

INFINITE **FLIGHT** AIRPORT **EDITING**

Beginner's Guide

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INFINITE FLIGHT AIRPORT EDITING

Have you ever wondered why airports in Infinite Flight by Flying Development Studio look how they look? Who helped Laura and the others to add lines years ago? Who made the layouts of San Francisco, Saint Marten and Amsterdam change? Who extended the runway length at Birmingham? It's the work of the editors in the Infinite Flight Airport Editing Team! Since the launch of global was announced back in 2016, the group is constantly growing – many users wanted to edit their favorite airports or their home airport for global release scheduled for 2017. Many people stayed with the team after their wish list was done and continued with airports they had never heard of before to contribute to everyone's experience in Infinite Flight of the future. You've probably already seen them on the Infinite Flight Community in the Infinite Flight Global Airport Tracking Thread.

Do you also have a local airport or a wish list of airports you want to see in Infinite Flight? You can join the Infinite Flight Airport Editing as well! If you don't know what skills and what software you need, this is the document you need to read! It will cover the entire editing process from the moment you apply until your airports are present in Infinite Flight.

Once you finished reading this and you are sure you want to become an Infinite Flight Airport Editor apply by mailing us at:

airports@liveflightapp.com

Alternatively, you can also use the form on our website.

GETTING STARTED

Once you join Infinite Flight Airport Editing, you will need to learn lots of new things to become a successful editor. It is totally normal that the first airport is not a masterpiece; however, the better you read this tutorial and check other sources listed in this script, the higher the quality of your first airports and the less disappointments will occur. Don't forget that everyone involved in Airport Editing will happily support you if you have any questions. You will learn more on how to get support and answers later in this tutorial.

IMPORTANT VOCABULARY

In this tutorial, you will come across lots of wordings you may not have heard before. To help you understand the explanations given more easily, you can find a list with frequently used "Editing Vocabulary" below.

Word	Synonyms	Meaning
Node	Vertex (pl. vertices)	Fix points used to form lines and polygons in WED
Overcurving		"Cosmetic" issue with curved lines causing unrealistic shapes.
Spawn	Ramp start	Object in WED that is used to set the start location for aircraft in IF
Snap(ping)		Practice to connect nodes of taxiways and lines to avoid gaps
Orthophoto		Image with coordinate information to position it in WED for editing
Repo	repository	Location of all IF airport files on GitHub
Issue Tracker		GitHub page where the progress on airports is documented and tracked
Scenery Package		Folder that can be created and opened in WED to edit the airport in
apt.dat	Airport file	File used to save the airport for Infinite Flight once it's completed
ICAO code/identifier	Airport code, airport identifier	Unique code used to identify all major airports in the world
.kml file		File containing geographic data e.g. coordinates for orthophotos
AGL	Height, "Above ground level"	Height or elevation above the ground, used e.g. for tower height
MSL	Elevation, "Mean sea level"	Elevation of e.g. the airport above the sea level (=0 ft MSL)
Isle of Man	English Channel	Island located in the English Channel, sometimes said to be in the Irish Sea

USEFUL LINKS

Apart from this main tutorial on Infinite Flight Airport Editing, the web offers loads of information on Airport Editing. You can find links to the main official sources below.

AIRPORT EDITING INFOS

Find information on airport editing and additional tutorials at:

<http://www.airportediting.com>

Our official website, offering all tutorials available

[Visit our YouTube channel](#)

Helpful tutorial videos on several topics

[Visit us on Instagram](#)

Follow our progress, new airports are posted regularly



AIRPORT INFORMATION

To find information on airport facts and figures, we recommend these websites:

www.worldaerodata.com

www.skyvector.com

www.aircharts.org

www.airnav.com (US and Canada only)

www.rocketroute.com

www.gcmap.com

www.opennav.com

www.airportnavfinder.com

SIGNING UP

Once you come to the conclusion that you want to volunteer as an Airport Editor, the first step you take is sending an email to airports@liveflightapp.com. This mail doesn't need to be a detailed application you would submit for a job offer at Airbus, Boeing, Google or wherever you would like to work, but we would ask you to at least include the following:

- Subject, e.g. Join request, Infinite Flight Airport Editing
- A short text stating that you want to become part of the team, don't send empty mails, that may get you a reply like "What do you want me to tell?" or, even worse, no reply at all (the people managing our inbox may be veteran editors but they can't find out your intentions by looking at an empty screen)

Things you may include additionally:

- Your user name on the Infinite Flight Community
- Your GitHub user name in case you already have one

This information will help us to make you a member with all abilities quicker and may also help us to find out who you are. It doesn't happen very frequently, but in very rare cases we may restrict access to the team if it turns out you are known for unruly behavior on the IFC.

Some important things you may want to consider before joining:

Even though the Editing Team consists of numerous nationalities and individuals speaking a wide range of languages, a good command of English is recommended. You may get help by some editors that are fluent in your mother language, especially if you speak German or Spanish; however, you will almost certainly get your review results after submitting an airport in English. Furthermore, the main language used in our conversations is English.

Once you have applied via mail, it may take some days until you get a reply. In extreme cases, it may take us up to 7 days to reply, but usually a reviewer will handle your request within a few days. Weekends are the best time to contact us since our reviewers are very active during this time of the week.

As soon as your reply is handled, you will get an email including some information on tutorials and software as well as some setup instructions. Additionally, you will get an invitation link to our group chat. All steps explained in the email are also covered in this document.

REQUIRED ACCOUNTS

In addition to our welcoming email, we will also invite you to join our Slack group. In case you included a GitHub user name, you will get an invitation to our organization as well, if not, you are asked to create an account in the setup process and to inform a supervisor about the user name in a private message.

GITHUB

Infinite Flight Airport Editing uses GitHub to organize and store airport files accessible for all members. Moreover, team members can create issues and are assigned to them to keep track of who is doing which airports. To create an account on GitHub visit github.com. If you already own an account, all you need to do is tell us your username, either in the application email/form or in a private message to a supervisor after joining us on Slack. If you didn't own an account before joining Airport Editing, create one and let us know your user name. Either way, you will get an

invitation to our GitHub organization granting you read access. This is needed so supervisors can assign you to issues and so reviewers can tag you once they upload your airport to the repo.

GENERAL RULES

- Don't share the link to the GitHub repository. There were several occasions where outside users messed up the issue tracker requiring a cleanup by supervisors afterwards.
- Always search before creating an issue, we don't want to have duplicates since GitHub doesn't allow for issues being deleted.
- You may only be assigned to three issues at a time. This will be enforced by supervisors.
- Don't close issues unless you are a supervisor. In case you want to give up on an issue, comment it in the issue and our staff will take care of your request. Having the airport sent for review is also no reason to close an issue.
- Don't work on Airports with a closed issue nor create a new one to update the airport. Always ask a supervisor to reopen an issue for an airport requiring updates and provide a good reason for additional work on the completed airport (e.g. new terminal was built, new runway was built, runway was extended/ closed etc.) Airports won't be reviewed if the issue is closed or if no issue exists.

SLACK

Slack is our way to communicate with each other. As soon as we welcome you, you will get an email inviting you to our Slack group chat. All members are asked to join the group. Slack is your place to go for questions regarding editing, feedback on your airports and much more. As a member, you will be able to join the public channels and to start private conversations with other members. Slack will also be the place where we manage the number of members in the team. We don't require editors to edit one airport per week but we ask for a certain level of activity. From time to time you will see announcements asking you to react in a limited period of time so we can remove inactive members. To make recognizing you easier it is recommended that your Slack username is similar to the GitHub one. You can still set a different display name.

You can use Slack in your browser or you can download the app for PC, Mac OS and your Smartphone.

GENERAL RULES

- Basic rules for conversations apply. We may not have a strict "only G rated content" policy active, however, insulting other users or other misbehavior may result in removal from the editing team.
- Be active regularly to check the chat for news and announcements, also regarding editing rules.
- Try to use the different channels (see next chapter) for the topics they are created for.
- Don't share internal conversations with non-editors.
- Main language used in the team is English. All editors are asked to chat in English in public channels. If you want to have a conversation in your mother language with other people, use direct messages or group chats.
- Please use the Deletron App at www.slackdeletron.com to clear storage regularly (at the latest we will ask you to do so in #announcements). We use a free plan and only have 5GB of storage available for our team.

CHANNELS

The Slack chat consists of several public channels with different purposes. Try to use the right channel whenever you start a public conversation.

#announcements	This channel is used by Airport Editing supervisors to announce new or changed editing rules, new software or tutorials and for administrative announcements e.g. removal of inactive members.
#discussion	All general questions on editing (e.g. "which line type should be used here?") go here.
#peer-review	Once your airport is completed you can upload it here to get a review by other members. This can help avoid rejections in the official review. Find more details on this channel in the chapter on the review process.
#sas	If you are unable to get accurate satellite imagery for your airport, request your airport here to get help from other members. Further details are located in the "SASPlanet" chapter.
#tracking	All activities on GitHub are posted by a bot here.
#off-topic	All conversations not related to editing go here, from aviation news to that cute cat picture you want to show your fellow editors.
#github-names	This channel may be in use whenever inactive members are about to be removed. Comment your GitHub user name so we know who will remain in the GitHub team.

HOW CAN I GET HELP QUICKLY WHEN NO OTHER EDITOR IS UP?

Type `/i-need-help` in any channel on Slack and all of our tutorials will be linked.

Type `/airport-info` to get links to airport info websites

REQUIRED DOWNLOADS

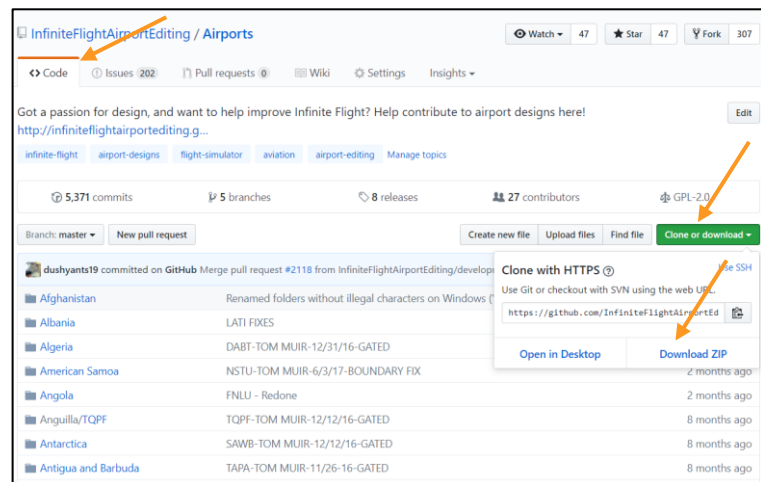
Apart from lots of time you also need some programs for airport editing. All programs we use are free and can be downloaded online.

WORLD EDITOR (WED) BY LAMINAR RESEARCH

World Editor is the core software for our project. WED is the program you use to edit the airports with. The program is available for Windows, MacOS and Linux. The software is available at <http://developer.x-plane.com/tools/worldeditor/> as a .zip download. Always download the latest stable version.

AIRPORT REPOSITORY

The airport repository “the repo” is our airport database. The airports are saved as .dat files which can be opened with World Editor. Since we highly recommend to import the existing airport files for editing, you need to download a copy of the repository on Github or using GitHub Desktop. You may want to update your download every now and then to have the latest versions of airports on your hard drive. To download a .zip copy of the repo go to “code” page of the

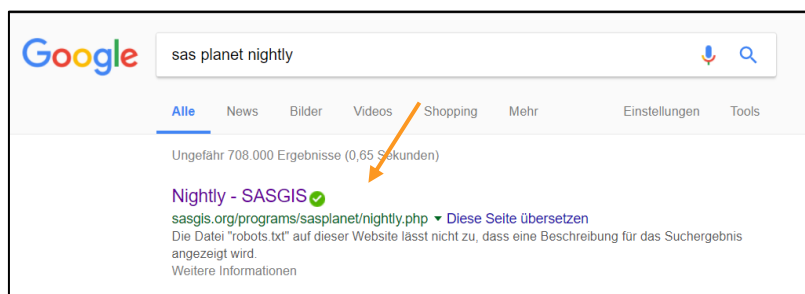


Picture 1: Downloading the repo through github.com

Airport Editing GitHub team and click on “Clone or Download” then select “Download ZIP”. Unzip the folder to you Airport Editing folder after the download is done. If you are using GitHub Desktop, select “Open in Desktop”.

SASPLANET

You may already have wondered how editors are able to create accurate airports. The answer is simple: We use software that provides orthophotos for import into WED. Our preferred software is SASPlanet. This program is capable of exporting orthophotos as well as their



Picture 2: Download Page for SASPlanet Nightly

respective coordinates from various sources like Google Earth, Bing or Yandex Maps in selectable quality. SASPlanet is only available for Windows and Linux unfortunately. MacOS users can either use the software “WED-o-Maker” or request SAS orthophotos in the #sas channel (recommended). To download SASPlanet, search for “SASPlanet Nightly” using google. The first result should show “Nightly – SASGIS”. Selecting this result will lead you to a page where SAS is downloaded automatically as a .7z file which can be opened using programs like 7-zip (available at www.7-zip.org).

