Bed Adhesion

Developing Level

> This level moves beyond simple sticking or not sticking. Students begin to compare why some parts need more adhesion help than others, how footprint size and sharp corners change risk, and why cleaning, temperature and first-layer settings must work together rather than in isolation.

At Developing level, students start to see that bed adhesion is influenced by the shape of the part and the conditions of the print, not just by whether the bed was cleaned. A small part with little contact area may need more attention than a wide flat part. A model with sharp corners may begin to lift more easily than one with rounded edges. This means the design of the part changes the adhesion challenge.

This matters because stronger adhesion planning reduces the need for repeated failed starts. Developing students should begin to connect model footprint, first-layer speed, bed temperature, cooling behaviour and surface preparation into one coordinated first-layer strategy rather than treating them as unrelated settings.

Overview

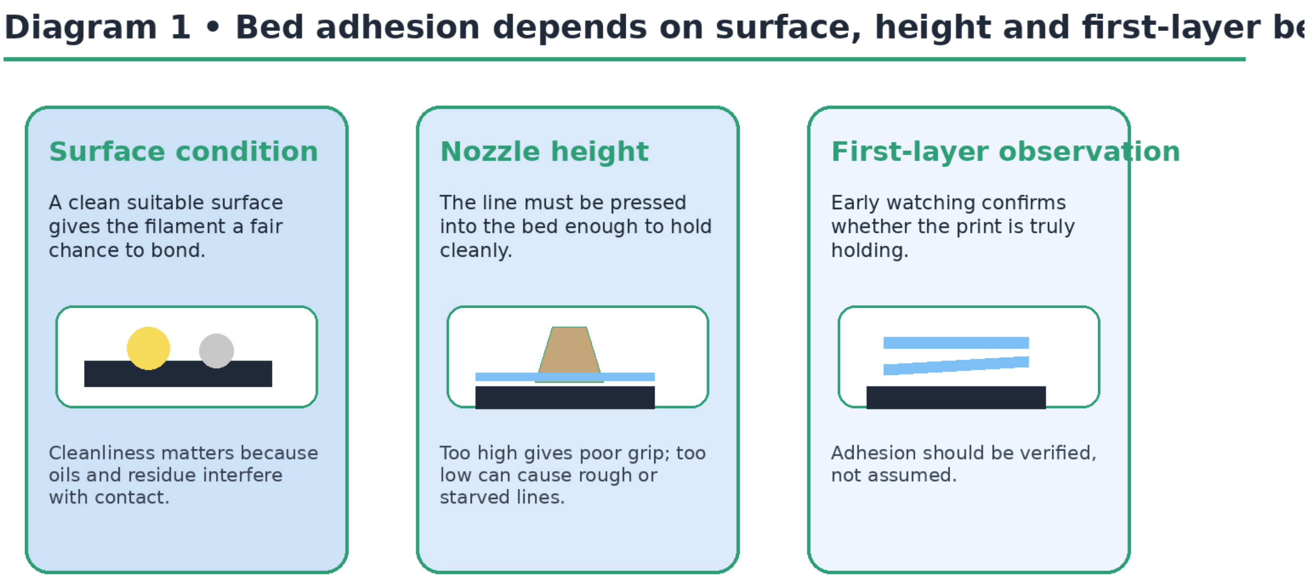
Indicative level	Developing
Suggested use	Students moving from simple first-layer watching to stronger planning
Best suited to	Classes comparing why some parts adhere more easily than others
Learning focus	Part footprint, first-layer strategy and better early diagnosis
Related	Assessment & Planning • PLA & Classroom Materials • Filament Storage & Handling

Why adhesion depends on both the bed and the part being printed

A clean bed alone does not guarantee success. The geometry of the part, the size of the footprint, the length of the print and the surrounding conditions all influence how much stress the first layer must resist while the part is being built.

A better workflow is to judge the risk of the model first, then prepare the surface and first-layer conditions to suit that risk instead of printing every part the same way.

How adhesion works



Bed adhesion depends on the condition of the surface, the shape of the first layer and the way the print begins. A strong first layer is created by several coordinated factors rather than one isolated setting.

Critical adhesion steps and why they matter

Step / Focus	What to check or do	Why the step matters
Judge the model footprint	Look at how much of the part actually touches the bed	Smaller or narrower footprints have less natural stability.
Notice corner and edge risk	Identify sharp corners or long thin edges	These areas often lift first when adhesion is marginal.
Coordinate first-layer settings	Use speed, temperature and line shape deliberately	Adhesion improves when the first layer is laid calmly and cleanly.
Use extra help only when justified	Consider brim or other support for risky prints	Extra adhesion tools should match the risk, not become a habit.
Interpret the failure pattern	Look at where and when lifting begins	Failure location gives clues about what to correct next.

Good bed adhesion is best understood as a controlled process. Each step exists to improve bonding, reduce early movement and protect the rest of the print from the consequences of a weak foundation.

Step 1: Compare easy-to-stick and hard-to-stick part shapes

Not all parts ask the same thing of the bed. A large flat model with a wide footprint often has more natural grip than a small, tall part with little contact area. In the same way, a part with long thin edges or sharp corners may be more likely to lift than a compact rounded base. Developing students should start to compare the geometry of the model before the print starts.

This step matters because adhesion planning should match the difficulty of the part. If the operator treats every model identically, they will sometimes over-prepare simple parts and under-prepare more difficult ones. Better results come from recognising which geometries are naturally stable and which ones place more demand on the first layer.

The deeper meaning is that print preparation is part-specific. The bed is only one side of the problem; the part shape is the other.

