CRO PROCESS

# Website Performance and Conversion: A Review of the Evidence

A review of the evidence linking Core Web Vitals and page speed to conversion, bounce, and search ranking, with practical guidance for CRO teams.

**Bhaskar Roy Sarkar**, cazyweb · June 28, 2026 ·

Core Web Vitals | page speed | conversion rate | LCP | INP

Download PDF

ABSTRACT

Website performance has measurable, documented effects on conversion rates, bounce behaviour, and organic search visibility. This paper reviews the primary evidence base -- Google's Core Web Vitals framework and its thresholds, published controlled case studies on web.dev, the Deloitte/Google 'Milliseconds Make Millions' report, and Google's mobile benchmarking research -- to give ecommerce founders and CRO managers an honest account of what the data actually shows. The evidence for a load-time-to-conversion relationship is real, but much of it comes from vendor-published case studies and before/after comparisons rather than randomised controlled trials; practitioners should treat magnitude claims as directional guides rather than universal constants. Google's page experience ranking signal exists and is confirmed in official documentation, but Google itself states that content relevance takes precedence, making

performance optimisation a necessary rather than sufficient condition for search success.

## 1. Introduction

Page speed has accumulated a dense mythology: half-second delays that halve revenue, milliseconds that 'make millions', and conversion curves that fall off a cliff at the three-second mark. Some of those claims are well-grounded; others are extrapolations, misattributions, or vendor marketing dressed in statistical clothing. This paper audits the evidence layer by layer, distinguishing strong primary data from industry case studies and secondhand summaries, so that CRO managers can calibrate their prioritisation accordingly.

## 2. Core Web Vitals: What the Thresholds Mean and Where They Come From

Google's Core Web Vitals (CWV) programme defines three field metrics that capture distinct dimensions of perceived page quality.[1] Each metric is evaluated at the 75th percentile of real user loads, segmented by device, which means a site must be 'good' for three-quarters of its visitors, not just the median case.

### 2.1 Largest Contentful Paint (LCP)

LCP marks the render time of the largest image or text block visible in the viewport -- a proxy for when a user perceives the page as useful.[2] Thresholds:[1]

- Good: 2.5 seconds or less
- Needs improvement: 2.5 to 4.0 seconds
- Poor: above 4.0 seconds

### 2.2 Interaction to Next Paint (INP)

INP replaced First Input Delay (FID) as the responsiveness Core Web Vital on 12 March 2024.[3] Where FID measured only the delay before the browser could begin processing the first input, INP measures the full duration from any interaction to the next frame paint, covering the entire page lifecycle.[4] Thresholds:[4]

- Good: 200 milliseconds or less
- Needs improvement: 200 to 500 ms
- Poor: above 500 ms

### 2.3 Cumulative Layout Shift (CLS)

CLS quantifies visual instability -- how much page elements move unexpectedly during load. The score is dimensionless, combining the fraction of the viewport affected and the distance of movement.[5] Thresholds:[1]

- Good: 0.1 or less
- Needs improvement: 0.1 to 0.25
- Poor: above 0.25

### 2.4 How the Thresholds Were Set

The thresholds are not arbitrary. Google published its methodology in detail: LCP's 2.5-second boundary is informed by human-factors research on response-time perception (citing Miller and Card); INP's 200 ms boundary draws on Michotte's causality research showing that interactions feel directly causal at delays below roughly 100 ms; and CLS's 0.1 threshold emerged from internal user testing where scores above 0.15 were consistently rated disruptive.[6] The 75th-percentile measurement rule was chosen to balance quality ambition against achievability -- at the time the thresholds were published, at least 10 percent of origins already met each standard.[6]

## 3. The Load-Time-to-Conversion Evidence Base

### 3.1 The Deloitte / Google / Fifty-Five Study (2020)

The most rigorous large-scale study specifically designed to isolate the revenue effect of speed is the 'Milliseconds Make Millions' report, commissioned by Google and conducted by data agency Fifty-Five and Deloitte Digital.[7] The study monitored 37 European and North American brand sites across retail, travel, luxury, and lead generation verticals, collecting data from over 30 million mobile user sessions over a 30-day period at end of 2019. Speed was measured on four dimensions -- First Meaningful Paint, Estimated Input Latency, observed page load time, and Time to First Byte -- and the central finding was the effect of a 0.1-second improvement in each metric across the full purchase funnel:[7]

- Retail: conversion rate increased 8.4%; average order value increased 9.2%
- Travel: conversion rate increased 10.1%; booking rate increased 10%; checkout completion increased 2.2%
- Luxury: progression from product detail page to 'add to basket' increased 40.1%
- Lead generation: form submission rate improved 21.6%

Important caveats: no UX redesigns occurred during the measurement window, which strengthens the isolation of speed as the variable. However, the study used hour-by-hour correlational analysis rather than a randomised experiment, so confounders (seasonal demand, campaign overlap) cannot be fully ruled out. Treat the percentages as directional magnitudes, not universal constants.

