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Measuring Virtual USA ROI – A Multnomah County Case Study (Final Report)

Organization:

Oregon State DAS/CIO Geospatial Enterprise Office
Multnomah County Emergency Management

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Collaborating Organizations:

University of Washington
Richard Zerbe and Associates

Executive Summary:

Multnomah County and the State of Oregon engaged Richard Zerbe and Associates through the University of Washington to determine the ROI of the Raptor and Bridge Emergency Management Systems. The results found that both RAPTOR and Bridge appear to be efficient and highly beneficial investments. Utilizing a series of conservative assumptions, we find that the net benefits from the use of RAPTOR were at least **\$1,752,196** over the past year, for a benefit-cost ratio of **6.73:1**. We also find that that the net benefits from the use of Bridge were at least **\$1,770,035** over the past year, for a benefit-cost ratio of **3.48:1**.

The following is the results of the study performed by the University of Washington.

AN ANALYSIS OF BENEFITS FROM THE USE OF THE RAPTOR AND BRIDGE GEOGRAPHIC INFORMATION SYSTEMS

RICHARD ZERBE AND ASSOCIATES

**Ryan Bodanyi
Adonis Ducksworth
Tyler Scott
Pradeep Singh
Richard Zerbe**

June 2013

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June 2013

¹ This study was supported by a grant from Multnomah County, Oregon.

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Executive Summary

Task:

The Richard Zerbe and Associates analysis team was contracted by Multnomah County, Oregon, to perform a return-on-investment study for two GIS platforms – RAPTOR and Bridge – used for emergency response.

Methods:

We use the with-and-without survey methodology pioneered in a previous benefit-cost study of GIS use in King County, Washington (Babinski et al, 2012). More specifically, we utilize a three-stage analysis to determine the value of the personnel time saved as a result of both RAPTOR and Bridge – that is, the gains in efficiency derived from each program. The first stage comprised interviews with users of these programs, the results of which were used to develop an employee survey. This second stage survey was administered via email to users of both programs, who were asked to estimate the employee time required to perform tasks with these programs, and without them. These differences were then converted into FTEs – full time equivalents – and monetized using a conservative estimate of the cost of employee FTEs. This third-stage analysis produced the final estimates of program benefits reported here.

Results:

We find that both RAPTOR and Bridge appear to be efficient and highly beneficial investments. Utilizing a series of conservative assumptions, we find that the net benefits from the use of RAPTOR were at least **\$1,752,196** over the past year, for a benefit-cost ratio of **6.73:1**. We also find that that the net benefits from the use of Bridge were at least **\$1,770,035** over the past year, for a benefit-cost ratio of **3.48:1**.

Report Contents:

The full report presents a more detailed description of both methods and findings, as well as an assessment of the relative strengths and weaknesses of this analysis. Tables provide a further breakdown of savings – in terms of both time and money – as well as qualitative assessments by survey respondents of the impact that both programs have had on emergency response efficacy.

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I. The RAPTOR and Bridge Projects

RAPTOR

The State of Oregon initiated the Real Time Assessment and Planning Tool for Oregon (RAPTOR) in 2011. Along with its mobile for iPad version, iRAPTOR, the program was developed by the Oregon Department of Administrative Services for use by Oregon Emergency Management (OEM), as well as the broader emergency management, preparedness, and response community, both within Oregon and across the Pacific Northwest Region.

RAPTOR enables authorized users – within Oregon’s emergency management community, and in bordering states and across the nation – to view and interact with geospatial basemaps, aerial imagery, and preparedness, hazards, weather and event-related data via the internet (see Figure 1). It therefore makes this critical data available anywhere, anytime, on a 24x7 basis.

RAPTOR operationalizes the GIS-enabled Common Operating Picture (COP) capabilities Oregon deployed as part of the 2009-2010 U.S. DHS Virtual USA (vUSA) Pacific NW Pilot program.

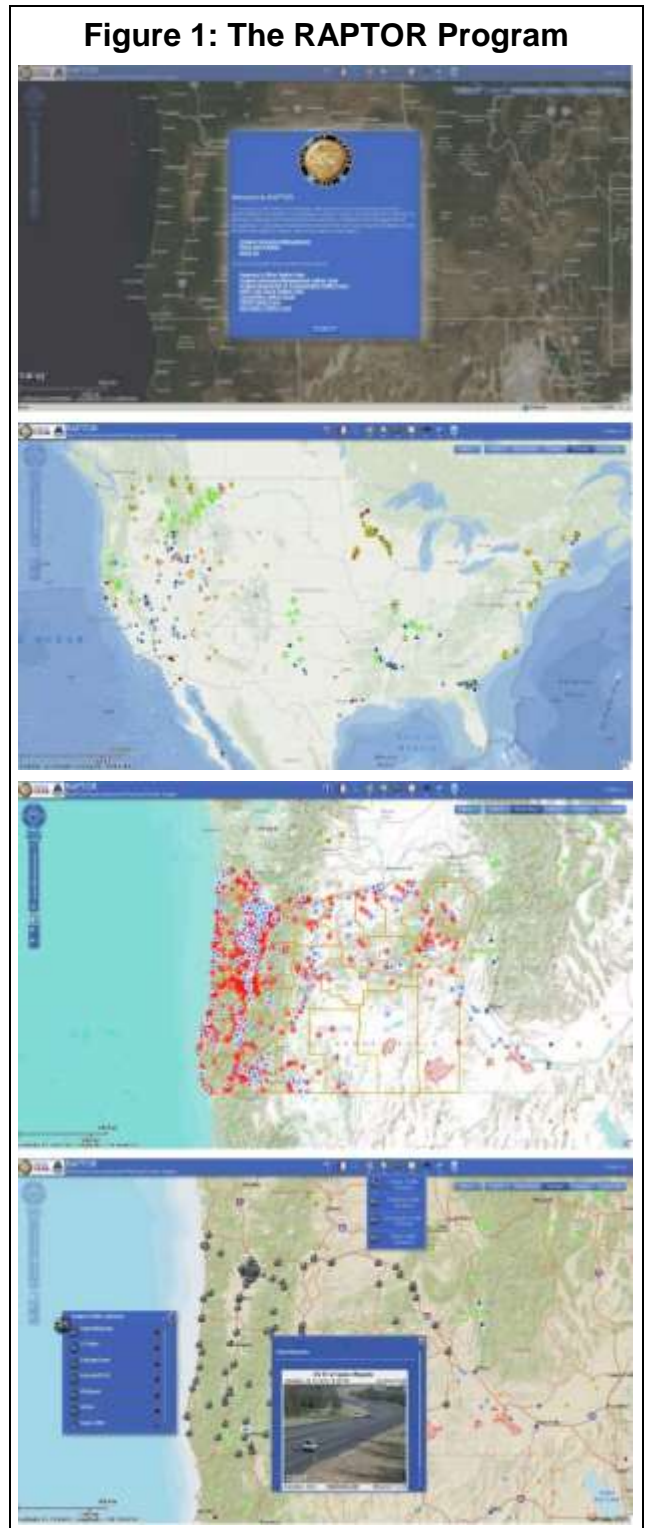
BRIDGE

Bridge is a shared platform for emergency management, developed through a partnership between the Multnomah County Emergency Management Department and IT Enterprise GIS group, FEMA, the State of Oregon Office of Administrative Services, and the State Emergency Management department. Initial support for Bridge – formerly the Virtual Emergency Network of Multnomah County (VENOM) – came from a National Homeland Security grant.

