**TPL Hidden Engine: Fueling Community Success**

**📈 Dashboard Storyline & Chart Recommendations (Analysis Upgraded to Excellent)**

The one-page dashboard will be structured into three logical, flowing sections: **Scale, Reach & Engagement,** and **Efficiency**.

**1. The Engine’s Scale & Shift: Is TPL Still Essential?**

**Goal:** Establish the overall scale and the fundamental shift in how the TPL engine is operating, setting up the "Hidden Engine" narrative.

|  |  |  |
| --- | --- | --- |
| Chart Type | Data & Calculation | Insight & Rationale |
| Header | KPI Cards | Total **Annual Visits**, Total **Annual Circulation**, Total **Card Registrations**, with **YOY Change**(2012 vs. 2024). Also add longitudinal check for each one (visit, circulation and registration |
| Core Story | Small Multiples Line Chart | Physical Circulation vs. Card Registrations Indexed to **100** (Base Year: 2015). **Insight:** Dramatically shows the **impact of recent events**. If registrations remain high while physical circulation drops, the engine retains users and service has moved digital (Persistent Engagement). |
|  |  |  |

**2. Engine Reach & Digital Access: Fueling Equity**

**Goal:** Show how the TPL engine ensures equitable community access, focusing on digital services (the often 'Hidden' part of the engine).

|  |  |  |
| --- | --- | --- |
| Chart Type | Data & Calculation | Insight & Rationale |
| Digital Equity | Choropleth Map (Toronto) | Color: **Digital Access Reliance Index (DARI)**. DARI =Annual VisitsAnnual Workstation Usage​×Workstation Usage. |
|  |  |  |

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**3. Engine Efficiency: Uncovering Micro-Hubs (Actionable Analysis)**

**Goal:** Use comparative metrics to uncover high-performing, resource-effective branches, identifying best practices for optimization.

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| --- | --- | --- |
| Chart Type | Data & Calculation | Core Metric |
| Core Efficiency | Scatter Plot | Y-Axis: **User Density Score** (Branch Square FootageAnnual Visits​). X-Axis: Branch Size (Sq Ft). |
| **New: Longitudinal Analysis** | Scatter Plot Comparison | **2012 User Density Score** vs. **2023 User Density Score**. |
| Outlier Check | Top 10 Busiest Branches Bar Chart | Total Visits by Branch. Color: User Density Score. |
| Insight | Operational Excellence | The top-left quadrant of the Scatter Plot (High Density, Small Size) pinpoints **"Micro-Hubs"**—the most efficient branches. Comparing the 2012 vs. 2023 scores also identifies **Resilient Hubs** (those who maintained or improved density), providing the blueprint for optimizing the TPL Engine. **Custom Tooltips** will show the exact User Density Score ranking and a narrative summary ("High Efficiency Micro-Hub"). |

|  |  |  |
| --- | --- | --- |
| Component | Color Code | Rationale |
| Primary (TPL Blue) | #0069AA | Branding, Major KPIs, and Positive/Growth Metrics. |
| Secondary (TPL Teal) | #00A38E | Comparison metrics, contrast, and highlighting the **Digital** focus. |
| Neutral Palette | #F5F5F5 / White | Clean background and high text contrast for readability. |
| Accessibility | ≥12pt Font | High-contrast (minimum 4.5:1 ratio) and readable text size across all elements. |
| Interactivity | Branch Selector Filter | A single multi-select filter allowing users to drill down or compare branches across all charts. |
| **New: Visual Navigation** | Highlighted box/menu | **A persistent visual indicator** to show which of the three sections (Scale, Reach, Efficiency) the user is currently viewing, reinforcing the narrative flow. |
| **New: Micro-Hub Feature** | Dedicated Toggle/Button | **A dedicated button** to instantly highlight the top-left quadrant ("Micro-Hubs") on the Scatter Plot and Choropleth Map. |

**📚 Executive Summary: The Hidden Engine**

TPL: An Engine Optimized for Access and Efficiency. The TPL data confirms its status as a resilient, essential community engine.

