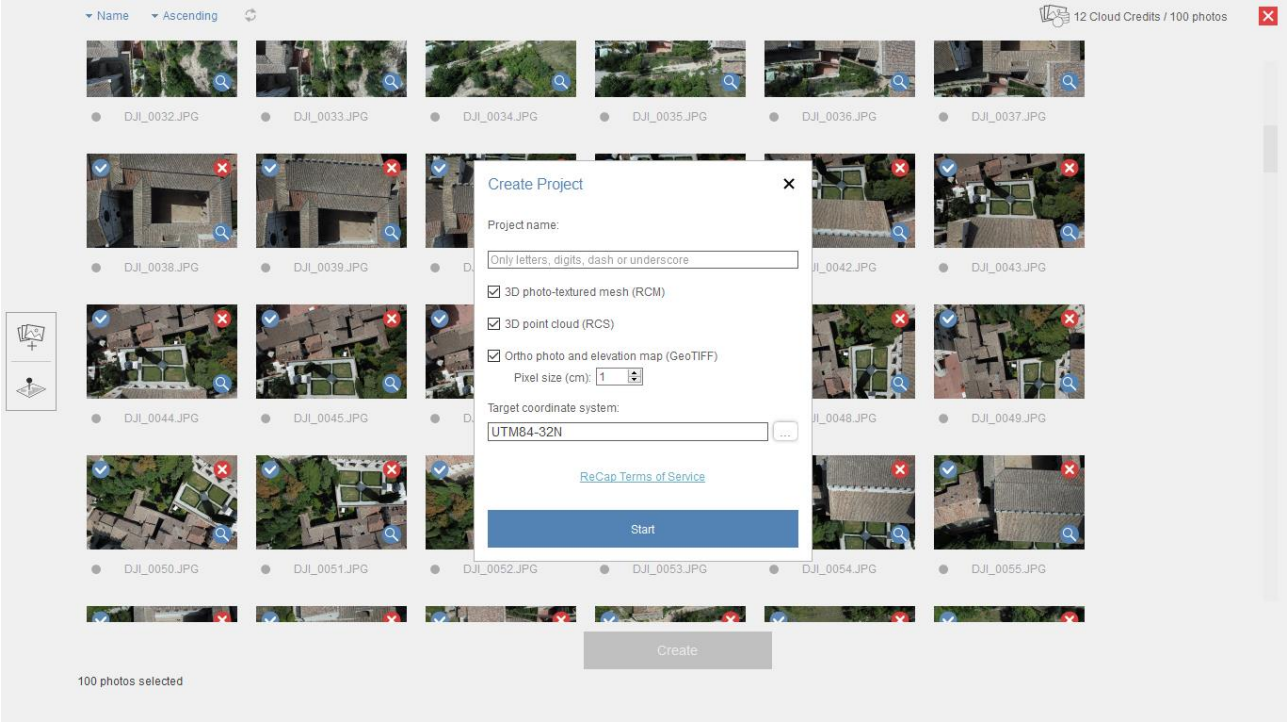


Figura 9 Project creation screen

Now from the dashboard we can see initially the uploading status of the project and subsequently we can see the processing status of the project.

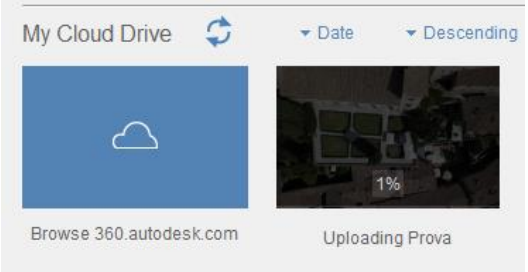


Figura 10 Uploading project screen

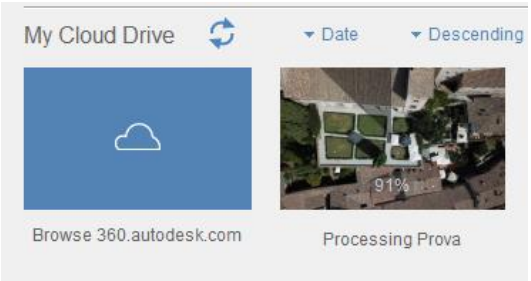


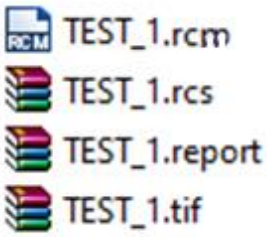
Figura 11 Processing project screen

When the processing status reaches 100% the 3D model is ready to download. If the project fails to complete processing and stalls during the process, the causes could be as follows:

