



Evaluating Key Site Performance Metrics Using Google Pagespeed Insights

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Abstract — The article focuses on evaluating the important performance indicators of a desktop website using Google's Pagespeed Insights tool. It analysis important aspects such as page load speed, content optimization, recommendations for improving performance and impact on user experience. The study is based on the example of site diagnostics <https://pm.lntu.edu.ua/> and includes an overview of the influence of loading speed on SEO indicators and positions in search engines. The findings demonstrate the value of using Pagespeed Insights to achieve optimal website performance across desktop platforms and maintain a high-quality user experience.

Keywords — metrics, site performance, Google Pagespeed Insights, analysis, diagnostics, evaluation, URL

I. INTRODUCTION

Evaluating the performance of websites is an important aspect of ensuring efficiency and meeting user needs [1-5]. For this purpose, there are a number of programs and tools that allow this analysis to be carried out:

- Google Pagespeed Insights is a free tool from Google that provides an estimate of your site's performance. It analysis page loading speed on both computers and mobile devices, provides optimization recommendations and displays an overall performance score [6].
- GTmetrix – This tool provides a detailed analysis of site load speed, including page load time, page size, number of requests, and provides recommendations for improving performance [7].
- Pingdom Website Speed Test – a tool that analyzes the site loading speed from different geographical connection points, measures page loading time and detects possible performance problems [8].
- WebPageTest is an open-source tool that allows you to study page loading speed, analyse watermarking and caching, and evaluate the impact of various server settings on performance [9].
- YSlow is a tool that analysis web pages and makes recommendations for improving their performance, including reducing page load times and optimizing resources [10].

All these tools help web developers and site owners effectively improve loading speed, reduce server response time and provide optimal user experience.

Evaluating the performance of websites is key to their successful performance and user experience. Google Pagespeed Insights provides valuable tools to analyse and evaluate the performance level of web pages as reflected in their speed and optimization. This is a unique tool that allows you to identify potential problems and offer recommendations for improving loading speed and overall site performance [11].

This work examines the assessment of the main performance indicators of sites using the Google Pagespeed Insights tool, the work methodology is given, the website <https://pm.lntu.edu.ua/> [12] has been checked, and practical recommendations are provided to ensure optimal work and meet the needs of users web resource.

Chapter II presents the methodology of research by the Google Pagespeed Insights service.

Section III describes the work of Google Pagespeed Insights on the example of the site <https://pm.lntu.edu.ua/>

In section IV, there are practical tips for ensuring better operation of the website of the Department of Applied Mechanics and Mechatronics.

Section V briefly summarizes the main results obtained.

II. RESEARCH METHODOLOGY

To evaluate the main performance indicators of sites using Google Pagespeed Insights, you can use the following technique:

- Access the Google Pagespeed Insights tool at <https://developers.google.com/speed/pagespeed/insights/>.
- Entering the URL of the site to be evaluated in the appropriate field and clicking the "Analyze" button.
- Waiting for results after the analysis is completed. Google Pagespeed Insights will display results on site performance.

- Estimate the total score, which is displayed at the top of the results. The score is measured from 0 to 100 and reflects how effectively the site is optimized.

- Analysis of key metrics. Check out the "Performance Metrics" and "Server Response Score" sections for key metrics such as page load time, first server response, caching efficiency, content size, and more.

- Optimization recommendations provided by Google Pagespeed Insights to improve site performance. These recommendations include practical advice on , resource caching, etc.

- Re-analysis and testing of changes. Make web page fixes as recommended and re-analyse with Google Pagespeed Insights to assess how well they affected performance metrics.

This technique will allow you to systematically evaluate and improve the performance of sites using Google Pagespeed Insights, ensuring fast loading and improving the user experience.

III. OPERATION OF THE GOOGLE PAGESPEED INSIGHTS SERVICE ON THE EXAMPLE OF THE SITE [HTTPS://PM.LNTU.EDU.UA/](https://pm.lntu.edu.ua/)

A. Access to the tool

Access to the Google Pagespeed Insights tool

Go to the Google Pagespeed Insights website at <https://developers.google.com/speed/pagespeed/insights/>.