WED-O-MAKER

In case you are a Mac user and you want to use WED-o-Maker, you need to know that WED-o-Maker only has Bing maps and that it tends to be outdated. In contrast to SASPlanet, WED-o-Maker will import imagery directly into WED. To use WED-o-Maker you will furthermore need Java installed on your computer. The software can be downloaded online from a google drive page linked at <https://wedomaker.wordpress.com/download/> and comes in a .zip file.

GITHUB DESKTOP (OPTIONAL)

As mentioned in the repository download chapter, you can also get your copy of the airport repository using the GitHub desktop app. It's available at www.desktop.github.com. The program is optional if you are a normal editor. Once you are granted pull access, meaning you can submit your airports to the repo without review, GitHub Desktop is needed so you can sync your changes to the repo.

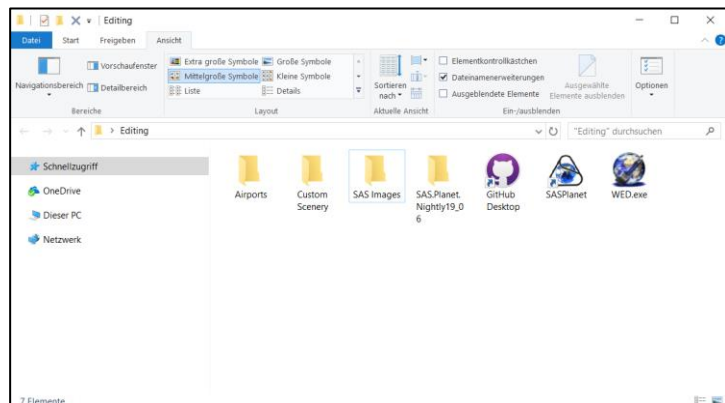
SETUP

After downloading all necessary software, it's time to set everything up for editing. Most of the programs you downloaded are stored in .zip or .7z files and only need to be unpacked. Several require a special setup nevertheless.

ORGANIZED FOLDER STRUCTURE

A helpful tip to keep your Airport Editing files at one place is creating a folder for it on your desktop. Since we don't ask you to download a demo version of X-Plane you even need a special folder structure required by WED.

We recommend that everyone creates a folder called "Airport Editing" or whatever you want it to be named. In this folder, you must create

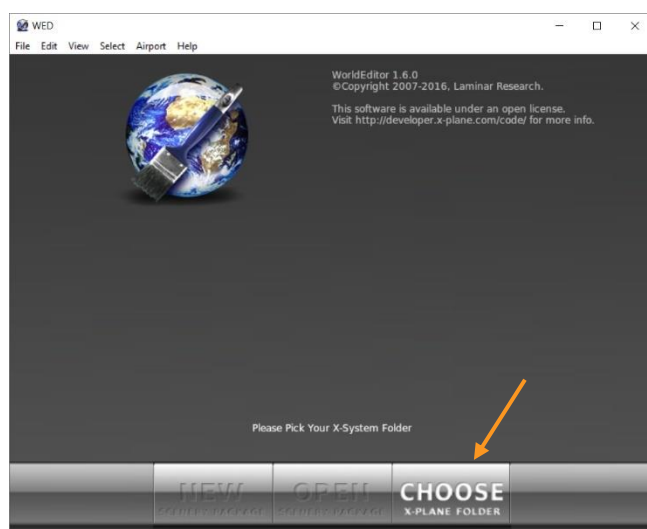


Picture 3: Typical Airport Editing Folder Structure

two folders which are called "Custom Scenery" and "Resources". Correct spelling is important here since these will be the folders WED is going to work with. Apart from that you can also save the unzipped folders for SAS, the repo and programs like WED or GitHub Desktop here. A folder for SAS imagery can be handy as well.

WED

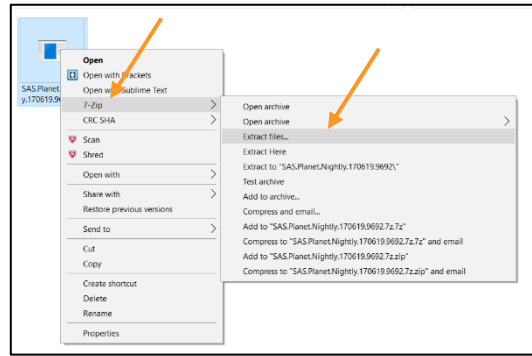
The setup of WED is easy. Once the download is completed, extract the .zip folder to your "Airport Editing" folder. Windows should be able to do that, otherwise you'll need 7-zip or a similar program. For easy access, you can pull WED.exe out of the folder. The rest of the folder is not needed and can be deleted. To complete the setup of WED, open the program. You will be asked to "pick your X-System folder". Click on "Select X-Plane Folder" in the lower right and navigate to your "Airport Editing" folder that contains the "Resources" and the "Custom Scenery" folders. After that, WED is ready for use and you can create your first scenery package.



Picture 4: WED's appearance when opening it for the first time

SASPLANET

The setup of SASPlanet is quite easy as well. However, you won't be able to extract the .7z file you downloaded without 7-zip, WinRAR or similar programs. To extract the file, right click the .7z folder and select 7-zip – Extract files. You can then select a place, preferably your Airport Editing folder, where SAS should be extracted to. Once this is done you can open that folder and create a shortcut to the SASPlanet Application in your Airport Editing folder so that you can access it more easily. SAS is ready for use



Picture 5: Extracting the SASPlanet .7z folder

from that point, no further installations are necessary. To keep your satellite image supply up to date it is recommended that you get a new version of SAS every now and then.

Once an image source like Google Earth/ Maps updates its images it doesn't take too long until a new SAS version is available. Simply extract the new folder to your Airport Editing folder again, copy the name of the old folder, delete the old one and name the new one after the deleted one and your shortcut will work again with the updated version.

WED-O-MAKER

To get WED-o-Maker running on your computer, all that you need to do is unzip the .zip folder the program comes in. If your computer has Java installed, the program will be launched in your browser after a double click on the .jar file (startup may take some moments). The program will ask you for your X-Plane folder in the upper left corner. Enter the directory of your Airport Editing



Picture 6: Landing page of WED-o-maker on first launch. Arrow indicates where the directory of the Airport Editing folder has to be inserted

folder where your "Custom Scenery" folder is located in there. You should then be able to choose the scenery packs you already created in WED in that bar.

HOW DO I GET MY AIRPORT FOLDER DIRECTORY EASILY?

Windows: To get the directory of a folder easily just do a left-click in the folder directory shown in the top bar of the folder. The directory will then be shown as a text and can be copied instantly.

Mac OS: Access the folder and hit command+i. The appearing window shows the directory in a visual way at "Where:" (e.g. User-Mark-Airport). Select that directory with your mouse and copy it (command+c). The directory will be posted in the correct form when hitting command+v.



QUICK TIP

THE FIRST AIRPORT

Congratulations! You are ready to edit your first airport for Infinite Flight! The following chapter will tell you how to do so starting with the preparations necessary before the editing process itself, followed by the editing part and a troubleshooting chapter containing tips on the most frequent issues.

PREPARATIONS

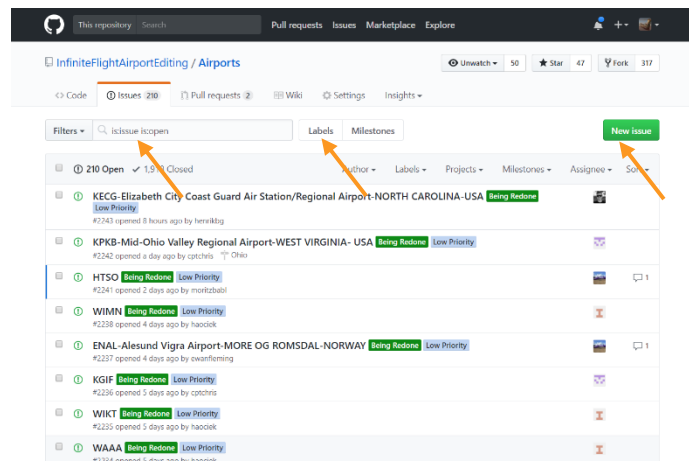
Before editing can start, there is still some work to do: satellite images need to be checked and downloaded, GitHub has to be checked and some more things. The following chapter explains the steps that are missing for a successful first airport.

CHECK SATELLITE IMAGES

So, you selected the airport you want to start your editing career with? Ideally, you already know the ICAO or FAA identifier next to the airport name and maybe you already collected data like the airport elevation or the ATC frequencies. Perfect! However, there is one thing you should have a look at before you open an issue on GitHub – the satellite images available for the airport. Open SAS or WED-o-maker and navigate to your desired airport. If you are using SAS you can choose from various maps. Construction sites, outdated imagery and low image quality can make editing quite hard, especially for a new editor. If your desired airport has low quality imagery and/or significant construction sites impeding editing in SAS or WED-o-Maker, consider postponing the airport to a later date when more recent or higher quality imagery may be available to avoid frustration and/or unassigning.

CHECK GITHUB AND GET ASSIGNED

Once you checked the available imagery, your next step is visiting GitHub. As stated in the very beginning of this tutorial, every editor must announce once he starts working on an airport. To avoid duplicate issues, always search before you create a new issue. Someone else may already have created a suggestion for your airport. To search all issues in our GitHub repository, navigate to the issue page of the “Airports” repository and use the search bar (only available in the desktop version of GitHub.com, there is no search bar in the mobile view). Type in the ICAO identifier and run the search. You will then see a list of all open issues with the ICAO code you entered. Also check the “Closed” section in the results. An airport will be listed there if it has been redone already. In case it is listed as “open”, check the labels attached to the issue.



Picture 7: The issue tracker - use the search bar indicated by the arrow to search for the identifier of your airport. Use the "Labels" button to only show airports with certain labels.

Labels are added to issues by supervisors. They show the progress and priorities of airports. You can also access airports with certain labels via the “Labels” button right next to the search bar on the issue tracker. If an airport is labeled as “Being Redone”, another editor is already working on the airport. If one label says “Suggestion”, no one is working on it and you can leave a comment in the issue stating that you want to work on the airport.

MY AIRPORT DOESN'T HAVE AN IDENTIFIER. WHAT CAN I DO?

Unfortunately, our repository only features airports that have an ICAO code or a FAA code. Airports without an identifier are usually of a very low priority (tiny airstrips for private aviation and similar). They cannot be added to our airport repository and won't be added to Infinite Flight consequently. Airports with a certain priority will have ICAO codes anyway.

QUICK TIP

If your search for the airport code didn't show any results, you can create a new issue for the airport by hitting the green “New Issue” button in the upper right. Enter the airport code as the issue title and state that you want to do the airport in the comment. If the airport has a runway with a length of 10,000 feet or above, also add this in the comment so the issue can be labeled correctly. A supervisor will assign you as soon as possible if you are within the limit for assignments at this time and will add the required labels.

IMPORT APT.DAT OR CREATE A NEW AIRPORT

Once you are assigned you can proceed with launching WED. Hit the “New Scenery Package” button in the lower left. WED will add a new Scenery Package to the list. You can name it instantly by typing something without clicking on anything before. If the Scenery Pack is saved as “Untitled 1” initially, you can rename it by double-clicking/selecting and clicking on it. Enter a name that allows you to identify the airport, so use something like the identifier or the name. Once you have more than one scenery package, WED orders them alphabetically.

To open the scenery package and start with your airport select the scenery pack with a single left-click on the scenery pack in the list and hit “Open Scenery Package” at the bottom of the WED window. The program will then open the editing window. Go to “File”- “Import apt.dat” (Ctrl+Shift+i) and access your “Airports” folder you downloaded from GitHub and find your airport by its identifier. The search bar in the folder window is very helpful for this task. Enter the folder with the correct identifier and open the “apt.dat”-file.

At this point, there are three different scenarios that can apply to your airport:

1. You can import a basic airport from the repo
2. You can import an empty airport file with the airport coordinates from the repo. The folders of these airports are marked with “[-]”
3. You have to create an entirely new airport

If the last scenario applies, you won't get any results in the “Airports” folder. However, this is very rare and only applies to a small number of airports (mainly tiny GA airports and brand-new airports). To start your airport, go to “Airport”- “Create Airport” (Ctrl+Shift+i). A new, empty airport will be added, named “unnamed entity”. You will have to add all information needed (including the identifier and the airport name) manually later.

If one of the first scenarios applies, you will be able to import an airport file. A popup in the style of World Editor will open where the airport name is shown. Select the name and hit "Import". The airport will either contain some generic taxiways (Scenario 1) or only a windsock called "Airfield Center" (Scenario 2). Usually, all airports are done from scratch when they have not been edited by another editor already, so you may want to delete all features apart from the runways (they contain some information we can use already) by selecting them or the groups they are in and hitting the "Del" key.

