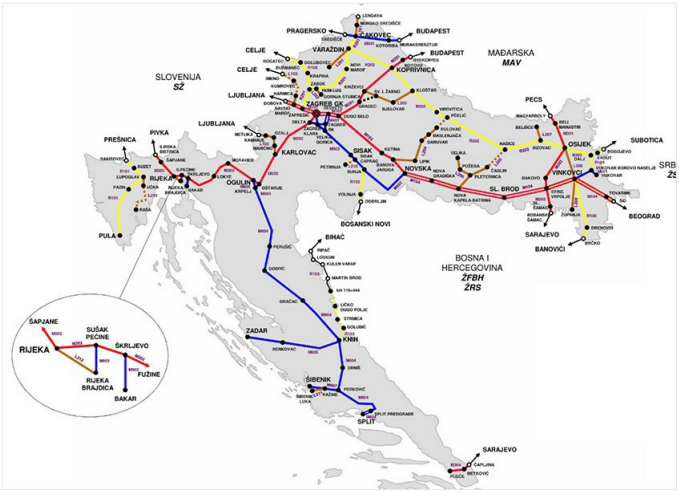
USER STORY

World Bank Deploys Dashboard

Solution to Improve Safety for Croatian Railways

With 189 member countries and offices in more than 130 locations, the World Bank Group is a global partnership that aims to end extreme poverty and promote shared prosperity in economically underdeveloped countries. Comprised of five unique institutions, the World Bank has worked with local governments on 12,000 projects to support development and relief and distributed more than $45 billion in financial assistance.

World Bank staff recently partnered with a group in Croatia to gain insight into the country's rail network—an effort that would lead to improved safety and efficient transport of goods. As part of this effort, they created an inventory of the Croatian railways to better identify sections that were at risk or in need of maintenance. However, rudimentary schematic diagrams and spreadsheets of data with differing systems of measurement made it difficult to manage and view data.



World Bank and local teams partnered with SymGEO to enhance and streamline the railways existing data management system. SymGEO, a Maryland-based company, provides cost-effective GIS mapping solutions and digital community engagement platforms for government, commercial, and nonprofit clients. SymGEO developed a high-resolution, unified dataset and a dashboard solution to help World Bank improve analysis and better manage railway operations data.

Challenge

The rail data in Croatia was stored in a series of spreadsheet files with different methods of linear referencing, depending on what was being queried. Linear referencing is the method of storing geographic locations using relative positions along a measured linear feature. The data included information such as network age, speed limits, and transportation volumes of the railways in Croatia.

The differing referencing systems made it time-consuming to cross-reference these pieces of data and get answers to specific questions, such as how many gross tons were transported on networks during a period of time.

Different linear referencing methods also meant differences in data, such as station names or segments of the railway being referenced dissimilarly. As such, it became challenging for the analytical staff to understand which section of the railway was being talked about in a particular file and how it related to another related spreadsheet file. This made it difficult to identify sections of the Croatian railway that required upgrades or maintenance . The World Bank sought to find railways that may be at risk of structural failure (for example, railways over a certain age that transport a specific amount of volume per year) or potential bottlenecks in trade due to speed limitations.

User
World Bank Group

Challenge
Enhance and streamline the Croatian railways data management system to improve safety and transportation of goods

Solutions
Operations Dashboard for ArcGIS

Results
A unique dashboard showing railways in Croatia, allowing stakeholders to perform interactive querying

