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Focus: Grandi Eventi

A Case Study Analysis of the Implementation of GIS Technology for Safety and Security Planning during Major Sport Events

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Keywords

Geographic Information System (GIS) technology, major sport events, safety and security planning, traffic management and transport system, common operating picture

Parole chiave

Sistema informativo geografico, grandi eventi sportivi, pianificazione di sicurezza, gestione del traffico e dei trasporti, quadro operativo comune

1. An Overview of Geographic Information System (GIS) Technology for the Safety and Security Sector of Major Sport Events

Planning safety and security measures for major sport events requires a reliance on spatial data and geographical reference maps to define resources and physical security system requirements. This holds true for major road sport events in particular, but also becomes a requirement for the overall management of the transport systems, logistic operations, and traffic generated by the major event itself.

The challenge begins when the geographical information available originates from different entities with varying scopes of end use. The information

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might be collectively complete for all intended planning purposes, however visualizing the interrelationship between the datasets of all maps simultaneously cannot be physically done. The answer to this challenge is to introduce Geographical Information System (GIS) technology computer software to avoid the following potential risks:

- Existence of multiple versions of the truth
- Data entry mistakes between internal role players and external stakeholders
- Data latency, which is a barrier to making timely and critical decisions resulting, in some occasions, in a delayed decision making processes
- Data not organized optimally for user access and analysis needs
- Users not having adequate tools to analyse the data
- Difficulty to share spatial data and make it available for analytical purposes especially with external stakeholders
- No central capability to store and analyse data in a comprehensive and holistic way

Geographic information system (GIS) technology allows visualising, questioning, analysing, interpreting and understanding geographic data in many ways that reveal relationships, patterns, and trends in the form of maps, reports, and charts. It provides for the manipulation of spatial and other data for presentational and analysis purposes. The technology consists in shape files (point, line, polyline and polygon) with associated attribute tables containing ancillary numerical or textual data, which can be related to other files (e.g. databases, sheets). In addition, there are tile-based raster data-sets which are used for presentational purposes (e.g. Ordnance Survey map tiles).

In many cases local law enforcement and government departments already utilize GIS for their internal planning purposes and have extensive databases of spatial datasets. By introducing a software platform intended for the major sport event, the process of integrating and coordinating the information also facilitates the involvement of those internal and external partners involved. GIS becomes the tool by which stakeholders can visually communicate their immediate and long-term needs and requirements for the event. This enables overlaying safety and security measures with increased accuracy and allows for managing and monitoring them during the event in real time.

Even though geographic information technology is advancing in a relentless way (e.g. developments in cloud-based infrastructure, availability of large data and open-source software), the principles and benefits of applying GIS for safety and security planning during major events remain, and are current, as detailed in this and other related articles (Chatterton, 2012). However, to operate and implement the software successfully on complex projects, individuals are required to have a comprehensive understanding of spatial information science, analysis and data management.

The implementation of GIS does bring its own challenges. In general, the control of chances to spatial data is highly difficult to manage due to the numerous contributing role-players coupled with frequent changes, especially as the event comes closer. It is therefore fundamental that quality control regards to data management (e.g. layers ownership) is sufficiently standardized to ensure the spatial information is current and shared effectively.

2. Case Studies

The following is a detailed description of the practical use of GIS technology for the safety and security planning of three major sport events from three different perspectives:

- For the 2010 FIFA World Cup, the capability was built within the Johannesburg Metropolitan Police Department (JMPD)
- For Glasgow 2014, the capability was built within the Organizing Committee (OC)
- For Baku 2015, the capability was provided by a private company external to the Organizing Committee (OC)

For these events, the spatial element, for which GIS provides an integrated and workable solution, was at the centre of integrated planning, particularly beyond the venue boundary in the wider games' theatre.

2.1 Case Study 1: 2010 FIFA World Cup – Johannesburg, South Africa

The use of the GIS technology was one of the key activities carried out by the Johannesburg Metropolitan Police Department (JMPD) to successfully plan and implement the 2010 FIFA World Cup (FWC) safety and security arrangements for Johannesburg, which resulted in a peaceful and incident free event (Asmal, 2012).

Initially, the tool was implemented for the 2009 FIFA Confederations Cup and other event's rehearsals at three venues between 2008 and 2010: Ellis Park Stadium (EPS), Orlando Stadium and Soccer City Stadium. As the implementation of the technology for the execution of the traffic management plans and the crime prevention operations was deemed positive during the rehearsals, the technology was then implemented for the 2010 FIFA World Cup event.