Bridge provides a common operating picture for emergency management operations by integrating dozens of data sets from multiple organizations and County systems. This wide range of data – including everything from crime trends to live weather – is made available via an intuitive mapping platform with robust analytical tools, thereby supporting emergency management planning, response, and recovery. And this platform is made available to those in the field via mobile phone capabilities.

The Bridge platform is based on VirtualUSA (vUSA) concepts, and builds on the work started by Virginia’s VIPER project. It utilizes Enterprise GIS infrastructure, and allows Multnomah County Emergency Management to better see – and therefore, better protect – many formerly-siloed County operations.

Figure 1: The RAPTOR Program



II. Methods

An abundance of research suggests that integrating new technology in general – and GIS in particular – can yield positive returns on investment. Rector (1993) found that the use of geographic information technology by US utilities yielded benefit-cost ratios of 1:1 to 5:1, and the case studies of 62 US federal government GIS installations by Gillespie (1994 and 1997) found benefit-cost ratios of 1.2:1 to 5.6:1. Additional examples are summarized in Table 1.

This study follows the with-and-without methodology pioneered in Babinski, et al (2012). That is, this study estimates the increase in operational efficiency yielded by the RAPTOR and Bridge GIS systems.

These estimates derive from surveys of the emergency response managers and personnel who utilize these systems. The survey questionnaire was designed by the Richard Zerbe and Associates team, and based on a literature review and feedback from qualitative interviews with users of both systems. Both surveys are included here as appendices.

The survey was administered via an email, which requested participation, provided some background information, and included a clickable hyperlink leading directly to the survey. Three respondents completed the RAPTOR survey, and thirty respondents submitted complete or partial responses to the Bridge survey, yielding response rates of 12% and 26%, respectively. Survey respondents were asked to estimate the employee time currently required for non-emergency public safety, emergency response, and particular emergency management tasks. When more than one estimate was received from the staff of a single department or agency, these estimates were averaged to yield a single estimate, and converted into full-time equivalents (FTEs). Qualitative assessments of each program’s impact on time use, and open-ended responses were also collected.

“The gains from new technology can be categorised into three types:

- **increases in efficiency**, so that the same task can be performed with fewer, often significantly fewer, resources;
- **increases in effectiveness**, so that the same task can be performed with greater accuracy and fewer mistakes;
- **new products and services**, which could not have been produced without this new technology.”

(OXERA, 1999, p. 5)

Table 1: Benefit-Cost Ratios from Geographic Information Systems

Date	Organization	Country	Type of Study	Benefit-Cost Ratio
1990	State of New South Wales	Australia	Economic Aspects of Digital Mapping	2:1 to 9:1
1990	Western Australia Dept. of Land Administration	Australia	Land Information Programme	5.9:1
1991	Office of Information Technology of South Australia	Australia	GI in the Public Sector	2.9:1 to 5.8:1
1992	AUSLIG	Australia	Economic & Social Benefits of Public Interest Programme	3.8:1
1992	Dept. of Defence	Australia	Economic Benefits of Hydrographic Programmes	2.7:1
1993	Gov. of Victoria	Australia	Strategic Framework for GIS Development	5.5:1
1995	ANZLIC	Aust/NZ	Australian Land and Geographic Data Benefits Study	4:1
1999	Dept. of Land & Water Conservation, New South Wales	Australia	Business Case for Community Access to Natural Resources Information (1999-2003)	1.82:1 average
2003	Environment Agency UK & Univ. of Sheffield, UK	EU-wide	Contribution to the Extended Impact Assessment for INSPIRE	4.4:1 to 8.9:1
2004	European Commission INSPIRE	EU-wide	Extended Impact Assessment for INSPIRE	5.4:1 to 12.4:1
2012	State of Maine	USA	Case Study on Orthoimagery ROI	4.21:1 to 12.64:1

This table is adapted from the table found in Craglia and Nowak, 2006, on p. 7, originally compiled by Roger Longhom.

III. Findings: RAPTOR

We find that that the net benefits from the use of RAPTOR were at least **\$1,752,196** over the past year, for a benefit-cost ratio of **6.73:1**. In reality, this estimate is likely to be conservative; the reasons for this are discussed in Section V.

Table 2: Benefits vs. Costs for the RAPTOR Program		
<i>System costs valued from September 2010 to July 2012; respondent benefits and costs from November 2011 to November 2012</i>		
	Benefits	Costs
Non-Emergency Public Safety	\$137,500	
Emergency Response	\$1,875,000	
Server and Storage		\$14,075
Internal Personnel Costs		\$42,135
Contracts for Application Software Development		\$204,094
Totals	\$2,012,500	\$260,304
Net Benefits	\$1,752,196	

Table 2 provides a summary of the benefits and costs associated with the RAPTOR program; later tables provide a further breakdown of the benefit data.

Quantitative valuations of benefits are based solely on the estimates that respondents made of personnel time saved due to the RAPTOR program. For the RAPTOR survey, these respondents included the Oregon Military Department Joint Operations Center, the Oregon Office of Emergency Management Plans and Training Department, and the Oregon Department of Administrative Services Chief Information Office.

Table 3: Annual Cost Savings from RAPTOR Use, By Agency, for Non-Emergency Public Safety					
	Estimated Savings, in FTE, of Respondent Time	Estimated Savings, in FTE, of Agency Staff Time	Total Estimated FTE Savings	Estimated Annual Cost Per FTE	Annual Savings, by Agency
Oregon Military Department	.25	0	.25	\$100,000	\$25,000
Office of Emergency Management	0	0	0	\$100,000	\$0
Department of Administrative Services	.125	1	1.125	\$100,000	\$112,500
Totals	.375	1	1.375	-	\$137,500

Table 3 provides this quantitative breakdown for non-emergency public safety. Table 4 provides this quantitative breakdown for emergency response.² Table 5 provides a further breakdown by specific emergency response tasks, but these time savings may overlap significantly if not entirely with those for emergency response, and are not independently valued.

All these estimates of personnel time saved are converted into FTEs and valued, as shown, at \$100,000 per FTE. This valuation is conservative and likely to underestimate the true value – which includes benefits and administrative costs – as explained in Section V.

² Unfortunately, the survey responses here are open to multiple interpretations. We interpret these responses in keeping with earlier questions in the survey, which ask respondents to specify time savings in terms of full-time (40hrs/wk) individuals.