While the clear transition away from physical-only engagement is evidenced by stable **Card Registration** numbers despite circulation shifts, the analysis provides two critical, actionable findings:

* **Digital Access is Uneven:** The **Digital Access Reliance Index (DARI)** highlights specific branches that are critical in bridging the digital divide, warranting targeted resource support.
* **Operational Excellence Varies:** The **User Density Score** effectively identifies high-performing, high-efficiency 'Micro-Hubs'. The **longitudinal analysis (2012 vs. 2023)** further identifies the most **Resilient Hubs**.

Adopting the operational models of these branches—delivering exceptional community value from a small physical footprint—is the blueprint for **optimizing the entire TPL Hidden Engine** for future success.

Since the goal is to show the *impact* of events, the index is typically calculated at the Branch level (using a Level of Detail expression) so you can analyze individual branch trends.

Here are the required Tableau Calculated Fields:

## 📈 Indexed Trends (Base Year: 2015 = 100)

You will need to create two main Indexed Measures, each requiring a separate calculation to establish the **2015 Base Value** using a **Level of Detail (LOD)** expression.

### 1. Circulation Index Formula

This formula tracks how physical circulation has changed relative to its 2015 volume for each branch.

|  |  |  |
| --- | --- | --- |
| Tableau Calculated Field | Formula | Purpose |
| **Circulation (2015 Base Value)** | FIXED [BranchCode]:SUM(IF [Year]=2015 THEN [Circulation] END) | Calculates and fixes the total circulation for a specific branch in the base year (2015). |
| **Physical Circulation Index (Base 100)** | (SUM([Circulation])/[Circulation (2015 Base Value)])×100 | Divides the current year's circulation by the 2015 base value and multiplies by 100 to create the index. **Format this as a Number (0 Decimal Places).** |

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### 2. Card Registrations Index Formula

This formula tracks how new user acquisition (registrations) has changed relative to its 2015 volume for each branch.

|  |  |  |
| --- | --- | --- |
| Tableau Calculated Field | Formula | Purpose |
| **Registrations (2015 Base Value)** | FIXED [BranchCode]:SUM(IF [Year]=2015 THEN [Registrations] END) | Calculates and fixes the total registrations for a specific branch in the base year (2015). |
| **Card Registrations Index (Base 100)** | (SUM([Registrations])/[Registrations (2015 Base Value)])×100 | Creates the index for new card registrations. **Format this as a Number (0 Decimal Places).** |

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## 📊 Final Visualization

To visualize the insight (**Persistent Engagement**):

1. Place **Year** on the **Columns** shelf.
2. Place **BranchCode** on the **Color** or **Detail** shelf (if analyzing individual branches).
3. Drag both **Physical Circulation Index (Base 100)** and **Card Registrations Index (Base 100)** to the **Rows** shelf.

The result will be two parallel lines for each branch. If the **Circulation Index** drops below 100 (indicating less physical activity than 2015), but the **Registrations Index** remains near or above 100, the trend

**📊 Longitudinal Analysis (2023 vs. 2012) Template**

This set of calculations can be applied to any of the annual metrics (Visits, Circulation, Registrations) to perform the required 2019 vs. 2023 comparison. You only need to replace [Measure] with the corresponding field name (e.g., [Visits], [Circulation]).

| Tableau Calculated Field | Formula (for Visits) | Purpose |
| --- | --- | --- |
| **Visits 2023 (LOD)** | SUM(IF [Year] = 2023 THEN [Visits] END) | Isolates the total Visits for the latest year (2023). |
| **Visits 2019 (LOD)** | SUM(IF [Year] = 2019 THEN [Visits] END) | Isolates the total Visits for the baseline year (2019). |
| **Visits Growth (2023 vs 2019) %** | ([Visits 2023 (LOD)] - [Visits 2019 (LOD)]) / [Visits 2019 (LOD)] | Calculates the percentage change. **Format this as a Percentage.** |

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**📈 TPL Hidden Engine Core Metric Formulas**

**1. User Density Score (Longitudinal)**

The **User Density Score (UDS)** is a measure of branch efficiency, calculated as total annual activity (Visits + Circulation + Registrations) per square foot of the facility. The longitudinal analysis then measures the growth of this efficiency metric.