During the bid process, the City of Johannesburg (CoJ) was identified as the main Host City of the 2010 FWC South Africa. It hosted two match venues (Soccer City Stadium and Ellis Park Stadium), two official Fan Fests areas (Elkah Sta-

dium in Soweto and Innes Free Park in Sandton), both the Opening and Closing Ceremonies, and the International Broadcaster Centre (IBC). Furthermore, the event was the biggest that the City ever hosted (City of Johannesburg, 2011):

- The opening ceremony held at Soccer City Stadium (Soweto) was attended by 84,490 spectators
- The total attendance at both Johannesburg match venues, Ellis Park Stadium and Soccer City Stadium, over the fifteen games played in the two stadiums was 1,040,000, with an average attendance at Soccer City Stadium of 99% and at Ellis Park Stadium 94% of their respective capacities
- The total number of supporters that streamed into the Johannesburg Fan Fests – Elkah Stadium in Soweto and Innes Free Park in Sandton – was 202,209. The combined attendance at both venues on the most attended days reached 51,000 spectators
- In total 225,836 people attended the Johannesburg Public Viewing Site situated in New Town in the Johannesburg Central Business District
- Over 220,000 football fans visited one or more of the nine Ekasi TV sites in the City of Johannesburg
- Football For Hope held in Alexandra, Johannesburg, had 2,500 visitors a day
- The International Broadcasting Centre situated in the Soccer City Stadium precinct was visited by a total of 13,642 accredited media and 2,542 Host Broadcast Services staff from 65 different countries

The safety and security measures for the FIFA event in Johannesburg were planned and implemented in conjunction with three law enforcement agencies: the South African Police Service (SAPS), the Gauteng Traffic Police and the Johannesburg Metropolitan Police Department (JMPD).

JMPD, a Department[2] of the City of Johannesburg (CoJ), was legislatively responsible for traffic policing, policing of municipal by-laws and regulations and the prevention of crime (Government of South Africa, 1998). In line with these functions for the 2010 event, the Department was tasked to "*...provide assistance*

[2] The JMPD's mandate is derived from the South African Police Service Amendment Act 83 of 1998. The Department's functions include traffic policing, policing of municipal by-laws and regulations and the prevention of crime. The department is responsible for co-ordination and development of a crime prevention strategy for the city, development of delivery mechanisms and systems for crime prevention and by-law enforcement, and guidance, operation and maintenance of an efficient and effective metropolitan police service. It has seven regional offices, precincts in each region, and sectors in those precincts. It has about 2,300 operational staff members, both uniformed and civilian, drawn from the traffic departments, crime prevention and by-law enforcement agencies of the former local councils within the Johannesburg area, who carry out patrol duties. The department plans to expand this number to 4,000 over the next three years (City of Johannesburg Official Website, 2014).

to the South African Police Service (SAPS) as well as traffic management (The Organising Committee's Safety and Security Division and NATJOINTS, 2008)".

GIS technology was already implemented successfully for crime-prevention projects including crime mapping and physical/social disorder audits by the Project Manager of the Joburg City Safety Programme[3] (JCSP) within JMPD to develop crime mapping/crime analysis[4] (CM/CA) reports, physical/social disorder audits[5], and CCTV system[6] incidents plotting in the Johannesburg inner city (Pisapia, 2012b). It became apparent that its benefits should be applied for the safety and security planning of the FIFA event. In particular, the technology's benefits included:

- Increasing efficiency: as GIS was already widely used among external stakeholders to optimize decision-making processes, it assisted in reducing staff time and improving efficient planning
- Better decision making: GIS assisted in making better decisions about the spatial planning for the event (e.g. route/corridor selection, evacuation planning) – making correct decisions about location is critical to the success of the event
- Improving communication: GIS-based maps and visualizations greatly assisted in understanding road events, traffic and transportation plans and to share them among internal role-players and external agencies. GIS-generated maps were a type of visual language that improved communication between different teams, departments, disciplines, professional fields, organizations, and the public at large
- Better record keeping: GIS assisted to better manage and maintain authoritative records about the status and change of the spatial plans related to event. GIS provided a strong framework for managing these types of records with full transaction support and reporting tools
- Managing the event geographically: GIS assisted in a better planning and operational understanding throughout event's theatre

[3] The Joburg City Safety Programme (JCSP) is an integrated, multi-disciplinary programme that aims to improve public safety and contribute to the reduction of crime by focusing on the management of the urban environment together with improved law enforcement and policing (City of Johannesburg).

[4] GIS technology was used to draft crime mapping and crime analysis to understand crime trends and patterns in the Johannesburg Inner City.

[5] The audit consisted in the geo-coding (providing X Y coordinates) of a range of physical, social, and land-use related disorder issues through GIS technology. The results of the audits were then linked with the crime mapping and crime analysis of the same precinct to determine possible correlations.

[6] The Johannesburg CCTV System, following an upgrade before the FIFA event, consisted in 237 dome cameras, which allowed coverage of the Johannesburg Inner City, including the Ellis Park Stadium precinct.

GIS technology[7] was thus used to capture all relevant event-related information into a spatial geodatabase which included: transportation hubs and routes; temporary facilities (e.g. park and rides, park and walks, rail stations, bus stations); security layers (e.g. traffic warning zone, traffic free zone, inner perimeter, stadium perimeter); road closures (e.g. traffic control points, vehicles permit checkpoints); permanent structures (e.g. stadiums), temporary overlays (e.g. fences, mag and bags screening areas) and police officers' deployment for traffic management purposes.

JMPD was able to share this geographical information in the form of shape files, geodatabases and maps with the South African Police Service (SAPS), the South African National Defence Force (SANDF), as well as local/provincial/national departments. This allowed all operational plans to be aligned through the available updated and detailed spatial information.