Table 4: Annual Cost Savings from RAPTOR Use, By Agency, for Emergency Response											
	Flooding	Fire	Industrial or Domestic Accidents	Transportation Accidents	Utility Problems (e.g., Water Main Break)	Storm Events	Special Events (e.g., Concert, Protest)	Chemical, Biological, Radiological, Nuclear and High-Yield Explosives (CBRNE)	Earthquake, Tsunami, Tornado	Annual FTEs Saved	Annual Cost Savings, at \$100,000 Per FTE
Oregon Military Department	1	1	1	1	1	1	1	1	N/A	8	\$800,000
Office of Emergency Management	1	1	1	1	1	1	1	N/A	N/A	7	\$700,000
Department of Administrative Services	0.75	0.75	0	0	0	0.75	0.75	N/A	0.75	3.75	\$375,000
Totals	2.75	2.75	2	2	2	2.75	2.75	1	0.75	18.75	\$1,875,000

Table 5: Days of Individual Labor Saved from RAPTOR Use, By Agency, Per Emergency Response Task									
	Medical Response	Law Enforcement	Civil Defense	Transportation Safety/Maintenance	Utility Repair (e.g., Water Mains, Electricity)	Administrative Support	Chemical, Biological, Radiological, Nuclear and High-Yield Explosives (CBRNE)	Coordinating Agency for the State Response to Emergency Circumstances	
Oregon Military Department	1	1	1	1	1	1	1	N/A	
Office of Emergency Management	0	0	0	0	0	0	N/A	0	
Department of Administrative Services	0	0	0	0	0	.75	N/A	N/A	
Totals	1	1	1	1	1	1.75	1	0	

Table 6: Impacts of RAPTOR on Emergency Response Efficacy, By Agency and Category

	Flooding	Fire	Industrial or Domestic Accidents	Transportation Accidents	Utility Problems (e.g., Water Main Break)	Storm Events	Special Events (e.g., Concert, Protest)	Chemical, Biological, Radiological, Nuclear and High-Yield Explosives (CBRNE)	Earthquake, Tsunami, Tornado
Oregon Military Department	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Office of Emergency Management	No Change	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A
Department of Administrative Services	Increased	Increased	Don't Know	Don't Know	Don't Know	Increased	Increased	N/A	Increased

Question: "How has the RAPTOR program increased or decreased your effectiveness in responding, or supporting response, to each of the following events? For each statement, please select the choice that you think is most accurate."

Table 7: Impacts of RAPTOR on the Efficacy of Emergency Response Tasks, By Agency and Category

	Medical Response	Law Enforcement	Civil Defense	Transportation Safety/Maintenance	Utility Repair (e.g., Water Mains, Electricity)	Administrative Support	Chemical, Biological, Radiological, Nuclear and High-Yield Explosives (CBRNE)	Coordinating Agency for the State Response to Emergency Circumstances
Oregon Military Department	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Office of Emergency Management	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Department of Administrative Services	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Greatly Increased	N/A	N/A

Question: "How does the RAPTOR program increase or decrease your effectiveness in responding, or supporting response, to each of the following emergencies? For each statement, please select the choice that you think is most accurate."

The survey also collected qualitative assessments of RAPTOR’s impact on the efficacy of emergency response – by emergency type and response task – and these results are reported in Table 6 and Table 7, respectively. In these tables, green reflects increases in efficacy, which may result in lives saved or property damage averted. This study does not quantify these savings, but respondents indicate they are more likely as a result of the RAPTOR program.

Table 8: Impacts of RAPTOR on Time Use, by Agency and Category

	Planning/ Strategy Development	Communication with Other Organizations/ Agencies	Generating/ Using Maps	Data Collection	Data Analysis	Data Manage- ment	Data/ Map Updating
Oregon Military Department	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Office of Emergency Management	No Change	No Change	No Change	No Change	No Change	No Change	No Change
Department of Administrativ e Services	Increased	Greatly Increased	Greatly Decreased	Decreased	Greatly Increased	Increased	Increased

Question: “How has the RAPTOR program increased or decreased the amount of time you and your staff spend on each of the following activities? For each statement, please select the choice that you think is most accurate.”

Table 8 reports the impact that RAPTOR has had on different forms of time use, according to the qualitative assessments of survey respondents. In this table, green indicates greater expenditures of time, while red and orange indicate time savings. Again, these results are unquantified, and may also reflect different base levels of time expenditure (for example, spending two hours on a task rather than one hour is a 100% increase, whereas spending nine hours on a task rather than ten is only a 10% decrease). Nonetheless, such subjective assessments may be informative.

Finally, respondents were asked open-ended questions; these questions and responses are reported in Table 9.

Table 9: Open-Ended Questions and Answers Regarding RAPTOR

<i>Please describe why or how RAPTOR has increased or decreased your effectiveness in responding or supporting response to such situations?</i>
Oregon Office of Emergency Management: “Raptor was of great use during our most recent flood event allowing us to refine the tool based on real world information, which resulted in a more accurate visual representation of the problem.”
Department of Administrative Services: “With RAPTOR we can immediately see and share information regarding critical infrastructure, vulnerable populations, weather, information on the event itself, etc.”
<i>Please describe why or how RAPTOR has increased or decreased your effectiveness in responding or supporting response to rare/severe emergencies?</i>
Department of Administrative Services: “Core information is connected to/available within RAPTOR for All Hazards/All event use.”

IV. Findings: Bridge

We find that that the net benefits from the use of Bridge were at least **\$1,770,035** over the past year, for a benefit-cost ratio of **3.48:1**. In reality, this estimate is likely to be conservative; the reasons for this are discussed in Section V.

Table 10: Benefits vs. Costs for the Bridge Program		
<i>System costs valued from September 2010 to July 2012; respondent benefits and costs from November 2011 to November 2012</i>		
	Benefits	Costs
Non-Emergency Public Safety	\$79,225	
Emergency Response	\$2,200,000	
Multnomah County Labor Costs		\$246,000
Oregon Emergency Management Funding for Application Software Development		\$213,190
Oregon Department of Administrative Services Funding for Application Software Development		\$50,000
Totals	\$2,279,225	\$509,190
<i>Net Benefits</i>	<i>\$1,770,035</i>	

Table 10 provides a summary of the benefits and costs associated with the Bridge program; later tables provide a further breakdown of the benefit data.

Quantitative valuations of benefits are based solely on the estimates that respondents made of personnel time saved due to the Bridge program. For the Bridge survey, these respondents included cities and agencies within Multnomah County, as well as the State of Oregon.

Table 11 provides this quantitative breakdown for non-emergency public safety. Table 12 provides this quantitative breakdown for emergency response.³ Table 13 provides a further breakdown by specific emergency response tasks, but these time savings may overlap significantly if not entirely with those for emergency response, and are not independently valued.

All these estimates of personnel time saved are converted into FTEs and valued, as shown, at \$100,000 per FTE. This valuation is conservative and likely to underestimate the true value – which includes benefits and administrative costs – as explained in Section V.

Tables 12 and 13 – as well as, later on, Tables 14 and 15 – contain a markedly high number of “Don’t Know,” “Not Applicable,” or “No Response” choices. These choices are shaded lightly in grey, so as to distinguish them from other choices – such as “0” or “No Change” – which communicate substantive information about the questions posed. These response selections may be a result of cognitive exhaustion with the survey, but they are more likely due to the relatively new nature of the Bridge program, as indicated by many of the answers that respondents submitted to the open-ended survey questions. In this sense, once again, this study represents a lower-bound, conservative estimate of the true value of the Bridge program, if we assume that value continues to grow with broader and more extensive use.

The survey also collected qualitative assessments of Bridge’s impact on the efficacy of emergency response – by emergency type and response task – and these results are reported in Table 14 and Table 15, respectively. In these tables, green reflects increases in efficacy, which may result in lives saved or property damage averted. This study does not quantify these savings, but respondents indicate they are more likely as a result of the Bridge program.

³ Unfortunately, the survey responses here are open to multiple interpretations. We interpret these responses in keeping with earlier questions in the survey, which ask respondents to specify time savings in terms of full-time (40hrs/wk) individuals.

