



THE PERFECT PLAYGROUND SAFETY HANDBOOK

Twenty-two years of playground safety surfacing experience, in one complete guide — the science, the standards, and the tools for everyone responsible for the ground a child lands on.

12 ft

certified fall protection at just 6 inches
deep

60+

independent studies over 20+ years — no
established health risk

22 yrs

playground safety surfacing experience

A Letter Before the Data

Step onto a playground surfaced with certified rubber mulch and you will feel it under your feet: a soft, springy give — cushioning you can feel through your shoes, standing ready before anyone needs it. Children feel it too. Watch them: they run harder, laugh louder, and play freer on ground that feels friendly. They have never heard of impact attenuation. They simply trust the ground — and the ground deserves it. At a demonstration, we like to prove the point the fun way: drop a watermelon from the top of a playset onto six inches of rubber mulch, and it comes up without a crack. That is what we provide: protection under their feet — the playground's seatbelt. Quiet, always on, never the star of the show, protecting every child, every minute, exactly the way a car seat does: so routinely that nobody thinks about it at all. For twenty-two years, playground safety surfacing has been our business, and in twenty-two years we have learned that a playground is really a promise. A backyard swing set, the daycare down the street, the HOA common, the church yard, the town park, the school playground, the state park — each one is a promise to children: play hard, land soft, get back up laughing. We supply the part of that promise that lives under their feet.

Every year, roughly 200,000 children are treated in U.S. emergency rooms for playground injuries — and according to the Consumer Product Safety Commission, the single largest cause is not broken equipment. It is the landing. Our goal at Perfect Rubber Mulch is simple to say and demanding to live up to: protect those 200,000 children. The equipment gets the attention and the budget meetings; the surface beneath it does the work that matters most. That is exactly what we provide — and why we wrote this handbook for every person responsible for that landing: the parent comparing options for a backyard set, the school board member preparing a budget request, the parks director writing a procurement spec, the daycare owner answering to licensing inspectors, and the facilities manager who has to defend a decision in front of a committee. It is not a brochure, and it is not a sales pitch. It is everything we have learned in twenty-two years — the science, the standards, the comparisons, the costs, and the tools to act on them — assembled into one document you can hand to anyone on your team. We are honored to share twenty-two years of science, work, and experience with you for your playground surfacing decision.

Play Hard, Land Soft, Get Back Up Laughing,

— Your Team at Perfect Rubber Mulch



A certified commercial customer playground on blue rubber mulch.

ONE

The Science of a Safe Landing

What Actually Injures Children on Playgrounds

The physics of a playground injury are unforgiving and simple. The CPSC's Public Playground Safety Handbook (Publication 325) identifies falls to the surface as the leading source of serious playground injuries — more than equipment failure, entanglement, and impact with moving equipment combined. This is why playground surfacing is regulated, tested, and certified as safety equipment. A properly specified surface is an impact attenuation system: engineering designed to absorb the energy of a fall so a child's body does not have to.

The Two Numbers That Decide Everything: G-max and HIC (Head Injury Criterion)

When a laboratory tests a playground surface, it drops an instrumented metal headform — built to measure the forces a human head would experience — onto the surface from increasing heights. Two measurements come back:

G-max measures how suddenly the falling head stops — peak deceleration. The pass/fail threshold is 200g. Below it, the surface absorbed enough energy to stay within survivable limits; above it, the surface failed.

HIC — the Head Injury Criterion — measures both the magnitude and duration of deceleration, capturing how the impact unfolds over milliseconds. The threshold is 1,000. HIC is the same family of measurement used in automotive crash testing; playground surfacing borrows directly from crash science.

From these tests, each surface earns a Critical Fall Height (CFH): the maximum height from which a child can fall onto that surface, at its certified depth, with both G-max and HIC remaining below thresholds. The CFH must meet or exceed the fall height of your tallest piece of equipment. This single specification — surface CFH versus equipment fall height — is the heart of every playground surfacing decision. Independent laboratory testing has confirmed rubber mulch at a 6-inch depth passing both thresholds at drop heights of 9 and 10 feet, with certified products rated to 12 feet.