The importance of having developed spatially focused operational plans for the event cannot be overemphasized. By physically defining, delineating and identifying, through GIS technology, all of the components of the Department's operational plans (e.g. road closures, transportation routes, spectators' flows, police deployment, temporary and permanent signs for vehicles and pedestrians), it was possible for JMPD to share the plan's spatial information with both internal role players (e.g. officers, management) and external partners. This ensured common alignment and understanding in the implementation of safety and security measures for the event in various locations by different role-players.

Furthermore, spatial-related information assisted in the development of accurate documentation related to the event safety and security measures (e.g. road closures plans) and traffic management plan (e.g. clients' routes) for the benefit of residents and business. GIS was thus utilized to communicate efficiently and effectively 2010-related information to the public.

In particular, in-depth analysis, utilizing GIS technology, was conducted on the Ellis Park Stadium (EPS) precinct, one of the FIFA event's venues, to identify crime hot-spots and assess crime trends and patterns (Pisapia and Fonio, 2015a). This many-fold spatial dataset, built in the run up to the tournament, was aimed at defining crime-prevention projects for the reduction of both the actual incidence of crime and the negative perceptions of crime. These projects consisted principally in:

- Implementing tactical policing techniques (e.g. visible policing, patrol enhancements) focused on identified crime hot-spots through the use of problem-oriented/community policing practices

[7] The technology for safety and security purposes was implemented by the Joburg City Safety Programme (JCSP).

- Addressing environmental underlying causes of crimes such as the absence of street lights, non-compliant liquor outlets, bad buildings, illegal taxi ranks, and waste management
- Mainstreaming safety and security principles, such as Crime Prevention through Environment Design (CPTED) notions, into urban regeneration projects by the Johannesburg Development Agency (JDA) with the aim of informing the City's urban planning projects at creating environments that diminished opportunities for criminal activities[8]

As reported by local, national and international media, the 2010 FIFA World Cup was a great success, in particular from a safety and security perspective: no serious incidents involving any client groups, including spectators or visitors, took place during the event. Some reporters even stated that this was the best world cup ever (Beth, Neil, 2010). This is in line with the outcome of an in-depth analysis by the JCSP, which utilized GIS technology for monitoring and evaluating crime levels before, during and after the event in the Ellis Park Stadium (EPS) precinct. The report indicated a drastic reduction of police recorded crime incidents in the area during the event (Pisapia, 2012a).

The evaluation of the implementation of the JMPD safety and security plan for the event detailed that the use of the GIS technology was one of the most tangible key aspects for the successful implementation of the operations for the event (Pisapia and Fonio, 2015b). Additional benefits include:

- The optimization of decision making within JMPD and the integration with external partners
- The recognition, among partners, of the importance of sharing spatial data for the benefit of conducting coordinated operations with multiple partners
- The collation of all spatial data into a single geospatial database, which realised significant cost savings in terms of information sharing/data accuracy
- The externalisation of a geospatial database, which allowed the benefits of a single source of truth to extend beyond JMPD
- The easy-to-use data visualisation, in particular mapping documents, enabled creative use of data throughout the project (e.g. leaflet for spectators and police officers)

To conclude, for the safety and security planning of the 2010 FWC in Johannesburg, GIS technology was used in a holistic manner to secure the event. It was implemented to draw the event's security measures (e.g. road restrictions, police deployment), to compile crime mapping/crime analysis and disorder audits, and to plot recorded CCTV system incidents. These activi-

[8] Improvements included, among others, the creation of a pedestrian friendly and walkable urban environment through the establishment of a network of public spaces, and improved circulation around and access to formal taxi, bus and rail facilities.

ties aimed at reducing both the actual incidences of crime and the negative perceptions of crime in the run up to and during the event in Johannesburg Inner City and the Ellis Park Stadium (EPS) precinct.

2.2 Case Study 2: XX Commonwealth Games 2014 – Glasgow, Scotland

Initially, Glasgow 2014 Limited did not scope the establishment of a GIS solution. However, as work started to progress, it became apparent that the spatial element, for which GIS technology provides an integrated and workable solution, was at the centre of integrated planning for the Games, particularly beyond the venue boundary and into the wider theatre.

The absence of a proper GIS solution triggered different risks for the Organizing Committee: from planning inaccuracies due to inadequacies of spatial data resources and the lack of spatial data management at the planning stage (e.g. failure to assess the interaction of Games activities with the city) to Games-Time inaccuracies (e.g. errors in map products such as spectator guides). Some of the unwanted consequences from not having a GIS solution consisted in:

- Exposure to additional costs from reliance on partners/stakeholders delivering GIS products
- Exposure to unnecessary time delays for decision-making and planning purposes from reliance on partners/stakeholders delivering GIS products (e.g. partners not providing timeously maps related to the road events courses)
- Future requirements and future costs related to the drawing of maps for internal role-players and external stakeholders both for planning and operational purposes (e.g. security staff deployment plans)
- Risk of delay and cost due to planning errors (lack of configuration control of ad-hoc planning using open sources (e.g. Google Maps, MS PowerPoint)
- Risk of additional cost of developing a short-notice capability at a more advanced stage of event's planning, rather than incremental development

Such risks were more acute for the safety and security planning of the road events, traffic management and transport system, which required strong integration between the security and transport operations both internally to the Organizing Committee and with external partners.