Table 11: Annual Cost Savings from Bridge Use, By Agency and Department, for Non-Emergency Public Safety

	Estimated Savings, in FTE, of Respondent Time	Estimated Savings, in FTE, of Departmental Staff Time	Total Estimated FTE Savings	Estimated Annual Cost Per FTE	Annual Savings, by Department
Multnomah County Emergency Management	0	0.667	0.667	\$100,000	\$66,700
Multnomah County Land Use and Transportation	0	0	0	\$100,000	\$0
Multnomah County DCA-IT	-0.025	0	-0.025	\$100,000	-\$2500
Multnomah County Human Services	0	0	0	\$100,000	\$0
Multnomah County Health	0	0	0	\$100,000	\$0
Multnomah County NW Oregon Health Preparedness Organization	0	0	0	\$100,000	\$0
Multnomah County Facilities Management	0	0	0	\$100,000	\$0
Multnomah County Community Services	0	0	0	\$100,000	\$0
Multnomah County Department of County Management	0	0	0	\$100,000	\$0
Multnomah County Multiagency Coordination Group	0	0	0	\$100,000	\$0
City of Gresham Emergency Management	0	0	0	\$100,000	\$0
City of Gresham Dept of Environmental Services	-0.01225	0	-0.01225	\$100,000	-\$1225
City of Gresham GIS	-0.025	0	-0.025	\$100,000	-\$2500
City of Gresham Transportation Engineering	0	0	0	\$100,000	\$0
City of Portland Bureau of Technology Services	-0.05	0.25	0.20	\$100,000	\$20,000
City of Portland Transportation	0	0	0	\$100,000	\$0
Port of Portland IT	0	0	0	\$100,000	\$0
State of Oregon OHA-PHD	0	0	0	\$100,000	\$0
State of Oregon DAS	0	0	0	\$100,000	\$0
Kaiser Permanente Environmental Health and Safety	0	0	0	\$100,000	\$0
Kaiser Sunnyside Medical Center Safety	-0.0125	0	-0.0125	\$100,000	-\$1250
City of Fairview Police	0	0	0	\$100,000	\$0
Totals	-0.12475	.917	.79225	-	\$79,225

Table 12: Annual Cost Savings from Bridge Use, By Agency and Department, for Emergency Response

	Flooding	Fire	Industrial / Domestic Accidents	Transportation Accidents	Utility Problems (e.g., Water Main Break)	Storm	Special Event (Concert, Protest, etc)	Domestic Terrorism	Landslides/Earthquakes	Public Health Emergency/Epidemic/Medical	Hazmat, Water Rescue, Technical Rescue	Annual FTEs Saved	Annual Cost Savings, at \$100,000 Per FTE
Multnomah County Emergency Management	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	N/A	N/A	N/A	20	\$2,000,000
Multnomah County Land Use & Transportation	0	0	0	0	0	0	0	N/A	0	N/A	N/A	0	\$0
Multnomah County DCA-IT	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A
Multnomah County Human Services	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A
Multnomah County Health	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A
Multnomah County NW Oregon Health Preparedness Organization	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A
Multnomah County Facilities Management	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	\$0
Multnomah County Community Services	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A
Multnomah County Department of County Management	0	0	0	0	0	0	0	N/A	N/A	0	N/A	0	\$0
Multnomah County Multiagency Coordination Group	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A

City of Gresham Emergency Management	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
City of Gresham Dept of Environmental Services	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
City of Gresham GIS	0	0	0	0	1	1	0	N/A	N/A	N/A	N/A	2	\$200,000
City of Gresham Transportation Engineering	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
City of Portland Bureau of Technology Services	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	\$0
City of Portland Transportation	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
Port of Portland IT	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
State of Oregon OHA-PHD	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
State of Oregon DAS	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
Kaiser Permanente Environmental Health and Safety	0	0	0	0	0	0	0	N/A	N/A	0	N/A	0	\$0
Kaiser Sunnyside Medical Center Safety	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	\$0
City of Fairview Police	No Resp onse	No Resp onse	No Respon se	No Respo nse	No Response	No Resp onse	No Respon se	No Resp onse	No Respo nse	No Respon se	No Respon se	N/A	N/A
Totals	2.5	2.5	2.5	2.5	3.5	3.5	2.5	2.5	2.5	2.5	2.5	22	\$2,200,000

Table 13: Days of Individual Labor Saved from Bridge Use, By Agency and Department, Per Emergency Response Task

	Medical Response	Law Enforcement	Civil Defense	Transportation Safety/Maintenance	Utility Repair (e.g., Water Mains, Electricity)	Administrative Support	Emergency Coordination	Facilities Management	Surge Tracking for Infectious Diseases
Multnomah County Emergency Management	2.5	2.5	2.5	2.5	2.5	2.5	2.5	N/A	N/A
Multnomah County Land Use and Transportation	No Response	No Response	No Response	0	0	No Response	N/A	N/A	N/A
Multnomah County DCA-IT	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Multnomah County Human Services	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Multnomah County Health	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Multnomah County NW Oregon Health Preparedness Organization	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Multnomah County Facilities Management	0	0	0	0	0	0	N/A	0	N/A
Multnomah County Community Services	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Multnomah County Department of County Management	0	0	0	0	0	0	N/A	N/A	N/A
Multnomah County Multiagency Coordination Group	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
City of Gresham Emergency	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A

Management			e						
City of Gresham Dept of Environmental Services	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
City of Gresham GIS	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
City of Gresham Transportation Engineering	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
City of Portland Bureau of Technology Services	1	0	0	0	0	0	N/A	N/A	N/A
City of Portland Transportation	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Port of Portland IT	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
State of Oregon OHA-PHD	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
State of Oregon DAS	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Kaiser Permanente Environmental Health and Safety	0	0	0	0	0	0	N/A	N/A	N/A
Kaiser Sunnyside Medical Center Safety	0	0	0	0	0	0	N/A	N/A	0
City of Fairview Police	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Totals	3.5	2.5	2.5	2.5	2.5	2.5	2.5	0	0

Table 14: Average Impacts of Bridge on Emergency Response Efficacy, By Agency, Dept and Category

	Floodi ng	Fire	Industria l/ Domesti c Accidenti s	Transport ation Accidenti s	Utility Problems (e.g., Water Main Break)	Storm	Special Event (Concert , Protest, etc)	Domestic Terrorism	Landslides/ Earthquakes	Public Health Emergency/ Epidemic/ Medical	Hazmat, Rescue
Multnomah County Emergency Management	Greatly Increase d	Increase d	Greatly Increase d	Greatly Increased	Greatly Increased	Greatly Increase d	Greatly Increase d	Greatly Increased	N/A	N/A	N/A
Multnomah County Land Use and Transportation	No Change	N/A	No Change	No Change	No Change	No Change	N/A	N/A	No Change	N/A	N/A
Multnomah County DCA-IT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multnomah County Human Services	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multnomah County Health	No Change	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	N/A	N/A
Multnomah County NW Oregon Health Preparedness Organization	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multnomah County Facilities Management	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	N/A	N/A	N/A	N/A
Multnomah County Community Services	Increase d	N/A	N/A	Increase d	N/A	Increase d	N/A	N/A	N/A	N/A	N/A
Multnomah County Department of County Management	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	N/A	N/A	Don't Know	N/A
Multnomah County Multiagency Coordination Group	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response
City of Gresham	Don't	Don't	Don't	Don't Know	Don't Know	Don't	Don't	N/A	N/A	N/A	N/A

Emergency Management	Know	Know	Know			Know	Know				
City of Gresham Dept of Environmental Services	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	N/A	N/A	N/A	N/A
City of Gresham GIS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
City of Gresham Transportation Engineering	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response
City of Portland Bureau of Technology Services	Increased	Increased	No Change	Increased	Increased	Increased	Increased	N/A	N/A	N/A	N/A
City of Portland Transportation	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response
Port of Portland IT	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response
State of Oregon OHA-PHD	No Change	No Change	No Change	No Change	No Change	No Change	No Change	N/A	No Change	N/A	N/A
State of Oregon DAS	No Change	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	N/A	N/A
Kaiser Permanente Environmental Health and Safety	No Change	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	No Change	N/A
Kaiser Sunnyside Medical Center Safety	No Change	No Change	Decreased	No Change	No Change	No Change	No Change	N/A	N/A	N/A	N/A
City of Fairview Police	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response

Question: "How has the Bridge program increased or decreased your effectiveness in responding, or supporting response, to each of the following events? For each statement, please select the choice that you think is most accurate."

