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Kingdom of Saudi Arabia,
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TARGETING TOURISM

Despite the difficult times, Oman is keenly pursuing investment in the country's tourism and industrial sectors in line with its diversification drive, which in turn will propel activity in the construction arena.



The newly-opened dusitD2 Naseem Resort, Jabal Akhdar offers breath-taking views of the surrounding Al Hajar mountain range.

THE subdued construction sector of Oman got a shot in the arm with the recent announcement of the multimillion-riyal Yiti integrated tourism development, even as the sultanate's Vision 2040 diversification programme progresses, keeping growth hopes alive.

The launch of the Yiti integrated tourism development and the interest it has garnered from regional developers sends a clear signal of confidence in the potential Oman offers in the tourism sector – despite the adverse impact of the Covid-19 pandemic on key sectors of the economy.

Spearheading the sultanate's ambitions in the sphere is the Omran group, which is developing tourism projects and assets, complexes and unique destinations that integrate key players in this dynamic sector.

The group has formed multiple partnerships with global and regional companies to develop mixed-use projects and integrated tourism complexes and continues

to attract seasoned players in the tourism and real estate development sector to help achieve the sultanate's goals.

Omran has in earlier years struck partnerships with regional players for the development of a number of other master-developments, namely the Madinat Al Irfan and Madinat Sultan Qaboos Development.

Tourism has been identified as one of the key enablers of the sultanate's economic diversification plan in line with Oman Vision 2040 and the 10th Five-Year Plan (2021-2025), while increasing the GDP's non-oil revenues, and attracting foreign direct investments.

In line with the diversification plan, industrial development is another major area of focus and driving its ambitions in this sphere is the Public Establishment for Industrial Estates (Madaayn). Plans for industrial cities abound and the sultanate is actively seeking foreign investment in pushing ahead with its agenda.

The diversification programme and focus

on other areas such as housing, renewable energy and transportation infrastructure are expected to support the expansion of the construction sector in the coming years. For this year, the industry is projected to register a growth of 3.3 per cent, and then expand by an annual average rate of four per cent over the 2023-2025, according to projections by Global Data's Construction in Oman – Key Trends and Opportunities to 2025 (H1 2021) report.

While the sultanate continues to enhance its oil recovery techniques to boost oil production, it will keep pursuing its Vision 2040 programme, and construction will continue to be a major contributor to growth in Oman's non-oil GDP, it said.

Meanwhile, Modor Intelligence, a market intelligence and advisory firm, states that Oman's construction market is expected to register a compound annual growth rate (CAGR) of more than five per cent during 2021-2026. The construction industry in Oman, as with other key

sectors, has been severely impacted by the Covid-19 outbreak and recovery is expected to be slow, it said.

In the wake of the pandemic the government has had to cut back on spending and hence Oman will have to increasingly look to the private sector to propel growth and assist in its diversification drive.

TRANSPORT

Oman's plans to develop a 2,144-km-long high-speed national railway system connecting the country's three main sea-ports at Salalah, Duqm and Sohar and integrating with the GCC network have been put on the backburner since 2014, when oil price plummeted.

However, Asyad Group – the state-owned holding company of government assets in ports, transport, shipping and logistics businesses – has been exploring options for a 375-km dedicated mineral railway line linking vast mining sites in the south of the country with the Port of Duqm, according to the *Oman Observer*.

Asyad Group's dedicated Oman Rail unit has been working with government agencies, including the wholly government-owned Mineral Development Oman (MDO) in exploring private investment in the venture via the public-private partnership (PPP) route.

Among other plans, Oman intends to set up a light metro network linking Muscat's Ruwi and Muttrah areas to the airport and Seeb. The metro will be one of the main transport arteries of a new, revitalised Muscat, which will have Ghala as the centre of its commercial activities.

Under this plan, multi-use areas will be



Omran has launched work on a 1,800-m dual zipline project in Wilayat of Khasab.

set up around the various metro stations for developments such as offices, retail stores, and residential areas.