The first step in establishing GIS technology capability within the Glasgow 2014 Organizing Committee (OC) was the conveying of a transfer of knowledge (ToK) workshop held on the 28-29 November 2012, with staff from the

Olympic Delivery Authority[9] (ODA). For London 2012, GIS technology was employed for a range of mapping purposes, including printed and online guides, maps for client groups (e.g. spectators, athletes), and planning work including public consultation, roads orders, the Olympic Route Network (ORN) and multi-agency planning and data exchange (Chatterton, 2012).

It was thus decided to implement GIS technology for the planning of safety and security measures for the event's road events, traffic management and transport systems with the aim of minimizing data latency risks and associated impacts with appropriate configuration control and management.

From a data architecture perspective, a common geodatabase and file repository[10] with configuration control to allow data access exclusively to approved users was established within the OC. Internally, data was shared through GIS Arc Reader[11], an ESRI free software viewing only licence, loaded onto staff's personal computers based in the OC Headquarters. As a direct link for third parties of the common file repository could not be activated, a Glasgow 2014 Share File internet-based secure webpage was established to allow file sharing with third parties[12], as GIS shapefiles tend not to be large. Thus, even though the interoperability with external stakeholders was limited, the sharing of basic spatial data in shape files/geodatabases was made possible.

One of the innovative tools utilized to share event spatial information with both internal and external partners consisted in the application of the ArcGIS Online (AGOL) system, which provided a convenient web-based application to visualize and share spatial data and conducting simple analyses[13].

[9] The Olympic Delivery Authority (ODA) was a public body responsible for developing and building new venues and infrastructure, including transport-related, for the Games. This included designing safety and security measures in accordance with statutory requirements.

[10] System memory requirements were limited (approximately, the total number of files supporting a single shape file totals 100KB), as most of the base data mapping (e.g. Ordnance Survey data sets) was retrieved remotely through Arc GIS On Line (AGOL). This was to avoid base datasets being stored internally.

[11] Arc Reader is a free, easy-to-use desktop mapping application that allows users to view, explore, and print maps and globes. Anyone with Arc Reader can view high-quality interactive maps authored by a high-level ArcGIS for Desktop product and published with the ArcGIS Publisher extension.

[12] Access to the share file website was regulated through a non-disclosure agreement (NDA) signed by the OC and the external stakeholders to ensure internal use only data were not leaked to the public.

[13] The initial cost for ArcGIS Online (AGOL) was approximately £ 1,900 for 5 licenses, rising incrementally to £7,500 for 50 licenses. As the planning advanced, the Organizing Committee made available licenses for internal and a limited number of external personnel. However, AGOL was not used as a standalone system without access to desktop ArcGIS.

The staff consisted of a project leader for the Security Department and a GIS Manager for the Transport Functional Areas (FAs), both with a professional working knowledge of GIS. In addition, the Security Department recruited one GIS technician and one Frontrunner (volunteer), while the Transport FA recruited two GIS technicians. GIS users increased as Games-Time approached. In general, OC staff working in the Security/Transport area had to have basic mapping capability to carry out their roles (e.g. consult/analyse data through AGOL).

From a data perspective, the GIS system set up for the event drew together various types of data in a spatial framework: shapefiles[14] (points, lines, polylines and polygons), tables (excel, database) and raster datasets (cell-based background maps and imagery).

From a data management perspective, a system to classify, store and share spatial data was created to ensure data integrity and alignment among all internal GIS users (Pisapia, 2013b).

From a governance perspective, the sharing of the event's spatial information among internal role-players and external stakeholders[15] was facilitated through the *GIS 2010 User Group*, chaired by the OC, which met regularly to oversee the advancement of the project and to enhance the cooperation between partners. A second group was instituted by Glasgow City Council (GCC) Land & Environmental Services (LES): the *GCC Commonwealth Games GIS Project Group*. Its mandate was to facilitate and manage the significant demands for spatially-referenced information for the Games by the Host City to ensure the availability of a streamlined, single version of data for the provision of spatial information for strategic, corporate and day-to-day planning for the event.

[14] Shapefile format have the following constituent files: .dbf, .prj, .sbn, .xml and .shx.

[15] The internal role-players were: the Security Department and Transport FAs – which initiated the primary task of jointly planning for the safety and security measures of road events, traffic management and transportation system, OC Accreditation, OC Accommodation, OC City Operations – particularly the last mile, OC Sport – road events planning, in particular focused on safety, security and traffic management, Venue Design and Overlay – exchange of CAD layer files in dwg/dxf format, Venue Management and Venue Operations.
The external stakeholders consisted in: Glasgow City Council with which the OC exchanged a wide range of spatial data, including addresses to determine the residents/business impacted by the Games' security measures (e.g. road closures), base mapping and imagery at a variety of scales, shapefiles for civic and public buildings (e.g. schools), Scottish Fire and Rescue, Police Scotland, Strathclyde Partnership for Transport (SPT), Ordnance Survey (OS), Angus Council, City of Edinburgh Council, Dundee City Council, North Lanarkshire Council, South Lanarkshire Council, Scottish Government, Ministry of Defence (MoD), AECOM (contractor for the Games Family Demand Model) and Halcrow/CH2M HILL (contractor for the Games Route Network).

To conclude, a project management approach was utilized to ensure objectives, resources and available time were aligned and integrated within the broader organization's commitments and project reviews were conducted accordingly.