DOWNLOAD SATELLITE IMAGES

With your airport file imported in WED, you can now download the satellite images you will use to create the airport with. As a user of Windows, you can utilize both, SASPlanet and WED-o-maker. SASPlanet is the recommended program however. As a Mac user, you can only use WED-o-maker on your computer.

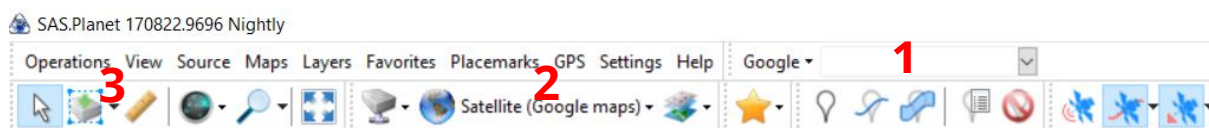
HOW CAN I USE SASPLANET IMAGERY AS A MAC USER?

Users of Apple computers are not lost with WED-o-maker as their only image source. Since SASPlanet generates normal image files and coordinate files, Windows users can send you images generated with SASPlanet via Slack! Just request your airport in #sas and inform the other editors about the picture quality you want and the approx. file size your WED can handle (see the SASPlanet chapter below for more information on the maximum image size)

SASPLANET

The download of satellite images via SASPlanet might be a bit more difficult than importing it with WED-o-Maker. While WED-o-Maker loads Bing images directly into WED, SASPlanet allows you to choose the area you want to load freely, offers various image sources but has to be imported manually into World Editor.

After opening SASPlanet, navigate to the airport you need images as you would do in a normal map program like Google Maps or Google Earth. Either enter the airport name in the search bar or navigate to it manually using your mouse. If you are using the search bar at the top of the SAS window, you can choose which search engine you want to use for finding your airport in the dropdown next to the search bar. Once you have found your airport, you need to check which image source provides the most recent images with the best image quality. You can choose from several sources at the dropdown menu in the toolbar. Google Earth, Bing and Yandex usually offer images for most of the places around the world. Other images may be available at certain places.

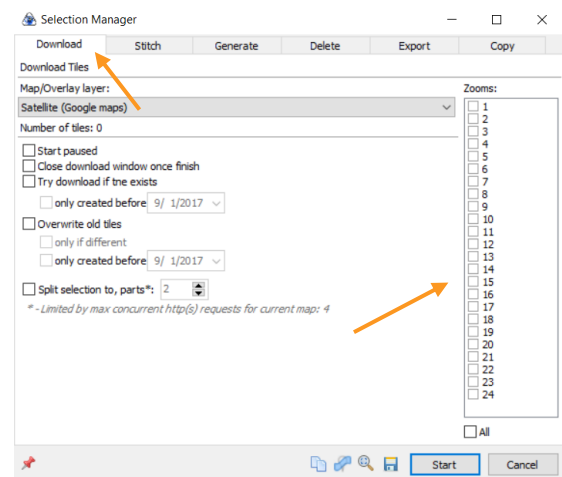


Picture 8: (1) Search Bar, (2) Source Selection, (3) Selection Tool

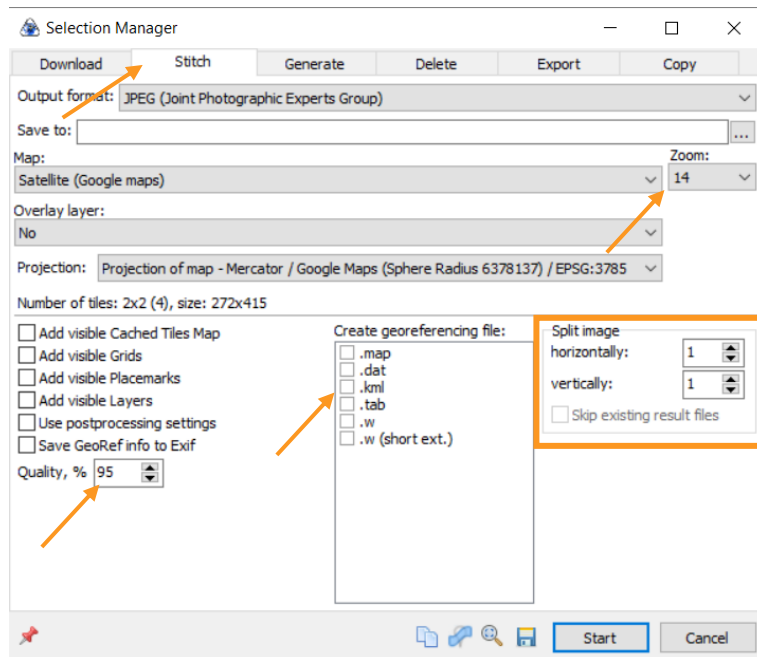
Once you have found an appropriate image source, choose the selection tool and select the airport. You can either select the airport in a rectangular selection or in a polygonal selection. To reduce the image size, you should rather use the polygonal selection, where you can create a free shape around the airport by clicking around the airport. Change the selection type by clicking on the little arrow next to the selection tool.

When the selection is completed, click the green check mark in the appearing popup window and a new popup will appear after a few seconds.

The popup is called “Selection Manager”. The first step to take in this popup is starting the download of the images. Therefore, go to the “Download” tab (the tab should usually be the open tab when the popup appears) and select the zoom level you want to download in the list on the right. You should at least download images at zoom level 19, rather use 20 or 21 for very high image quality. Please note that a high image quality results in a high file size which might impact the speed and performance of World Editor during editing. To start the download, hit “Start” at the bottom of the window. A new



Picture 9: Selection Manager, Download page



Picture 10: Selection Manager, Stitch page

popup that shows you the download progress will appear. The completed download will be announced by the text “The Task is completed!”. Return to the Selection Manager by clicking on the blue rectangle at the lower left of the progress window. This time, you want to use the “Stitch” tab

to export the downloaded images as an image file you can use in WED. The “Stitch” page offers several options to control image quality and size. At first, select the image format you want to use, common formats are PNG or JPEG. In the field below, select the folder you want to save the images to (It’s helpful to create an image folder in your Airport Editing folder for that). In the “Zoom” dropdown, select the zoom level you downloaded before. You can furthermore change the image quality in the lower left, 95% usually works fine however. Since

you have to position the image at the correct location you must select a georeferencing file, most of the editors use kml files. The kml file will later show coordinates for the corners of the image.

The “Stitch” page is furthermore equipped with a menu to split the image in the lower right. This might be necessary since World Editor can only handle a limited file size for a single image. This limit may differ depending on the computer. Depending on the quality of your image and the airport size the file size can go up to 100 MB. If the image appears blank in World Editor, the file is too large and has to be split since WED will be able to handle the overall size of the image when it is split into smaller portions. The performance of WED might go down in both cases. To split the file, select how many pics should be cut in the “Split image” menu (Example: If you choose 3 in the “horizontally” window and 2 in the “vertically” window, SAS will produce 3x2=6 single images.) To export the image(s), click “Start” once all settings are correct. You can close SAS after exporting is completed.

The only thing left to do now is import the images into World Editor. Open the scenery package of your airport and go to "File"- "Import Orthophoto..." and select the image(s) you generated for the airport. Depending on your system it may take a while until the picture shows up. If you import several images, all images will be placed on top of each other. To position them correctly, you now need the generated kml files. Every image has a kml file with the same name that contains the coordinates for the image corners. To enter the coordinates, copy one of them from the kml file. Select one of the nodes of the image by clicking on it and copy the coordinate in the right section in the lower right window of World Editor.

Of course, you have to enter the right coordinate at the right position and you will notice, that the kml file only contains four coordinates (north, east, south west) but each corner needs two coordinates. So how to enter the coordinates correctly? See the graphic below to learn how to do it:



Picture 11: Which coordinate from the kml goes in which section

HOW DO I IMPORT MANY ORTHOPHOTOS QUICKLY?

You might be shocked by the number of pictures to import and position. However, it's way easier than it seems since you can use the following tips:

- You can use the same coordinates for an entire row of pics (e.g. the north coordinates of the upper row are the same for all pics in the row)
- Once you have the first pics positioned you can snap the adjacent pics to them
 - ➔ Start with the corners and snap, the last pic won't need any manually entered coordinate anymore

QUICK TIP

WED-O-MAKER

In contrast to SASPlanet, WED-o-Maker can be very easy to use. Once the airport is imported in the scenery package/the new airport has been created at the correct location, save the changes, close the scenery pack and close World Editor. After that, start WED-o-Maker and wait for it to launch. You can then select the scenery pack you imported the airport into via the dropdown menu in the toolbar. WED-o-Maker will go to the airport on the map automatically. Afterwards, select an image quality level in the dropdown next to it. The entire map visible in the browser window will be imported into WED by the program once you hit "Make visible in WED", so the only way to influence the area you will see in WED later is zooming in or out and moving the map with the cursor. After starting the loading process, the number of downloaded tiles (=parts of the picture) will be displayed in the tool bar. Once the process is finished, you can open the scenery package in World

Editor again. The loading process might take longer and the performance of WED might be impacted. Once the launch is completed, you will see the satellite image imported in World Editor and you can start working on your airport.

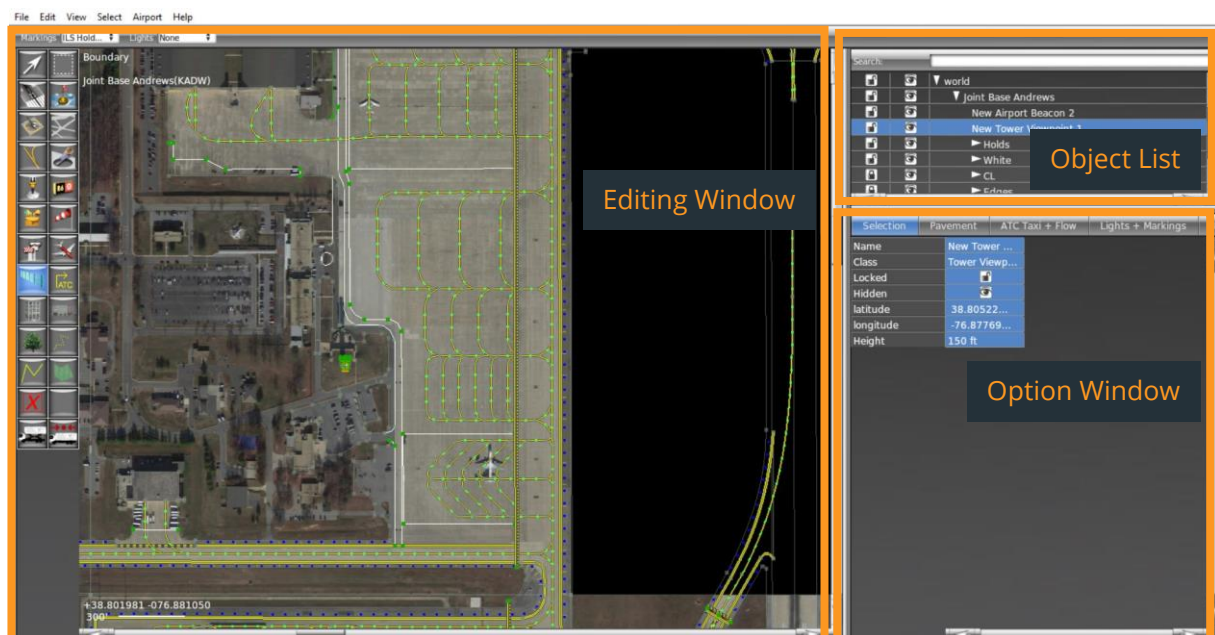
AIRPORT EDITING

With all downloads and installations completed, you are now ready for editing your first airport. Editing will happen in World Editor. You will use the software to draw taxiways, taxi lines and outlines as well as for editing airport numbers (elevation, runway lengths etc.) and spawn information.

BASIC WED TOOLS

To create airports of a high quality it's important to know the tool you use for that. World Editor offers various tools and options for all elements.

The editing window of World editor comes split into three columns. For Infinite Flight airports, you won't need the left column (Libraries) so you can just minimize it by dragging the edge of the column to the left. You then have a large editing column and a smaller column with an object list including a search tool (top) and an option window (bottom). The width of the right column can be varied by dragging the edge around. Your basic WED setting will then look like this:



Picture 12: Basic World Editor Setting with left (Library) column removed

Obviously, the different sections have different functions:

- Editing Window

The editing window is the area where you draw and edit your airport. After selecting a tool, you can either move the airport, separate nodes, draw lines and taxiways. You can also select objects to edit them using the option window. Move around in the scenery by clicking with the right key of the mouse while dragging with the mouse and zoom in and out with the wheel of your mouse.