Alongside the metro, revised transportation plans include a passenger rail service that will connect Seeb to Sohar, the capital of the North Al Batinah Governorate.

Meanwhile, a key road project opened at the end of last year was the 725-km Rub-el-Khali Highway, the first direct link between Oman and Saudi Arabia. The road is expected to play a significant role in boosting trade, investment and tourism between the two countries.

PORTS

Omani authorities have launched an international competitive tender for the development and management of a world-class container terminal planned at the Port of Duqm. Expressions of Interest (EOIs) have been invited to develop and

operate the first phase of the port's container terminal for 30 years. On completion, it will boast a capacity of 1.7 million TEUs with additional scope for expansion in the future.

Also planned are a 300-m-long dry bulk terminal with a capacity of about 5 million tonnes per year, and a 425-m-long multipurpose terminal for cargoes totalling 800,000 tonnes per year.

Other ports that have been opened to developers include the Port of Khasab in Musandam Governorate and Port of Shinas in North Al Batinah Governorate.

Khasab Port, in particular, is a major draw for cruise liners, having attracted as many as 66 passenger ships in 2016 carrying over 35,500 tourists. The port is tipped to be transformed into a waterfront and leisure destination replicating the ambitious plan that Omran envisions for Port Sultan Qaboos in Muscat. Part of the port was converted into a fishing harbour last year.

Shinas has a jetty that primarily caters to fishing boats and dhows. Plans for the development of the facility include potential investments in tourism, leisure and commercial components.

POWER & WATER

In line with the global trend, the sultanate has been focusing on renewables, particularly its solar energy potential. Oman last month witnessed the inauguration of the country's largest renewable energy facility of its kind in the Wilayat of Ibri, Governorate of A'Dhahirah. The Ibri Solar Project, a 500 MW utility costing RO155 million (\$401 million) is a partnership be-



The 500-MW Ibri Solar Project was inaugurated last month.

tween Oman Power and Water Procurement Company (OPWPC) and group of GCC investment firms led by Acwa Power, Gulf Investment Corporation (GIC) and the Alternative Energy Projects Company (AEPC).

Among other solar projects, late last year OPWPC announced its intention to embark on two solar power plant projects – Manah Solar Power 1 and Manah Solar Power 2, the development of which is expected to involve an investment of RO300 million for a total output of 1,000 MW.

In line with Vision 2040's sustainability goals, Madayn has also embarked on an initiative to provide a significant portion of the energy needs of its tenants from a sustainable renewable energy source.

The authority has joined hands with Mubadrah and Solar Wadi to set a 100 MW solar photovoltaic farm in Suhar Industrial City which will be operational this year. Madayn and its partners plan to roll out the Madayn Renewable Energy Project initiative across all industrial cities and free zones in the next couple of years, involving larger centralised solar plants that will cater for needs of all tenants within the industrial city.

INDUSTRIAL FACILITIES

Madayn, meanwhile, has opened up a number of industrial cities – existing and greenfield – for local and international investment, according to *Oman Observer*. Opportunities for investment range from the development and operation of business hotels to the management and opera-



The LPG plant in Salalah ... built by Petrofac.

tion of new industrial cities based on the PPP model, the report stated. The 90-plus project proposals span multiple sectors, including manufacturing, tourism, logistics and fisheries.

In Sur Industrial City, Madayn – with private sector participation – intends to set up a township for the integrated workforce as well as a shipyard project which will also house a factory for modern fishing vessels along with a ship maintenance facility and repair centre, among other related services.

The authority also plans to develop a new industrial city within Al Dhahirah Governorate. Detailed design work has been completed for the proposed new industrial city which will come up over a 10-million-sq-m area in Ibri. Phase One of the cluster is being planned on a 3-million-sq-m area.

In addition, Madayn aims to establish

new industrial cities in Thumrait, Shinas, Al Mudhaibi and Al Rawdah.

