

FRAMEWORK v1.1.1

ROBOT-READY ARCHITECTURE

A field guide to **robot-ready buildings**

Robots are moving into buildings designed for human eyes, legs and judgment. Eight domains, five strategies, six levels, eleven environments and five phases: the framework in ten pages.

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WHY THIS GUIDE

Every building was designed **for one kind of occupant**

Every building you have ever worked in was designed around a single occupant: a human being, with human eyes, human legs and human judgment. Stair heights, corridor widths, lighting, signage and door handles all encode that assumption so deeply that nobody thinks about it anymore.

Robots break the assumption quietly. They see with lasers and cameras that read glass as empty air. They roll on wheels that a two-centimeter doorstep can defeat. They run on batteries that need a home, a schedule and a circuit that will not trip. And when they fail, they fail wherever they happen to be standing.

A robot-ready environment is one where these differences have been engineered for in advance, not discovered in the middle of a deployment.

Extremity is not a place.

It is a mismatch between what an environment assumes and what its occupant can do. To a robot, your corridor is the extreme environment. The method in this guide comes from spacecraft and extreme-environment architecture, where that mismatch is the daily work.

ONE FRAMEWORK, FIVE QUESTIONS



1

What do we assess?

Eight readiness domains
D1 to D8 · p. 3



2

How do we share the space?

Five strategies
S1 to S5 · p. 5



3

How far along are we?

Six readiness levels
RRL 0 to 5 · p. 6



4

Where are we?

Eleven environments
Profiles · p. 7



5

When does it matter?

Five lifecycle phases
P0 to P4 · p. 8

This guide is the short companion to the working paper *Robot-Ready Architecture: A Readiness Framework for Buildings in the Age of Physical & Embodied AI*. It orients; it does not score.

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1 · WHAT TO ASSESS · D1 TO D8

Eight things robots need **from a building**

Each domain names something the environment does, not something the robot is. Read them as lenses on one building, with your own routes in mind, at operating hours and again at night.



D1

To see where they are

PERCEPTION ENVIRONMENT

Glass, gloss and night lighting decide what a robot can perceive.



D2

To move, and to reach

TRAVERSABILITY & GEOMETRY

Thresholds, ramps, widths and shelf heights set where a robot can go and what it can do.



D3

To pass doors, ride elevators, and use what they find

INTERFACES & CONNECTIVITY

Doors, elevators and networks make a robot a user of the building, or an escorted guest.



D4

To charge, rest, and be repaired

POWER & FLEET INFRASTRUCTURE

Every robot is a battery on the building's schedule; fleets need a back-of-house.



D5

To be safe around people, provably

SAFETY & COMPLIANCE SPATIALIZATION

Separation distances, fall zones and exclusion zones become lines on the plan.



D6

To be accepted by the people they work with

HUMAN-ROBOT COHABITATION

Acceptance is won or lost at corners, doors and the night shift.



D7

To fail without causing chaos

OPERATIONS & RESILIENCE

A stalled robot in a storeroom is a ticket; in an escape route it is an incident.



D8 NEW IN v1.1

To survive the room's climate, and leave it clean

AMBIENT & PROCESS CONDITIONS

Cold, humidity, washdown and cleanliness wear machines down, and machines can contaminate rooms.

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1 · WHAT TO ASSESS · IN DEPTH

One building, **eight lenses**

A glass door is a perception problem (D1), an interface problem (D3) and, at the wrong moment, a safety problem (D5). The domains are lenses on one building, not partitions of it.

D1 PERCEPTION ENVIRONMENT

Robots do not see a building; they sense it. A glass door reads to a lidar as an open doorway, a dark dock against a dark wall cannot be found, and the 2 a.m. lighting regime is the one nobody assessed.

D2 TRAVERSABILITY & GEOMETRY

Floors, thresholds, ramps, and widths decide whether a robot moves at all, and the tolerances are machine tolerances. For robots with arms, geometry now includes reach: shelf heights, bench clearances, the top tier of a rack.

D3 INTERFACES & CONNECTIVITY

Doors, elevators, and networks are the civic rights of a machine occupant. Where they are granted, the robot is a user; where they are not, it is a guest who needs an escort. A humanoid must also work the handle, and inherits every door closer sized for a human shoulder.