- Object List

The object list shows all objects used in your airport. They are automatically named and don't need any edits in the first place. Only spawns have to be named with suitable names or according to charts. You can use the search bar to find a certain object. Furthermore, grouping of objects is possible. The position in the list will impact how the airport is rendered in IF. If one line is above another line in the list, it will be rendered on top of the other one in both, WED and IF. Selecting an object in the list will also show the details in the option window. To get a clean list it's highly recommended to create groups (e.g. one for taxiways, one for lines and one for ATC frequencies.) To group objects, select the desired items by clicking on them while holding shift and choose "Group" in the "Edit" menu or hit Ctrl+G. To avoid unintended object movements, the object list (and the object itself in the option window) offer an option to lock elements or entire groups. Just select the object/ group in the object list and click on the lock symbol. You can also make certain objects invisible by clicking on the eye symbol. ATTENTION: objects made invisible will not be exported when the airport is exported. Make all objects visible again before sending it for review!

HOW DO I USE THE GROUPING FUNCTION BEST?

Ideally, you group all objects of a kind, so one group for all lines, one for all taxiways and so on. Additionally, you can create further groups for different types of lines. By creating separate groups for holds, road lines/ outlines, taxiway edge lines and centerlines, you can easily edit the rendering of the airport e.g. by moving holds on top of centerlines only by reordering the groups in the object list.

QUICK TIP

- Option Window

In the option window, you can change certain settings for the selected object. These can be runway markings, lightning and line types as well as spawn attributes. Find more on these topics in later chapters. The option window also allows to switch between different views where WED only shows certain objects (only pavement, only lines, also show plane shapes for the spawns etc.)

On the left side of the WED window you can see the tools available. You won't need all of them for airports created for Infinite Flight. Each tool offers different options in the top line of the editing window. The taxiway and line tools will show options for lines and lights, the runway tools allow quick settings for new runways and the ramp start tool will allow you to set different spawn attributes before positioning the spawns. These settings can be altered in the option window later in the editing process. There are only two tools that can be used universally: The Vertex tool and the Marquee tool. While the other tools are used to create certain object, these two tools allow to edit and move them afterwards. The vertex tool allows you to select and move single lines or line parts, nodes, or other objects. The marquee tool can be used to select several entire objects up to the entire airport and move them completely. The selected elements can be moved and scaled by dragging. When holding the Alt key, arrows will appear at the edges and you can rotate selected objects. The same rule applies to runways and helipads.

Below, you can find an overview of all tools available, the shortcuts for the tools are displayed in brackets:

Vertex Tool (V)			Marquee Tool (M)
Runway Tool (R)			Sealane Tool (S)
Helipad Tool (H)			Taxiway Tool (T)
Taxilines Tool (L)			Hole Tool (K)
Light Fixture (F)			Signs Tool (G)
Beacon Tool (E)			Windsock Tool (W)
Tower Viewpoint Tool (A)			Ramp Start Tool (O)
Boundary Tool (B)			Taxiroutes Tool (not used in IF)
Object Tool (not used in IF)			Facades Tool (not used in IF)
Forests Tool (not used in IF)			Strings Tool (not used in IF)
Lines Tool (not used in IF)			Polygon Tool (not used in IF)
Exclusions Tool (not used in IF)			Truck Destination Tool (not used in IF)
Truck Parking Tool (not used in IF)			

Apart from these tools, the different columns at the very top (File, Edit, View, etc.) offer various tools to change things.

- File

The File column offers options for the import and export of the airport files, to save changes and to revert the airport to the last saved changes. Orthophotos are also imported through this menu.

- Edit

Use the Edit menu to undo and redo actions, to reorder objects and to duplicate them. The grouping option is also selectable here.

- View

This column is for everything regarding rendering directly in World Editor. You can change the transparency level of the taxiways, make the low definition world map invisible, switch the rendering of nodes and lines on and off or change from meters to feet and vice versa.

- Select

This menu won't be used to much. Use it if you want to select several objects at once, also depending on their ordering.

- Airport

In the Airport menu, you can create new airports, add ATC frequencies and meta data.

- Help

Help allows access to the WED guide by Laminar Research and some software information.

AIRPORT SETTINGS AND EQUIPMENT

The first thing to edit at your airport are some facts and numbers. Every airport needs an identifier entered, the airport elevation assigned and the correct ATC frequencies added. Apart from that, all airports for Infinite Flight need a tower viewpoint and a boundary. If the airport has one, a rotating beacon can be added as well.

AIRPORT NAME

The naming of the airport should follow the charts. To make the search for the airport in the simulator easier, you may also add the name of the city the airport services in addition to the official name. Note that the first two words of the airport name will be read by Infinite Flight when calling ATC frequencies (e.g. when the airport name is "Paris Charles De Gaulle", the ATC voice will read "Paris Charles [Frequency Name]"). To change the name of the airport, double click it in the object list or in the option window when the entire airport is selected.

AIRPORT IDENTIFIER

The airport identifier can be altered in the same way. Select the airport and edit the entry "ICAO code" in the option window. In case your airport only has a FAA identifier you can enter this one as well.

AIRPORT ELEVATION

The airport elevation is a very crucial piece of data for IF. If you enter an elevation that is too low, the airport may end up in a giant hole, if it's too high you will generate an artificial cliff around the airport. The best sources are usually official charts, if you can't find any, there are several web pages that offer information on airports (see chapter "useful links"). Always make sure to have the correct units selected in the "View" menu – there's a significant difference between feet and meters. The airport elevation can be changed in the option window when the airport is selected in the object list.

ATC FREQUENCIES

When it comes to ATC frequencies, there are several scenarios of what you can do. When the airport is selected, you can find the line "Has ATC" in the option window next to other options. If your airport has ATC services, you have to set a checkmark here. If a "X" is selected, click on it to change it to the check mark. The airport will be displayed with a blue airport icon in IF and controllers will be able to operate at the airport. If your airport doesn't have ATC services or only an Unicom frequency or something equal, set the ATC status to "X". The airport will then get a violet icon. Airports usually come with a set of ATC frequencies in the .dat file. If you didn't delete them when starting your work, you still have to check the frequencies for the correct numbers and frequency types. Select a frequency in the object list and have a look at the frequency information in the option window. Frequencies can be found in charts and on the internet.

Note that you can choose different frequency types:

- AWOS – used for ATIS and AWOS frequencies
- CTAF – used for Unicom and CTAF frequencies
- Clearance Delivery – not yet supported in IF, can be added nevertheless
- Ground Controlled – used for ground and apron frequencies
- Tower
- Approach
- Departure

For Infinite Flight, you only need to add one frequency per type. Also, Center frequencies don't have to be added. Furthermore, you can name the frequencies like they are called in real life instead of the generic "TWR" or "GND" names. The names may not have an impact on IF now, but this might change in the future. In case you have none or less frequencies than needed for your airport, you can easily create a new frequency. Select the airport in the object list and select "Add Frequency" in the "Airport" menu or hit Ctrl+F with the airport selected. The new frequency will be added at the bottom of the object list as "unnamed entity". Rename it and enter the required data.



CHARTS ARE A GREAT SOURCE! WHERE DO I GET THEM?

For many airports, airport charts can be found by searching with the ICAO on Google. Apart from that, some countries offer the official charts for free in their AIPs. The most convenient way to get a chart as an editor is far easier though! Ask Tom (@kilt46) for it – he can get you charts for almost all airports in the world.

QUICK TIP

Apart from these data sets, our airports also need some "hardware" – at least a tower viewpoint and a boundary. In addition, the rotating beacon can be added to airports that are equipped with one.

TOWER VIEWPOINT

To add a tower viewpoint, select the tower viewpoint tool. At the upper edge of the editing window, you can select the tower height (AGL not MSL; in the unit selected in "View") before placing the tower viewpoint on the tower visible in the satellite images by clicking with the mouse. If you have a hard time finding the tower with the images in WED, an airport chart can help. In case you need to change the altitude later, you can do this in the option window upon selecting the tower viewpoint in the object list or in the editing window.

AIRPORT BOUNDARY

The airport boundary has to be added to define the area that should be rendered at the airport elevation. For that reason, you have to redraw the airport fence with the boundary tool. You are required to follow the boundary as precisely as possible. This includes curving the boundary where the real-world airport boundary is curved. More on curving can be found in the "Nodes" chapter. Often, the boundary of the airport may also be defined by terminal buildings, hangars or other buildings. Include them in the airport and draw the boundary around them. You may later snap the boundary to these buildings. However, you have to make sure that NO OBJECT included in the airport is located outside of the boundary.

AIRPORT BEACON

A respectable number of airports in the world are equipped with an airport beacon. This doesn't mean a navigation aid but a light mounted on a tower or a pole identifying controlled airports at night. To see if your airport has an airport beacon, you can again use an airport chart or you utilize the internet. <http://www.worldaerodata.com> usually lists an airport beacon if an airport is equipped with one. It may be hard to find the location of the beacon very often, but a chart also helps here since the position of the beacon is often marked there. If you can't find the real position just place the beacon on top of the tower.

The airport beacon is available for several types of airports. You must always select the correct beacon type for your airport, either before placing it by clicking on the location in the editing window with the beacon tool selected or later. To select the beacon type before placing it, choose the type at the upper edge of the editing window when the beacon tool is activated, if you want to edit it afterwards, select it using the vertex tool or in the object list and do so in the option window. The following beacon types are available:

- Airport
- Seaport
- Heliport
- Military Airport



Picture 13: Airport Beacon

If your airport is a military airport with civil use, rather select "Airport" instead of "Military Airport".

RUNWAYS AND HELIPADS, PAPIS AND VASIS

Obviously, all airports require a runway or a helipad to get planes off the ground. Those can be runway and sea-lanes as well as helipads. Helipads and sea-lanes are not yet rendered in IF, runways are of course.

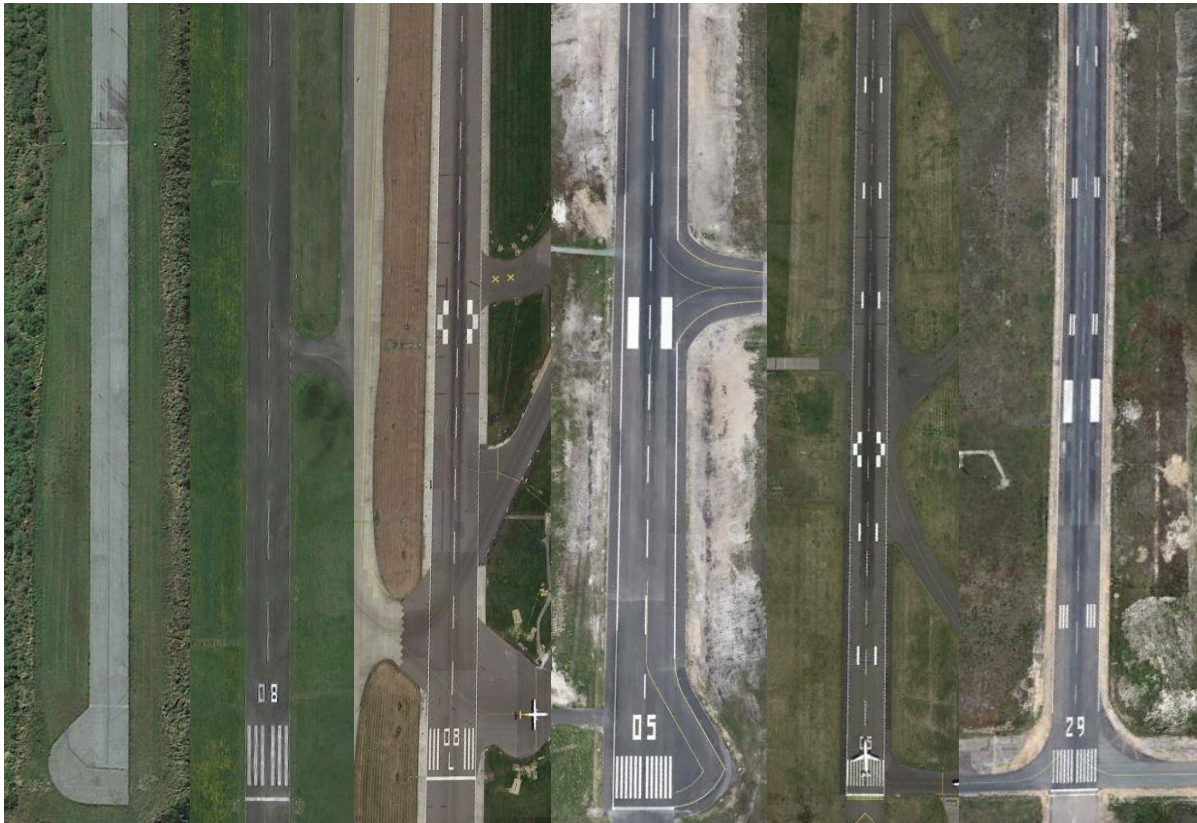
RUNWAYS

To add a runway, start the runway tool. Before drawing the runway, you can already select the runway material, the shoulder material (if there is one) and several light options. The runway shoulder will be generated with an automatic width that can't be altered. If the shoulder doesn't fit the shoulder in real life, draw it manually. All settings can be edited at the finished runway in the options window. There you can also set different markings and lights for each runway end.