B. Entering the website URL: <https://pm.lntu.edu.ua/>

Enter the URL of the website https://pm.lntu.edu.ua (Department of Applied Mechanics and Mechatronics) to be evaluated in the appropriate field and click the "Analyze" button (Fig. 1).



Fig. 1. Entering the URL of the site: <https://pm.lntu.edu.ua/>.

C. Waiting for results

Wait for the analysis to complete, after which Google Pagespeed Insights will display the page performance results.

Site efficiency is 68%, accessibility is 69 %, optimal methods are 78%, optimal search systems are 85 % (Fig. 2).

Based on the results of the check, the parameters of the site were obtained:

1) Emulated computer with Lighthouse 12.0.0:

- Unlimited CPU or memory bandwidth: 552
- CPU bandwidth limitation: 1x slowdown (Simulated)

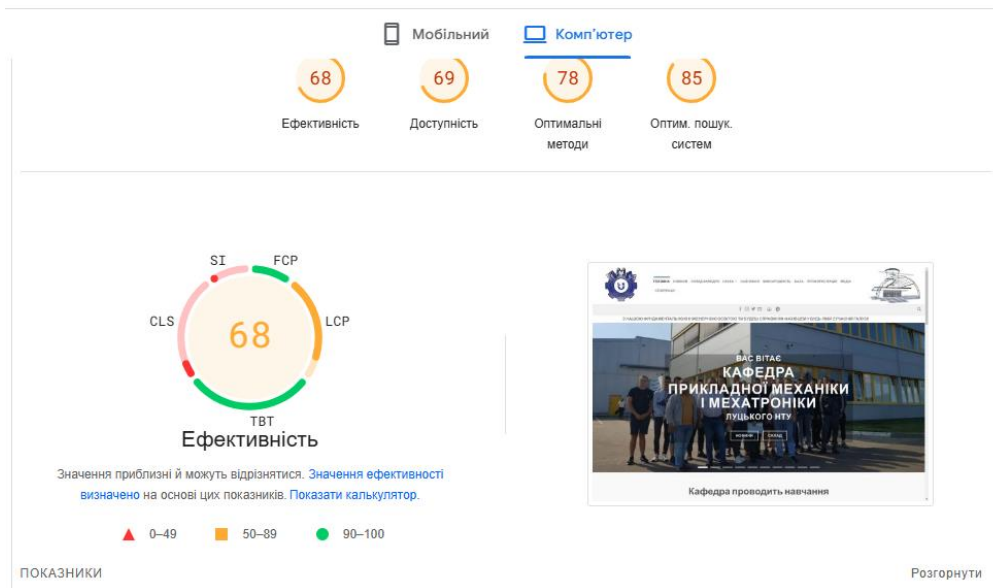


Fig. 2. Site for evaluating parameters.

- Screen emulation: 1350x940, DPR 1
 - Ax version: 4.9.0
- 2) Special bandwidth limitation:
- Reduction of network bandwidth: 40 ms TCP RTT, 10,240 kb/s throughput (Simulated)
- Browser location: Europe

3) Using HeadlessChromium 125.0.6422.175 with lr:

- User agent (network): "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/119.0.0.0 Safari/537.36"

In more detail with the check, you can familiarize yourself with the Lighthouse Scoring Calculator (Fig. 3).