### 3.2 Akamai / SOASTA Mobile Retail Benchmarking (2017-2018)

Akamai, which had acquired SOASTA in April 2017, published the 'State of Online Retail Performance' data from approximately 10 billion real user monitoring sessions across leading online retailers.[8] Google subsequently extended this research using a neural network trained on 11 million mobile landing pages across 213 countries (February 2018).[9] Key findings:

- A two-second delay in page load increases bounce rates by 103 percent
- As load time extends from one second to 10 seconds, the probability of a mobile visitor bouncing increases by 123 percent
- A 100-millisecond delay was associated with a 7 percent reduction in conversion rates (SOASTA/Akamai attribution)
- 70 percent of analysed mobile pages took over five seconds for above-the-fold content to display

Methodological note: the bounce rate figures derive from correlational analysis of observational data, not a controlled experiment. The direction of the relationship is robust, but the precise percentages should be understood as industry benchmarks rather than causal effect sizes.

### 3.3 Google 'Need for Mobile Speed' (2016)

An earlier Google report analysed aggregated, anonymised data from 4,500 mobile websites over 12 months (June 2015 to May 2016) and found that 53 percent of mobile site visits were abandoned when pages took longer than three seconds to load.[10] The same study found that sites loading within five seconds earned up to twice the mobile ad revenue of sites loading in 19 seconds, and had 35 percent lower bounce rates and 70 percent longer average sessions. This figure -- '53% abandon after 3 seconds' -- has since become the most cited statistic in mobile performance discourse; it is real and sourced, though it describes behaviour under 2015-2016 network conditions and should be read in that context.

## 4. Controlled Case Studies: A/B Evidence from web.dev

Google's web.dev platform publishes performance case studies; the evidentiary quality varies significantly between them. The strongest evidence comes from cases with explicit A/B methodology:

**Vodafone Italy (2021):** An A/B test on a landing page sent approximately 100,000 clicks per day to each variant. The optimised version (version A) received server-side rendering and image optimisation, achieving a 31 percent improvement in LCP. Version B was the unchanged baseline, visually identical. Outcome: 8 percent more total sales, 15 percent uplift in lead-to-visit rate, 11 percent uplift in cart-to-visit rate.[11] This is among the cleanest causal evidence available in the public domain.

**Rakuten 24 (2022):** A month-long 50/50 A/B test of a landing page optimised for Core Web Vitals (CLS improved 92.72%, FID improved 7.95%) against the original. Outcome: 53.37 percent increase in revenue per visitor and 33.13 percent increase in conversion rate.[12] The magnitude is large enough to invite scrutiny -- these results likely reflect a landing page that was severely underperforming on CWV before optimisation, and should not be extrapolated as typical returns.

**Fotocasa (2025):** After almost all pages moved from 'good' to 'needs improvement' or 'poor' when INP replaced FID in March 2024, the Fotocasa team reduced desktop INP from 440 ms to 64 ms (CPU 4x throttle) and mobile INP from 832 ms to 232 ms (CPU 6x throttle). Outcome: 27 percent increase in contact and phone lead ads.[13]

**QuintoAndar (2025):** Reduced INP by 80 percent (mobile INP from 1,006 ms to 216 ms) through React transitions, memoisation, and removal of CSS-in-JS. Outcome: 36 percent year-over-year increase in conversion volume (property visit bookings). This case study used before/after real user monitoring rather than a controlled experiment, so year-on-year confounders such as market seasonality cannot be excluded.[14]

**redBus (2023):** INP on the search results page reduced from 870-900 ms to 350-370 ms via debounced scroll handlers and reduced lazy-load batch sizes. The team reported approximately 7 percent sales increase. Methodology is before/after RUM with no explicit control group.[15]

The aggregate picture from web.dev's case study collection -- synthesised by Rajpal and Gopalakrishnan (2021) -- shows positive business outcomes across Vodafone, Tokopedia, Rakuten, Lazada, GYAO, Cdiscount, and others.[16] However, the majority of these are before/after comparisons, not randomised trials. Interpret them as converging directional evidence, not precise effect-size estimates.