The above set-up allowed the maintenance of a single spatial database as a shared resource and the creation of a "*single source of truth*". The data register for the safety and security planning of the road events, traffic management and transport system, consisted in the following data sets:

- For the safety and security measures for each of the road events:
  - Routes (in conjunction with GCC) and sectors
  - Temporary overlay such as barriers, pedestrian, vehicles crossing points
  - Security/safety/spectators service workforce locations on/adjacent to the field of play (FoP)
  - Police Scotland officers locations on/adjacent to the FoP
  - Broadcast and media positions
  - Sport specific signage locations & workforce location
  - Intermediate time points locations
  - Location of Vehicle Permit Checkpoints (VPC)
  - High spectators areas (HAS)
  - Police Scotland route risk assessment segments and OC Security risk mitigation measures
- For the safety and security measures for the traffic management and transport system, spatial data was divided into:
  - Spatial datasets from Games partners (e.g. GCC, contractors):
    - Base maps and imagery for contextual mapping, from regional mapping to the kerb-line
    - Transport infrastructure: roads, railways and rail stations
    - Traffic management infrastructure: street furniture traffic signals, CCTV and speed enforcement cameras
    - The Games Route Network (GRN) and associated temporary traffic regulation orders (TTROs)
    - Key transport routes: bus routes and bus stops which could be potentially affected
  - OC-generated spatial data[16]:
    - List of addresses (residents and businesses) impacted by the event's security measures (e.g. road closures)
    - Anti-Terrorism Traffic Regulation Orders (ATTROs)
    - Hostile Vehicles Mitigations (HVMs)

[16] The OC Transport FA used GIS technology to support all the Games' transport/traffic management planning deliveries, from Games' venue to fleet/busses operations. Closer to Games-Time, the OC Transport FA employed a full-time GIS Manager and two GIS technicians.

- Transport-led road restrictions (TTROs)
- Vehicle Permit Checkpoints (VPCs)
- Local Area Traffic Management Plans (LATMPs) for each venue and village
- Venues Last Mile routes and interaction with TTROs/LATMPs
- Ad-hoc planning tasks (e.g. context maps, distances to venues, walking distances from City centre)
- Event Day Controlled Parking Zone (EDCPZ) Areas
- Secure Residents Access Parking and Permit (RAPP) Scheme Areas
- Venues Grid Reference Systems (island sites and precincts)

Furthermore, the OC Security Department used GIS technology to support its security venue deployment plan, in conjunction with Police Scotland and Scottish Fire and Rescue, by digitizing positions of security, spectators' service and safety personnel's locations within and around the venue perimeters. The OC Security Department also created GIS data of the venues' physical security system[17] (e.g. CCTV system, secure perimeter, pedestrian screening areas, vehicle screening areas, exit gates). Such data, compiled with that related to road events, traffic management and transport system, provided a common operating picture related to safety and security measures for the protection of the event's venues.

An important element in managing the safety and security spatial data was the adherence to the internal OC policies on information technology security and UK Government Protective Marking Scheme (GPMS) (Cabinet Office, 2014). Similarly to the London 2012 approach (Chatterton, 2012), security of information was kept proportionate to the data sensitivity as opposed to enforcing the high security level and associated technology constraints across all data. To ensure the spatial data was easily accessible to end-users, information was categorized per its level of confidentiality and required protection. OC-managed data consisted of information for public consumption or internal use only, which made up the majority of knowledge content. Instead, Police Scotland managed and organized confidential data, using secure systems to access it.

Parallel to the digitizing and continuous update of the spatial data, the successful implementation of the technology was achieved through a strong data management, administration and organization. Different tools were used for this purpose, such as: drafting policies, detailing a comprehensive data register, keeping metadata updated, tracking the project's open issue and detailing the project's outcomes against achievable timelines (e.g. Gantt charts, MS Project planning worksheets). This was essential in setting up the safety and security spatial-data integrated database, maintain its accuracy and

[17] Such data was compiled through the use of FME software, which translated information from CAD drawings.

avoid the risk of error or inaccuracy. The database provided the backbone for the developing of the Security Department operational plans for the road events, traffic and transport system for the event.

The benefits inherently connected with the use of the technology, which consisted principally in an enhanced sharing of geographical information in a timely and accurate manner based upon a "*single source of truth*" to allow collaborative work both within the Organization and with third parties, became apparent to both internal role-players and external stakeholders within the safety and security fraternity.

Thus, following a request to expand the GIS scope (Pisapia, 2013), the initial focus, which consisted exclusively in the safety and security planning of the road events, traffic management and transport system, evolved closer to Games-Time to encompass other functional area activities[18].

The technology was thus used to support operational planning and the exchange of spatial information for a number of different purposes, such as: city operations, last mile, venue development and overlay drawings, venues and villages transport operation plans, Games Route Network (GRN) design, traffic management plan, traffic regulation orders (road closures), Queens Baton Relay journey and integration of 2014 Glasgow Festivals with Games operations. This provided the opportunity for maximising the use of GIS to add value and reduce data latency risks in the prelude to the Games.