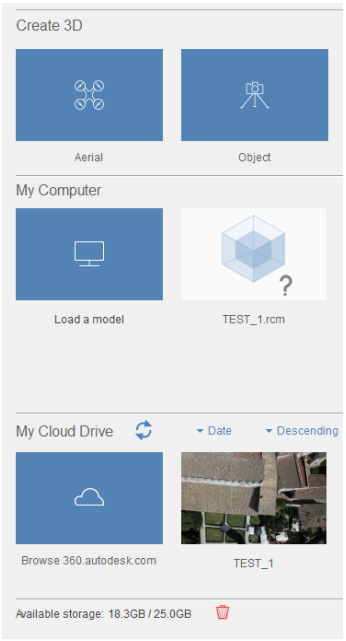
- If the uploaded photos are extracted frames from a video, they may appear too blurry to process properly.
- Aerial projects require GPS data in the photo metadata.
- Photos should have roughly 60% overlap with adjacent images.
- The background is either too similar to the subject or not in focus.
- There are not enough photos of the given area.
- If creating an Aerial project with Ground Control Points (GCP), there may be an error with the GCP data. This can be confirmed by resubmitting the project without the GCPs.

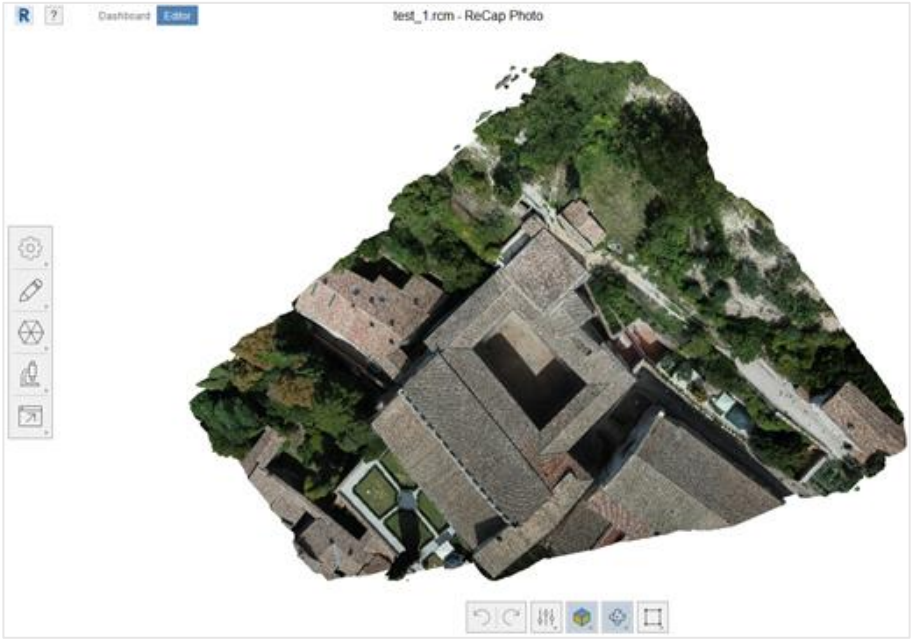
DOWNLOADING AND ANALYZING 3D MODEL

When the project is ready we can download the 3D model from the cloud and we can save the model on our device. Now let's check the files in the folder which should contain the followings files:



rcm file contains the polygonal mesh of object (also called TIN), **rcs** file contains the point cloud, **report** file contains a link to view the project report on the web, **tif** file contains the geolocated orthoimage.