Table 15: Average Impacts of Bridge on the Efficacy of Emergency Response Tasks, By Agency, Department and Category

	Medical Response	Law Enforcement	Civil Defense	Transportation Safety/Maintenance	Utility Repair (e.g., Water Mains, Electricity)	Administrative Support	Emergency Coordination	Facilities Management	Surge Tracking for Infectious Diseases
Multnomah County Emergency Management	Increased	Increased	Greatly Increased	Greatly Increased	Increased	Increased	Greatly Increased	N/A	N/A
Multnomah County Land Use and Transportation	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	N/A
Multnomah County DCA-IT	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Multnomah County Human Services	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multnomah County Health	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	N/A
Multnomah County NW Oregon Health Preparedness Organization	Increased	No Response	No Response	No Response	No Response	Increased	N/A	N/A	N/A
Multnomah County Facilities Management	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	N/A	Don't Know	N/A
Multnomah County Community Services	N/A	N/A	N/A	Increased	Increased	Increased	N/A	N/A	N/A
Multnomah County Department of County Management	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	No Response	N/A	N/A	N/A
Multnomah County Multiagency Coordination Group	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
City of Gresham Emergency Management	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	N/A
City of Gresham Dept of	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	N/A	N/A	N/A

Environmental Services									
City of Gresham GIS	Greatly Increased	Greatly Increased	Greatly Increased	Increased	Decreased	No Response	N/A	N/A	N/A
City of Gresham Transportation Engineering	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
City of Portland Bureau of Technology Services	No Change	No Change	No Change	Increased	No Change	Increased	N/A	N/A	N/A
City of Portland Transportation	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
Port of Portland IT	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
State of Oregon OHA-PHD	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A
State of Oregon DAS	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	N/A
Kaiser Permanente Environmental Health and Safety	No Change	No Change	No Change	No Change	No Change	No Change	N/A	N/A	N/A
Kaiser Sunnyside Medical Center Safety	Increased	No Change	No Change	Increased	No Change	No Change	N/A	N/A	Increased
City of Fairview Police	No Response	No Response	No Response	No Response	No Response	No Response	N/A	N/A	N/A

Question: "How does the Bridge program increase or decrease your effectiveness in responding, or supporting response, to each of the following emergencies? For each statement, please select the choice that you think is most accurate."

Table 16: Average Impacts of Bridge on Time Use, by Agency, Department and Category

	Planning/ Strategy Development	Communication with Other Organizations/ Agencies	Generating/ Using Maps	Data Collection	Data Analysis	Data Management	Data/Map Updating
Multnomah County Emergency Management	Increased	Increased	Greatly Increased	Increased	Greatly Increased	Greatly Increased	Greatly Increased
Multnomah County Land Use and Transportation	No Change	No Change	No Change	No Change	No Change	No Change	No Change
Multnomah County DCA-IT	N/A	N/A	Decreased	Decreased	Decreased	No Change	No Change
Multnomah County Human Services	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multnomah County Health	No Change	No Change	No Change	No Change	No Change	No Change	No Change
Multnomah County NW Oregon Health Preparedness Organization	N/A	No Change	Decreased	Decreased	Decreased	N/A	N/A
Multnomah County Facilities Management	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know	Don't Know
Multnomah County Community Services	Increased	Increased	Increased	Don't Know	Don't Know	Don't Know	Increased
Multnomah County Department of County Management	No Change	No Change	No Change	No Change	No Change	No Change	No Change
Multnomah County Multiagency Coordination Group	No Change	Decreased	Greatly Decreased	No Change	Decreased	No Change	Greatly Decreased
City of Gresham Emergency Management	Decreased	Decreased	No Change	No Change	Decreased	No Change	Decreased
City of Gresham Dept of Environmental Services	N/A	N/A	N/A	N/A	N/A	N/A	N/A
City of Gresham GIS	N/A	N/A	N/A	N/A	N/A	N/A	N/A
City of Gresham Transportation Engineering	Greatly Increased	No Change	Greatly Increased	Increased	Increased	No Change	Increased
City of Portland Bureau of Technology Services	Increased	Increased	Increased	Increased	Increased	Increased	Increased
City of Portland Transportation	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Port of Portland IT	No Change	No Change	No Change	No Change	No Change	No Change	No Change
State of Oregon OHA-PHD	No Change	No Change	No Change	No Change	No Change	No Change	No Change
State of Oregon DAS	No Change	No Change	No Change	No Change	No Change	No Change	No Change
Kaiser Permanente Environmental Health and Safety	No Change	No Change	No Change	No Change	No Change	No Change	No Change
Kaiser Sunnyside Medical Center Safety	Decreased	No Change	Decreased	Decreased	No Change	No Change	Decreased
City of Fairview Police	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Question: "How has the Bridge program increased or decreased the amount of time you and your staff spend on each of the following activities? For each statement, please select the choice that you think is most accurate."

Table 16 reports the impact that Bridge has had on different forms of time use, according to the qualitative assessments of survey respondents. In this table, green indicates greater expenditures of time, while red and orange indicate time savings. Again, these results are unquantified, and may also reflect different base levels of time expenditure (for example, spending two hours on a task rather than one hour is a 100% increase, whereas spending nine hours on a task rather than ten is only a 10% decrease). Nonetheless, such subjective assessments may be informative.

Finally, respondents were asked open-ended questions; these questions and responses are reported in Table 17.