2.3 Case Study 3: 1st European Games 2015 – Baku, Azerbaijan

The practical experience in implementing GIS technology for safety and security planning for the 1st European Games in Baku, Azerbaijan, benefitted from previously applying it to Johannesburg 2010, London 20112 and Glasogw 2014. Thus, some elements inherited from previous events and implemented for Baku 2015 will not be detailed again. Instead, this case study focuses mainly on the differences in its application.

The experience in Baku was different from the one in Glasgow and Johannesburg. In Baku, an external company provided the GIS services, whereas for Glasgow and Johannesburg the capability was built up in-house. Regardless, GIS was used for supporting the safety and security planning of road events, traffic management and transport system with similar outcomes, in terms of maps, shape files and geodatabases, as the previous events.

[18] The most ardent supporter for the increase in scope for the GIS project was the Scottish Government, which, through representatives taking part in the GIS 2014 User Group meetings, proposed to assist the OC to broaden the implementation of GIS technology.

During the planning process, the Baku European Games Operation Committee (BEGOC) recognized the need of GIS technology to support the planning and operations of the largest sporting event ever held in Azerbaijan. It was also acknowledged that a GIS solution would have to satisfy multiple internal and external purposes (e.g. publications).

Due to time constraints, BEGOC decided to appoint an external company to provide GIS services through a public request for proposal (RFP). The ultimate aim was to ensure BEGOC had a managed central data repository for the Games' spatial data, and the capability to use this data to produce analysis and map outputs for both internal and external purposes.

The Baku-based GIS company awarded the contract provided various services and resources to ensure the project was successfully implemented, such as project management, GIS analysts, data collectors, data provision, traffic and road network information, cartography design services, training and support services. Similar to Glasgow 2014, the company supplied both ESRI ArcGIS Desktop licences to GIS technicians working within the OC to digitize and create spatial data and ArcGIS Online (AGOL) to share information with both internal and external partners.

A peculiarity of the European Games, in terms of GIS implementation, was that the contracted company was tasked to identify, source and assist in the procurement of spatial data (base data) primarily related to the city of Baku and country of Azerbaijan, as it was not easily available through local/national government agencies[19].

The safety and security requirements for the road events, traffic management and transport system were relatively straightforward, with some necessary adjustments to the idiosyncrasies of the Games' operations compared to Glasgow and Johannesburg. Some of the spatial information that was created with GIS technology to support the safety and security planning consisted in the following:

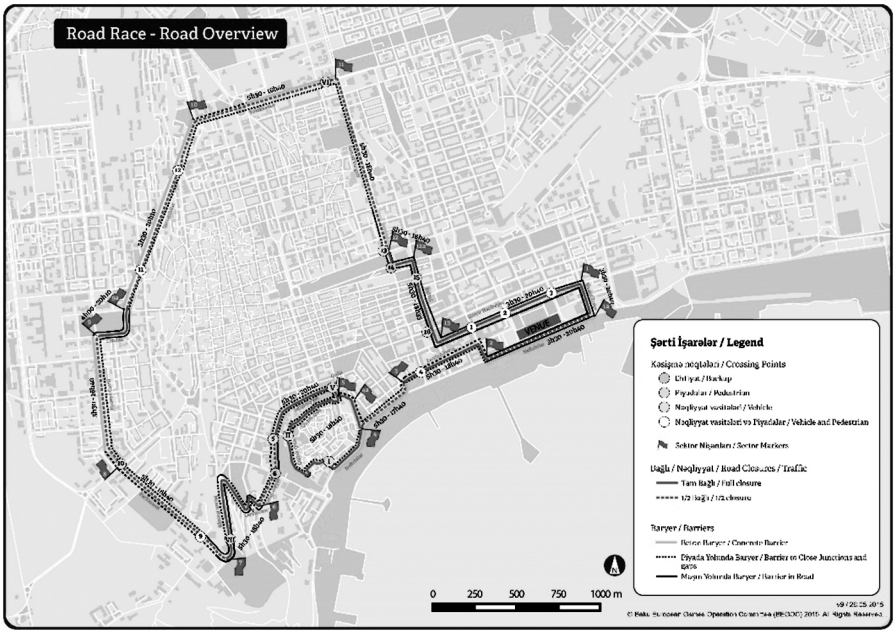
- For venue centered-data: secure perimeter, pedestrian screening areas (PSA), vehicle screening areas (VSA), vehicle permit checkpoints (VPC), temporary overlay, permanent construction, transport load zones
- For transport system data: roads, Games Route Network (GRN), railway/metro stations and lines, accredited shuttle, bus stops, parking areas, competition/non-competition venues
- For road events data: routes, sectors, crowd barriers, pedestrian and vehicle crossing points, broadcast & media positions, athletes feeding points, street furniture road closures and advisory closures, traffic management

[19] For the XX Commonwealth Games, the OC benefitted, through the Glasgow City Council (GCC), of the One Scotland Mapping Agreement (OSMA) on a sub contractual basis, thus obtaining base data (e.g. road centerline, aerial pictures) free of charge. However, license agreements may have changed.

(e.g. diversion routes, points of interest), high spectators areas (HSAs), police deployment (FoP and road closures), sport deployment (marshals). In addition, all points of interest in the proximity of the routes were digitized, for planning purposes, such as: embassies, post offices, hospitals, police/fire and rescue stations, hotels and government buildings

GIS-derived maps for the road events were created for both operational and stakeholders' engagement purposes, highlighting road closures timeframes, diversion routes and vehicle permit checkpoints. An example is provided in the map below.