Lighthouse Scoring Calculator

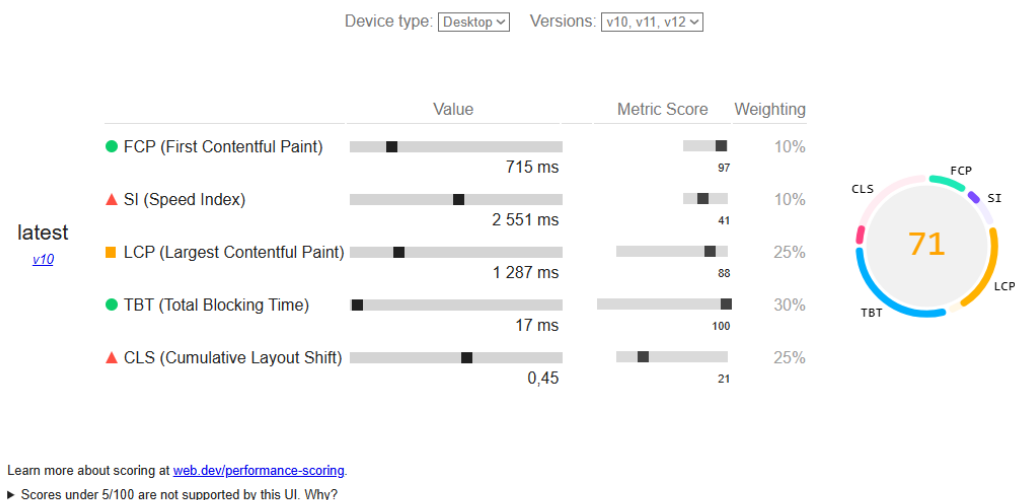


Fig. 3. Lighthouse Scoring Calculator.

According to the test results, there are two critical indicators SI (Speed Index) and CLS (Cumulative Layout Shift). The detected errors of the site diagnostics <https://lntu.edu.ua/uk> are listed in Table 1.

TABLE I. ДІАГНОСТИКА САЙТУ [HTTPS://LNTU.EDU.UA/UK](https://lntu.edu.ua/uk)

Indicator	Action	Detected errors	Comment
CLS	Large layout offset	3 layout offsets detected	Uploaded Webfont; late network request; the correct size is not specified
LCP FCP	Images in new formats	Can be reduced by 322 KiB	WebP and AVIF image formats generally compress better than PNG or JPEG
LCP FCP	Choose the right image size	Can be reduced by 361 KiB	Show images at the right size to save mobile traffic and improve load times
LCP	Large content rendering element	1,290ms	The largest content element visible in the viewport <div class="bg fill bg-fill bg-loaded">
LCP FCP	Minimize JavaScript code	Can be reduced by 91 KiB	Minimize unused JavaScript code, delay loading scripts until needed
LCP FCP	Removing a resource that blocks rendering	Savings - 420 ms	Resources block the first rendering of the page. Submit critical pieces of JavaScript or CSS tables first and defer all non-critical elements
LCP FCP	Reduce CSS code that is not used	Can be reduced by 38 KiB	Reduce data traffic on the network: reduce the number of unnecessary rules in style sheets; delay the loading of CSS code that is not used for content in the visible part of the page

Among the errors of the website, the most important can be noted:

1) Large layout shifts (Fig. 4). One of the layout figures is 0.449. This is the largest layout offset seen on the page. Each table element represents one layout offset and points to the object with the largest offset. Below each object are listed the possible reasons that led to the displacement of the layout.

2) The largest element of visualization of large content is 1,290 ms, which is visible in the viewing area in Table 2.

div#banner-1184844652 > div.banner-inner > div.banner-bg > div.bg

```
<div class="bg fill bg-fill bg-loaded">
```

TABLE II. THE LARGEST VISUALIZATION ELEMENT

Phase	% of LCP	time
TTFB	11 %	160 ms
Loading delay	69 %	1010 ms
Loading time	18 %	260 ms
Display delay	2 %	30 ms

URLs to minify unused CSS code in Table 3.