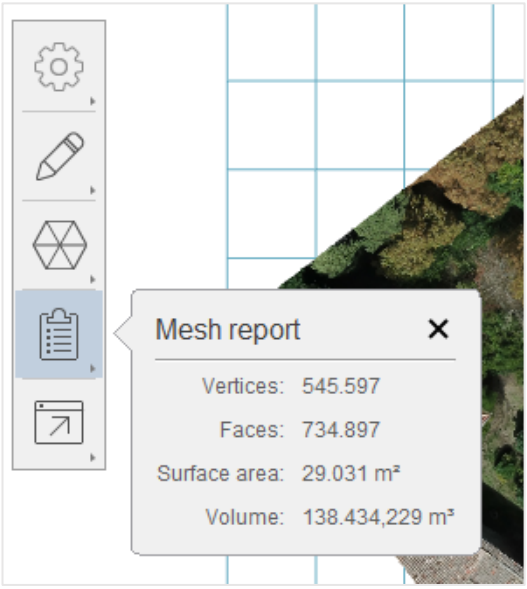


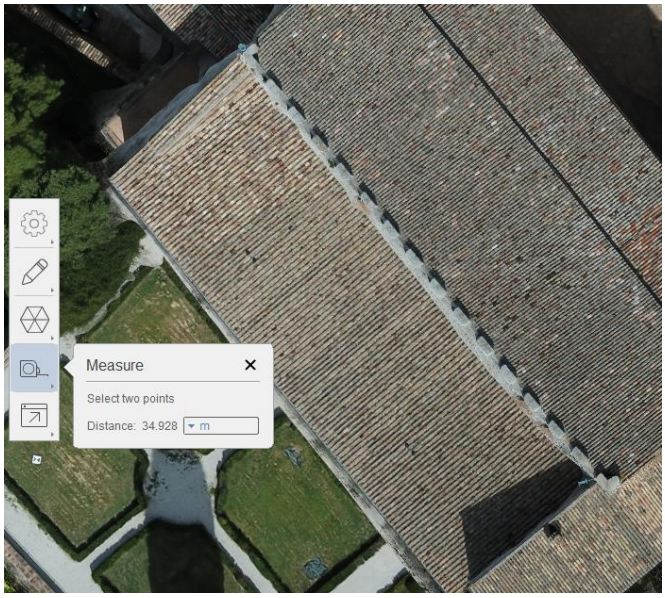
Now we can opening the project by clicking the project on “My Computer” section, from editor panel it’s possible to see the 3D model. The editor panel is characterized by two toolbars. The toolbar on the left of the screen is formed by follows tools:

- Edit , this tool allows you to edit the mesh;
- Re-topologize allows you to decimate the mesh;
- Analyse allows you to detect and fix model, measure distances, view the mesh report and compare two model;
- Export allows you to export image, video or model;

The toolbar on the bottom of the screen is formed by follows tools:

- Undo (shortcut ctrl+z) ;
- Redo (shortcut ctrl+y) ;
- Option allows you to camera positions, set theme, activate or disactivate enviroment, select the orthogrphic projection and select the orbit gimbal;
- Visualization allows you to set up some visual styles;
- Navigation ;
- Selection allows you to select the mesh or a portion of it through window selection, lasso selection and brush selection;





PROJECT REPORT

The project report it's important because shows the main results of the project. Project Report is divided into five sections: Summary, Orthophoto, Digital Elevation Model, Image Overlap and Ground Control Points. In these sections the report provides us many information about the 3D model like: Processing Date and Processing time, Area Covered, Image dimension and image resolution. This report still provides us two schemes: Digital Elevation Model and Image Overlap. Finally in the last section "Ground Control Points" we can check the accuracy of the model, through the error (x,y,z) for Control points and Check points.

Project Report

Summary

Project:
provadefinitiva

Date:
Wed Mar 4 17:30:50 2020

Number of Cameras:
1

Camera Model(s):
[0] DJI FC220

Average Ground Sampling Distance (GSD):
1.000032 cm / 0.010000 m

Area Covered:
11348.391602 m sq / 0.011348 km sq

Processing Time:
1 hours 21 minutes 12 seconds

Target Coordinate System:
UTM84-32N

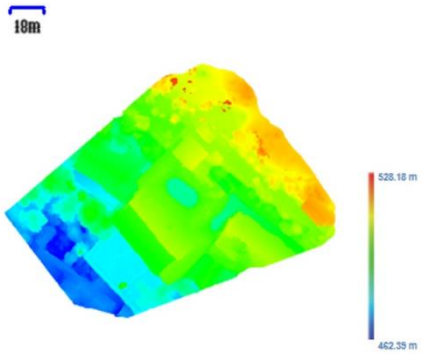
Calibration:
99 out of 100

Images with GPS:
100 out of 100

Orthophoto

Orthophoto Dimensions:
15603 x 12095
Orthophoto Elevation Dimensions:
1560 x 1209
3D Texturing Parameters - Texture Size:
8192 x 8192 (1)

