ARTIFICIAL GRASS MARKHAM · RESEARCH SERIES

Playground Surfaces in Markham: Safety & Fall-Height Performance Review

A standards-based review of impact attenuation, surfacing options, climate factors and costs for playgrounds, daycare play yards and backyard play areas in Markham

REPORT	RR-2026-MAR-02 · August 2026
COVERAGE	City of Markham, Regional Municipality of York, Ontario
PREPARED BY	Artificial Grass Markham Research, Markham, Ontario
CONTACT	+1 289-514-5387 · artificialgrassmarkham.ca

Artificial Grass Markham Research publishes data-driven local studies on residential landscaping, water use and outdoor surfaces in Markham and the Greater Toronto Area. This report is provided free for information purposes.

ABSTRACT

This report reviews the published safety basis for playground surfacing and applies it to Markham. It draws on the U.S. Consumer Product Safety Commission's Public Playground Safety Handbook, the ASTM F1292 impact-attenuation test method and Canada's CSA Z614:20 standard, together with Markham-specific inputs: 1991–2020 climate normals from the Buttonville station located inside the city, 2021 Census housing figures, the July 2024 flood record and published local installation pricing. It is an evidence review, not a site assessment; every figure is cited, and every modelling assumption is stated where it is used.

The review finds that falls are precisely the risk surfacing standards target — the CPSC estimates **over 200,000 playground injuries** are treated in U.S. emergency rooms each year, and it does not consider grass or dirt protective surfacing at any depth; that unitary systems such as poured rubber, or synthetic turf over an engineered shock pad, are tested as complete systems against the **200 g-max / HIC 1,000** thresholds; and that Markham's freeze-thaw winters and 27.3°C July average high make frost-resistant bases and heat management part of the local specification. A 300 sq ft backyard play area with a playground-rated turf system prices at roughly **$5,700–$7,500** at published planning rates.

KEY FINDINGS AT A GLANCE

200,000+	10 ft	200 / 1,000	$11–13
estimated U.S. emergency-room-treated playground injuries per year (CPSC)	fall height protected by 9 in of wood chips or 6 in of shredded rubber (CPSC Table 2)	g-max / HIC pass-fail thresholds in ASTM F1292, referenced by CSA Z614:20	per sq ft, published Markham installed rate with full base preparation

Contents

1 Why the surface under play equipment matters

Playground safety standards exist because children fall. The U.S. Consumer Product Safety Commission estimates that **more than 200,000 playground injuries are treated in emergency rooms each year** in the United States alone [1]. Comparable Markham counts are not published, but the city's scale makes the issue local by arithmetic: 338,503 residents in 110,867 households at the 2021 Census, homes 81.7% owner-occupied, and an average household of 3.0 people [7] — a family housing stock in which play structures sit in schoolyards, daycare yards and a large share of backyards.

The one injury factor a specification can directly control is the surface beneath the equipment. The CPSC handbook is blunt about the most common default: **grass and dirt are not considered protective surfacing**, because wear and environmental factors reduce their shock-absorbing effectiveness [1]. In Markham's post-1990s growth subdivisions, where standard detached lots run roughly 10–13 m of frontage and newer designs are narrower [8], backyard play areas are compact — which makes the performance of every square foot under a swing or slide matter more, not less.

2 The standards: CSA Z614, ASTM F1292 and critical fall height

Two documents govern how playground surfacing performance is judged in Canada. CSA Z614, *Children's playground equipment and surfacing*, is the Canadian standard; its 2020 edition (Z614:20) aligned surfacing impact testing with the American test method ASTM F1292 [3]. That method drops an instrumented headform onto the surface and records the impact; a surface system passes when peak deceleration stays at or below **200 g-max** and the Head Injury Criterion score at or below **HIC 1,000**, thresholds stated in the standard text [2]. The highest drop a system passes defines its critical fall height — the single number every surfacing comparison comes down to.

Table 1 — The standards framework at a glance. *Sources: [1][2][3].*

Document	Role	Key published figures
CSA Z614:20	Canadian playground equipment and surfacing standard	2020 edition aligned surfacing impact testing with ASTM F1292
ASTM F1292-22	Impact-attenuation test method (headform drop test)	Pass/fail: 200 g-max peak deceleration; HIC 1,000
CPSC Handbook Pub 325	U.S. public playground safety guidance	Loose-fill depth table; grass and dirt not protective

For loose-fill materials, the CPSC handbook publishes minimum compressed depths and the fall height each protects to (Table 2, Figure 1). Two findings stand out. First, depth is doing the work: nine inches of sand protects only to 4 ft, while six inches of shredded rubber protects to 10 ft. Second, even the best loose-fill ratings sit near typical play-structure deck heights, leaving little margin once material thins, compacts or migrates out of the fall zone.