TABLE III. URLS TO MINIFY CSS CODE

URL	Transfer size, KiV	Potential savings, KiV
lntu.edu.ua	44.6	38,1
https://pm.lntu.edu.ua/wp-content/themes/flatsome/assets/css/flatsome.css?ver=3.13.0	30.5	24,1
https://pm.lntu.edu.ua/wp-includes/css/dist/block-library/style.min.css?ver=6.4.4	14.0	14,0

Елемент	Показник зміщення макета
 <pre>"МАТЕРІАЛИ ТА ТЕХНОЛОГІЇ В ІНЖЕНЕРІЇ"-2024, ЯК ВАЖЛИВИЙ ЕЛЕМЕНТ РОЗВИТКУ НАУКИ ... <div class="row large-columns-3 medium-columns-1 small-columns-1 slider row- slider sli..." data-flickity-options="{&quot;imagesLoaded&quot;: true, &quot;groupCells&quot;: &quot;100%&quot;, &quot;dragThreshold&quot; : 5, &quot;cellAli..." tabindex="0"></pre>	0,449
...v24/S6u9w4BMU...woff2 (fonts.gstatic.com)	Веб-шрифт завантажено
...v24/S6uyw4BMU...woff2 (fonts.gstatic.com)	Веб-шрифт завантажено
...block-library/style.min.css?ver=6.4.4 (pm.lntu.edu.ua)	Макет сторінки змінено через запізнілий запит мережі

Fig. 4. Large layout shifts.

Need to reduce the number of WordPress plugins loaded per page (unnecessary CSS stylesheets). To identify plugins that add redundant CSS tables, you need to check the code coverage in Chrome DevTools. You can define a theme or plugin via a stylesheet URL. In code coverage, you need to find plugins with many style sheets by a large amount of red text. The plugin should set the stylesheet only if it is actually used on the page.

D. Evaluation of the total score

Evaluate the overall performance score displayed at the top of the results. The score is measured from 0 to 100 and reflects how effectively the page is optimized.

E. Analysis of key metrics

Check out the "Performance Metrics" and "Server Response Score" sections for key metrics such as page load time, first server response, caching efficiency, content size, and more.

IV. PRACTICAL ADVICE FROM THE GOOGLE PAGESPEED INSIGHTS SERVICE

1) The [user-scalable="no"] parameter is used in the <meta name="viewport"> element or the [maximum-scale] attribute is less than 5.

2) If touch areas are insufficiently sized or spaced, these elements provide common practical advice on accessibility. If zoom is turned off, users with poor vision will not be able to enlarge the screen to better see the content of the web page.

3) ARIA [aria-hidden="true"] contain interactive derivatives. They will help improve the use of ARIA roles in the application, which can positively affect the interaction for users of assistive technologies such as screen readers.

4) Insufficient contrast ratio between background and foreground colors. These recommendations will help improve the readability of the content.

5) Lists do not contain only elements and elements to support script execution (<script> and <template>). This

will help improve the viewing of data in a table or list using technology for people with disabilities, such as a screen reader.

6) Header elements are not sequentially arranged in descending order. These recommendations will help improve keyboard navigation in the application.

V. CONCLUSION WORK

Based on the analysis of the main performance indicators of the site <https://lntu.edu.ua/uk> (Department of Applied Mechanics and Mechatronics) for a computer using Google Pagespeed Insights, the following conclusions can be drawn:

Pagespeed Insights provides information about how long it takes a page to load on computers. It is critically important for users, as it affects their first impression of the site.

The tool indicates the ability to optimize content such as images, CSS, JavaScript and HTML. Appropriate compression and minification can improve page loading speed.

Pagespeed Insights offers specific tips and recommendations for improving site performance. These could be caching optimizations, reducing first display time (FCP), or fixing JavaScript issues.

The tool takes into account metrics that affect the user experience, such as time to first interactivity (TTI) and time to full page load. This allows you to maintain user satisfaction from interacting with the site.

SEO and search engine rankings: The speed at which a website loads on computers also affects its ranking in search engines, particularly Google. High performance indicators contribute to higher positions in search results.

Hence, Google Pagespeed Insights is a must-have tool for improving your site's desktop performance. Analyzing and implementing recommendations allows you to improve loading speed, provide a positive user experience and increase SEO indicators. Regular use of Pagespeed Insights helps keep your site up to date with performance and efficiency standards.

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