The runway will be created between two points you select. It's crucial, that you draw the runway in the right direction, otherwise you will get in some trouble when you want to export the airport. To create a runway correctly, you have to set the starting point at the middle of the runway threshold of the runway with the lower number (e.g. at the 08 end of a RWY 08/26) or, as a general rule, draw from the south and west towards the north and east. Once you click on the spot on the runway, you will see a small green cross displayed. Move to the other runway end and click on the other threshold and the runway will be generated with numbers. You can change them manually as well.

Once the runway is generated, you can still alter the size. The length can be adjusted by pulling on the green boxes at the runway ends. The width can only be adjusted by changing the number in the width line in the option window. In that window, you can also change lighting, markings and the shoulders. Always make sure to add the correct attributes. The runway lighting is often listed in airport charts (e.g. Jeppesen) or has to be guessed by the shape of the approach lights. The runway markings can be easily checked visually using the orthophotos.

The following runway marking types exist:



Picture 14: Runway Marking Types (Left to Right): None, Visual, Non-Precision (UK), Non-Precision (US), Precision (UK), Precision (US)

The different markings are:

- None No touch down zone markings, no centerline and threshold markings
- Visual No touch down zone markings, centerline and threshold markings present
- Non-Precision Single touch down zone markings, centerline and threshold markings
 - UK Touch down marking chequered
 - US Touch down marking solid
- Precision Multiple touch down zone markings, centerline and threshold markings
 - UK Main touch down marking chequered
 - US Main touch down marking solid

In case you have to find out the approach lights from the orthophoto, here's a visualization:



Apart from the normal runways, you might also see runways with stopways and/or displaced thresholds. **Don't draw the arrows and markings manually**, the special runway parts can be rendered automatically. When the runway is selected you will see two arrows at the threshold, one facing towards the runway and one facing away. To draw a displaced threshold, align your runway end with the end of the displaced threshold (either the end of the paved runway or where it touches the stopway), then use the arrow facing towards the runway and align the white line with the displaced threshold line (beginning of the runway itself). The displaced threshold is part of the calculated runway length in WED. To add a stopway, drag the arrow facing away from the runway until the yellow rectangle reaches the end of the pavement.

See how a runway equipped with stopway and displaced threshold will look compared to the real-world example:



Picture 15: Runway in WED and the real-world runway in comparison

Generating sea lanes works exactly like the creation of runways. The options are limited nevertheless.

WHAT ARE STOPWAYS AND DISPLACED THRESHOLDS?

Displaced Threshold: An area of the runway fit for aircraft movements during takeoff roll and landing, not suitable to touch down on it. Displaced thresholds are marked with a centerline of white arrows

Stopway (or blast pad): Area that may not be used for any regular aircraft movements. Usually made from a weaker material. Often marked with large yellow chevrons

QUICK TIP

HELIPADS

Helipads are not rendered in IF now. Nevertheless, it is not permissible to draw helipad markings manually. When you see a helipad in the airport, add it using the helipad tool. You can add helipad lights and select the material before and after creating it. If it's a helipad that's only drawn on the apron with markings, add it as "transparent". To generate a helipad, click in the middle of the helipad. To set the orientation, hold the key on your mouse and drag away. A movable arrow will

appear and can be moved so the arrow is rectangular to the taxiway edge. Release the mouse and the helipad will appear. Renaming of the helipad is only possible when you keep the format H[number] (H01, H02, H03 etc.). By changing the numbers in the option window you can adjust the helipad size as well as you can use the mouse by dragging the edges around with the green boxes with your mouse.

PAPI AND VASI LIGHTS

Apart from instrument equipment like ILS, the majority of airports are equipped with visual guidance hardware, namely VASI (Visual approach slope indicator) and PAPI (Precision approach path indicator) lights. You can add these using the light fixture tool. You can choose between

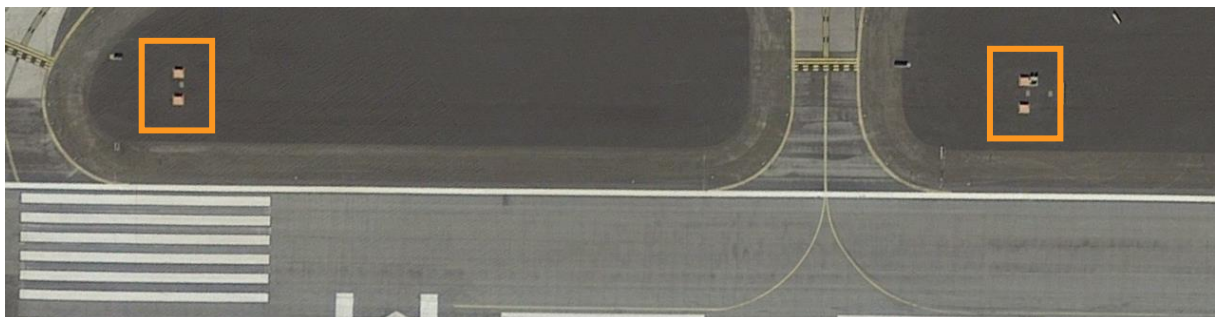
- PAPI (Left Side)
- PAPI (Right Side)
- PAPI (20 Degrees)
- VASI
- VASI (Tri-Color)
- Wig-Wags (These don't have to be added to IF, they mark runway hold lines flashing yellow)

The left and right side attached to the taxiway refer to the position of the lights relative to the runway from the perspective of the plane approaching. Make sure to orientate the lights correctly, meaning that the (tiny) arrow and the wider side of the light is facing the plane that would approach the runway. Also make sure to enter the correct approach angle. Usually, 3° are in use, some airports have different angles though. Some airport charts show the angle of the PAPI lights. 20 degree PAPI lights are only used at aerospace facilities for their approaches. These PAPI lights are not located next to the runway but in front of it. PAPI lights are usually built in groups of four or two single lights somewhere around the touchdown zone. Ideally, position the light in the middle of the group in WED. How a PAPI light set looks like on satellite imagery can be seen on the right.



Picture 16: PAPI (left)

In contrast to PAPI lights, VASI lights are not ordered next to each other but in a line parallel to the runway. There are "normal" VASI lights and VASI (Tri-Color) lights. Which kind of VASI light the airport you are doing has, can be found in charts and/or online.

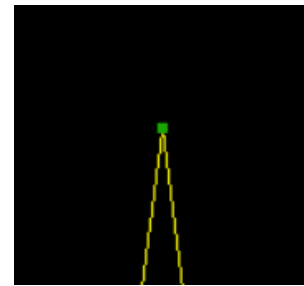


Picture 17: VASI lights

NODES

For the next chapters, this word will be your best friend: node. So, what is a node?

Nodes are used for taxiways, lines and boundaries in World Editor when editing for Infinite Flight. When creating those, every click will create a node that will appear as a green dot once the object is created. A node is basically a fixed point of a so-called Bezier curve that can be straight as well as curved. The node is not only a fixed point though, but it is made a true control center for the lines that use it as an “anchor” through a lot of very helpful key combinations. You can curve the adjacent lines and you can control line features such as line types and lights. All in all, the node enables you to create every shape that can be found in any airport of the world. Since nodes define fix coordinates that will be saved in your airport file, one of the most important aim we have is reducing the number of nodes. This is achieved by adding edge markings directly to the taxiway edge itself, by reducing the number of separate taxiway parts and using the hole cutting tool and, most important: curving instead of recreating curves with lots of nodes.

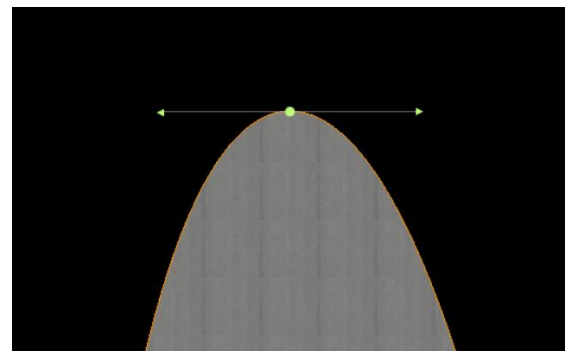


Picture 18: A node (not selected)

Since we want a small airport file, you are asked to use as little nodes as possible and therefore you should create objects with as little points as possible initially. You can easily add additional nodes where they are needed by selecting the object and clicking on that point of the taxi line/taxiway edge where you want a new node to be while holding **Alt**.

Upon creating a taxiway or a line in WED, you can already curve the lines you create by selecting fix points/nodes. To do so, you hold the left mouse key when creating a node and move your mouse. This way of curving tends to be quite inaccurate though since you will most likely curve the next section of the line in a way you don't want. Therefore, rather curve the lines once the taxiway/line is completed. You will have to use key combinations for curving.

Before you can curve something, you must select the object. Then, click on a node and keep the left mouse key clicked while holding **Alt**. Drag the mouse away while keeping the keys pressed. The node will then turn to a green circle and arrows will appear. Initially, they will be synchronized, so the line parts on both sides of the node will be curved. Due to the different look of a node with arrows, it's easier to detect nodes that have curving arrows added accidentally.












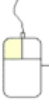





















Picture 19: Node with curving arrows

Since very often, curves are only needed on one side of a node or the curve on one side goes into the opposite direction of the other side. In these cases, you can alter one arrow only or remove it. To curve one arrow independent from the second one, click on the arrow and keep the mouse clicked while holding **Alt** again. To remove one arrow entirely, click on the arrow while holding **Alt+Shift**. In case you remove one arrow accidentally or you want to synchronize the arrow again, click on the still existing arrow while holding **Shift**. In case you want to synchronize the arrows, click on the arrow with the length and orientation you want to set for both arrows. In case you have the arrow synchronized and you click one arrow while holding **Shift**, the arrows will be removed completely.

With these key combinations, you will be able to create almost every curve you will find in airports without creating a new node in addition to the nodes at the two ends of the line part to be curved.

Laminar Research has done a nice list with all key combination:

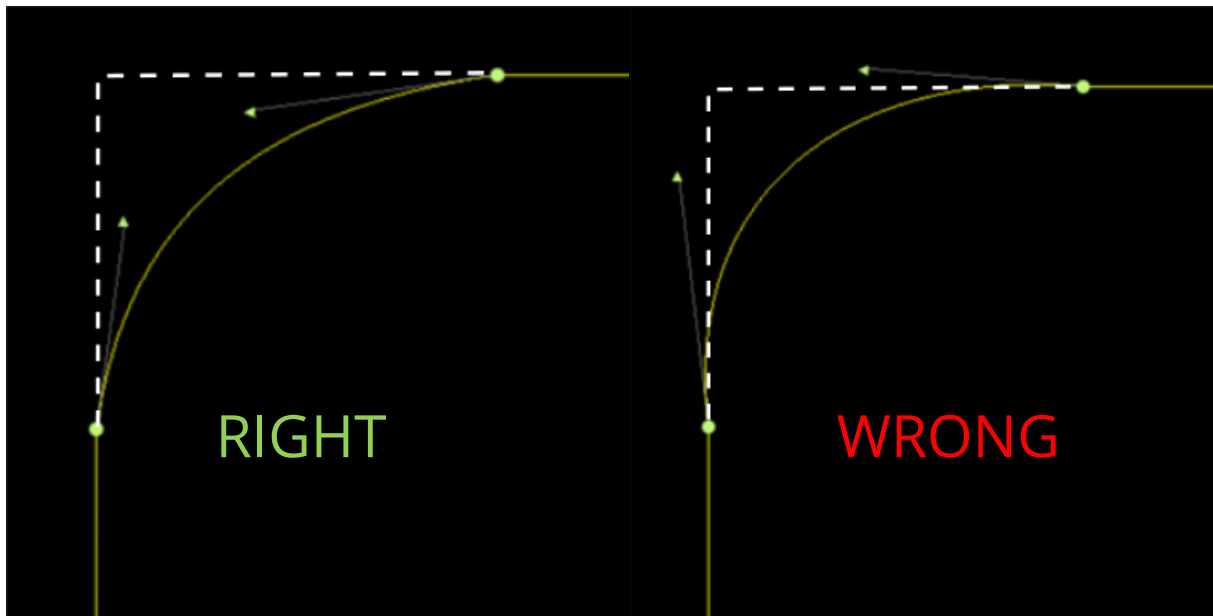
	TO CONVERT FROM	TO	ACTION
1			 + 
2			 + 
3			 + 
4	 		 +  + 
5			 + 
6			COMBINE STEPS 1 & 4
7			COMBINE STEPS 1 & 3
8			COMBINE STEPS 5 & 2
 ENTITY TO OPERATE ON  SINGLE CLICK  CLICK-DRAG			

Picture 20: Key combinations and their effect on WED nodes

To create high quality airports and to avoid issues in later stages of airport editing, you are asked to remove every arrow that is not needed for a curve. If you have a straight taxiway leading to a curve, create the curve and remove the arrow that is not needed for the curve so it doesn't impact the form of the straight part of the taxiway. This is crucial where two taxiways touch (see next chapter).