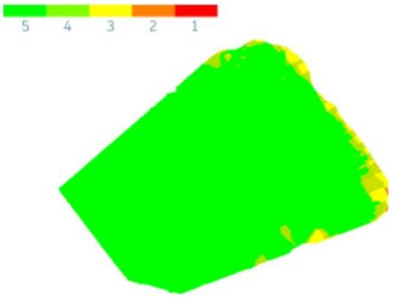
Digital Elevation Model



Digital Elevation Model Resolution:
10.00 cm / px

Image Overlap

Overlapping images computed for each pixel of the orthomosaic. Red and yellow indicates poor overlaps that would generate poor results. Green indicates an overlap of more than 5 images for every pixel.



Effective Overlaps:
3.69 images per pair

Ground Control Points

Coordinate System:
LL84

User Input Control Points

Name	Valid	X	Y	Z	Calculated XY Error (m)*	Calculated Z Error (m)*
9	Yes	12.579129000000	43.353714000000	480.280743000000	< 0.020	< 0.020
7	Yes	12.579469000000	43.354278000000	501.132176000000	< 0.020	< 0.020
5	Yes	12.579921000000	43.354099000000	504.973397000000	< 0.020	< 0.020
1	Yes	12.579886000000	43.353913000000	488.795579000000	< 0.020	< 0.020
100	Yes	12.579778000000	43.354064000000	498.074377000000	< 0.020	< 0.020
200	Yes	12.579846000000	43.354024000000	493.218774000000	< 0.020	< 0.020
3	Yes	12.579617000000	43.353924000000	487.079627000000	< 0.020	< 0.020

User Input Check Points

Name	Valid	X	Y	Z	Calculated XY Error (m)*	Calculated Z Error (m)*
8	Yes	12.579466000000	43.354369000000	503.802308000000	0.232	0.179
6	Yes	12.579380000000	43.354085000000	485.855197000000	0.245	0.165
4	Yes	12.579574000000	43.354043000000	486.964177000000	0.434	0.168
10	Yes	12.579320000000	43.353560000000	479.997581000000	0.175	0.415
2	Yes	12.579741000000	43.353833000000	487.034100000000	0.139	0.142

*XY Error(m) and Z Error(m) are the diffrerences between user's inputs and system calculated coordinate points and is related to the GSD.

2_General workflow Object Project

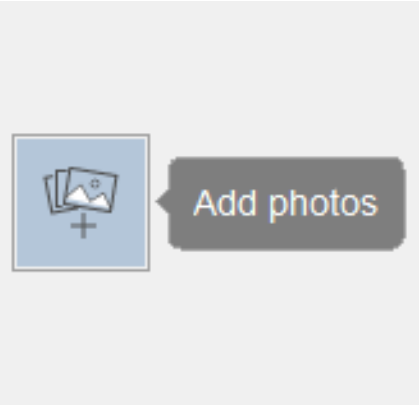
Before starting any operation, it is necessary identify what photos will be used for 3D reconstruction.

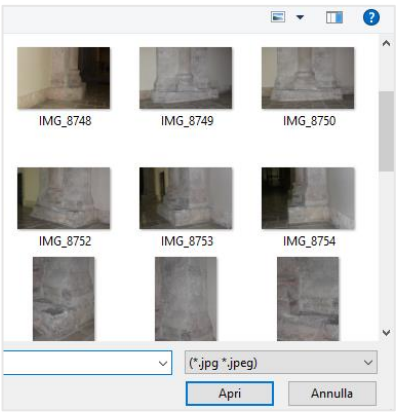
Processing of images with ReCap Photo includes the following main steps:

- loading photos into ReCap;
- inspecting loaded images, removing unnecessary images;
- creating 3D model;
- downloading and analysing 3D model;

ADD PHOTOS

The first step is to add the photos via the command **ADD PHOTOS** (the icon is present on the left of the screen) ReCap accepts the following image formats: *.jpg *.jpeg. Photos in any other format will not be shown in the Add photos dialog box.