## 5. Core Web Vitals as a Google Search Ranking Signal

Google officially confirmed that Core Web Vitals are used within its ranking systems.[17] The rollout timeline: page experience signals for mobile search began in mid-June 2021 and were fully integrated by August 2021.[18] Desktop followed, starting February 2022 and completing by March 2022.[19] INP joined the ranking signal set when it replaced FID as a stable Core Web Vital on 12 March 2024.[20]

Three important qualifications apply:

1. **Content relevance takes precedence.** Google's page experience documentation states explicitly: 'Google Search always seeks to show the most relevant content, even if the page experience is sub-par.'[21] A technically fast but thin or irrelevant page will not outrank authoritative content.

2. **The signal operates among competitors.** Where multiple pages have similar relevance, page experience becomes a differentiating factor -- effectively a tiebreaker rather than a primary ranking driver.[21]

3. **Good CWV scores do not guarantee top rankings.** Google's own Search Central documentation is explicit that strong Core Web Vitals report performance 'doesn't guarantee that your pages will rank at the top of Google Search results.'[17]

Practical implication: CWV optimisation earns organic search credit incrementally and asymmetrically -- the lift is most visible in competitive SERPs

where content quality is roughly equivalent across ranking candidates.

## 6. Mobile Performance: A Distinct Priority

The mobile/desktop gap in performance is structural, not accidental. The 2018 Google benchmarking study found that the average mobile landing page took over five seconds to display above-the-fold content.[9] The Akamai/SOASTA data showed that mobile shoppers have the highest bounce rates in ecommerce, and that only one in five consumers who browse on smartphones complete a purchase on the same device -- with speed cited as a contributing factor.[8]

The Milliseconds Make Millions study was conducted entirely on mobile, reinforcing that funnel sensitivity to speed is more acute on mobile than desktop.[7] Core Web Vitals are measured separately per device segment,[1] meaning a site can pass on desktop and fail on mobile -- a common pattern given heavier JavaScript payloads and lower-powered CPUs.

For ecommerce teams, the implication is straightforward: mobile CWV should be the primary optimisation target, because mobile users have less patience for delays, more constrained hardware, and often slower network conditions.

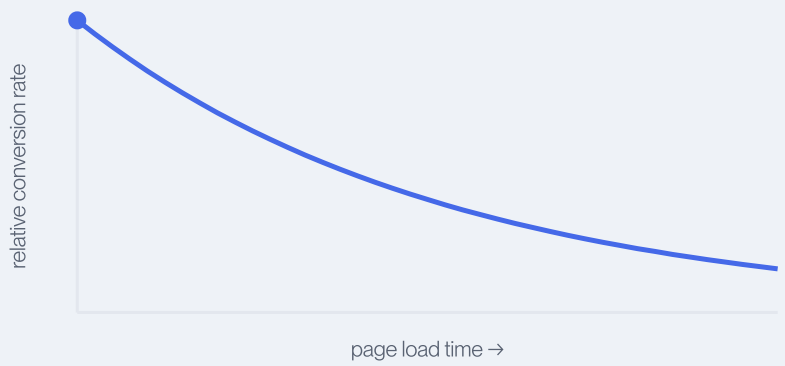
## 7. The Shape of the Speed-to-Conversion Curve

The relationship between load time and conversion is not linear. Several independent data sources point to the same shape: steep degradation between approximately one and five seconds, then a plateau at higher values.

The Google/SOASTA neural-network analysis found that bounce probability increases 123 percent as load time moves from one second to ten seconds -- but the curve is not proportional. The 2018 Google benchmark page notes that as page elements increase from 400 to 6,000, the probability of conversion drops 95 percent, suggesting element count (and its proxy, load time) has diminishing marginal effects at higher values.[9] The Akamai/SOASTA data

similarly shows a 103 percent bounce increase from two-second to beyond that threshold -- most of the damage is done in the early seconds.

The practical consequence for CRO prioritisation is significant: moving from a 6-second LCP to a 3-second LCP will almost certainly yield more measurable conversion lift than moving from a 2-second LCP to a 1.5-second LCP. Resources should therefore be directed at closing the gap to 'good' thresholds before pursuing micro-optimisation below them. Once a site achieves good LCP (under 2.5 seconds), INP (under 200 ms), and CLS (under 0.1), the next highest-return lever is usually page experience or content, not further speed gains.