Published summaries of a separate shock-attenuation study report different protected heights at a 6-inch depth — 14 ft for rubber mulch versus 6 ft for engineered wood fiber [4]. The test basis differs from the CPSC table, so the two sets of figures are not interchangeable; this report uses the CPSC values throughout.

Table 2 — CPSC minimum compressed loose-fill depths and protected fall heights. *Source: CPSC Pub 325, Table 2 [1].*

Material (compressed depth)	Protects to fall height
Shredded / recycled rubber (6 in)	10 ft
Wood chips (9 in)	10 ft
Wood mulch, non-CCA (9 in)	7 ft
Pea gravel (9 in)	5 ft
Sand (9 in)	4 ft

Figure 1 — Fall-height protection by loose-fill material at the CPSC handbook's minimum compressed depths (6 in shredded rubber; 9 in wood chips, wood mulch, pea gravel and sand). *Source: CPSC Pub 325, Table 2 [1].*

3 Unitary systems: poured rubber and turf over shock pad

Unitary surfaces take the opposite approach to loose fill: rather than relying on maintained depth, they bind the shock-absorbing layer into a fixed structure. The best-documented example is poured-in-place rubber — a wear layer of typically 9.5 mm EPDM or TPV granules over a cushion layer of 25–127 mm of crumb rubber, with thickness set by the fall height the application demands [4].

Synthetic turf over an engineered shock pad follows the same two-layer logic: a fibrous wear surface over a resilient cushion of fixed thickness, with the assembled system — not the turf carpet alone — tested under the F1292/Z614 headform regime [2][3]. Because the cushion is bound in place, protection does not depend on where material has migrated: loose fill thins under swings and at slide exits, precisely where falls concentrate, while a pad's thickness is the same at every point.

The trade-offs are honest ones. Unitary systems cost more up front (Section 6), and turf systems raise an infill question the evidence speaks to directly. A 2018 study identified 92 chemicals in tire-crumb samples, about half never studied for health effects, and its authors warned against use where human exposure is likely; studies around 2020 found modern turf cancer risks negligible; and in September 2022 the European Commission drafted a proposal to restrict intentionally added microplastic granule infill [5] — one reason specifiers increasingly choose non-rubber infills for child-serving sites.

4 Markham climate factors: frost, snow and summer heat

Markham's climate file reads like a stress test for playground surfacing. At Toronto/Buttonville Airport — the climate station located inside Markham — the 1991–2020 normals show a January average low of **−10.1°C** and **146.4 cm of annual snowfall** [6]. Freeze-thaw cycling is hard on every surfacing category: it compacts and displaces loose fill, and it is the failure mode unitary installations are engineered against, with the crushed-stone base doing the frost-protection work.

Summer brings the opposite stress. The July average high is 27.3°C [6], and the heat evidence is unambiguous: artificial turf absorbs significantly more radiation than living grass and retains heat, running much hotter than natural grass in sun [5]. For child-serving sites this is a genuine design constraint — siting, shade and timing of use belong in the specification discussion. Annual precipitation of 862.4 mm is well distributed, with July among the wetter months at 85.2 mm [6], so every surface also needs a drainage answer: a play area that ponds is a play area out of service.

LOCAL CONTEXT — JULY 16, 2024

Slow-moving thunderstorms dropped over 100 mm of rain in a few hours across Toronto and southern Ontario — Pearson recorded 97.8 mm, more than a month's rain in one morning — flooding roads, rivers and basements across the region including York Region; insured damage exceeded $940 million, the costliest Ontario weather event of a record-setting 2024 [9]. Extreme rain is part of Markham's design reality: the base under a play surface should be built to drain storm-scale water, not just sprinkler runoff.