	Oznaka Code	početak beginning	kraj end	Dužina (km) Length (km)	Ukupno Total 2013	2014	2015	2016	2017	Putnički vlakovi Passenger trains 2013	2014	2015	2016	2017	Teretni vlakovi Freight trains 2013	2014	2015	2016	2017
3	Dionice, pruge i koridori (nova podjela) Sections, lines and corridors (new classification)				Vlak kilometri Train-kilometres														
4		Granični kolodvori Bordering stations																	
6	A	B	C	D	E = F + G					F					G				
7	ΣM + ΣR + ΣL			2592	22,016,644	20,330,956	20,381,881	20,803,897	21,013,711	16,766,730	15,244,062	15,352,656	15,489,460	15,195,278	5,249,915	5,086,895	5,029,225	5,334,438	5,818,433
8	ΣM			1455	16,275,693	15,114,687	15,338,508	15,585,498	15,772,928	11,507,581	10,379,431	10,621,517	10,580,140	10,295,242	4,768,112	4,735,256	4,716,991	5,005,359	5,477,686
9	RH1 (M101+M102+M103+M104)			317	6,849,965	6,498,243	6,739,335	6,765,728	6,650,776	5,322,696	4,985,350	5,292,839	5,144,762	4,895,831	1,527,269	1,512,893	1,446,496	1,620,967	1,754,945
10	RH2 (M201+M202+M203)			338	4,722,218	4,514,839	4,649,836	4,769,765	5,103,472	2,874,383	2,620,888	2,647,016	2,620,623	2,653,695	1,847,834	1,893,950	2,002,819	2,149,142	2,449,778
11	RH3 (M301+M302+M303+M304)			126	650,518	508,562	487,408	484,769	487,593	518,440	398,779	379,429	382,283	375,044	132,078	109,783	107,978	102,486	112,550
12	ΣMo (M401...M607)			674	4,052,992	3,593,042	3,461,930	3,565,236	3,531,087	2,792,062	2,374,413	2,302,233	2,432,472	2,370,673	1,260,930	1,218,629	1,159,697	1,132,764	1,160,414
13	ΣR			624	4,028,156	3,701,275	3,578,279	3,698,015	3,685,745	3,647,312	3,420,724	3,331,611	3,425,666	3,417,507	380,843	280,551	246,668	272,349	268,238
14	ΣL			513	1,712,796	1,514,995	1,465,094	1,520,385	1,555,038	1,611,836	1,443,907	1,399,528	1,463,654	1,482,529	100,959	71,088	65,566	56,731	72,509
15	M101 DG - Savski Marof - Zagreb GK (RH1)			26.7	999,343	942,524	944,715	1,027,290	1,034,938	868,741	806,730	821,259	842,442	804,477	130,602	135,794	123,456	184,848	230,461
16	101	Savski Marof DG	Savski Marof	5.1	43,065	50,925	49,153	61,961	64,848	20,265	27,263	27,477	28,154	21,884	22,800	23,662	21,676	33,807	42,964
17	102	Savski Marof	Zaprešić	6.5	224,181	214,466	220,456	240,478	244,469	193,829	183,079	191,442	196,177	188,423	30,352	31,387	29,014	44,302	56,046
18	103	Zaprešić	Zagreb ZK	13.0	583,640	545,228	546,243	580,892	584,980	517,406	475,295	482,838	488,095	468,942	66,234	69,932	63,404	92,798	116,038
19	104	Zagreb ZK	Zagreb GK	2.1	148,458	131,905	128,864	143,958	140,640	137,241	121,093	119,502	130,017	125,228	11,217	10,812	9,362	13,941	15,413
20	M102 Zagreb GK - Dugo Selo (RH1 / RH2)			20.7	1,200,245	1,173,723	1,189,745	1,167,028	1,179,901	1,072,792	1,051,857	1,069,239	1,016,983	1,004,263	127,453	121,866	120,506	150,045	175,638
21	105	Zagreb GK	Zagreb Borongaj	4.8	272,208	254,996	259,037	252,063	247,618	259,979	243,296	250,246	237,994	234,245	12,229	11,700	8,791	14,069	13,373
22	106	Zagreb Borongaj	Sesvete	5.8	317,467	297,383	418,798	443,095	443,993	308,403	287,966	391,378	399,378	394,580	9,063	9,418	27,420	43,717	49,413
23	108	Sesvete	Dugo Selo	10.2	610,570	621,343	511,910	471,870	488,289	504,410	520,595	427,615	379,611	375,438	106,160	100,748	84,295	92,259	112,852
24	M103 Dugo Selo - Novska (RH1)			84.2	1,694,101	1,595,238	1,653,360	1,618,788	1,609,752	1,251,108	1,170,558	1,253,864	1,192,558	1,137,250	442,993	424,679	399,496	426,229	472,502
25	109	Dugo Selo	Kutina	57.9	1,228,170	1,110,723	1,150,590	1,126,621	1,127,030	900,942	811,161	870,275	823,365	785,878	327,229	299,562	280,316	303,256	341,151
26	110	Kutina	Banova Jaruga	9.1	121,163	166,614	173,666	169,760	168,400	90,273	122,337	131,990	127,036	120,905	30,890	44,278	41,676	42,723	47,495
27	111	Banova Jaruga	Novska	17.3	344,768	317,901	329,104	322,407	314,322	259,894	237,061	251,600	242,157	230,467	84,874	80,840	77,504	80,250	83,855
28	M104 Novska - Tovarnik - DG (RH1)			185.1	2,956,276	2,786,759	2,951,515	2,952,622	2,826,185	2,130,055	1,956,204	2,148,477	2,092,778	1,949,840	826,221	830,555	803,038	859,844	876,345
29	112	Novska	Nova Kapela Batrina	56.6	962,454	906,766	960,963	955,572	922,646	713,052	661,031	718,236	697,576	653,114	249,402	245,735	242,727	257,995	269,532
30	113	Nova Kapela Batrina	Slavonski Brod	29.7	518,940	487,481	516,104	512,656	492,772	387,970	359,796	387,248	376,126	352,581	130,970	127,684	128,855	136,530	140,191
31	114	Slavonski Brod	Strizivojna Vrpolje	32.9	603,081	579,242	602,417	606,088	574,354	454,598	419,495	448,532	440,629	414,301	148,483	159,748	153,885	165,459	160,052
32	115	Strizivojna Vrpolje	Vinkovci	31.9	609,121	560,124	590,544	586,004	565,998	425,231	392,112	427,088	414,383	391,622	183,890	168,011	163,456	171,621	174,376
33	117	Vinkovci	Tovarnik	32.4	255,263	244,809	271,576	281,490	261,295	146,923	121,201	162,602	159,048	135,078	108,340	123,608	108,975	122,442	126,218
34	118	Tovarnik	Tovarnik DG	1.5	7,416	8,337	9,910	10,812	9,120	2,281	2,569	4,770	5,015	3,144	5,136	5,768	5,140	5,797	5,976
35	M201 DG - Botovo - Dugo Selo (RH2)			79.1	1,292,549	1,189,796	1,181,179	1,259,105	1,441,142	870,521	798,690	766,719	706,611	735,528	422,028	391,106	414,460	552,494	705,614
36	201	Koprivnica DG	Botovo	1.5	14,550	9,393	8,948	12,037	15,389	8,482	3,375	2,614	3,044	3,878	6,068	6,018	6,335	8,993	11,511
37	202	Botovo	Koprivnica	11.9	98,826	89,812	91,398	113,209	141,001	23,448	25,789	22,965	23,582	30,085	75,377	64,022	68,434	89,627	110,916
38	203	Koprivnica	Križevci	29.8	475,497	430,245	426,966	492,570	556,823	315,829	284,152	271,232	282,974	293,932	159,669	146,092	155,734	209,596	262,891
39	204	Križevci	Dugo Selo	35.9	703,676	660,347	653,866	641,289	727,929	522,762	485,374	469,909	397,011	407,633	180,914	174,974	183,957	244,278	320,296
40	M202 Zagreb GK - Rijeka (RH2)			228.4	3,289,909	3,192,265	3,336,330	3,374,980	3,563,191	1,919,708	1,754,298	1,806,617	1,833,915	1,843,913	1,370,201	1,437,967	1,529,713	1,541,065	1,719,278
41	205	Zagreb GK	Trešnjevka (R)	1.5	18,418	16,847	16,954	18,532	18,753	18,211	16,624	16,913	17,819	18,035	208	222	41	713	717
42	206	Trešnjevka (R)	Delta	4.1	56,453	53,346	54,291	59,293	59,301	51,039	46,676	48,389	49,933	50,556	5,415	6,669	5,902	9,360	8,745
43	207	Delta	Karlovac	47.0	851,930	822,673	856,604	868,749	963,646	580,493	544,353	555,288	568,738	575,549	271,436	278,320	301,317	300,012	388,096
44	208	Karlovac	Oštarije	49.9	845,355	834,374	885,223	881,677	928,720	541,947	513,880	534,456	539,736	549,321	303,407	320,494	350,767	341,941	379,399
45	209	Oštarije	Ogulin	6.1	98,119	91,622	93,817	92,738	96,177	57,377	50,589	49,737	50,549	51,594	40,743	41,034	44,080	42,189	44,583