D4 POWER & FLEET INFRASTRUCTURE

Every robot is a battery with a schedule, and the schedule belongs to the building. One charger in a borrowed corner works for one robot. At ten it is a layout problem, an electrical problem, and sometimes a fire-safety problem.

D5 SAFETY & COMPLIANCE SPATIALIZATION

The rules now look at the robot in its actual building. Separation distances become corridor dimensions, a balancing robot needs engineered room to fall, and exclusion, containment, and perception zones are lines drawn on the plan.

D6 HUMAN-ROBOT COHABITATION

Nobody sabotages the robot. They route around it, stop assigning it work, and return it. Acceptance is built or lost in ordinary spatial moments: a blind corner, a corridor encounter with no rules, a night shift that was never asked.

D7 OPERATIONS & RESILIENCE

The honest question is where the robot will be standing when it fails. A dead robot in a storeroom is a maintenance ticket; in an escape route it is a life-safety event. Pilots become fleets, and what carried three robots collapses under twenty.

D8 AMBIENT & PROCESS CONDITIONS

Every robot is specified for a climate, and most are specified for an office. Cold stores, washdown bays, and grow rooms wear machines down slowly. In a cleanroom, a ward, or a hangar the question also runs the other way: what does the machine shed, carry, or emit?

Why an eighth domain

Version 1.0 had seven domains and called them exhaustive. Cold stores, cleanrooms, hospitals, hangars and grow rooms showed otherwise: the climate, cleanliness and atmosphere of a space had no home. Version 1.1 adds it as D8 and keeps D1 to D7 at their numbers.



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2 · HOW TO SHARE THE SPACE · S1 TO S5

Five ways to **share a building**

Once a building must hold people and robots, someone has to decide how they will share it. The answer shapes layout, hardware, safety paperwork and how the deployment feels to the people in it.



S1
Full segregation

Robots get their own territory: corridors, shafts, and zones that people enter only under controlled conditions. Safest and simplest to reason about, and the most expensive in floor area.



S2
Temporal separation

Same spaces, different clocks. Robots own the night while people are gone. Almost no construction, but someone has to know what the fleet did at 3 a.m.



S3
Zoned hybrid

People and robots share space under mapped rules: speed zones, marked lanes, defined crossings. The workhorse of warehouses and daytime hospital corridors.



S4
Full cohabitation

Robots anywhere, meeting anyone, on human terms. The promise of the humanoid, and the hardest case: every encounter becomes a design subject.



S5
Reconfigurable

The strategy itself changes: by hour, by season, or as a pilot grows into a fleet. The discipline lies in managing the changes.