Figure 1: Baku 2015 Road Race GIS Map



The digitization of similar maps, which depicted the event's spatial information, constituted the backbone of the operational plans and enabled the alignment of internal role-players and external stakeholders' operations (e.g. Baku Major Office). In particular, these maps assisted in bridging language gaps during Games-Time, which existed between the OC, which had English as its official language, and the Government Security Authorities (GSA), which operated in Azerbaijani. As the saying goes, 'a picture is worth a thousand words,' the GIS generated maps provided a common working language.

3. Conclusion

As these three case studies have illustrated, GIS technology allows the integration of spatial information into a single, holistic picture, whereby a dynamic, common operating picture is created to enable everyone to see the same information and deploy resources accordingly (Kataoka, 2007).

From a data sharing and command, control and communications (C3) perspective, various software options are available, for example ArcGIS Online, which depends on internet access and file upload, and ArcGIS Server, which is more accessible for individuals within an organization. However, technology is rapidly evolving and new solutions will be made available in the future for more effective, user-friendly applications, which will take into consideration end-users requirements. Even though software packages have different benefits associated with them, the basic principles surrounding the implementation of the tool are similar.

The examples from Johannesburg, Glasgow, and Baku highlight how critical maps are for major sport events as they provide an invaluable context to decision-making. Major risks from not utilizing GIS technology for such large scale projects include, but are not limited to:

- Silo approach: disjointed plans with inaccurate spatial data between internal role-players and external stakeholders, in particular outside the venue boundaries. This could affect both planning stage (e.g. failure to assess the interaction of event activities with the city day to day movements) and event time (e.g. difficulty in coordinating emergency operations)
- Not-envisaged mapping costs: additional non/envisaged mapping-related tasks rise as the planning progresses. The costs to effectively carry them out by outsourcing them could be costly for the OC
- Copyrights breach: possible civil penalties and reputational damage arising from inadvertent license breach by OC staff using online maps for business purposes without authorization
- Un-scoped mapping tasks: as the event approaches, external stakeholders request OC to provide updated and detailed event maps outside the venue boundaries (e.g. event client groups' movements), which are not available
- Internal and external unfulfilled expectations: general expectation, from both internal functional areas and partner agencies, that some of the maps will be produced by the OC through GIS technology closer to the event

While this article focused on the use of the GIS technology for safety and security purposes, an all-encompassed use of the technology for the entire event's planning activities could lead to identifiable downstream cost and time savings, as well as reducing exposure to risks arising from errors in the planning process from data latency. In addition, expanding the usage of the

software can strengthen the level of cooperation and collaboration between internal role-players and external partners.

Beyond the safety and security applications, possible uses of GIS include, but are not limited to: spectator journey planner, games-time information web-site, signage and way finding, maps for inside the venues/village, clients groups' guides, public consultation maps, maps for media (e.g. newspapers), mapping for the OC staff, tablet maps and apps for mobile devices, advertising/trading/brand protection/temporary concession areas (e.g. street vendor zones), spectator routes to Games' venues (e.g. last mile), cultural venues (e.g. nation houses), maps for training venues and test events, map production for OC operational plans and OC deployment plans.

An area which requires further attention and consideration is the post-games legacy use of GIS. There are tangible benefits, including newly developed or enhanced spatial databases, as well as intangible benefits, such as enhanced cooperation and networking between local and national government departments. It is therefore recommended that future use of GIS should parallel the holistic vision of the host city, and most opportunely, if possible, for crime-prevention (i.e. crime mapping, crime analysis) and disaster management. GIS for major sport events can establishment significant lasting legacies for the resident population if coordinated with the host city effectively from its inception.

Annex: List of Acronyms

Full Name	Acronym
Anti-Terrorism Traffic Regulation Orders	ATTROs
ArcGIS Online	AGOL
Baku European Games Operation Committee	BEGOC
City of Johannesburg	CoJ
Command, Control and Communications	C3
Crime Prevention through Environment Design	CPTED
Ellis Park Stadium	EPS
Environmental Systems Research Institute	ESRI
Event Day Controlled Parking Zone Areas	EDCPZ
Fédération Internationale de Football Association	FIFA
Field of Play	FoP
FIFA World Cup	FWC
Games Route Network	GRN
Glasgow City Council	GCC

Geographic Information System	GIS
Government Protective Marking Scheme	GPMS
High spectators areas	HAS
Hostile Vehicles Mitigations	HVMs
International Broadcaster Centre	IBC
Italian Team for Security, Terroristic Issues & Managing Emergencies	ITSTIME
Joburg City Safety Programme	JCSP
Johannesburg Development Agency	JDA
Johannesburg Metropolitan Police Department	JMPD
Land & Environmental Services	LES
Local Area Traffic Management Plans	LATMPs
Olympic Delivery Authority	ODA
Olympic Route Network	ORN
Ordnance Survey	OS
Organizing Committee	OC
Pedestrian Screening Areas	PSA
Secure Residents Access Parking and Permit	RAPP
South African National Defence Force	SANDF
South African Police Service	SAPS
Temporary Traffic Regulation Orders	TTROs
Transfer of Knowledge	ToK
United Kingdom	UK
Vehicle Permit Checkpoint	VPC
Vehicle Screening Areas	VSA

References Cited

Asmal, Z., ed (2012) *Reflections & Opportunities: Design, Cities and the World Cup*, Designing South Africa.