A landmark project on Oman's industrial scene is a green ammonia project announced by Acme Group, one of the India's fastest growing companies in the solar energy sector. Acme Group has signed a land agreement with Oman's Public Authority for Special Economic Zones and Free Zones (Opaz) to set up the plant in the Port of Duqm, which will be one of the world's largest green ammonia projects.

The plant would be developed at an estimated cost of \$3.5 billion in phases over the next three years, with the first phase to be operational later this year. It will be an integrated facility using 3 GWp of solar and 0.5 GWp of wind energy to produce 2,400 tonnes per day (tpd) of green ammonia with an annual production of 0.9 million tonnes. The project will export green ammonia to demand centres like Europe and Asia.

A major industrial venture launched last month in Oman was the first liquefied petroleum gas (LPG) plant in Salalah, which was developed by OQ, the sultanate's national petroleum investment company. The state-of-the-art plant was built by Petrofac, a leading provider of oilfield services to the international oil and gas industry, which currently is working on two contracts worth a total of around \$300 million for Petroleum Development Oman (PDO).

Meanwhile, work is ongoing on the 230,000-barrels-per-day Duqm refinery, which is a 50-50 joint venture owned by state-owned energy company OQ and Kuwait Petroleum International (Q8).



Golf Beach Residences ... the latest neighbourhood to be launched at Al Mouj Muscat.

The \$8-billion Duqm refinery, which will mainly produce diesel, jet fuel, naphtha and LPG, is expected to come online in the first quarter of 2023.

Among other developments, Saudi Basic Industries Corporation (Sabic), the biggest petrochemical maker in the Middle East that is 70 per cent owned by Aramco, has joined hands with OQ to study the development of a petrochemical project in the Duqm free zone.

REAL ESTATE & TOURISM

Late last year, Oman unveiled the masterplan for the massive Yiti project, one of the largest integrated tourism developments in the sultanate. Spanning over 11 million sq m, the Yiti Development is strategically located in Muscat overlooking the Sea of Oman. It is being undertaken in four phases with the first phase set to host the sultanate's first-of-its-kind projects under the Sustainability City brand of the Dubai-based Diamond Developers (see Page 38).

The project is being spearheaded by Omran Group, which with another Dubai-based group Majid Al Futtaim, is developing Madinat Al Irfan, the sultanate's largest urban development project that will create a new downtown area for the Muscat capital district, adjacent to the Oman Convention and Exhibition Centre (OCEC).

Omran Group late last month inaugurated the dusitD2 Naseem Resort, Jabal Akhdar, which boasts Oman's first 8,000-sq-m Adventure Park. Built with an investment of RO24 million and located in Al Jabal Al Akhdar, dusitD2 Naseem Resort offers over 250 rooms with breathtaking views of the surrounding Al Hajar mountain range.

Meanwhile, Omran has launched work on a 1,800-m dual zipline project in Wilayat of Khasab which begins from Jebel Fitt and passes through scenic landscapes of Khor Qadi and Mokhi area and sea views of the Strait of Hormuz, to end at the upcoming Atana Khasab Hotel.

Among the most successful leading integrated tourism complexes launched by the sultanate is Al Mouj Muscat – previously known by its English equivalent The Wave Muscat. The \$3.5-billion mixed-use waterfront development, which is a public-private venture between Omran, Tanmia and Majid Al Futtaim, has seen major growth since it first broke ground in 2006.

Its latest launch was the premium gated neighbourhood, Golf Beach Residences, featuring beachfront mansions offering six-bedroom homes located in the prestigious Shatti District and within walking distance of the Golf District and award-winning Al Mouj Golf.

Meanwhile, the sultanate's largest shopping and leisure destination, the Mall of Oman, was opened in September last year by Majid Al Futtaim.

Another government entity driving development in several sectors of the country

is Muscat National Development and Investment Company (ASAAS), which has recently launched construction works for the development of the 60,000-sq-m Al Hafa waterfront in Al Hafa area of Salalah among other projects.