Conversion tends to fall as load time climbs, with the steepest drop in the first few seconds. Published field studies repeatedly find this directional relationship between speed and both conversion and bounce.

## 8. Distinguishing Strong Evidence from Vendor Claims

The practitioner should maintain the following hierarchy when weighing claims:

**Strongest evidence:** Randomised A/B tests with pre-registered hypotheses, no concurrent changes, and adequate statistical power. In the public performance literature, Vodafone Italy (web.dev, 2021) is the clearest example.

**Strong evidence with caveats:** Large-scale observational studies with robust sample sizes and reasonable confound controls, such as the Deloitte/Fifty-Five/Google Milliseconds Make Millions report (2020) and the Akamai/SOASTA retail benchmarking data (2017-2018). Treat effect sizes as directional.

**Useful but lower-confidence:** Before/after RUM comparisons without a concurrent control group (Rakuten, QuintoAndar, redBus, Tokopedia on web.dev). Confounders -- marketing spend changes, seasonality, concurrent UX changes -- cannot be excluded. The direction of the effects is plausible and consistent across many independent sites; the magnitudes should be taken as indicative upper bounds.

**Treat with scepticism:** Unattributed statistics circulated without primary source links (e.g., '1-second delay = 7% conversion loss' frequently appears without a verifiable original study). The 7 percent figure traces to Akamai/SOASTA 2017 benchmarking; always verify the chain of attribution before citing a number in a client report.

## 9. Practical Guidance for CRO Teams

Based on the verified evidence:

1. **Audit field data, not just lab data.** PageSpeed Insights and Google Search Console's Core Web Vitals report show real user data at the 75th percentile -- the same data Google's ranking systems use. Lighthouse lab scores are useful for diagnosis but not what ranking systems or user experience analyses are based on.

2. **Prioritise LCP and INP on mobile first.** The conversion impact of speed is most pronounced on mobile, and the mobile gap is widest. LCP is typically the highest-impact metric for ecommerce product and landing pages.

3. **Close the 'good' threshold gap before chasing sub-2-second gains.** The diminishing-returns curve means the performance-to-conversion slope

flattens below the 'good' threshold. Crossing from 'poor' to 'good' on LCP is a more reliable lift than shaving 100 ms off an already-good score.

4. **Run A/B tests when possible.** Before/after comparisons can attribute gains to performance when no other changes occur, but a concurrent control group eliminates doubt. The Vodafone methodology -- visually identical variants, isolated performance change, 100K daily sessions per arm -- is the gold standard to emulate.

5. **Frame performance in CWV terms for SEO stakeholders, and in conversion terms for commercial stakeholders.** The ranking signal is real but secondary; the conversion evidence is the stronger commercial justification and is more directly tied to revenue.

## 10. Conclusion

The evidence that website performance affects conversion rates and organic search visibility is robust in direction and consistent across multiple independent data sources. The specific magnitude of any given improvement will depend on the current baseline, the vertical, device mix, and the nature of the optimisation. The most defensible claims are: (a) reducing LCP from poor to good has a material, measurable positive effect on conversion rates in ecommerce; (b) 53 percent of mobile users historically abandoned pages taking over three seconds to load under 2015-2016 conditions; (c) Google incorporates Core Web Vitals into its ranking systems, with content relevance taking precedence; and (d) the speed-to-conversion relationship has a non-linear shape with the steepest returns between one and five seconds. CRO teams that treat performance as a foundational optimisation layer -- rather than a final polish -- are building on the strongest available evidence.