THE BOTTOM LINE: Match one number to another. Your surface's certified Critical Fall Height must meet or exceed your tallest equipment's fall height. Certified rubber mulch at 6 inches: 12 feet.

The Standards That Protect Children, In Plain Language

ASTM F1292 — Impact Attenuation

The primary U.S. standard for playground surface impact performance. It defines the laboratory drop-test procedure described above and the G-max/HIC thresholds. When a surfacing product states a Critical Fall Height, ASTM F1292 testing is what stands behind that number. Plain language: this standard verifies the surface can actually protect a child's head from the height of your equipment.

ASTM F3012 — Material Purity for Loose-Fill Rubber

This standard governs what is allowed to be in the bag. It sets limits on hazardous metals including lead, restricts tramp metal content (loose steel from tire processing), prohibits sharp contaminants, and specifies particle size requirements. The CPSC Public Playground Safety Handbook states that rubber mulch should be

used on playgrounds only if it meets ASTM F3012. Plain language: this standard verifies the material itself is clean, metal-free, and safe for the children who will sit in it, dig in it, and — because they are children — occasionally taste it.

IPEMA — Independent, Ongoing Verification

The International Play Equipment Manufacturers Association operates a third-party certification program that goes beyond one-time testing. IPEMA certification for loose-fill rubber requires periodic manufacturing site inspections, quality audits, and re-verification that the product being shipped today still matches the product that passed the laboratory test. Plain language: ASTM tests a sample once; IPEMA keeps checking. Require both.

ASTM F1951 and the ADA — Accessibility

Public playgrounds are subject to the Americans with Disabilities Act, and the 2010 ADA Standards for Accessible Design require accessible routes to and within play areas. ASTM F1951 measures whether a surface permits wheelchair travel. Loose-fill surfaces, including rubber mulch, achieve accessibility in practice through engineered solutions: compacted sub-surfacing with wear mats at transfer points, accessible routes of unitary surfacing connecting to equipment, and maintained depth. Public buyers should plan accessible routes into the surfacing design from day one — this handbook's specification section includes the language to require it.



Unpainted black rubber mulch: identical ASTM F3012 purity, lowest cost.

The Toxicity Question — What Twenty Years of Independent Science Found

No question in playground surfacing has been studied more intensively than whether recycled tire rubber poses a health risk to children. The record is unusually deep, spans two decades, and comes from government agencies and universities with no product to sell:

- The U.S. Federal Research Action Plan on Recycled Tire Crumb (EPA, CDC/ATSDR, and CPSC, 2016–2019) — the largest study ever conducted on recycled tire material — characterized the chemicals present and measured real-world exposures, finding that while many substances exist in tire rubber at trace levels, measured exposures during normal play activity were low, generally at or near background levels.
- The University of California, Berkeley review of crumb rubber impacts (2010) found ingestion of tire shred did not elevate cancer risk.
- The Connecticut Department of Public Health human health risk assessment (2010) found exposures below levels of health concern.
- The Washington State Department of Health crumb rubber study found no elevated cancer rates among the athletes studied.

- The EPA has classified finished shredded tire rubber as a non-hazardous, filled hydrocarbon polymer — non-toxic, non-metallic, and principally organic — and confirmed that rubber added to soil is not hazardous.
- Independent laboratory toxicity testing immersed rubber mulch in hydrochloric acid stronger than human stomach acid and observed virtually no reaction from the rubber.

Across more than 60 independent studies spanning 20+ years, no causal link between recycled rubber playground surfacing and cancer or systemic illness has been established. Children have played on rubber surfacing in public parks, schools, and daycare centers for more than two decades — the longest-running real-world safety record any surfacing material has.

THE BOTTOM LINE: More than 60 independent studies across 20+ years — from the EPA, CDC, CPSC, and major universities — and no established link to cancer or systemic illness. The science is not close.

The Honest Questions, Answered One at a Time

What about heat?