Bennett, C.J. and Haggerty, K.D. (2011) *Security Games, Surveillance and Control at Mega-Events*, Routledge, New York.

Beth, N. (2010) South Africa 2010: Why This Has Been the Best World Cup Ever, *Daily Mirror*, 12 July 2010, http://www.mirror.co.uk/news/top-stories/2010/07/12/why-this-hasbeen-the-best-world-cup-ever-115875-22406810/ [accessed 14 October 2015].

Boyle, P. and Haggerty, K.D. (2009) *Spectacular Security: Mega Events and the Security Complex*, International Political Sociology, Volume 3, Issue 3, p 257-274, September 2009.

Cabinet Office (2013) *Government Security Classifications April 2014*, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/251480/Government-Security-Classifications-April-2014.pdf [accessed 19 October 2015].

Chatterton, M. *et al.* (2012) *Transport Knowledge Management Legacy and Lessons*, London 2012 Organizing Committee.

City of Johannesburg, Department of Finance and Economic Development, *Joburg City Safety Strategy: Executive Summary*, http://www.joburg-archive.co.za/2007/pdfs/citysafety/exec_sum.pdf [accessed 19 October 2015].

City of Johannesburg (2011) *Delivering a Promise, Creating a Legacy City of Johannesburg: 2010 FIFA World Cup*, Cut to Black.

City of Johannesburg Official Website (2015) http://www.joburg.org.za/index.php?option=com_content&Itemid=311&catid=94&id=702&lang=en&view=article&limitstart=1#departments#ixzz3oW8DJ6b9 [accessed 14 October 2015].

Field, K., (2012) Mapping the London 2012 Olympics, *The Cartographic Journal, The British Cartographic Society*, Vol. 49 No. 3, August 2013, p 281-296.

Fussey, P. et al. (2011) *Securing and Sustaining the Olympic City: Reconfiguring London for 2012 and Beyond*, Ashgate, Aldershot.

Fussey, P. *et al.* (2012) The Regeneration Games: Purity and Security in the Olympic City, *British Journal of Sociology*, 63, p 260-84.

Government of South Africa (1998) South African Police Service, Amendment Act 83 of 1998, http://www.gov.za/sites/www.gov.za/files/a83-98.pdf [accessed 14 October 2015].

Greene, R.W. (2004) *Confronting Catastrophe: A GIS Handbook*, Esri Press, 1 July 2004.

Kataoka, M. (2007) *GIS for Homeland Security* (Case Studies in GIS), Esri Press, 1 December 2007.

Klauser, F. (2008) Spatial Articulations of Surveillance at the FIFA World Cup 2006 TM in Germany, in Franko, Aas K., Oppen, Gundhus H. and Lomell, Mork H. eds, *Technologies of Insecurity Routledge*, London, p 61-80.

The Organising Committee's Safety and Security Division and NATJOINTS (2008) in consultation with all host cities and provinces, *2010 FIFA World Cup General Security Concept, The Organising Association Agreement – OAA, 23.4.1: 2010 FIFA World Cup*™, 30 June 2008.

Pisapia, G. (2012a) *An Evaluation on the Impact of the 2010 FIFA World Cup on Crime Levels in the Johannesburg Inner City*, Joburg City Safety Programme (JCSP), Johannesburg Metropolitan Police Department (JMPD), internal use only, unpublished document.

Pisapia, G. (2012b) *Evaluation of the CoJ Surveillance Technology's Impact on Safety and Security in the Johannesburg Inner City*, Joburg City Safety Programme (JCSP), Johannesburg Metropolitan Police Department (JMPD), internal use only, unpublished document.

Pisapia, G. (2013a) *Geographic Information Systems (GIS) Technology Briefing Note*, 26 March 2013, internal use only, unpublished document.

Pisapia, G. (2013b) *Arc GIS Data Management, Classification and Handling*, Glasgow 2014 Limited Policy, 17 December 2013.

Pisapia, G. and Fonio, C. (2011) Gran Torino: Social and Security Implications of the XX Winter Olympic Games, in Bennett, C.J. and Haggerty, K.D. eds *Security Games: Surveillance and Control at Mega-Events*, Routledge, London, p 137-49.

Pisapia, G. and Fonio, C. (2015a) Security, Surveillance and Geographical Patterns at the 2010 FIFA World Cup in Johannesburg, *The Geographical Journal, Royal Geographical Society*, Vol. 181 No. 3, September 2015, p 242-248.

Pisapia, G. and Fonio, C. (2015b) Analisi delle principali attività realizzate dalla Polizia Metropolitana di Johannesburg (JMPD) durante i Mondiali di Calcio FIFA 2010, *Sicurezza, Terrorismo e Società (Security, Terrorism and Society)*, Fascicolo 1, 2015, http://www.sicurezzaterrorismosocieta.it [accessed 13 October 2015].

Radke, S.L. and Hanebuth, E. (2008) *GIS Tutorial for Homeland Security*, Esri Press, 1 August 2008.

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