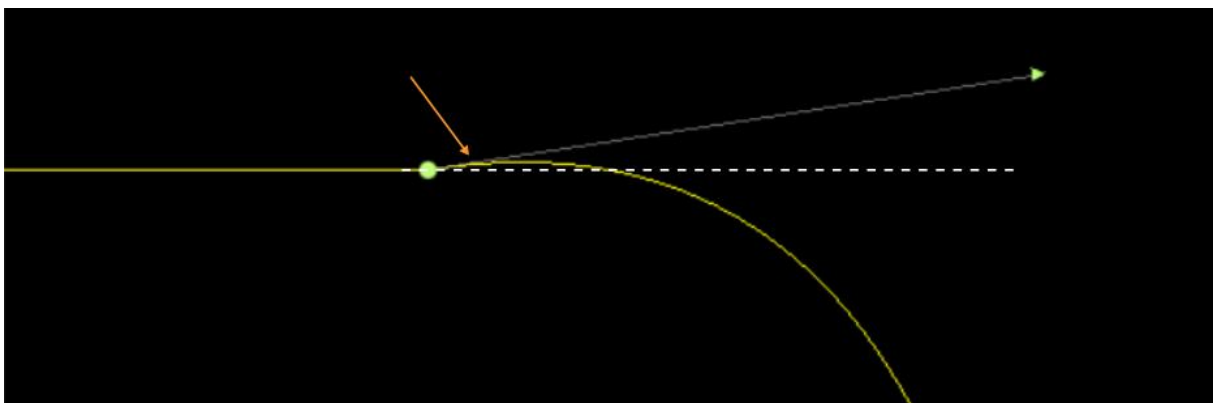
Another important thing is to avoid overcurving. In most of the cases, overcurving will only cause curves that don't look realistic. However, there might be cases where overcurving can cause taxiways to become invisible. You may ask yourself now "What is overcurving?". It basically means that your curve arrow exceeds a certain length. To avoid it, your arrows have to stay in a certain area. You want the ends of the arrows to remain in the area between the curve and the (imaginary)

extension of the straight line adjacent to the curve. Yes, this sounds very complicated and you probably still don't know where to put your arrow, so here's a visual explanation.



Picture 21: Correct and incorrect curving

If you don't follow this curving guideline, you will cause curves which will look like in the following picture. The curve will not curve in one direction but will first follow a path in the opposite direction:



Picture 22: Badly curved line

Nodes are not only used for curving but also for the most important quality factor in Infinite Flight Airport Editing: snapping.

SNAPPING

When drawing taxiways and taxi lines you will come across points where two or more lines or taxiways meet each other. Obviously, we don't want gaps between different taxiway materials or between taxiways and buildings. The same applies for taxi lines. That's why snapping is mandatory at every airport. Whenever two lines merge and wherever two taxiways meet, they need to be snapped. Of course, also lines that touch taxiway edges must be snapped.

To allow snapping in World Editor, make sure the option "Snap to vertices" is selected (✓) in the upper left corner of the editing window when the Vertex tool is activated. This will allow you to snap nodes together.

To snap nodes, simply drag one node towards the node of the other line it has to be snapped to until it “jumps” onto the other node. Alternatively, you can snap nodes that are very close to each other by double clicking on one of the nodes.

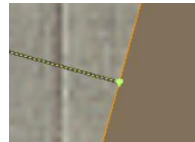
When you are snapping taxiways together which are curved, the arrows have to be snapped as well! Snapping arrows works exactly like normal snapping. Where straight taxiway edges are touching, make sure to remove superfluous arrows so you don’t need to snap unnecessarily.

Often, there are locations where two taxiways and a line meet at one point. In that case you must create a node to snap the line to at *both* taxiways and snap all three nodes together. This often happens where taxiway centerlines enter hangars or where holds need to be snapped to taxiways with a separate shoulder.

While snapping might be important at lots of places, there are also constellations where snapping is not necessary.

Snapping is mandatory at the following locations:

- Two lines merge
- Line touches a taxiway edge
- Spawn points on taxi lines (details in the “Spawns” chapter)
- Line touches two bordering taxiways
- Two taxiways touch each other



Snapping is not required here:

- Two lines cross
- Line crosses taxiway borders
- Holds cross the taxiway but don’t reach the taxiway edge (you may snap these lines where they cross the centerline)



TAXIWAYS AND BUILDINGS

In IF, airport buildings are not added in 3D but as taxiways. Therefore, the taxiway tool is not only a taxiway tool for us but also a building tool. The taxiway tool offers several different taxiway tools:

- Asphalt
- Concrete
- Grass
- Dirt
- Gravel
- Dry Lakebed
- Snow
- (Transparent)

As of now, only asphalt and concrete taxiways are rendered in Infinite Flight. The other materials are currently rendered as concrete.

When drawing taxiways, always use the real-life taxiway material. Note that it can happen quite often that asphalt is colored very bright, while dirty concrete may be very dirty from rubber. Don't replicate the colors but the material. Concrete can often be identified by rectangular shapes in the taxiway since concrete taxiways are usually cut to remove water and reduce tensions in the material. Asphalt usually doesn't have these. Charts can be helpful here as well as historic satellite images e.g. by Google Earth.

To draw a taxiway, select the taxiway tool and a taxiway material. Create a path around the taxiway of one material until you reach your starting point and the taxiway is generated. You may simplify certain areas, e.g. when small asphalt patches are located inside of a concrete area. Use your best judgement to decide how much detail you add with different taxiway colors. However, there's a rule you have to follow: Buildings have to be made from the opposite material (either concrete or asphalt) of the taxiway it touches. Therefore, you might have to simplify areas near terminal buildings to keep the terminal distinguishable. Otherwise, try to be as precise and exact as possible for the taxiways. When adding buildings, don't add movable jet bridges as part of the building. You also must not add land-side paved areas such as public roads or parking lots.

WHAT DO I NEED TO PAY ATTENTION TO WHEN DRAWING TAXIWAYS AND RUNWAYS?

Runways don't have nodes and cannot be snapped as a result. Instead, you have to overlap taxiways with the runway to avoid gaps. You don't have to follow the runway edge closely, but you can overlap it as much as you want. Just make sure to remove edge lines of the taxiway when you are overlapping a lot so the markings aren't drawn on the taxiway too much.

When the runway shoulder in real life isn't matched by the automatic shoulder generated by World Editor, add the shoulder manually. You don't need to spare the runway or cut a hole for it. Simply draw a rectangle around the runway, it can also be included in another taxiway.

When drawing a grass runway, it will be rendered on top of any taxiway. It is recommended to remove any taxiway lines where the grass runway crosses.

QUICK TIP

To keep the quality of the airport up while reducing the number of nodes, try to use as little separate taxiways as possible. To achieve this, try to include as many areas of the same material as possible and use the hole cutting tool afterwards. To cut a hole you have to make sure that the taxiway you want to add a hole to is selected before you activate the hole cutting tool. To cut a hole, just draw it by clicking around the edges of the holes or where different pavement patches are to be inserted.

Before as well as after creating a taxiway, you can add taxiway edge lines and lights to the edges of the taxiway if the edge lines are drawn directly at the edge of the taxiway (Find all line types in the next chapter). If the taxiway has a taxiway shoulder of the same material as the main taxiway, you should add the edge lines/lights using the line tool. You can add/remove the edge lines in different ways. Firstly, you can select lines and lights for the entire taxiway by selecting the line and light types in the editing window prior to drawing the taxiway. Furthermore, you can select the taxiway after its creation and edit the line type for the entire taxiways. In these cases, you have to make sure that you remove the lines and lights wherever the taxiway touches a runway, a terminal building or another taxiway. Also, you have to be precise and remove taxiway edge lines where there are none. To edit/add lines and lights at certain areas of a taxiway, select one of the nodes next to the area you want to edit. You can also select all nodes of a taxiway by pressing Ctrl+Shift+Down. Changes to the lines at the node in the option window will affect the line up to the next node. If the wrong edge section is edited, you have to edit the line attributes at the node on the other end of the section you want to edit. You may need to add additional nodes to create a precise line layout. When using holes you can also choose a separate line type for the entire edge of the hole without changing the line type for the entire taxiway by selecting the hole outline using the vertex tool.

Don't forget to snap additional nodes to adjacent taxiway elements and be precise with lines!

LINES AND LIGHTS

Lines can also be added manually. Use this for taxiway edge markings that are not directly at the outline of the taxiway. Also, the lines are used to add taxiway centerlines, roads and gate outlines.

You can choose line and light types before and after creating a line with the line tool. Taxi lights are not yet part of IF but we create them to prepare airports for an addition of these lights. There are no strict rules for taxiway lights because of that. Basically, use common sense. You are not required to add lights and are not required to leave them entirely either. If you know exactly which lights an airport has, it's of course very appreciated if you add them during editing. When assigning taxiway edge lights, you must make sure that the lights are added on the outer side of the taxiway.

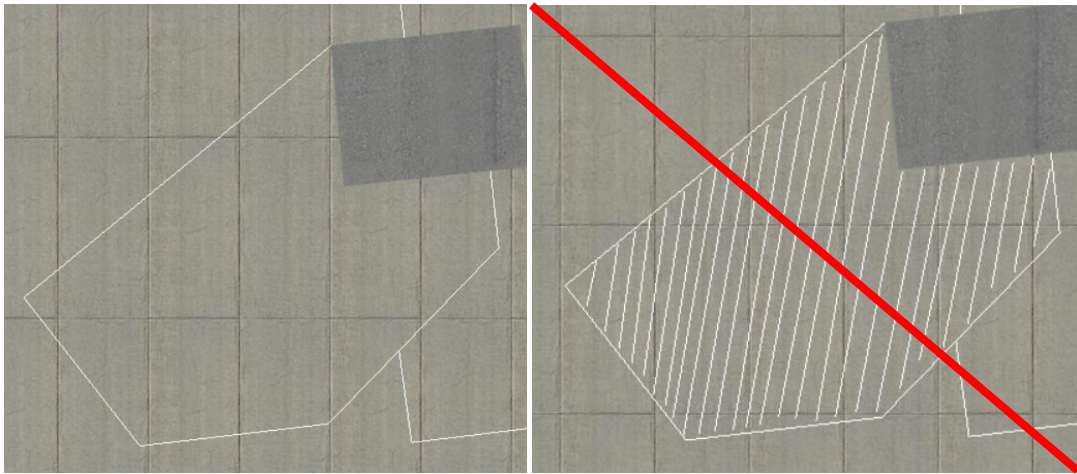
A list of taxiway lines and lights can be found below.

As a general rule, for lines, you are asked to draw everything you see. You even *have to* draw all taxiway edge lines, centerlines and hold lines. Roads and gate outlines are not mandatory as well as arrows (e.g. the arrows indicating where to turn into the parking position), but it's highly recommended to add them. It may take more time but it will increase the overall realism of your airport. However, there are things you must not add.