Step 2: Coordinate cleaning, temperature and first-layer speed

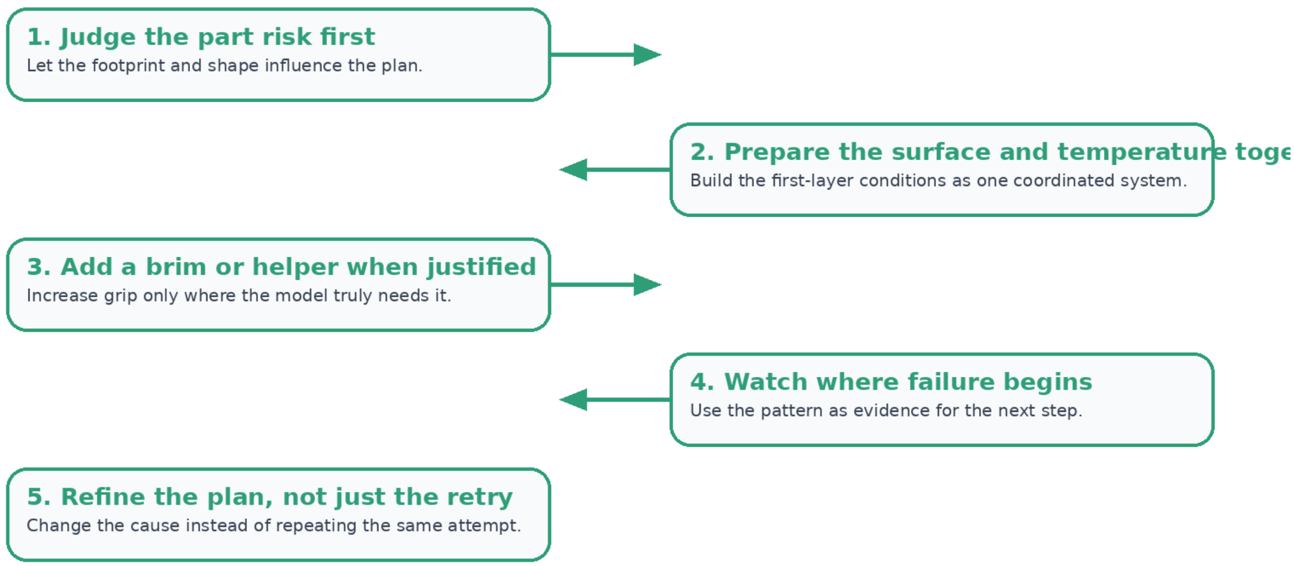
Good adhesion usually comes from several supportive conditions working together. The surface should be clean, the bed should be at a suitable temperature for the material, and the first layer should often be printed in a calm controlled way rather than too quickly. If one of these conditions is poor, the others may not fully compensate.

This step is taken because beginners sometimes change one setting dramatically and expect it to solve everything. Developing students should learn that adhesion is a coordinated system. Cleanliness supports wetting, temperature affects bonding, and slower first-layer motion can help the line settle accurately into place.

The deeper lesson is that first-layer reliability comes from combined control, not a single miracle setting.

Developing bed-adhesion workflow

Diagram 2 • Developing bed-adhesion workflow



Step 3: Use brims or extra adhesion help deliberately

When a part has a difficult footprint or a history of lifting, extra adhesion help such as a brim can increase the contact area and resist early corner lift. However, these tools also add removal work and may not be needed on every job. Developing users should therefore use them for a reason, not simply as the default for every print.

This step matters because adhesion helpers are most useful when they match the actual risk. A brim can protect a small footprint or sharp corners very effectively, but it also changes post-processing. Students should understand both why it helps and why it should be used deliberately.

The deeper reason is that added adhesion support is a print-planning choice. It should be justified by the geometry and the risk of failure.

Step 4: Read the failure pattern instead of restarting blindly

When adhesion fails, the location and style of the failure matter. Did one corner lift first? Did the entire print fail to grip from the beginning? Did the filament stick on one side of the bed but not another? Developing students should use these patterns as evidence instead of just restarting repeatedly without learning from the result.

This step matters because the pattern often points toward the next correction. Local lifting may suggest a surface or geometry issue in that area. Global failure may suggest height, temperature or surface contamination. Pattern reading improves troubleshooting and reduces repeated wasted attempts.

The deeper meaning is that a failed first layer still contains information. The goal is to use that information to make a better next decision.

Key reminders and discussion points

Key reminders	Discussion prompts
A clean bed does not replace correct first-layer height. The shape of the part changes how hard adhesion will be.	Which features of the model increase adhesion risk? What clues show that the nozzle is too high or too low?

Brims and helpers should solve a reason, not be automatic. Watching the first layer is part of the process, not an optional extra.	When is extra adhesion help justified? What does the failure pattern suggest about the next step?

Vocabulary for this level

Term	Meaning in this topic
Footprint	The area of the model that touches the bed at the start of printing.
Brim	Extra first-layer lines around the part used to improve adhesion.
Local lift	Adhesion failure in one area rather than across the whole print.
Global failure	A general first-layer failure across most or all of the part.
First-layer speed	The speed used while printing the initial layer.
Risk-based preparation	Adjusting the setup to match how difficult the part is to stick down.

Why developing understanding matters

As students progress, they need to stop treating bed adhesion as a simple yes-or-no issue. Better first-layer planning comes from matching the preparation to the shape and risk of the actual part.

Teacher / Lab prompt

Ask students why a tall narrow print may need more adhesion support than a short wide print, even if both are using the same material and printer.