Every outdoor surface gets hot in direct summer sun. In comparative testing at 101°F ambient, rubber mulch measured up to 20°F cooler than play sand. Dark colors absorb more heat than light colors. The universal best practice — for rubber, wood, metal slides, and everything else — is a quick touch test before barefoot play on very hot days, and shade design where possible.

What about fire?

Tested under the Federal Hazardous Substances Act (16 CFR 1500.44), rubber mulch burned at a rate well below the flammability classification threshold and is classified non-flammable, with a spontaneous combustion flashpoint of 610°F. Wood mulch, by contrast, ignites at roughly 300–400°F and is classified combustible.

What about pets?

Rubber is inert and non-hazardous; it does not attract chewing, insects, or animals, and toxicity testing showed virtually no acid reactivity.

What about plants and soil?

Rubber mulch does not decompose, so unlike wood mulch it does not pull nitrogen from soil as it breaks down. Water and air pass freely to root systems. The EPA's Comprehensive Procurement Guide includes recycled rubber landscape applications.

What if a child swallows a piece?

No non-food material should be eaten, but the acid-immersion testing and the Berkeley ingestion findings place rubber mulch among the most-studied and lowest-risk loose-fill materials on this question.

What about odor and off-gassing?

Independent air testing found compounds at or below naturally occurring ambient levels for outdoor installations.

How Rubber Mulch Is Made — and Why the Process Is the Safety Story

Certified playground rubber mulch begins as end-of-life tires — one of the most engineered rubber products in the world — and is transformed in stages: mechanical shredding separates the majority of tire fiber; electromagnetic separation removes steel belts and wire; sizing produces consistent nugget dimensions; purity testing under ASTM F3012 verifies metal and contaminant limits; and for colored products, UV-stable non-toxic pigments are chemically bonded to the rubber surface.

An honest note buyers deserve: some nylon and rayon tire cord fiber remains visibly embedded in finished nuggets, because fiber runs through tire sidewalls. This is a natural characteristic of the material — not a defect and not a hazard. The fiber is inert (it survived the same acid testing), and ASTM F3012 governs acceptable fiber content. A vendor who tells you their rubber mulch has zero fiber is describing a product that does not exist.

One more fact that matters to public buyers with sustainability mandates: every pallet of rubber mulch diverts roughly the equivalent of dozens of scrap tires from landfills and stockpiles. The United States generates more than 250 million scrap tires a year (U.S. Tire Manufacturers Association); certified playground surfacing is one of the EPA-recognized beneficial uses. For municipalities and districts with green-procurement policies, certified rubber mulch is a line item that satisfies both the safety office and the sustainability office.

TWO

**Every Surfacing Option, Compared
Honestly**

Critical Fall Height by Material

Surface material	Required depth	Critical Fall Height	Degrades over time?	Annual replacement?
Rubber mulch (ASTM F1292 tested)	6 inches	12 feet	No	No
Pour-in-place rubber (5 in.)	5 inches	12 feet when new	Hardens with age	Re-seal every 2–3 yrs
Pour-in-place rubber (3.5 in.)	3.5 inches	6–8 feet when new	Hardens with age	Re-seal every 2–3 yrs
Wood chips (non-CCA)	12 in. installed / 9 in. compressed	10 feet	Decomposes	Yes
Engineered wood fiber / wood mulch	12 in. installed / 9 in. compressed	7 feet	Decomposes	Yes
Pea gravel	12 in. installed / 9 in. compressed	5 feet	Compacts / displaces	Yes
Fine sand	12 in. installed / 9 in. compressed	4 feet	Compacts; harbors bacteria	Yes

Sources: CPSC Public Playground Safety Handbook Publication 325; independent laboratory impact attenuation summaries. Note the structural difference: rubber mulch achieves its rating at 6 inches because it does not compact the way organic and mineral loose fills do — the CPSC handbook itself notes rubber mulch requires 6 inches versus 9+ compressed inches for other loose-fill materials.