Don't add:








- Letters and numbers
- Outlines to terminals
- Manually drawn runway numbers
- Arrows on displaced thresholds and stopways

- Hashed areas, i.e. don't fill areas with lines (e.g. jetway movement areas) but only add the outlines:





Picture 23: Correct way to draw hashed areas (left) and what not to add

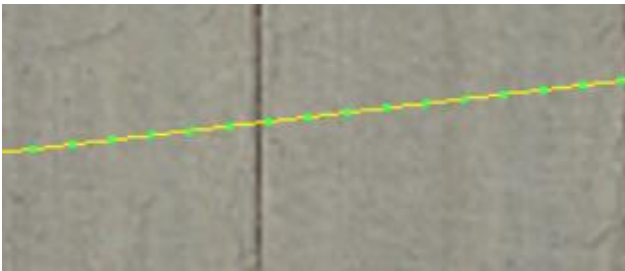
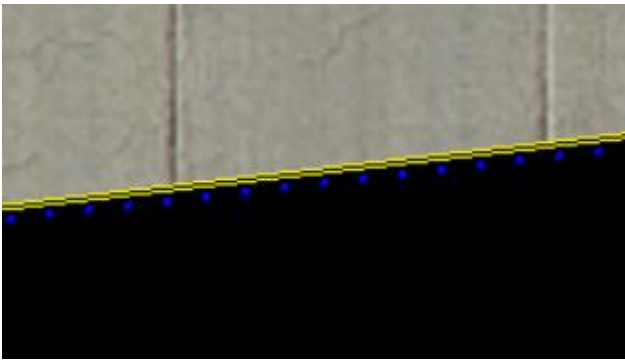


Again, make sure to snap all lines! Especially when you are new you don't all the markings, so here's a list of all lines available in World Editor and Infinite flight along with example pictures:

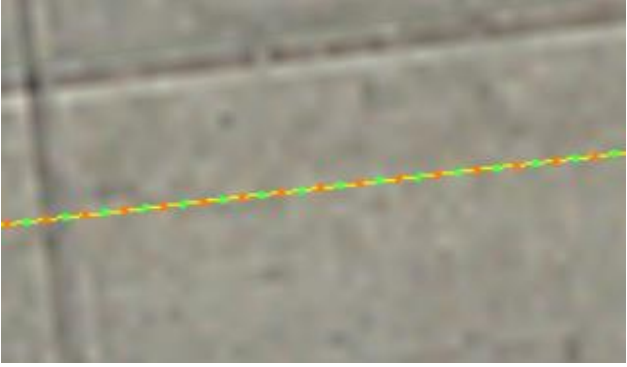
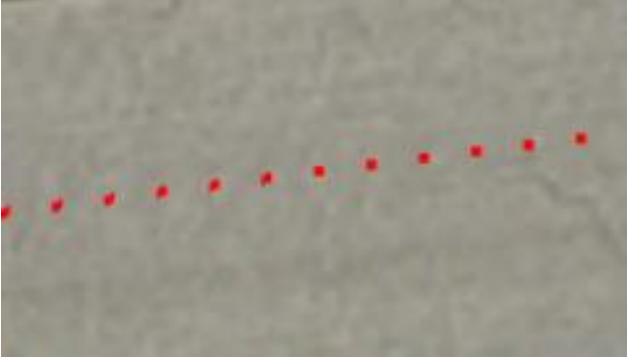
Line Type Image	Line Type Name	Description and Use
	Single Yellow	Yellow Line without gaps, usually used as a TWY centerline
	Single Yellow (Black)	Yellow line with black edge, usually used as a TWY centerline
	Broken Yellow	Short yellow lines with small gaps, used as centerlines and holds
	Broken Yellow (Black)	Short yellow lines with small gaps on black ground, used as centerlines and holds
	Other Hold	Solid Yellow line with a broken yellow line on top, used as intermediate hold
	Other Hold (Black)	Solid Yellow line with a broken yellow line on top on black ground, used as intermediate hold
	Runway Hold	Two Solid Yellow Lines with two Broken Yellow lines, broken part of the hold is facing the runway

A close-up photograph of a runway hold marking. It consists of two parallel solid yellow lines with two broken yellow lines in the center, all on a black background. The broken part of the hold is facing the runway.	Runway Hold (Black)	Two Solid Yellow Lines with two Broken Yellow lines on black ground, broken part of the hold is facing the runway
A close-up photograph of an ILS hold marking. It consists of two parallel yellow lines connected by solid yellow line pairs, used as holds.	ILS Hold	Two parallel yellow lines connected by solid yellow line pairs, used as holds
A close-up photograph of an ILS hold marking on a black background. It consists of two parallel yellow lines connected by solid yellow line pairs, used as holds.	ILS Hold Black	Two parallel yellow lines connected by solid yellow line pairs on a black ground, used as holds
A close-up photograph of a wide broken single yellow line marking on a grey surface.	Wide Broken Single Yellow	Solid yellow lines with wide gaps, used as centerline and for alternate parking positions
A close-up photograph of a wide broken single yellow line marking on a black background.	Wide Broken Single Yellow (Black)	Solid yellow lines with wide gaps on black ground, used as centerline and for alternate parking positions
A close-up photograph of two parallel solid yellow lines on a grey surface, used as a taxiway edge line.	Double Solid Yellow	Two solid yellow lines, used as taxiway edge line
A close-up photograph of two parallel solid yellow lines with black edges on a grey surface, used as a taxiway edge line.	Double Solid Yellow (Black)	Two solid yellow lines with black edges, used as taxiway edge line
A close-up photograph of pairs of yellow lines with wide gaps on a grey surface, used as a taxiway edge line on some aprons.	Wide Broken Double Solid Yellow	Pairs of yellow lines with wide gaps, used as taxiway edge line on some aprons
A close-up photograph of pairs of yellow lines with wide gaps on a black background, used as a taxiway edge line on some aprons.	Wide Broken Double Solid Yellow (Black)	Pairs of yellow lines with wide gaps on black ground, used as taxiway edge line on some aprons
A close-up photograph of an ILS critical centerline marking. It consists of a solid yellow line with dashed lines on each side, used for centerline marking near some runway holds.	ILS Critical Centerline	Solid yellow line with dashed lines on each side, centerline marking near some runway holds
A close-up photograph of an ILS critical centerline marking on a black background. It consists of a solid yellow line with dashed lines on each side, used for centerline marking near some runway holds.	ILS Critical Centerline (Black)	Solid yellow line with dashed lines on each side on black ground, centerline marking near some runway holds
A close-up photograph of a solid white line on a grey surface, used for roads and gate outlines, replacing red lines in gate areas.	Solid White (Roadway)	Solid white line, used for roads and gate outlines, replaces red lines in gate areas

	Chequered White (Roadway)	Mixed white-black line, marks roads where they cross taxiways
	Broken White (Roadway)	Broken white line, used for roads and some gate outlines, replaces broken red lines

In addition to the lines, you have the following options for lights:

Light Image	Light Name	Description and Use
	Taxiway Centerline Lights (Green)	Green lights built into the taxiway on or next to the centerline to indicate the taxiway; not all airports have these
	Taxiway Edge Lights (Blue)	Blue lights mounted next to the taxiway or on the shoulder, indicate the taxiway edge; quite a lot of airports have them
	Hold Short Light (Amber)	Orange lights built into the taxiway to highlight holding points. Used for intermediate holds and runway holds (Europe)
	Hold Short Lights (Pulsing Amber)	Flashing orange lights marking runway hold lines (US)

	Hold Short Centerline Lights (Amber/Green)	Orange and Green lights built into the centerline to highlight runway areas, usually used from runway holds to the end of the line on the runway
	Boundary Edge Lights (Red)	Red lights, often used to mark construction sites on the apron

SPAWNS

Now that you have finished the drawing part of the airport, there's one more thing to add: Spawns. By setting the spawns, you set the parking layout of the airport.

To add spawns, select the ramp start tool (O). You can set the spawn attributes at the top of the editing window. It's recommended to set the attributes before adding the spawn since it will be much quicker to set the attributes for one set of spawns at once instead of changing them for every single spawn after adding them.

You have to set the following spawn attributes

- Ramp Start Type

You can choose between

- Gate: Used for all kinds of airline parking and cargo positions
- Tie-Down Especially used for GA spawns where aircraft are tied to the ground
- Misc Used for all other parking outside of hangars (try to avoid this)
- Hangar Used for spawns that are placed *inside* of a hangar

- Equipment Type

You can add the equipment types Heavy Jets, Jets, Turboprops, Props, Fighters and Helicopters, choose with common sense, several attributes can be selected at once (e.g. Heavy Jets, Jets). *The Heavy Jet attribute is only allowed for spawns with a size of class E and F!*

- Size

You can choose from six different spawn sizes. To choose the correct ones, select the “ATC Taxi + Flow” above the option window. WED will display the size of spawn in shape of airplane shadows. See the table below to check which airplane sizes represent the aircraft types in Infinite Flight

Aircraft Size	IF Aircraft Types
A	CESSNA 172, CIRRUS SR22, F-14, F-16, F/A 18, F-22, Spitfire, Super Decathlon
B	A-10, Cessna 208, Cessna Citation X, Bombardier CRJ-200, P-38
C	Airbus A318-100, Airbus A319-100, Airbus A320-200, Airbus A321-200, Boeing 717-200, Boeing 737-700, Boeing 737-800, Boeing 737-900, Bombardier Dash 8 Q400, Embraer E170, Embraer E175, Embraer E190, Embraer E195
D	Boeing 757-200, Boeing 767-300, C-17 Globemaster III, C-130 Hercules
E	Airbus A330-200, Airbus A330-300, Airbus A340-600, Boeing 747-200, Boeing 747-400, Boeing 777-200, Boeing 777-200F, Boeing 777-200LR, Boeing 777-300, Boeing 787-8, Boeing 787-9, Boeing 787-10
F	Airbus A380-800, Boeing 747-8

- Ramp Operation Type

Ramp operation types represent the use of the spawn. There are:

- General Aviation
- Airline
- Cargo
- Military

Use common sense when adding the ramp operation types. *You must not add ramp operation types to Misc and Hangar spawns!*

Once you are done adding all of the spawns, continue by snapping the spawns to the centerlines of the parking positions. The spawn points you place is the location where the nose wheel of your aircraft will be positioned upon spawning. You don't have to snap them at the very end of the lines but you can increase realism by snapping them to an additional node on the line. The stop bars at the gates give a good impression where the spawns can be added. If you add a spawn to a parking position that includes a turn, there are two different types. Type one consists of a straight line followed by a curve, another short straight line and a second curve part leaving the position. In this case the spawn is to be placed at the second straight line (see picture) Type two consists of a straight line



Picture 24: Type 1 curved parking

followed by a curve leaving the parking position. You must position the spawn at the end of the straight line in this case. another short straight line and a second curve part leaving the position. Once the spawns are snapped, use the arrows going away from the spawn symbol to set the heading of the spawn as precisely to the heading of the line as possible. Simply click on them, hold on your mouse and turn the airplane symbol.



Picture 25: Type 2 curved parking

In contrast to all other objects, ramp starts have to be named. The names you add will later show in Infinite Flight when you select a location to start your flight from. The names of the parking positions must follow the real-life gate names/numbers as listed in charts. In addition to the gate numbers you can also add a more describing title to it. See various name options below – they have to be in English regardless of the airports location!

HOW DO I NAME THE DIFFERENT SPAWNS CORRECTLY?

Most charts will only show numbers or number letter combinations as spawn names. To improve the user experience, you may add additional titles and/or the name of the area the parking spot is located at.

Some of the general titles you should add are

- Gate: For positions used by airlines, especially at the terminals
- Remote (Gate): For positions used for airline operations away from the terminals
- Cargo: For parking positions used for cargo operations, combined with the Gate label in the spawn settings
- Maintenance: When spawns are located away from the terminals near hangars, maintenance might be used for them
- General Aviation (GA): Use this for all spawns where private aircraft of all sizes are parked, FBO is another name option for certain GA areas
- Hangar (Shelter): Place a spawn in a hangar completely to name it this way. Small hangars for a single fighter at military bases can also be named as shelter
- (Military) Apron: Whenever a positions use is unclear you may use apron as a name. At military airports, you can add military airports to the majority of positions. There might also be "Military Hangar" or "Military Gates", however.

Some possible area names are

- Terminal Name: At airports, it can be very helpful to add the terminal name to gates (e.g. Terminal 1, International Terminal, Satellite Terminal etc.)
- Company Name: Major flight club's names may also be added to GA spawns (e.g. English Channel Glider Club)

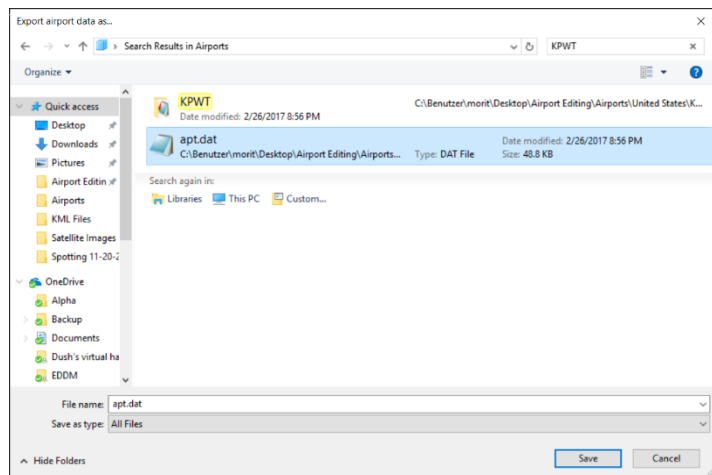
You can also combine all these titles (e.g. Terminal 2 Gate 221, Glider Club Apron 1)



QUICK TIP

AIRPORT EXPORT

Congratulations! You've just completed your first airport! There's one more thing that's left to do. Since we can't work with scenery pack in Infinite Flight, you have to export the airport in an apt.dat file again. To do so, ensure that the export target (File menu) is set to X-Plane 10.50 and go to "File – Export apt.dat". Save the file in the folder for the airport in your "Airports" folder. It might still be open in the export window opening from the import at the beginning of editing. If not, you can either navigate through the country



Picture 26: Airport export window

folders manually or, if you don't know in which country an airport is located, search for its identifier in the search bar of the export window. After that, overwrite the old apt.dat file in the folder. During export, WED will automatically check if there are any issues.