5 Inspection and maintenance over the surface's life

Impact attenuation is a property to be maintained, not just achieved on installation day. The CPSC depth table is explicit that its figures are minimum *compressed* depths [1]: loose-fill protection erodes as material compacts, scatters and decomposes, and must be restored by raking, levelling and top-ups. Unitary systems shift the burden rather than eliminating it — artificial turf is not maintenance-free, requiring regular raking, patching and periodic cleaning or disinfection [5] — and shock-pad systems add seams, edges and drainage paths to the inspection list. Z614's alignment with the F1292 drop test gives owners a repeatable check: surfaces can be re-tested over their life against the same 200 g-max / HIC 1,000 thresholds [2][3]. In Markham's climate the sensible rhythm is a spring inspection after frost exit and a fall inspection before snow cover, verifying loose-fill depth under swings and at slide exits, and checking unitary surfaces for seam lift, tears and blocked drainage.

6 The cost picture for Markham schools, daycares and backyards

Two published price references frame the local cost picture. Artificial Grass Markham publishes installed rates of $6–8 per sq ft installation-only and **$11–13 with full base preparation** [11]; a GTA-wide guide publishes $10–12 entry, $13–18 mid and $19–25+ premium fully installed, with a typical 400–700 sq ft backyard at $5,000–12,000 [10]. Playground-rated builds — turf over a certified shock pad, or poured rubber — are quoted as engineered systems rather than at published per-foot rates; this report uses the guide's premium band ($19–25+/sq ft) as a planning proxy, labelled as an assumption.

Applied to three representative settings, the proxy produces the planning ranges in Table 3 and Figure 2. A compact 300 sq ft backyard play zone — the scale that fits Markham's 10–13 m-frontage detached lots [8] — prices at $3,300–3,900 in landscape-grade turf and roughly **$5,700–7,500** as a playground-rated system. The figures cover the surface only: play equipment, borders, ramps and site furniture sit outside them. Natural-grass play areas avoid the capital line but carry an upkeep constraint turf does not: Markham's Water Use By-law 2019-53 restricts outdoor watering from June 1 to September 30 to alternate days by address parity, in one three-hour window per permitted day [12] — a regime under which high-traffic grass under play equipment is hard to keep alive, and which the CPSC reminds us is not protective surfacing in any case [1].

Table 3 — Planning cost ranges by setting. Landscape turf at published Markham full-base rates; playground-rated systems at the GTA premium-band proxy (assumption — §M). *Sources: [10][11].*

Setting	Area	Landscape turf ($11–13/sq ft)	Playground-rated proxy ($19–25/sq ft)
Backyard play zone	300 sq ft	$3,300–3,900	$5,700–7,500
Daycare play yard	1,000 sq ft	$11,000–13,000	$19,000–25,000
School play zone	2,500 sq ft	$27,500–32,500	$47,500–62,500

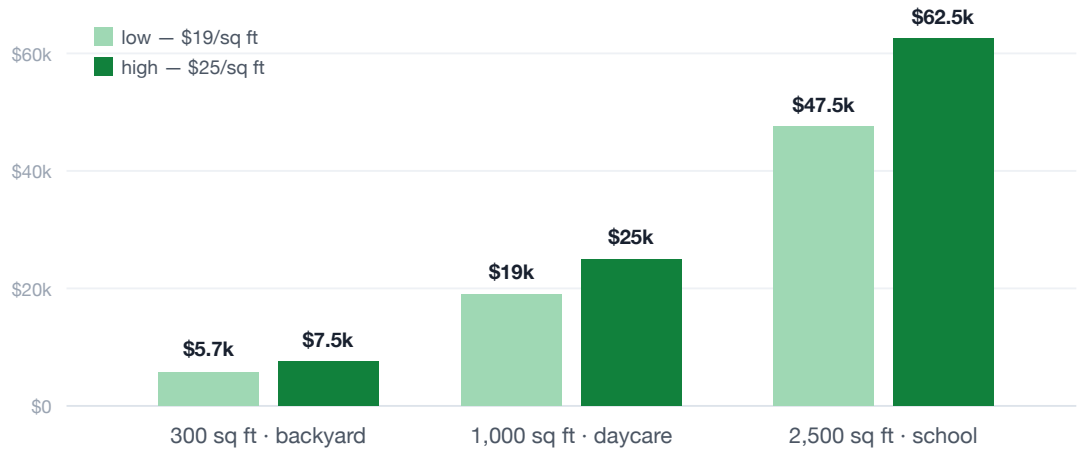

Figure 2 — Playground-rated system planning ranges by setting, at the GTA premium-band proxy of $19–25 per sq ft (assumption — §M). *Derived from [10]; ranges in Table 3.*