An interesting project on which work is in progress is the Oman Botanic Garden in the dramatic landscapes of the northern Hajar Mountains. Covering 420 hectares, the botanic garden will be the largest of its kind in the Arabian Peninsula and one of the largest in the world. ■



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OMAN AT A GLANCE

Package name	Owner	Status*	\$ Million **
Al Ansab Sewage Pipeline	Haya Water	Project Announced	390
Al Hafa Waterfront	Muscat National Development and Investment Company (Asaas)	Construction	400
Al Mouj Muscat Mixed-Use Development	Al Mouj Muscat	Construction	3,500
Al Nakheel Integrated Tourism Complex (ITC)	Alargan Towell Investment Company	Design	688
Al Suwaiq ISTP	Haya Water	Feasibility Study	1,000
Barka Waste-to-Energy Plant	OPWP	Project Announced	800
Batinah Coastal Road – Phase 2 (Sohar-Suwaiq)	Oman's Ministry of Transport Communications and Information Technology (MOTC)	Project Announced	700
Dhofar 2 Wind IPP (150 MW)	Oman Power and Water Procurement Company (OPWP)	Project Announced	500
Dhofar 3 Wind IPP (150 MW)	OPWP	Project Announced	500
Diar Ras Al Hadd – Overview	Qatari Diar Ras Al Hadd Development Company	Construction	650
Diba-Lima-Khasab Road – Section 2	MOTC	Design	400
Dualisation of Adam – Thumrait Road – Overview	MOTC	Construction	800
Duqm 300 MW Wind Power Plant (Wind 2025)	OPWP	Feasibility Study	1,000
Duqm Cement Plant	Duqm Cement Projects International (DCPI)	EPC ITB	435
Duqm Integrated Power and Water Project (DIPWP)	Marafiq	Construction	483
Duqm Thermal Solar plant	OPWP	Feasibility Study	500
GCC Interconnection Grid – Oman-KSA Link	GCC Interconnection Authority (GCCIA)	Feasibility Study	1,500
Green Hydrogen Ammonia Plant	Acme, Tatweer Petroleum	Feasibility Study	2,500
Haima Waste-to-Energy Facility	Petroleum Development Oman (PDO)	Feasibility Study	684
Hayy Al Sharq – Overview	Muscat National Development and Investment Company	Design	1,200
Ibri 2 Solar IPP	AcwaPower, Alternative Energy Projects Company, Gulf Investment Corporation (GIC), Shams Al-Dhahirah Generating Company	Commissioning	385
Integrated Tourism Complex (ITC)	Little India	Construction	748
International Pharmaceutical Complex	Philex Pharmaceuticals	Construction	365
Khazaen Economic City – Overview	Khazaen Economic City	Construction	500
Manah Solar 1 (500 MW)	OPWP	E&P	500
Mixed-Use Development	Al Khonji Real Estate & Development	Design	1,000
Multi-Specialty Hospital	Al Madina Real Estate	Design	500
Muscat Light Rail Network	Mwasalat	Project Announced	1000
National Railway Network – Mineral Line (Segment 4D)	Oman Rail Company (ORC)	Feasibility Study	500
National Railway Network – Overview	ORC	Design	15,000
North Al Sharqiyah Large-Scale Wind Power Plant	OPWP	Feasibility Study	500
North-South Power Grids Interconnection	Oman Electricity Transmission Company (OETC)	E&P	750
Oman Across Ages Museum	Royal Court Affairs	Construction	371
Oman Nano City – Overview	The Public Establishment for Industrial Estates (PEIE)	Project Announced	780
Quriyat Integrated Tourism Complex – Overview	Quriyat Development Company	Construction	1,000
Rusayl-Bidbid Road Improvement	MOTC	Construction	400
Salalah Dams (Scheme)	Ministry of Agriculture Fisheries and Water Resources	E&P	400
Sinaw-Duqm Road – Overview	MOTC	Construction	500
Sino-Oman Industrial City	Oman Wanfang	Construction	10,000
Sohar Freezone	Sohar Port and Freezone	Construction	2,000
Solar 2022 IPP – Overview	OPWP	E&P	800
Solar 2023 IPP	OPWP	Project Announced	500
Solar 2024 IPP	OPWP	Project Announced	500
Steel Plant	Omani Brazilian Company for Steel Products (BrOman)	Project Announced	400
Sur Seaport	Suez Ports Oman	E&P	2,500
The Mandarin Oriental Muscat	Eagle Hills Muscat	Construction	351