Table 17: Open-Ended Questions and Answers Regarding Bridge
<i>Please describe how you and your staff use the Bridge program as part of your daily (non-emergency response) work.</i>
Multnomah County Emergency Management: "It comes in handy for planning purposes for events, and for training for emergency response and recovery" and "Engagement with other departments around the county as well as the Region through the Regional Disaster Preparedness Organization (UASI Area)."
Multnomah County DCA-IT: "Bridge application development and maintenance, as well as GIS data maintenance."
Multnomah County Multiagency Coordination Group: "Occasionally to display infrastructure in relationship to risk factors, as well as incident scenarios."
City of Portland Bureau of Technology Services: "Bridge is a tool we are looking at to possibly recommend to our Emergency Mgmt office. It is good to see how our data can be viewed and shared in a web environment."
Port of Portland: "We evaluated Bridge side-by-side with our own internal emergency management tools. As part of disaster/event planning we've used Bridge but found that our internal data and mapping systems were more helpful for our staff. However I do log in periodically to check on the latest functionality."
Kaiser Sunnyside Medical Center: "We use the program for mapping purposes, to determine other type facilities are located, such as nursing homes, schools, etc. So far we've not used other bridge for other uses besides mapping."
Kaiser Sunnyside Hospital: "We so far are using infrequently for Emergency Preparedness drills."
<i>Please describe why or how Bridge has increased or decreased your effectiveness in responding or supporting response to such situations?</i>
Multnomah County Emergency Management: "It has greatly increased the ease of information gathering, common operating picture, and mapping solutions" and "Accurate situational awareness can be shared between agencies, departments and even other counties or the State."
Multnomah County Community Services: "Has great capabilities and makes it easy to keep other jurisdictions informed."
City of Gresham Emergency Management: "Bridge allows for a better Common Operation Picture between our City and the County."
City of Gresham GIS: "Don't use it because it is too slow and I can do better/faster maps with ArcMap."
City of Portland Bureau of Technology Services - Corporate GIS team: "Since we have not fully implemented use of Bridge within our SOPs, I can't say that Bridge has had much direct effect on response. However, tracking the development of Bridge has encouraged us to interact with responders and ECC staff to better evaluate solutions to their needs."
Kaiser Sunnyside Medical Center: "During shooting at Clackamas Town Center, we were able to use mapping to locate distances, from where fire etc, may be responding."
<i>Please describe why or how Bridge has increased or decreased your effectiveness in responding or supporting response to rare/severe emergencies?</i>
Multnomah County Emergency Management: "Better Communication of situation awareness and a common operating picture for all agencies or departments to view in real time."
City of Portland Bureau of Technology Services: "Bridge has encouraged us to implement the GIS infrastructure needed to provide GIS-enabled info sharing during emergencies."
Kaiser Sunnyside Medical Center: "Bridge gives the ability to track roads so we can note from where patients may be coming to our facility and what other facilities may take patients in a divert situation."

V. These Findings Are Conservative

We find that that the net benefits from the use of RAPTOR were at least **\$1,752,196** over the past year, for a benefit-cost ratio of **6.73:1**. We also find that that the net benefits from the use of Bridge were at least **\$1,770,035** over the past year, for a benefit-cost ratio of **3.48:1**. However these findings are based solely on the value of personnel time saved – that is, solely on the basis of increases in operational efficiency. These estimates are likely to be conservative for the following reasons:

- 1. We do not include the value of lives or property saved from greater emergency response speed or efficacy.** A primary purpose of emergency management is to save lives and property. Survey respondents indicate that both the RAPTOR and the Bridge systems increase the effectiveness of emergency response; the fact that such vital impacts go unmeasured here reflects the difficulty of measuring them within the budget and time frame of this study, rather than any lack of importance. In this respect, this study differs from the King County GIS study (Babinski, et al, 2012): both studies capture the value of the new technology in producing prior levels of output, but the King County study also captured the value of increases in output due to the new technology. That is, RAPTOR and Bridge may enable the same level of output (lives saved; property damage averted) at lower cost – value that is measured here – but any *additional* lives saved or *additional* property damage averted, which RAPTOR and Bridge make possible *beyond* the prior level of output, is not accounted for in our estimates.
- 2. We do not quantify the duplication of effort and cost that would have resulted if multiple siloed departments had created their own systems.** By creating a common, shared platform for emergency response, both RAPTOR and Bridge avoided the need for such wasteful duplication while simultaneously enabling shared capabilities from collaborative emergency response that siloed systems would have made more difficult. Again, creating a quantitative measure of the value of this avoided effort and shared capability goes beyond the bounds of this study, but that value nonetheless exists, therefore making our benefit-cost estimates more conservative than the true value.
- 3. Our knowledge of the costs exceeds our knowledge of the benefits.** That is, the direct costs associated with the creation of both systems are known and accounted for in our estimates, while the value that both systems create for their users is not fully known. These are not fully known because neither survey attained a 100% response rate. Non-respondents to the survey may differ systematically from respondents, and this includes their ratio of benefits to costs, which may be greater than or less than the values reported by respondents. If it is less than the ratio reported by respondents, however, the ratio for non-respondents is nevertheless unlikely to be negative. Both RAPTOR and Bridge are voluntary systems, and if we assume that non-respondents are rational, we can therefore assume that these parties will not utilize these programs unless they experience a net positive benefit from doing so. If the benefits that non-respondents experience are therefore positive but unmeasured, it follows that this study's estimates of the benefits from RAPTOR and Bridge are conservative.
- 4. System costs are valued over a period of 23 months, while respondent benefits and costs are measured over 12 months.** That is, the benefits and costs associated with the use of RAPTOR and Bridge are both reported by survey respondents over a 12-month period. In addition, however, this study includes the full cost of developing both systems, which begin 14 months prior to the time period of the survey. In this way, again, the benefit-cost ratios reported by this study are conservative, and understate the true benefits.
- 5. Valuations of benefits are based on conservative valuations of public employee FTEs.** We estimate that the cost of one FTE is \$100,000 – that is, we estimate that it costs \$100,000 to employ a full-time public employee. This might be a fair estimate of public employee *salaries*, but understates the full cost, which also includes the cost of all benefits and the indirect costs of administrative support. If we assume that these benefits and indirect costs each add 30% to the cost of a base salary, a salary of \$63,000 would yield a full cost that exceeds \$100,000 per FTE. Additionally, we do not distinguish between employee and managerial time. That is, we measure the time saved as a result of RAPTOR and Bridge, and then make the conservative assumption that all of the time directly saved is employee time, rather than managerial time, which is more costly.

Therefore our estimates of the net benefits from the RAPTOR and Bridge systems are low-bound estimates, and the true benefits may exceed those published here.

VI. References

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Appendix I: The Oregon RAPTOR Program Survey

INTRODUCTION

The Oregon RAPTOR Program would appreciate your completion of this survey on how you and your organization/department use RAPTOR. The primary purpose of the program is to make emergency response and management more effective and efficient. This survey has been designed to gather information on current RAPTOR program use in order to gauge how the program has performed thus far and identify opportunities for further enhancement/investment.

This survey is being conducted in partnership with the Benefit Cost Analysis Center in the Evans School of Public Affairs at the University of Washington. Your responses will not be disclosed outside the RAPTOR Program, except to the research team at the University of Washington. None of the questions ask you to state opinions or disclose personal information.

If you have any questions about this survey, please contact Professor Richard Zerbe at the University of Washington, [contact information given] or Cy Smith at the State of Oregon Geospatial Enterprise Office, [contact information given].

WORK INFORMATION

We would first like to gather information about your work.

1. What organization do you work for? (e.g., OEM, University of Oregon, DAS, etc)
2. Do you work in a specific department within your organization?
 - No
 - Yes (please specify)
3. What job/position do you hold at your organization?
 - First responder
 - Manager/director
 - IT specialist
 - GIS specialist
 - Planner/architect
 - Other (please specify)

DAILY TASKS

We would now like to ask several questions about how you use the RAPTOR program in your typical non-emergency activities (e.g., planning, analysis)

4. Please describe how you and your staff use the RAPTOR program as part of your daily (non-emergency response) work.
5. How has the RAPTOR program increased or decreased the amount of time you and your staff spend on each of the following activities? For each statement, please select the choice that you think is most accurate. [Options include Greatly decreased, Decreased, No change, Increased, Greatly increased, Don't Know, NA]
 - Planning/strategy development
 - Communication with other organizations/ agencies
 - Generating/using maps
 - Data collection
 - Data analysis
 - Data management
 - Data/map updating

DAILY TASKS II

6. How many hours/week do you typically work on all emergency management/public safety tasks EXCEPT for actual incident/event response (e.g., planning, data management)?