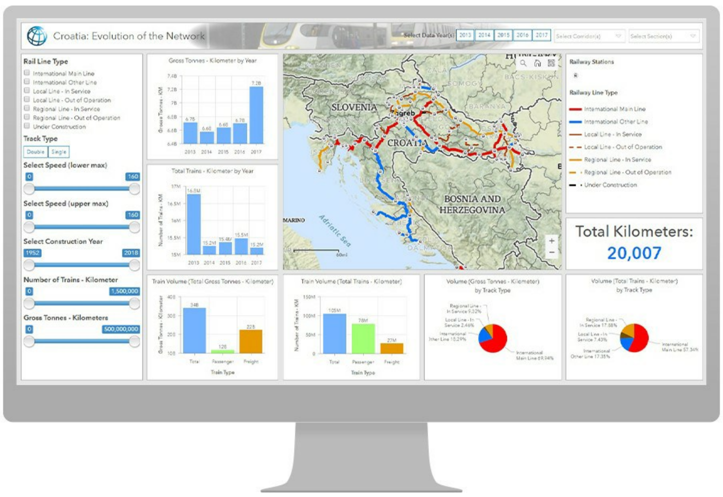
The World Bank and the Croatian group wanted a solution that would allow them to get answers to their questions interactively rather than having to request individual analysis on a per-question basis. To answer this challenge, SymGEO developed an automated solution that would streamline data management for Croatian railways, allow the client to answer their own queries on the fly, and enable them to create their own report graphics.