The Ten-Year Cost Reality

Wood fiber wins the first purchase order. Rubber mulch wins the next decade. Engineered wood fiber typically costs \$1.65–\$2.00 per square foot installed versus \$4–\$8 for rubber mulch — and then requires 10–15% depth replacement every year, full replacement every 5–7 years, plus the recurring delivery and labor that come with both. An independent industry cost analysis found that choosing wood over rubber surfacing costs a typical 1,000-square-foot institutional playground \$31,000 or more in avoidable expense over the long term. Pour-in-place rubber occupies the other extreme: excellent when new at \$12–\$20+ per square foot, but professional-install-only, with re-sealing every 2–3 years and progressive hardening that quietly erodes its fall protection.

Budget committees should evaluate surfacing the way they evaluate roofing: by cost per protected year, not by invoice total. On that math, certified rubber mulch is consistently the lowest total cost of ownership among certified-performance options.

THE BOTTOM LINE: Evaluate surfacing like roofing — cost per protected year. Certified rubber mulch wins that math by a wide margin.

Every Surface Compared, Factor by Factor

Factor	Rubber mulch	Wood mulch / EWF	Sand	Pea gravel	Pour-in-place
Fall protection (at spec depth)	12 ft	7 ft	4 ft	5 ft	12 ft when new
Performance over 10 years	Consistent	Degrades	Compacts	Displaces	Hardens
Annual replacement	No	Yes	Yes	Yes	Re-seal cycle
Freeze behavior	Stays loose	Freezes solid	Freezes	Freezes	Hardens further
Free drainage	Yes	Partial	Partial	Yes	No
Insect / pest attraction	No	Termites, ants	Ants, fleas; animal waste	No	No
Mold / mildew risk	No	High in wet climates	Moderate	No	Moderate
DIY-installable	Yes	Yes	Yes	Yes	No
ADA accessibility	Partial (with engineered routes)	Yes (when maintained)	No	No	Yes

THREE

**Specification, Installation, and
Maintenance**





A customer's backyard playground on brown rubber mulch — one weekend, decades of protection.

Depth Requirements

Installation type	Minimum depth	Basis
Landscaping / garden beds	2 inches	General landscaping practice
Home playground, low equipment	3 inches	Residential best practice
Home playground, taller equipment	4 inches	Residential best practice
Schools, daycares, parks, commercial	6 inches	CPSC guidelines — required for certified protection

Add 10–15% to calculated volume for displacement in high-traffic zones. Certified fall protection exists only at certified depth — a 6-inch surface allowed to thin to 3 inches under the swings is no longer the surface that passed the test. One money-saving truth your calculator-wielding competitor won't tell you: concentrate your depth where falls actually happen. The fall zone — roughly 6 to 8 feet around the equipment — is where full depth matters. Outside that zone, depth is an aesthetic choice, not a safety requirement.

Use Zones

The use zone is the area where a child could land, and it must be surfaced to the same standard as the spot directly under the equipment: a minimum of 6 feet in all directions from stationary equipment, and for swings, twice the pivot height in front of and behind. Use-zone square footage — not equipment footprint — determines your material requirement.

Installation That Protects the Investment

A note on who does what: Perfect Rubber Mulch delivers nationwide — our shippers bring the product to your site. Installation itself is a straightforward job for a homeowner, facilities crew, or local contractor, and the steps below are exactly what you or your installer should follow.

- Strip the use zone of existing surfacing, debris, and vegetation.
- Verify drainage; standing water under any loose fill degrades protection.
- Lay geotextile filter fabric — contains the rubber, passes water, blocks weeds.
- Install perimeter borders at fill depth plus at least 2 inches of freeboard (8-inch border for a 6-inch fill).
- Place wear mats beneath swings and slide exits — the two highest-displacement zones.
- Mark equipment posts at minimum fill level for at-a-glance depth inspection forever after.

Maintenance Schedule

- Monthly (commercial/institutional) or seasonal (residential): inspect depth against post markings.
- After heavy-use periods: rake displaced material from kick-out zones back across the use zone.
- Ongoing: remove leaves, litter, and foreign objects.
- Spring in freeze-thaw climates: full rake and depth verification.
- Every 3–5 years (high-use commercial): budget 10–15% replenishment to maintain certified depth.