7. In your estimation, how many hours would it take you to complete your typical weekly non-emergency public safety tasks without the RAPTOR program?

8. If "1" represents one full-time (40hrs/wk) individual, how many employees on your staff typically work on non-emergency public safety tasks (e.g., planning, data management)? (fractional answers are acceptable)

9. In your estimation, how many full time employees would be required to fulfill the current output/work level of your staff/department without use of the RAPTOR program? (a full-time employee is considered to work 40hrs/wk; fractional answers are acceptable)

COMMON EMERGENCIES

We would now like to ask several questions about how you use the RAPTOR program in responding to or addressing common emergency events or situations. For each question, please select an answer that you think is most accurate.

10. To which of the following types of events do you respond or support response in some way? Please check all that apply.

- Flooding
- Fire
- Industrial or domestic accidents
- Transportation accidents
- Utility problems (e.g., water main break)
- Storm
- Special event (concert, protest, etc)

11. Do you respond or support response to any other type of emergency or event? If so, please specify.

COMMON EMERGENCIES II

12. Approximately how often do you respond, or support response, to the following events/emergencies? For each event/emergency type, please select both a number of responses and the time period in which said responses occur (e.g., per day, per month). [Survey allows respondents to specify both a number of responses, and a time period]

- Flooding
- Fire
- Industrial or domestic accidents
- Transportation accidents
- Utility problems (e.g., water main break)
- Storm
- Special event (concert, protest, etc)
- Q11 Response, if any

13. Please describe why or how RAPTOR has increased or decreased your effectiveness in responding or supporting response to such situations?

14. How has the RAPTOR program increased or decreased your effectiveness in responding, or supporting response, to each of the following events? For each statement, please select the choice that you think is most accurate. [Options include Greatly decreased, Decreased, No change, Increased, Greatly increased, Don't Know, NA]

- Flooding
- Fire
- Industrial or domestic accidents
- Transportation accidents
- Utility problems (e.g., water main break)
- Storm
- Special event (concert, protest, etc)

- Q11 Response, if any

COMMON EMERGENCIES III

15. Consider your current ability to respond to events. With "1" representing one responder or support personnel, how many people do you use to provide your current response level with regards to each of the following items? (fractional answers are acceptable)

- Flooding (w/RAPTOR)
- Fire (w/RAPTOR)
- Industrial or domestic accidents (w/RAPTOR)
- Transportation accidents (w/RAPTOR)
- Utility problems (e.g., water main break) (w/RAPTOR)
- Storm (w/RAPTOR)
- Special event (concert, protest, etc) (w/RAPTOR)

16. Given your previous responses, how many people do you estimate would be required to provide the same response level in the absence of the RAPTOR program?

(fractional answers are acceptable)

- Flooding (w/out RAPTOR)
- Fire (w/out RAPTOR)
- Industrial or domestic accidents (w/out RAPTOR)
- Transportation accidents (w/out RAPTOR)
- Utility problems (e.g., water main break) (w/out RAPTOR)
- Storm (w/out RAPTOR)
- Special event (concert, protest, etc) (w/out RAPTOR)

SEVERE EVENTS

We would now like to ask several questions about how you might use the RAPTOR system in responding, or supporting response, to rare/severe emergency situations (e.g., earthquake, tsunami, terrorist attack).

17. Which of the following tasks would you perform in the event of a rare/severe emergency situation? Please check all that apply.

- Medical response
- Law enforcement
- Civil defense
- Transportation safety/maintenance
- Utility repair (e.g., water mains, electricity)
- Administrative support

18. Are you responsible for any other type of task in the event of a rare/severe emergency situation? Please specify.

SEVERE EVENTS II

19. How does the RAPTOR program increase or decrease your effectiveness in responding, or supporting response, to each of the following emergencies? For each statement, please select the choice that you think is most accurate. [Options include Greatly decreased, Decreased, No change, Increased, Greatly increased, Don't Know, NA]

- Medical response
- Law enforcement
- Civil defense
- Transportation safety/maintenance
- Utility repair (e.g., water mains, electricity)
- Administrative support
- Q18 Response, if any

20. Please describe why or how RAPTOR has increased or decreased your effectiveness in responding or supporting response to rare/severe emergencies?

21. Consider your current ability to respond to severe/rare events. With "1" representing a full day of work from one individual, how many people do/would you use to provide your current severe event response level with regards to each of the following items? (fractional answers are acceptable)

- Medical response (w/RAPTOR)
- Law enforcement (w/RAPTOR)
- Civil defense (w/RAPTOR)
- Transportation safety/maintenance (w/RAPTOR)
- Utility repair (e.g., water mains, electricity) (w/RAPTOR)
- Administrative support (w/RAPTOR)
- Q18 Response, if any (w/RAPTOR)

22. Given your previous responses, how many people do you estimate would be required to provide the same response level in the absence of the RAPTOR program?

(fractional answers are acceptable)

- Medical response (w/out RAPTOR)
- Law enforcement (w/out RAPTOR)
- Civil defense (w/out RAPTOR)
- Transportation safety/maintenance (w/out RAPTOR)
- Utility repair (e.g., water mains, electricity) (w/out RAPTOR)
- Administrative support (w/out RAPTOR)
- Q18 Response, if any (w/out RAPTOR)

CONCLUSION

Thank you for your time. Your input will be greatly beneficial for future decision making and investment regarding technology infrastructure and emergency management.

Appendix II: Multnomah County Bridge Program Survey

INTRODUCTION

The Multnomah County Bridge Program would appreciate your completion of this survey on how you and your organization/department use Bridge. The primary purpose of the program is to make emergency response and management more effective and efficient. This survey has been designed to gather information on current Bridge program use in order to gauge how the program has performed thus far and identify opportunities for further enhancement/investment.

This survey is being conducted in partnership with the Benefit Cost Analysis Center in the Evans School of Public Affairs at the University of Washington. Your responses will not be disclosed outside the Bridge Program, except to the research team at the University of Washington. None of the questions ask you to state opinions or disclose personal information.

If you have any questions about this survey, please contact Professor Richard Zerbo at the University of Washington, [contact information given] or Cy Smith at the State of Oregon Geospatial Enterprise Office, [contact information given].

WORK INFORMATION

We would first like to gather information about your work.

1. What organization do you work for? (e.g., Multnomah County, City of Gresham, etc)
2. Do you work in a specific department within your organization?
 - No
 - Yes (please specify)
3. What job/position do you hold at your organization?
 - First responder
 - Manager/director
 - IT specialist
 - GIS specialist
 - Planner/architect
 - Other (please specify)

DAILY TASKS

We would now like to ask several questions about how you use the Bridge program in your typical non-emergency activities (e.g., planning, analysis)

4. Please describe how you and your staff use the Bridge program as part of your daily (non-emergency response) work.
5. How has the Bridge program increased or decreased the amount of time you and your staff spend on each of the following activities? For each statement, please select the choice that you think is most accurate. [Options include Greatly decreased, Decreased, No change, Increased, Greatly increased, Don't Know, NA]
 - Planning/strategy development
 - Communication with other organizations/ agencies
 - Generating/using maps
 - Data collection
 - Data analysis
 - Data management
 - Data/map updating

DAILY TASKS II

6. How many hours/week do you typically work on all emergency management/public safety tasks EXCEPT for actual incident/event response (e.g., planning, data management)?

7. In your estimation, how many hours would it take you to complete your typical weekly non-emergency public safety tasks without the Bridge program?