---

## References

1. Philip Walton (2024). Web Vitals. *web.dev*. https://web.dev/articles/vitals
2. web.dev team (2025). Largest Contentful Paint (LCP). *web.dev*. https://web.dev/articles/lcp
3. web.dev team (2024). Interaction to Next Paint becomes a Core Web Vital on March 12. *web.dev*. https://web.dev/blog/inp-cwv-march-12
4. web.dev team (2025). Interaction to Next Paint (INP). *web.dev*. https://web.dev/articles/inp
5. web.dev team (2023). Cumulative Layout Shift (CLS). *web.dev*. https://web.dev/articles/cls
6. Bryan McQuade and Barry Pollard (2025). How the Core Web Vitals metrics thresholds were defined. *web.dev*. https://web.dev/articles/defining-core-web-vitals-thresholds
7. Olga Demidova (2020). Milliseconds Make Millions. *web.dev / commissioned by Google, conducted by Fifty-Five and Deloitte Digital*. https://web.dev/case-studies/milliseconds-make-millions
8. Akamai / SOASTA (2017). Akamai Releases Spring 2017 State of Online Retail Performance Report. *Akamai*. https://www.akamai.com/newsroom/press-release/akamai-releases-spring-2017-state-of-online-retail-performance-report
9. Google / SOASTA Research (2018). Find Out How You Stack Up to New Industry Benchmarks for Mobile Page Speed. *Think with Google*. https://business.google.com/ca-en/think/marketing-strategies/mobile-page-speed-new-industry-benchmarks/
10. Google / DoubleClick (2016). The Need for Mobile Speed. *Think with Google*. https://www.thinkwithgoogle.com/_qs/documents/2340/bc22e_The_Need_for_Mobile_Speed_-_FINAL_1.pdf
11. web.dev team (2021). Vodafone: A 31% improvement in LCP increased sales by 8%. *web.dev*. https://web.dev/case-studies/vodafone
12. web.dev team (2022). How Rakuten 24's investment in Core Web Vitals increased revenue per visitor by 53.37% and conversion rate by 33.13%. *web.dev*. https://web.dev/case-studies/rakuten
13. web.dev team (2025). How improving Fotocasa's INP contributed to 27% growth in key metrics. *web.dev*. https://web.dev/case-studies/fotocasa-cwv
14. web.dev team (2025). How QuintoAndar reduced INP by 80%, increasing conversions by 36%. *web.dev*. https://web.dev/case-studies/quintoandar-inp
15. web.dev team (2023). How redBus improved their website's Interaction to Next Paint (INP) and increased sales by 7%. *web.dev*. https://web.dev/case-studies/redbus-inp
16. Saurabh Rajpal, Swetha Gopalakrishnan (2021). The business impact of Core Web Vitals. *web.dev*. https://web.dev/case-studies/vitals-business-impact
17. Google Search Central (2024). Understanding Core Web Vitals and Google search results. *Google Search Central*. https://developers.google.com/search/docs/appearance/core-web-

vitals

18. Google Search Central (2020). Evaluating page experience for a better web. *Google Search Central Blog*. https://developers.google.com/search/blog/2020/05/evaluating-page-experience

19. Google Search Central (2021). Timeline for bringing page experience ranking to desktop. *Google Search Central Blog*. https://developers.google.com/search/blog/2021/11/bringing-page-experience-to-desktop

20. Google Search Central (2023). Introducing INP to Core Web Vitals. *Google Search Central Blog*. https://developers.google.com/search/blog/2023/05/introducing-inp

21. Google Search Central (2024). Understanding Google Page Experience. *Google Search Central*. https://developers.google.com/search/docs/appearance/page-experience

## Cite this

**APA** Copy

```
Bhaskar Roy Sarkar (2026). Website Performance and Conversion: A
Review of the Evidence. cazyweb Research.
https://cazyweb.com/research/website-performance-and-conversion-
evidence
```

**BIBTEX** Copy

```
@techreport{website-performance-and-conversion-evidence,
  author = {Bhaskar Roy Sarkar},
  title = {Website Performance and Conversion: A Review of the
Evidence},
  institution = {cazyweb Research},
  year = {2026},
  url = {https://cazyweb.com/research/website-performance-and-
conversion-evidence}
}
```

RELATED READING

Core Web Vitals, SEO, and sales

Is headless Shopify worth it?

Want a team to run experiments like this for you? See how we help

## Let's build something that converts.

Start a project with us, or join the bench of specialists and agencies we deliver with.

**Start a project** ↗

cazyweb

The engineering and growth team behind leading brands and companies across the US and Europe.

### CRO and ecommerce insights

Occasional, genuinely useful notes. No fluff.

you@company.com Subscribe →

Work email only. No spam. Unsubscribe any time. Privacy.

Solutions

Product Optimization

For Ecommerce

CRO Program

Experimentation Program

cazyweb Platform

Email & Retention

Paid Ads

Landing Pages

Revenue Calculator FREE

A/B Test Calculator FREE

CRO Agency

Shopify CRO

Ecommerce Growth

Website Performance

## Company

About

For Brands

For Agencies

Careers HIRING

Contact

## Explore

Services

Pricing

Performance program

Subscription

Website + CRO from $99

Case Studies

Blog

CRO Ideas

Apps

Learn

**CazyWeb IT Solutions**

GSTIN: 19JTLPS8476P2ZZ

hello@cazyweb.com

© 2026 cazyweb. All rights reserved.