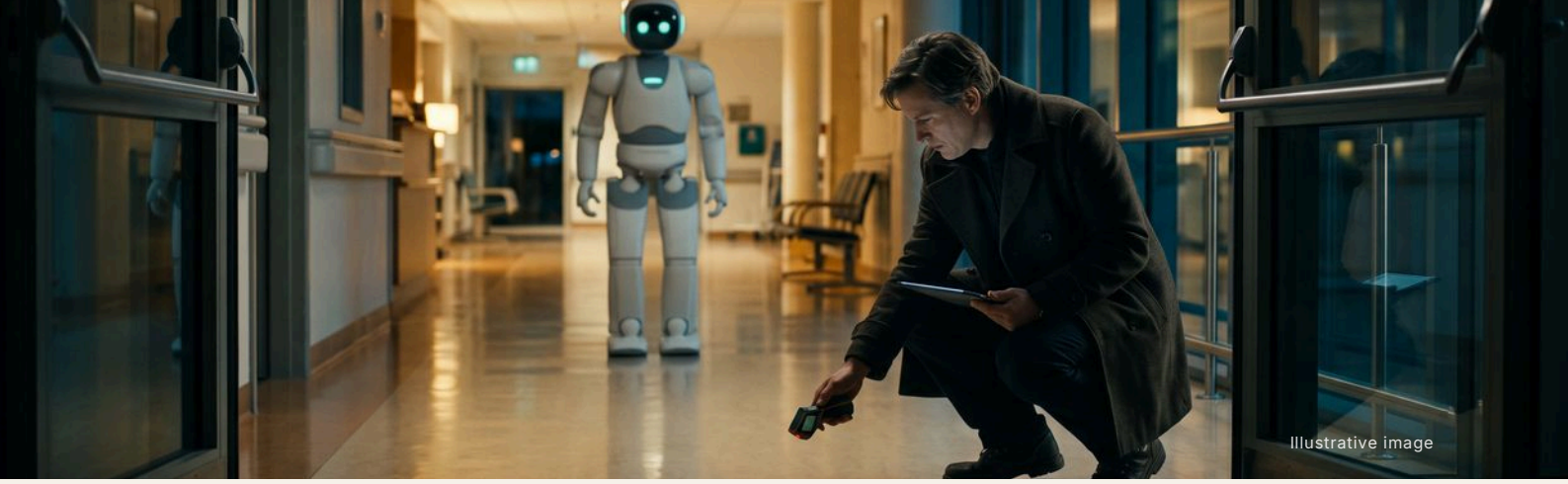
Portfolios, not choices

A hospital may run S1 in its logistics basement, S3 in its daytime corridors, S2 for the night restock and one carefully designed S4 moment at the ward door. Holding that portfolio together is the real design work.

What tilts the choice

The robot class, the criticality of the function, who is in the room, the liability regime, the cost of floor area, retrofit or new build, and the room itself. S2 needs an empty hour, and an airport or an acute hospital has none.

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3 · HOW FAR ALONG · RRL 0 TO 5

How ready is **your building?**

Six levels describe how far an environment has moved from hostility toward native accommodation of machine occupants. A pilot wants RRL 2. A fleet wants RRL 3.

LEVEL	WHAT IT MEANS	EVIDENCE BEHIND THE CLAIM
RRL 0 Robot-hostile	The building actively defeats deployment.	**Observed**
RRL 1 Robot-tolerant	One robot survives, through detours, escorts, and the patience of individual champions.	**Walked**
RRL 2 Robot-compatible PILOT GATE	Pilot-viable: the worst friction on defined routes is known and locally fixed.	**Walked and measured**
RRL 3 Robot-ready FLEET GATE	Fleet-viable: friction engineered out, infrastructure dimensioned, compliance documented.	**Assessed and documented**
RRL 4 Robot-optimized	The environment improves fleet economics and human experience, and is measured on both.	**Operated and monitored**
RRL 5 Robot-native	Designed for mixed occupancy from the first sketch.	**Designed in and commissioned**

Ready for whom?

A level is claimed for an occupant class. The same corridor can be RRL 3 for A2 and RRL 1 for A3.



A1
Guided and scripted



A2
Task-autonomous



A3
Generalist embodied AI



A4
Teleoperated and shared autonomy

A claim has a date

A readiness claim names four things: a level, an occupant class, the evidence behind it and a date. Buildings are re-planned and machines update. Most existing buildings, walked honestly, start at 1 or 2 in some domains and 0 in at least one.



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4 · WHERE · ASSET-CLASS PROFILES

Eleven environments, **one spectrum**



ROBOTS AS GUESTS OR CO-WORKERS

Logistics & Warehousing D2 D4 D5

Scaling: improvised charging and traffic rules collapse somewhere between robot five and robot twenty.



ROBOTS AS GUESTS OR CO-WORKERS

Manufacturing D5 D7

Assessment decay: the risk assessment quietly loses validity with each re-planning event.



ROBOTS AS GUESTS OR CO-WORKERS

Healthcare D6 D3

Staff rejection, and consultation started too late.



ROBOTS AS GUESTS OR CO-WORKERS

Laboratories & Cleanrooms D8 D5

The boundary: proven inside one room, stopped at the airlock.



ROBOTS AS GUESTS OR CO-WORKERS

Commercial & Office D1 D6

Aesthetic collision: readiness measures meet corporate design standards.



ROBOTS AS GUESTS OR CO-WORKERS

Aviation: Hangars, Terminals & Aprons D5 D8 D1 D6

The approval chain: many vetoes, long before any technical limit.



ROBOTS AS GUESTS OR CO-WORKERS

Residential Dwellings D6 D2

The showroom gap: flawless in the demonstration apartment, defeated by a lived-in one.



HUMANS AS THE VISITING MINORITY

Data Centers & Technical Facilities D7 D5 D3

Trust, not traction: the robot must earn clearance in a security-graded space.



HUMANS AS THE VISITING MINORITY

Controlled-Environment Agriculture D8

Transfer: a warehouse platform meets humidity, light spectrum, and washdown together.