8. If "1" represents one full-time (40hrs/wk) individual, how many employees on your staff typically work on non-emergency public safety tasks (e.g., planning, data management)? (fractional answers are acceptable)

9. In your estimation, how many full time employees would be required to fulfill the current output/work level of your staff/department without use of the Bridge program? (a full-time employee is considered to work 40hrs/wk; fractional answers are acceptable)

COMMON EMERGENCIES

We would now like to ask several questions about how you use the Bridge program in responding to or addressing common emergency events or situations. For each question, please select an answer that you think is most accurate.

10. To which of the following types of events do you respond or support response in some way? Please check all that apply.

- Flooding
- Fire
- Industrial or domestic accidents
- Transportation accidents
- Utility problems (e.g., water main break)
- Storm
- Special event (concert, protest, etc)

11. Do you respond or support response to any other type of emergency or event? If so, please specify.

COMMON EMERGENCIES II

12. Approximately how often do you respond, or support response, to the following events/emergencies? For each event/emergency type, please select both a number of responses and the time period in which said responses occur (e.g., per day, per month). [Survey allows respondents to specify both a number of responses, and a time period]

- Flooding
- Fire
- Industrial or domestic accidents
- Transportation accidents
- Utility problems (e.g., water main break)
- Storm
- Special event (concert, protest, etc)
- Q11 Response, if any

13. Please describe why or how Bridge has increased or decreased your effectiveness in responding or supporting response to such situations?

14. How has the Bridge program increased or decreased your effectiveness in responding, or supporting response, to each of the following events? For each statement, please select the choice that you think is most accurate. [Options include Greatly decreased, Decreased, No change, Increased, Greatly increased, Don't Know, NA]

- Flooding
- Fire
- Industrial or domestic accidents
- Transportation accidents
- Utility problems (e.g., water main break)
- Storm
- Special event (concert, protest, etc)
- Q11 Response, if any

COMMON EMERGENCIES III

15. Consider your current ability to respond to events. With "1" representing one responder or support personnel, how many people do you use to provide your current response level with regards to each of the following items? (fractional answers are acceptable)

- Flooding (w/Bridge)
- Fire (w/Bridge)
- Industrial or domestic accidents (w/Bridge)
- Transportation accidents (w/Bridge)
- Utility problems (e.g., water main break) (w/Bridge)
- Storm (w/Bridge)
- Special event (concert, protest, etc) (w/Bridge)
- Q11 Response, if any (w/Bridge)

16. Given your previous responses, how many people do you estimate would be required to provide the same response level in the absence of the Bridge program? (fractional answers are acceptable)

- Flooding (w/out Bridge)
- Fire (w/out Bridge)
- Industrial or domestic accidents (w/out Bridge)
- Transportation accidents (w/out Bridge)
- Utility problems (e.g., water main break) (w/out Bridge)
- Storm (w/out Bridge)
- Special event (concert, protest, etc) (w/out Bridge)
- Q11 Response, if any (w/out Bridge)

SEVERE EVENTS

We would now like to ask several questions about how you might use the Bridge system in responding, or supporting response, to rare/severe emergency situations (e.g., earthquake, tsunami, terrorist attack).

17. Which of the following tasks would you perform in the event of a rare/severe emergency situation? Please check all that apply.

- Medical response
- Law enforcement
- Civil defense
- Transportation safety/maintenance
- Utility repair (e.g., water mains, electricity)
- Administrative support

18. Are you responsible for any other type of task in the event of a rare/severe emergency situation? Please specify.

SEVERE EVENTS II

19. How does the Bridge program increase or decrease your effectiveness in responding, or supporting response, to each of the following emergencies? For each statement, please select the choice that you think is most accurate. [Options include Greatly decreased, Decreased, No change, Increased, Greatly increased, Don't Know, NA]

- Medical response
- Law enforcement
- Civil defense
- Transportation safety/maintenance
- Utility repair (e.g., water mains, electricity)
- Administrative support
- Q18 Response, if any

20. Please describe why or how Bridge has increased or decreased your effectiveness in responding or supporting response to rare/severe emergencies?

21. Consider your current ability to respond to severe/rare events. With "1" representing a full day of work from one individual, how many people do/would you use to provide your current severe event response level with regards to each of the following items? (fractional answers are acceptable)

- Medical response (w/Bridge)
- Law enforcement (w/Bridge)
- Civil defense (w/Bridge)
- Transportation safety/maintenance (w/Bridge)
- Utility repair (e.g., water mains, electricity) (w/Bridge)
- Administrative support (w/Bridge)
- Q18 Response, if any (w/Bridge)

22. Given your previous responses, how many people do you estimate would be required to provide the same response level in the absence of the Bridge program?

(fractional answers are acceptable)

- Medical response (w/out Bridge)
- Law enforcement (w/out Bridge)
- Civil defense (w/out Bridge)
- Transportation safety/maintenance (w/out Bridge)
- Utility repair (e.g., water mains, electricity) (w/out Bridge)
- Administrative support (w/out Bridge)
- Q18 Response, if any (w/out Bridge)

CONCLUSION

Thank you for your time. Your input will be greatly beneficial for future decision making and investment regarding technology infrastructure and emergency management.

NSDI CAP Feedback

What are the CAP Program strengths and weaknesses?

The program provides an opportunity for innovation, but it doesn't sufficiently leverage that innovation.

Where did it make a difference?

We would not have pursued our project without a CAP grant, so we would not have measured the ROI for the RAPTOR or Bridge projects.

Was the assistance you received sufficient or effective?

Yes, we were able to complete the ROI study.

What would you recommend that the FGDC do differently?

The results of CAP grants are provided to anyone that wants to see them, but I don't see a proactive attempt to extend the results for use on other projects. The 50 States Strategic Planning and Business Planning grants were an example of this, but I'm not aware of others. Those were part of a nationwide effort to move the NSDI ball down the field. If other CAP grants were used collectively, they could also serve to more effectively move the ball down the field. Strategic thinking needs to be employed, the CAP grants need to be a key strategic part of the new NSDI Strategic Plan...both new grants and the existing body of CAP grant work. I know that's the general intent, but it doesn't seem like that vision has really been implemented. If one of the success criteria, and perhaps the most important one, is the way a proposal fits with and enables the components or objectives of the NSDI Strategic Plan, I think the results would be more effective and would end up helping more of us by moving the Strategic Plan forward and forming a real, tangible body of best practice guidance.

Are there factors that are missing or are there additional needs that should be considered?

See answer to question directly above. In addition, we proposed something that was outside the scope of the original grant category description. It was successful, but I know that lots of folks feel very constrained to stay within the grant category descriptions. As a result, many projects are pursued that don't produce good results. If the categories were a bit less restrictive and an important success criteria was support of the NSDI strategy, more innovation would likely occur, which would help everyone. I know that makes the projects more difficult to manage, but I would suggest that it's possible to enlist the geospatial community in some way to assist with project management. Also, I would say that the geospatial community, particularly through the professional associations, could be used to help ensure that the project results are more widely known and more used.

Are there program management concerns that need to be addressed, such as the time frame?

I know in our case it probably would have been good to have had an ability at the beginning to say that it would likely take more than a single year. Maybe it's possible to say that, but I don't believe we thought our proposal would be successful if we proposed a more realistic timeframe.

If you were to do the project again, what would you do differently?

Nothing. 😊 I'm sure that's not true, but nothing comes to mind.