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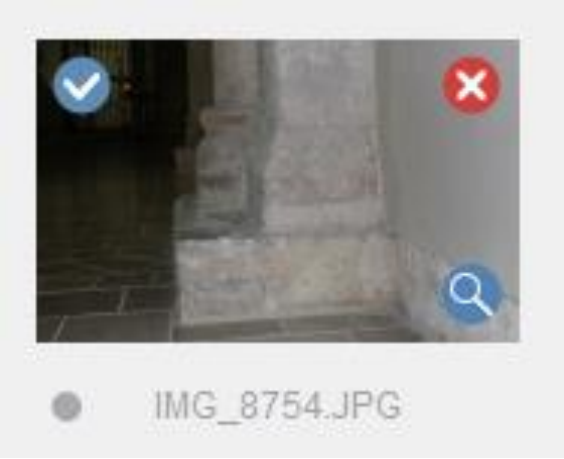
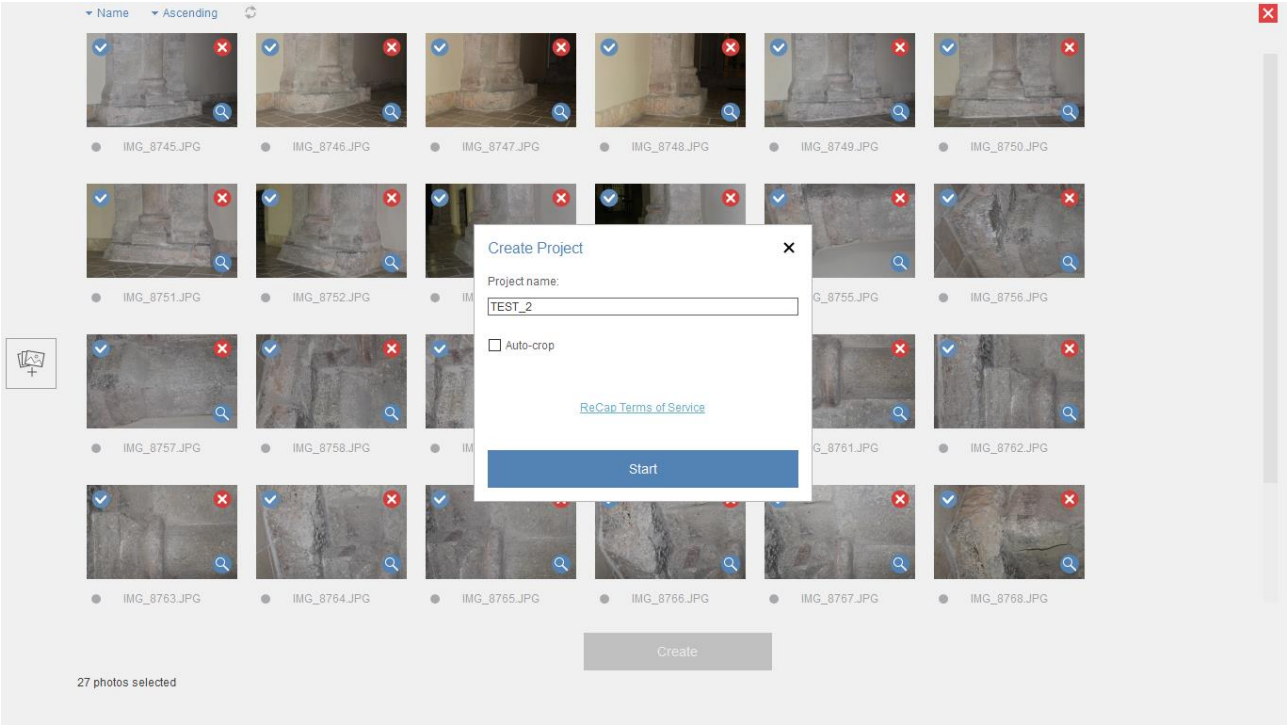


CREATING 3D MODEL

The second step is to create the project by clicking on the **CREATE** command (the icon is present at the bottom of the screen). In this case we can't select from the results seen previously: 3D photo-textured mesh, 3D point cloud, Ortho photo and elevation map. But we just click on the **START** command.