* E&P = Engineering and procurement; EPC ITB = Engineering, procurement and construction invitation to bid



Consultant	Contractor	Start date	End date
-	-	2020-Q1	2025-Q2
-	-	2017-Q3	2025-Q3
Turner Construction International	Al Turki, Carillion Alawi, SNE	2006-Q1	2022-Q4
-	-	2017-Q2	2026-Q4
-	-	2020-Q1	2025-Q2
-	-	2017-Q4	2024-Q4
Consolidated Consultants Engineering and Environment	Nagarjuna Construction Company (NCC)	2005-Q2	2022-Q4
-	-	2018-Q4	2025-Q4
-	-	2018-Q4	2025-Q4
-	Al Jaber Engineering Services	2012-Q3	2025-Q4
-	-	2008-Q4	2024-Q3
-	-	2012-Q1	2023-Q2
-	-	2018-Q4	2025-Q2
-	-	2020-Q4	2023-Q1
Fichtner	Alghanim International General Trading & Contracting, Cobra-Sojitz, Tedagua	2015-Q2	2022-Q4
-	-	2019-Q3	2025-Q1
-	-	2020-Q1	2024-Q4
-	-	2021-Q1	2026-Q4
-	-	2020-Q4	2024-Q4
Kayan	-	2016-Q4	2024-Q4
-	PowerChina Huadong Engineering Corporation	2016-Q1	2022-Q1
Semac and Partners	Al Duqm Global Construction	2017-Q1	2032-Q1
Al Manara Engineering Consultancy	MPI Construction	2017-Q1	2022-Q3
Atkins	Galfar Engineering & Contracting	2014-Q2	2030-Q4
-	-	2017-Q4	2023-Q4
-	-	2016-Q2	2023-Q4
-	-	2017-Q2	2023-Q4
-	-	2019-Q2	2027-Q2
-	-	2014-Q4	2024-Q4
Tecnicas Reunidas	-	2008-Q2	2035-Q4
-	-	2020-Q1	2024-Q4
-	Larsen & Toubro (L&T)	2015-Q2	2024-Q4
Corduff Oman Architecture	Oman Shapoorji Construction Company	2015-Q3	2022-Q2
-	-	2020-Q3	2027-Q3
F & M Engeria	Adhi Oman	2017-Q1	2030-Q4
Parsons	Galfar Engineering & Contracting	2017-Q3	2023-Q3
-	AZ Engineers, Premier International Projects	2019-Q1	2025-Q2
-	-	2008-Q2	2024-Q1
Ross Consultancy Engineering	Al Duqm Ningxia Construction Engineering and Investment, Global Engineering and Infrastructure	2016-Q1	2030-Q1
-	Al Naboodah Contracting, Dredging International, Earth Moving Worldwide, Premier International Projects	2010-Q1	2023-Q1
-	Marubeni Corporation	2017-Q4	2024-Q4
-	-	2018-Q2	2023-Q2
-	-	2018-Q2	2024-Q2
-	-	2019-Q2	2025-Q2
-	China Harbour Engineering Company (CHEC)	2016-Q2	2023-Q4
-	-	2019-Q3	2022-Q3

** List includes projects worth over \$365 million only.

Source: DMS Projects

YITI TO HOST SUSTAINABLE CITY



Yiti ... a mega integrated tourism development spanning over 11 million sq m.