HUMANS AS THE VISITING MINORITY

Mining & Underground Environments D3 D7

The seams: transition zones where automated areas meet manned ones.



SHARED BY EVERYBODY

Open Spaces & Urban Environments D1 D2 D5 D6

Permission withdrawn: pilots end through complaint, long before the machines wear out.

Read the cards

The coloured codes are each environment's dominant domains, where its friction concentrates. The line beneath is the failure pattern that recurs there.

- Guests or co-workers
- Humans as the minority
- Shared by everybody



5 · WHEN · P0 TO P4

Readiness has **a calendar**

Deployments are decided, selected, fitted out, handed over, lived in and renewed, and the same building asks different questions at each step.

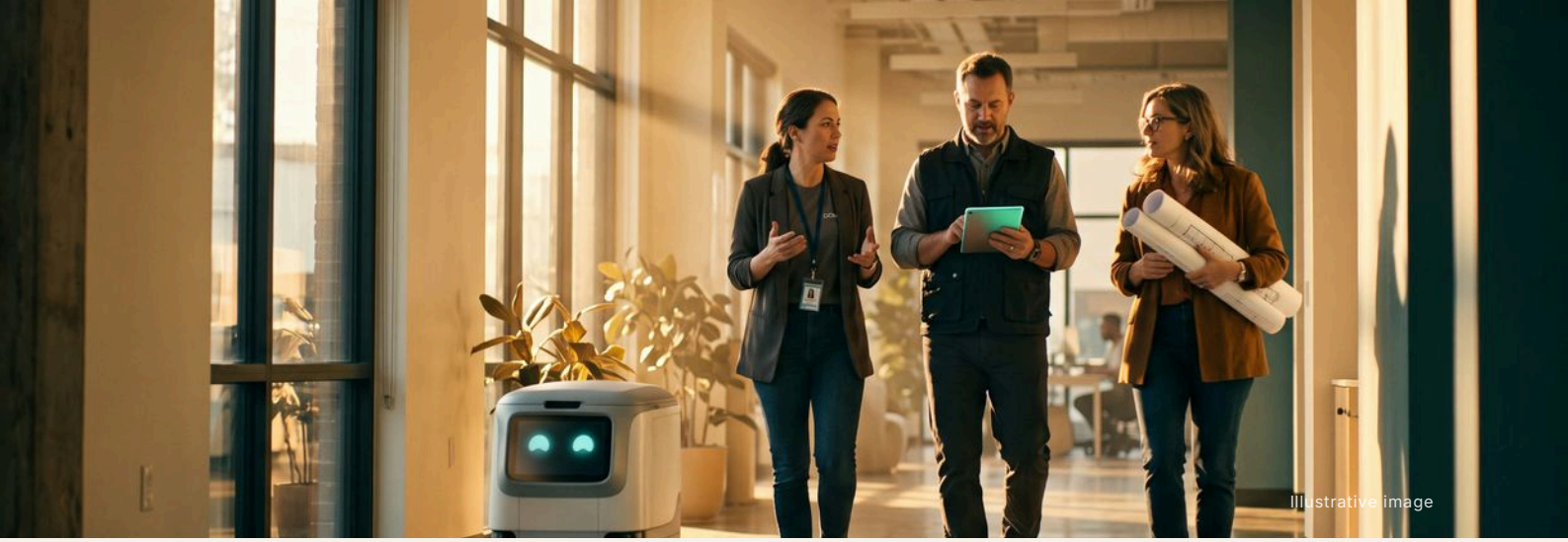
	**P0** Brief	**Should a robot do this task here at all?**	The task and its alternatives; today's baseline; the occupant class; who must agree.	**The decision to assess**
	**P1** Select	**Which machine, in which zones, on which strategy?**	Readiness baseline per domain; strategy portfolio; fit to the machine's operating envelope; contract and exit terms.	**Baseline RRL per domain**
	**P2** Fit-out	**What must the building become before the first robot arrives?**	Remediation and interfaces; back-of-house; zones drawn; staff trained; acceptance criteria agreed.	**RRL 2: the pilot gate**
	**P3** Cohabit	**What do building, people, and machine do to each other in service?**	Handover and a defects period; interventions, incidents, and wear logged; adjustments on both sides.	**RRL 2 held in operation**
	**P4** Renew	**What changes when the fleet grows, the robot is replaced, or its software learns?**	Scaling provisions; multi-fleet rules; reassessment after any change; vendor exit.	**RRL 3: the fleet gate**

The apartment test

Anyone who has bought an apartment off plan knows the shape: the choice of the unit, the showroom, then handover and the months in which occupant and building get used to each other. Robot deployment has the stages and, so far, almost none of the discipline.