M Methodology & data sources

This is a desk-research evidence review. Sources were collected in August 2026 from the documents listed under References: the CPSC Handbook for Public Playground Safety (Publication 325), the ASTM F1292-22 and CSA Z614:20 standards, Environment and Climate Change Canada 1991–2020 climate normals for Toronto/Buttonville A (carried in the Wikipedia weatherbox for Markham — ECCC's own normals pages could not be rendered programmatically, so the weatherbox is the cited carrier of the ECCC figures), 2021 Census figures via Canadian Data Insights, a local development firm's summary of Markham lot standards, Insurance Bureau of Canada event reporting, and published installer price guides. The ASTM and CSA documents are cited as standards; their threshold values are stated in the standard texts (the astm.org product page blocks automated access and is not itself quoted).

Stated assumptions (not sourced facts): (i) scenario areas of 300 / 1,000 / 2,500 sq ft are illustrative, chosen to span backyard, daycare and school settings; (ii) the playground-rated planning proxy of $19–25+/sq ft is the GTA guide's premium installed band [10], used because playground systems are quoted per project rather than at published per-foot rates — it may overstate or understate any specific quote; (iii) cost ranges cover the surface system only and exclude play equipment, edging, ramps and site works; (iv) no discounting or inflation adjustment is applied. Derived figures are simple products of the cited rates and the stated areas.

Limitations

U.S. injury statistics are used as context; comparable Canadian counts were not available in the sources reviewed. Standards describe test performance of installed systems; real-world protection depends on installation quality and upkeep, which this report does not measure. The heat and infill evidence cited is general to product categories, not measured on Markham sites, and product-specific claims (for example, one manufacturer's warranty or drainage design) apply to that manufacturer only. Cost figures are planning ranges, not quotations, and no site assessment of any Markham playground was performed. This report is not a safety audit, an engineering specification, or a substitute for a certified playground inspection.

R References

1. U.S. Consumer Product Safety Commission — Handbook for Public Playground Safety (Publication 325). https://www.cpsc.gov/s3fs-public/325.pdf (accessed August 2026).
2. ASTM International — ASTM F1292-22, Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment. https://www.astm.org/f1292-22.html (accessed August 2026).
3. CSA Group — CSA Z614:20, Children's playground equipment and surfacing. https://www.csagroup.org/store/product/CSA%20Z614%3A20/ (accessed August 2026).
4. Wikipedia — Playground surfacing. https://en.wikipedia.org/wiki/Playground_surfacing (accessed August 2026).
5. Wikipedia — Artificial turf. https://en.wikipedia.org/wiki/Artificial_turf (accessed August 2026).
6. Wikipedia — Markham, Ontario (ECCC 1991–2020 climate normals, Toronto/Buttonville A station). https://en.wikipedia.org/wiki/Markham,_Ontario (accessed August 2026).
7. Canadian Data Insights — Markham census demographics (2021 Statistics Canada Census data). https://canadiandatainsights.com/location/markham/ (accessed August 2026).
8. Cedarwood Development — Markham lot frontage standards and By-law 2006-96. https://www.cedarwooddevelopment.ca/post/markham-driveway-widening-by-law-2006-96-what-you-can-legally-build-and-what-will-get-you-fined (accessed August 2026).
9. Insurance Bureau of Canada — July flash floods in Toronto and southern Ontario caused over $940 million in insured damage. https://www.ibc.ca/news-insights/news/july-flash-floods-in-toronto-and-southern-ontario-caused-over-940-million-in-insured-damage (accessed August 2026).
10. Toronto Turf Pros — Artificial grass cost in Toronto (2026 guide). https://torontoturfpros.ca/blog/artificial-grass-cost-toronto/ (accessed August 2026).
11. Artificial Grass Markham — published installed pricing. http://artificialgrassmarkham.ca/ (accessed August 2026).
12. York Region — Outdoor Water-Use Bylaws (incl. City of Markham Water Use By-law 2019-53). https://www.york.ca/environment/water-and-wastewater/outdoor-water-use-bylaws (accessed August 2026).

CITE THIS REPORT

Artificial Grass Markham Research (2026). *Playground Surfaces in Markham: Safety & Fall-Height Performance Review*. AGM Research Series RR-2026-MAR-02, Markham, Ontario. https://artificialgrassmarkham.ca/research/playground-turf-safety-fall-height-markham/