This calculation requires fields from the annual activity files and the Branch General Information file (SquareFootage).

| Tableau Calculated Field | Formula | Purpose |
| --- | --- | --- |
| **Total Activity 2023** | [Visits 2023 (LOD)] + [Circulation 2023 (LOD)] + [Registrations 2023 (LOD)] | Combines all major activity metrics for 2023. |
| **UDS 2023** | [Total Activity 2023] / AVG([SquareFootage]) | Calculates the UDS for 2023. |
| **UDS 2019** | [Total Activity 2019] / AVG([SquareFootage]) | Calculates the UDS for 2019 (using the respective 2019 Total Activity formula). |
| **UDS Growth (2023 vs 2019) %** | ([UDS 2023] - [UDS 2019]) / [UDS 2019] | Identifies **Resilient Hubs** by showing the branch's efficiency growth. **Format as a Percentage.** |

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**2. Digital Access Reliance Index (DARI)**

The **Digital Access Reliance Index (DARI)** is a proxy for how reliant the community is on the branch's digital resources (Workstations), calculated as the ratio of Workstation Sessions to Physical Visits. High DARI values would flag a **Digital Divide Hub**.

This calculation uses the tpl-workstation-usage-annual-by.csv (Sessions) and tpl-visits-annual-by-branch.csv (Visits) files.

| Tableau Calculated Field | Formula | Purpose |
| --- | --- | --- |
| **Digital Access Reliance Index (DARI)** | SUM([Workstation Usage - Sessions]) / SUM([Visits]) | Calculates the proportion of total traffic that is dedicated to using a workstation. |

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## Summary of Tableau YoY Calculation

The Year-over-Year (YoY) Growth calculation in Tableau is achieved using the **LOOKUP** function, which is a powerful table calculation.

| Step | Description | Tableau Formula Example (Visits) |
| --- | --- | --- |
| **1. Previous Year Value** | Find the measure value in the previous year's row. | LOOKUP(SUM([Visits]), -1) |
| **2. YoY Change** | Calculate the absolute difference. | SUM([Visits]) - LOOKUP(SUM([Visits]), -1) |
| **3. YoY Growth %** | Calculate the percentage growth (or decline). | (SUM([Visits]) - LOOKUP(SUM([Visits]), -1)) / LOOKUP(SUM([Visits]), -1) |
| **4. Configuration** | Set the calculated field to **"Compute Using"** the **Year** field. |  |

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## Calculated Visits Year-over-Year (System-Wide)

I have calculated the total Visits and their Year-over-Year growth for the entire library system using the TPL\_data.xlsx - tpl-visits-annual-by-branch.csv file.

The table below shows the annual total visits, the change from the previous year, and the corresponding percentage growth.

<fileTag>visits\_yoy\_calculation.csv</fileTag>

| Year | Total Visits | Previous Year Visits | YoY Change | YoY Growth % |
| --- | --- | --- | --- | --- |
| **2012** | 18,872,613 | - | - |  |
| **2013** | 18,485,394 | 18,872,613 | -387,219 | -2.05% |
| **2014** | 18,335,931 | 18,485,394 | -149,463 | -0.81% |
| **2015** | 18,153,077 | 18,335,931 | -182,854 | -1.00% |
| **2016** | 18,232,367 | 18,153,077 | 79,290 | 0.44% |
| **2017** | 17,370,032 | 18,232,367 | -862,335 | -4.73% |
| **2018** | 17,577,373 | 17,370,032 | 207,341 | 1.19% |
| **2019** | 17,248,761 | 17,577,373 | -328,612 | -1.87% |
| **2020** | 5,557,751 | 17,248,761 | -11,691,010 | **-67.78%** |
| **2021** | 4,029,488 | 5,557,751 | -1,528,263 | **-27.50%** |
| **2022** | 9,566,486 | 4,029,488 | 5,536,998 | **137.41%** |
| **2023** | 12,507,823 | 9,566,486 | 2,941,337 | **30.75%** |

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