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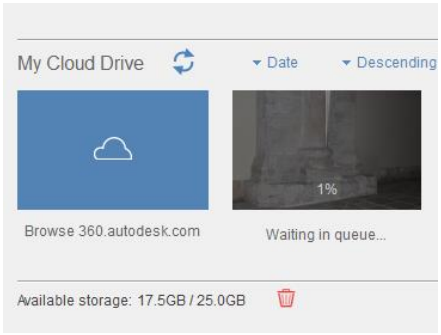

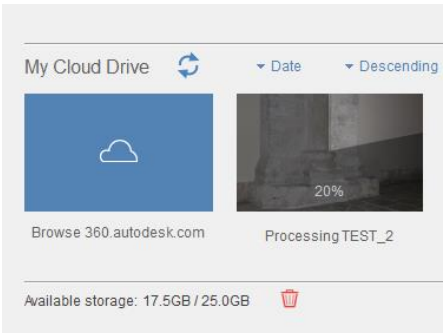

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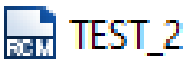
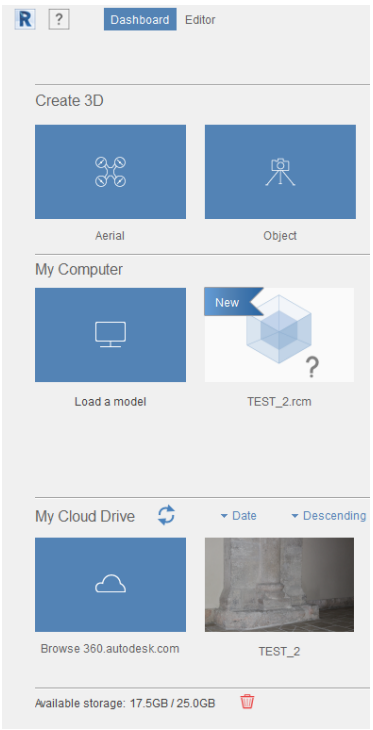
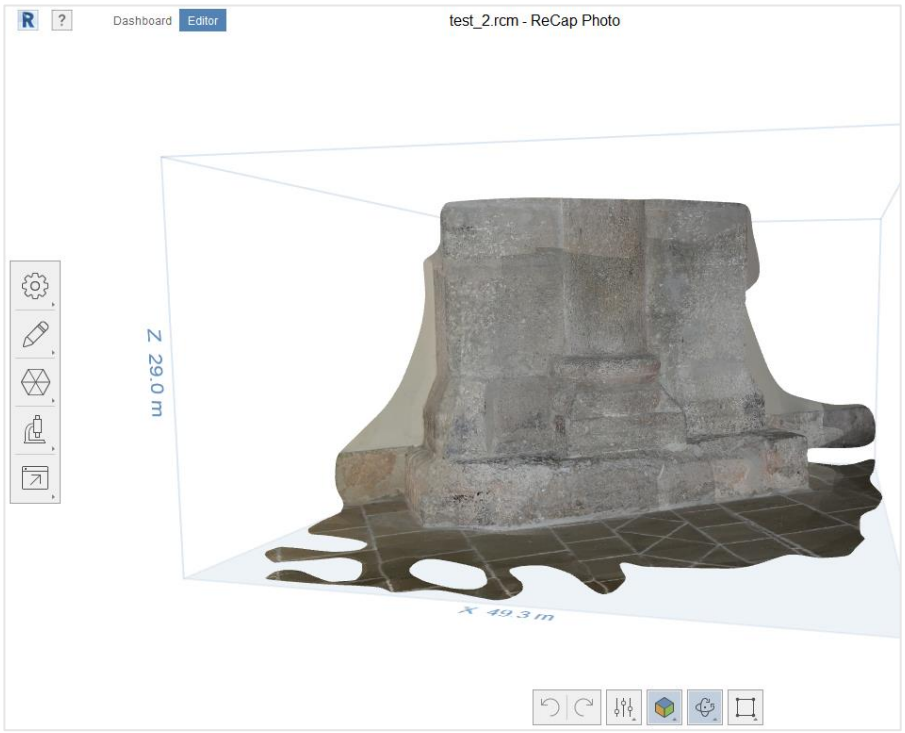


rcm file contains the mesh.





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- Selection  allows you to select the mesh through window selection, lasso selection and brush selection;