FOUR

The Decision-Maker's Toolkit



A public park use zone — surfacing sized to the equipment, not the footprint.

Ten Questions to Ask Any Surfacing Vendor (Including Us)

- 1. Can you provide current ASTM F1292 test documentation, and what Critical Fall Height does it certify at what depth?
- 2. Does the product carry IPEMA certification — and can I verify it in IPEMA's public database?
- 3. Does the product meet ASTM F3012 material purity limits, including lead and tramp metal?
- 4. What is the certified depth requirement for my equipment's fall height, and how much material does my use zone require?
- 5. What does the warranty cover — color, material integrity, or both — and for how long?
- 6. What is the true 10-year cost including replenishment, delivery, and labor?
- 7. How is the product packaged and delivered, and what equipment do I need on site?
- 8. What documentation will you provide for my insurance carrier and licensing inspections?
- 9. What is your replenishment availability — will color-matched material exist in five years?
- 10. Who do I call when something is wrong, and will a human answer?

Budget Justification — The One-Pager for Your Board

A template any administrator may adapt: 'Our playground serves approximately [N] children. CPSC data identifies surface falls as the leading cause of serious playground injury. Our current surfacing is [material] with

an effective fall-height rating of [X] feet against equipment requiring [Y] feet. Certified rubber mulch at 6 inches provides a 12-foot certified rating, eliminates annual replacement (saving approximately \$[Z] per year in material and labor), carries ASTM F1292, ASTM F3012, and IPEMA certification accepted by insurers and licensing agencies, and is the lowest 10-year total-cost option meeting certified performance. Requested appropriation: \$ [total], a one-time investment replacing a recurring annual expense.'

Cut-and-Paste Procurement Specification Language

For RFPs and purchase orders: 'Playground protective surfacing shall be loose-fill recycled rubber mulch meeting ASTM F1292 (impact attenuation) with documented Critical Fall Height equal to or exceeding the fall height of installed equipment; ASTM F3012 (material purity for loose-fill rubber); and shall carry current IPEMA certification. Material shall be 99%+ metal-free with UV-stable, non-toxic color coating (where colored product is specified). Installed depth shall be a minimum of 6 inches maintained, over geotextile filter fabric, with perimeter containment and wear mats at swing and slide exit locations. Vendor shall supply certification documentation prior to acceptance.'

Inspection Log Template

[Monthly checklist: date / inspector / depth at posts A-B-C-D / displacement raked? / debris removed? / border integrity / mat condition / action items.] Laminate it, hang it in the facilities office, and your licensing inspection becomes a filing exercise.

About Perfect Rubber Mulch

Perfect Rubber Mulch LLC brings twenty-two years of playground safety surfacing experience to certified playground and landscape rubber mulch — ASTM F1292 tested, ASTM F3012 compliant, IPEMA certified — delivered nationwide. Twenty-two years in this work creates a depth of knowledge you can hear within a minute of calling us, and we hope you will. Questions this handbook did not answer? A human who has done this for decades will answer: 800-918-3357 • support@perfectrubbermulch.com • perfectrubbermulch.com

Primary Sources

- CPSC Public Playground Safety Handbook, Publication 325 (cpsc.gov)
- U.S. EPA / CDC-ATSDR / CPSC Federal Research Action Plan on Recycled Tire Crumb (2016–2019)
- ASTM F1292, ASTM F3012, ASTM F1951; IPEMA certification program (ipema.org)
- University of California, Berkeley: Review of the Impacts of Crumb Rubber (2010)
- Connecticut Department of Public Health: Human Health Risk Assessment (2010)
- Washington State Department of Health Crumb Rubber Study
- EPA Comprehensive Procurement Guide; EPA Child-Specific Exposure Factors Handbook

- Hofstra University recycled rubber exposure study (2007); NY State DOH crumb rubber fact sheet (2008)
- American Tire Recycling Environmental & Safety Testing Results Summary (2012)
- 2010 ADA Standards for Accessible Design; independent industry cost analyses (2025)



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Get Back Up Laughing.**

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