Cost rises at every step

A door operator specified at the brief is a line in a schedule. The same operator discovered in P3 is a change order, a shutdown and a meeting with the landlord.



USING THE FRAMEWORK

Three doors in, **four moves**

The same building is read from more than one side. The framework's unit is the building: the one element of a deployment that every party must work with, whoever owns it.

Operators and facility managers

Find your environment on page 7 and note its dominant domains. Then walk your own routes with the eight domains as a lens, at operating hours and at night.

Robot makers and deployment teams

Read the domains as the customer's half of your operating envelope: D8 for the climate, D2 and D3 for what wheels, legs and hands will meet, D7 for cycle time and interventions.

Architects and developers

Begin at RRL 5 and at P0. Readiness is cheapest at the brief, and a building designed for mixed occupancy never has to be retrofitted for it.

FOUR MOVES PUT THIS GUIDE TO WORK

1
Locate

Find your asset class among the eleven environments.

2
Walk

Take the eight domains along your real routes, by day and by night.

3
Sketch

Draw your strategy portfolio: which of S1 to S5 you run today, and which you need.

4
Claim

Write the result as a claim: a level, an occupant class, the evidence and a date.

What this guide is not

This is orientation, not a scoring tool. The assessment method behind the levels is a separate instrument and is not published here. Standards named in the working paper are pointers for qualified review, not compliance advice.

Why now

The 2025 revision of the industrial-robot safety standard moved the assessment from the machine to the application, which is to say into the building. The EU Machinery Regulation applies from January 2027.

WHERE THIS COMES FROM

Further apart in gravity **than in principle**

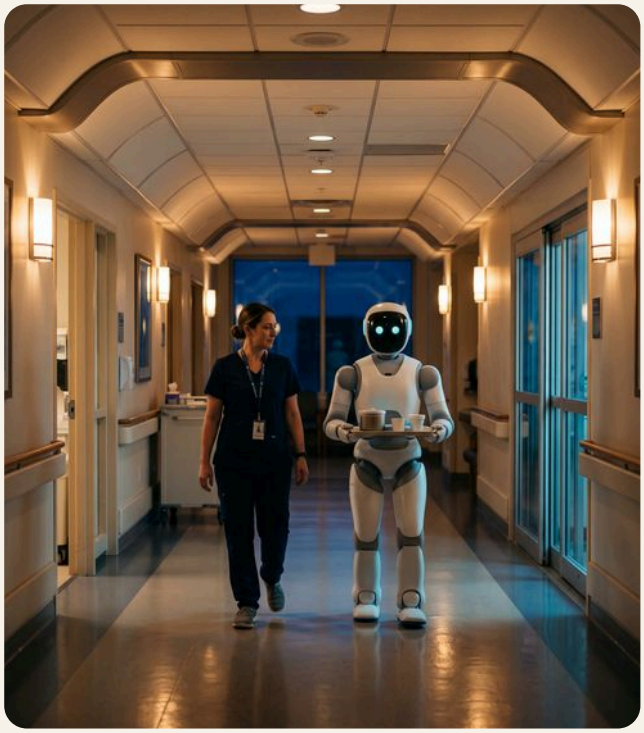
The method behind this guide was not invented for robots. It comes from extreme-environment and spacecraft architecture, where every surface, volume and system is judged by its consequences for the performance, health and psychology of the people inside.

Buildings receiving robots are the newest version of an old problem: an environment meeting an occupant it was not designed for, with human wellbeing as the constraint that cannot move.

The working paper

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About the author

Omar Alayli is an architect with more than twenty years of building design and delivery experience, and a specialist in environments where performance, physiology and psychology are first-order design constraints: spacecraft interiors, extreme-environment habitats, and now the buildings that robots are moving into. He hosts the Omar Alayli Podcast.

The framework is versioned and improves through practitioner correction. If your building or your deployment breaks it, the author wants to hear how.

All images are illustrative and AI-generated; the framework, its concepts and its errors are the author's.