Kevin McMaster, principal at SymGEO, explains, "They approached us with a classic GIS problem: They have attribute data in one format and geospatial data in another. Unfortunately, the two don't talk. Our job was to facilitate communication between datasets, leading to greater insight and the ability to tell a story with their data."

Solution

To simplify data management and increase accessibility, SymGEO used best-available railway data from OpenStreetMap for the geospatial component and calibrated the network based on the multiple linear referencing systems. Attribute values were then attached to the geospatial data on a per-section basis. Once the data was cleaned, validated, and published, SymGEO configured a unique dashboard for the World Bank showing the railways in Croatia using Operations Dashboard for ArcGIS. Operations Dashboard for ArcGIS is a configurable web app that provides real-time data visualization and analytics of assets, events, and services in a dashboard setup.

According to McMaster, the World Bank client invested in an Operations Dashboard solution because the app included tools for data analysis, aggregation, data processing, and preparation, and it could address their business needs. For this project, it meant Croatian railway stakeholders could perform interactive querying in Operations Dashboard for ArcGIS and get access to all the attributes originally contained in spreadsheet files.



"Operations Dashboard was the most cost-effective solution given that it is an easily configurable application as opposed to building custom code from the ground up. It is also a very shareable resource," says McMaster.

To create the Croatian railway dashboard, all information in the spreadsheets had to be available to be queried by the application, which included data such as railway segment name, age, speed, transport volume, and rail type. Once the data was set up, McMaster says configuring Operations Dashboard to read the feature service and summarize the statistics was "relatively easy."

"With Operations Dashboard for ArcGIS, you can now click on a particular segment and get the network age, what is the total speed, and what is the transportation volume. And the client also has access to multiple years of data," says McMaster. He adds that based on the queries run through Operations Dashboard for ArcGIS, the tool was able to efficiently summarize data.

"The real power of the application is being able to summarize one attribute based on another, as

this wasn't possible with the multiple spreadsheet files referenced to different systems. The fact that now a spatially accurate, attributed railway system was produced as part of this project was an added bonus," says McMaster.

Results

The implementation of Operations Dashboard for ArcGIS has improved data accessibility and analysis as well as streamlined processes. To begin, the use of Operations Dashboard for ArcGIS has made information easily accessible to decision-makers and provided better insights for a more informed strategy. As a result, the World Bank does not have to field multiple requests for maps focused on different aspects of rail infrastructure in Croatia.

The new tool also improves analysis. McMaster explains that traditionally every railway section examined would have to be logged as a new mapping request. Then, every query would be run individually. With Operations Dashboard for ArcGIS, queries can be made interactively, data is summarized on the fly, and report-ready information is immediately available.

The World Bank now has the ability to zoom in and out of a map, create report-ready graphics, and focus only on the segments of interest. Overall, this has increased efficiency and allows the team to get the answers they need quickly without the lengthy process of logging a request and waiting for the result.

"This configurable application is a solution that allows deeper insight into the data than was possible using the individual source datasets," says McMaster. "The railway feature service data can be easily expanded to include future years of data, and Operations Dashboard for ArcGIS provides the robust solution they need."

The World Bank was very appreciative of the new dashboard solution as it saves them a lot of time when processing requests. According to McMaster, there is now a complete railway infrastructure using the best available data for all of Croatia, and the client can get actionable information based on attribute data that previously lived in spreadsheet files.

In the future, McMaster would like to continue work on this project, whether it's adding new years of current data, answering new questions, or developing similar projects for other countries. "I think that now that the data is set up, there is certainly a lot of room for advances using the GIS analytical capabilities [of Operations Dashboard for ArcGIS]," says McMaster.