TROUBLESHOOTING

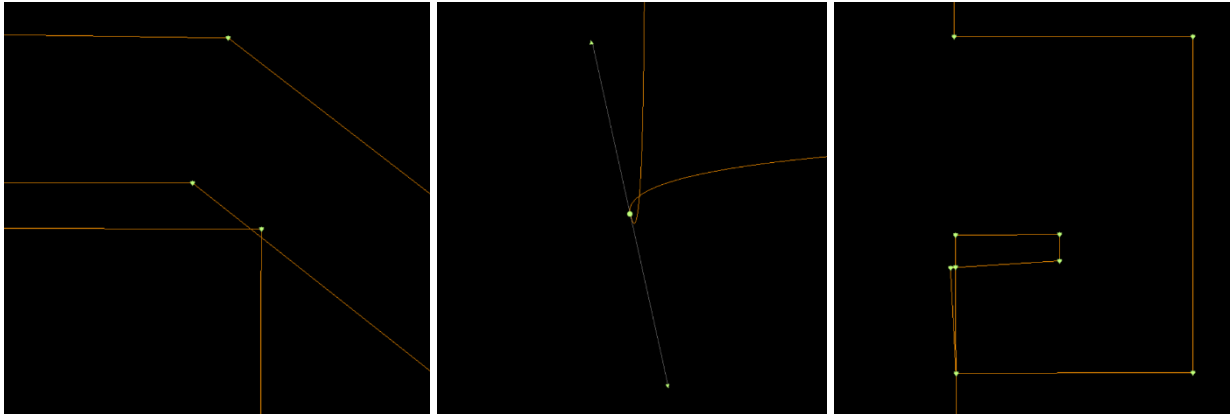
Sometimes issues may occur during editing and you might ask yourself how to fix them. Here you can find some solutions for frequent issues.

TRANSPARENT/INVISIBLE TAXIWAYS

Transparent taxiways can be caused by several things:

- Check the pavement transparency setting
Maybe you've just set the pavement transparency to "None". Go check it in the View menu.
- The satellite image can cover the taxiway
If you have your SAS images ordered on top of the airport, one taxiway will always be covered by the image. Set the images to invisible and check if you can see the taxiway again.
- It might be caused by a bug in World Editor
Sometimes, WED doesn't show taxiways at certain zoom levels when there are lots of holes cut into the taxiway. Try to zoom in and out and check if the taxiways appears at other zoom levels
- A hole in the taxiway might be located outside of the taxiway/might overlap the taxiway outline
Holes have to be positioned inside the taxiway entirely. Check if you have holes cut that are crossing the taxiway outline. If yes, edit the holes until they are inside the taxiway or snapped to the edges. If this doesn't help, select the taxiway and zoom out. The taxiway will be highlighted orange. If you see anything outside the taxiway that is orange as well, it might be a hole that was supposed to be cut into another taxiway. Instead, you might have had the now transparent taxiway selected when using the hole cutting tool. Remove the hole outside of the taxiway and delete it. If the taxiway doesn't appear again, check the next solutions.
- The taxiway might be wound the wrong way around
For whatever reason, your taxiway might be wound the wrong way around. To fix this, use the reverse option in the edit menu (Ctrl+Shift+R). If this doesn't help, undo the reversing to have the taxiway wound correctly again.

- The taxiway might overlap itself
This can be caused by inaccurate drawing and snapping as well as by bad curving. Below you can see examples of how these issues may look in World Editor.



Picture 27: Different causes of transparent taxiways. (1) Inaccurate drawing (2) accidental/wrong curving (3) snapping issue

As a first step to restore the pavement you should try to find a spot where one of these issues is present. At first, check if there are any places like in image (3) where the taxiway is snapped with itself. If this is the case, check the snapping. To avoid this as a potential issue, try to design holes in the taxiways with the hole cutting tool!

If this doesn't help, try to find out if and, if yes, where an issue like in (1) and (2) is present in your taxiway. Therefore, save your current progress. After that, start deleting all curving arrows. If the taxiway becomes visible this way, go to File – Revert to Saved. Your saved progress will be restored. Delete the last node you've deleted before again. If the taxiway remains transparent, check all the arrows you've deleted before until the taxiway becomes visible. If you can delete all arrows without the taxiways becoming visible again, start to delete the nodes (select the node and hit the "Delete" key). Once the taxiway becomes visible you might have found the location with the fault. Restore the last saved version and try to fix any issues at that location. If this doesn't help, there have to be other issues at nodes you have already deleted before, so check the nodes you have deleted before the taxiway became visible as well.

Once you fixed all issues, the taxiway will be visible again. If you tried all steps and all that is left of the taxiway is a rectangle, you have to recreate the taxiway.

WRONGLY ORIENTATED LINES AND LIGHTS

There are some issues with line orientation that can be fixed easily.

As already mentioned in the lines section of this guide, runway holds and other holds have to be oriented correctly. Wrongly oriented hold lines are subject to rejection in the review process.

Additionally, taxiway edge lights (blue) must be on the outside of the taxiway. If the edge lights are directly added to the taxiway, the lights will always be added on the outside. If this isn't the case, you probably added the lights to the wrong taxiway (e.g. a taxiway shoulder or another taxiway touching it). Add the taxiway lights to the right nodes then. You can select all nodes of a taxiway when it is selected. This way you can access the nodes of the taxiway located lower in the ordering as well.

For hold lines and when edge lights are added on the wrong side, select the line and use the reverse tool in the edit menu (Ctrl+Shift+R).

FAILING AIRPORT EXPORT

Sometimes, you may get an error message when attempting to export your airport. Below you can find solutions for several

RAMP OPERATION TYPES ONLY ALLOWED AT REAL RAMP STARTS

If you got this message, you have assigned ramp operation types to "Misc" or "Hangar" spawns during editing. This is not allowed. Remove all ramp operation types from spawns with ramp start type "Misc" or "Hangar" to fix this.

POLYGON WOUND CLOCKWISE

A taxiway is wound incorrectly. World Editor automatically selects the taxiway with the issue. If the taxiway is visible, you have to redraw it. If it's transparent, reverse it (Ctrl+Shift+R).

RUNWAY HAS ILLEGAL HIGH-END NUMBER

Runways must be named with the lower number first, e.g. 09/27, 18/36 etc. Change the name of the runway to fix this issue.

RUNWAY NEEDS TO BE REVERSED TO MATCH ITS NAME

Runways have to be drawn from the south/west to the north/east, so from the lower number side to the higher number. You have drawn it the opposite way. Reverse the taxiway to fix this issue.

THIS AIRPORT HAS GROUND/DELIVERY BUT NO TOWER

Airports that are equipped with a clearance delivery and/or ground frequency must have a tower frequency as well. You probably forgot to add that one. Select the airport and create a new Tower frequency (Ctrl+F) with the correct frequency information to allow an export of the airport.

REVIEWING PROCESS

All issues are fixed and the airport is exported. All you need to do now is submitting the airport successfully.

#PEER-REVIEW

To ensure that your airport doesn't have any issues you didn't notice it's highly recommended to use the peer-review channel on slack. Simply upload the apt.dat file of your airport and tell your fellow editors which airport this is. You can upload the file by clicking on the "+" next to the text bar. Search your directory for the file and upload it. You can also upload it using drag and drop. Usually, other editors will have a quick look at the airport within a day. They might not detect every single issue but they definitely help reducing the risk of a rejection in the official review.

Obviously, peer-review is a channel that only works if it is considered a "give and take" service. Once you are more experienced you are asked to have a look at the airports of other editors asking for help.

*Please note: Peer-Review only makes sense if you use it **before** submitting the airport for official review!*

OFFICIAL REVIEW

When your airport has passed peer-review and any remaining issues have been fixed, you can send it for review. To do so, attach it to an email to airports@liveflightapp.com. Use the airport code as the subject of the email. If there are any special characteristics for the airport, please let us know in the email. Examples of these characteristics are:

- Changed airport code
- Recently added features (longer runway, new apron, new terminal etc.)
- Data source you used in case you edited a very remote field without many information on the web

Please comply with some basic guidelines when emailing airports for review:

- If you only edited minor issues (e.g. runway markings) please let us know to speed up the review!
- If you detect issues with your airport after you've sent it in, you can still resubmit the changes. Do this by replying to/forwarding the original email you sent. This might sound strange but it has a reason: The emails are threaded in our inbox, meaning that all replies are listed with the original mail. This makes sure that we always review the latest version of the airport and that we can quickly see the issues that have led to a rejection before. Therefore, also send corrections after the airport was rejected as a reply to the rejection email.
- Please don't send the entire folder of your airport but only attach the apr.dat file. This speeds up review since reviewers don't have to unzip any folders before review.
- It's not needed to rename the apt.dat file (e.g. with the airport code). Just send it as "apt.dat"

Once you've sent the mail, don't close the issue for the airport on GitHub! You can comment that the airport has been sent for approval, anything else will be handled by the reviewer.

The airport won't be added to Infinite Flight instantly but it will be added with the next scenery update.

ILS ADJUSTMENTS AFTER REVIEW

Once the airport was accepted, it will be added to the repository. Once this happens, everyone can get the latest version of the airport from GitHub. In case you moved one or more runways equipped with ILS, or if you changed the airport elevation of an airport with an ILS-equipped runway, you must create an issue in the Navigation repository of our organization. A navigation editor will then update the runway data for the airport to ensure the functionality of the ILS. If this is not done, discrepancies can cause the Autoland feature in IF to land the plane at the wrong location and the ILS will not guide you to the runway precisely.

AIRPORT EDITING CHECKLIST

Before submitting your airport for review, use this checklist to make sure you edited everything required for an acceptance.

- ✓ Airport Code is correct
- ✓ Airport Elevation is correct
- ✓ Airport Location is correct
- ✓ ATC frequency information is correct

- ✓ Airport Boundary is added
- ✓ Tower Viewpoint is added
- ✓ Tower Height is correct
- ✓ Airport Beacon is added (if present in real life)
- ✓ No objects are located outside of the boundary or cut the boundary

- ✓ Runways are added
- ✓ Runway numbers are correct
- ✓ Runway length is correct
- ✓ Displaced thresholds and stopways are added (if present IRL)
- ✓ Runway markings are correct
- ✓ Runway lighting is correct
- ✓ PAPI/VASI lights are added correctly

- ✓ All Taxiways are added
- ✓ Taxiway materials are correct
- ✓ All buildings are added
- ✓ Buildings be distinguished from taxiways
- ✓ Taxiways are overlapping runways
- ✓ All taxiways are snapped

- ✓ Taxiway markings are drawn accurately
- ✓ Marking types are correct
- ✓ Lines are snapped
- ✓ Hold lines are snapped
- ✓ Gate outlines are drawn
- ✓ No runway markings are drawn
- ✓ No hashed areas are present

- ✓ Spawns are added
- ✓ Spawn attributes are complete and correct
- ✓ Spawns are named correctly
- ✓ Spawns are snapped to lines
- ✓ Spawns are oriented correctly

- ✓ Export Target is set to X-Plane 10.50
- ✓ Email includes the ICAO code and necessary information

WED SHORTCUTS

World Editor is full of functions. Most have a shortcut key combination you can use to select it more quickly. All shortcuts are displayed as Windows key combinations. For Mac, use command instead of Ctrl.

MENUS

FILE

Close (the editing window) Ctrl+W

Save (the progress in your scenery pack)
Ctrl+S

Validate Ctrl+Shift+V

Import apt.dat Ctrl+Shift+I

Export apt.dat Ctrl+Shift+B

EDIT

Undo Ctrl+Z

Redo Ctrl+Shift+Z

Duplicate Ctrl+Shift+D

Group Ctrl+G

Ungroup Ctrl+Shift+G

Move First Ctrl+Shift+[

Move Up Ctrl+[

Move Down Ctrl+]

Move Last Ctrl+Shift+]

TOOLS

Vertex Tool V

Marquee Tool M

Runway Tool R

Sealane Tool S

Helipad Tool H

Taxiway Tool T

Taxilines Tool L

VIEW

Zoom to Airport Ctrl+Alt+/,

Zoom Selection Ctrl+/,

SELECT

Select All Ctrl+A

Select None Ctrl+D

Select Polygon (entire taxiway; only works
when one node of the taxiway is selected)
Ctrl+Shift+Up

Select Vertices (select all nodes separately;
only works with taxiway selected)
Ctrl+Shift+Down

AIRPORT

Create Airport Ctrl+Shift+A

Create ATC Frequency Ctrl+F

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IMAGE SOURCES

Satellite Images taken from Google Earth

Approach Light visualization:

http://www.fsdeveloper.com/forum/attachments/approach_lighting_2-jpg.5788/

Picture 13: <https://airportlightinginc.com/contact-airport-lighting-systems/>

Picture 20: <http://developer.x-plane.com/manuals/wed/>

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"KILT MCHAGGIS"



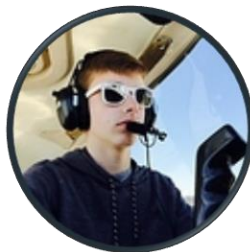
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