ONE of Oman's largest integrated tourism projects – the masterplan for which was unveiled last November – has drawn keen interest among developers in the GCC and will now see the sultanate's first sustainable city take shape under a \$1-billion investment plan.

Among the first developers joining efforts in creating the vision for the mega Yiti Development in Muscat are the UAE-based Diamond Developers and the Saudi-based Dar Al Arkan.

Oman Tourism Development Company (Omran Group) – the government's executive arm for tourism development – last month signed a partnership deal with Diamond Developers to set up the sustainable city within Phase One of its mega Yiti Tourism masterplan.

Meanwhile, Dar Al Arkan has signed an agreement with Omran, which is a fully-owned subsidiary of Oman Investment Authority, to develop a premium, mixed-use project overlooking the Arabian Gulf in Muscat as part of the masterplan, marking its first entry into Oman.

Yiti aims to set a new model for urbanisation connecting and extending the city of Muscat, enriching its offerings and

possibilities, through a multi-phased expansion approach.

Spanning over 11 million sq m, the development is a massive venture, strategically located overlooking the Sea of Oman. The Yiti masterplan is designed according to placemaking principles that ensure the establishment of innovative standards in urban development and architecture, as well as the activation of valleys, plateaus and coasts that harmonise within the topography of the site.

It will be spread over four phases involving a developable area of 3.5 million sq m, offering a plethora of opportunities for domestic and foreign direct investments alike. This four-phased development approach takes into consideration the accessibility to infrastructure, connection to main roads and ease of development as well as to promote an organic expansion.

Yiti's masterplan places a huge importance on the creation of a well-balanced integrated mixed-use residential and resort-oriented community that will include various components, such as tourism, commercial and business spaces as well as residential areas. In addition to leisure and entertainment attractions and educational and health facilities, it envi-

sions inclusivity for the people through diverse and open-to-all public and community facilities.

PHASE ONE

Phase One covers a 900,000-sq-m area and will focus on constructing a fully sustainable mixed-use project, the sultanate's first-of-its-kind community that promotes sustainable living.

This marks the entry of the Sustainable City brand, the first fully operational sustainable community in the Middle East, into the Oman market. To develop the project, Omran and Diamond Developers are setting up a new joint venture, Sustainable Development Investment Company.

Omran CEO Hashil bin Obaid Al Mahrouqi says: "This marks a major milestone in the Yiti Development as we together begin the first phase of this integrated urban destination in Muscat."

The project will include green public spaces, residences, tourism, commercial and educational facilities, all with well-balanced and integrated components. Visitors and residents alike will enjoy a variety of unique lifestyle experiences, including restaurants, cafés, shops, an

equestrian centre and a farm, along with other distinctive components that create a meaningful green-living environment.

Further details of the project are expected to be revealed this month, a spokeswoman for Diamond Developers tells *Gulf Construction*.

The signing further attests to Omran's strategic vision in expanding the nation's tourism sector and its pivotal role as a catalyst and enabler of multi-fold, lucrative investment opportunities in the country in line with Oman Investment Authority's directions in realising the ambitious goals of Oman Vision 2040 and supporting the delivery of the National Tourism Strategy, Al Mahrouqi adds.

Diamond Developers Chairman Faris Saeed says: "We are very excited to join hands with Omran to execute our first project in Oman, and to work together on preserving the sultanate's rich natural environmental resources in accordance with the best global green practices."

"Over the past decade, we have gained and harnessed invaluable knowledge from our working proof-of-concept, which we are leveraging to set new standards for building sustainable and resilient cities with the highest sustainable standards to achieve a carbon-neutral future that also suits the local culture, environment, and economy," he adds.

MASTERPLAN

"Yiti Development masterplan is an epitome of progression, embodying com-



Diamond Developers' Saeed and Omran's Al Mahrouqi after signing the agreement.

ponents complementing each other, and based on a vision of balanced land use and urban design as key elements of its ethos. We have consciously created a development plan that will be executed through holistic partnerships with world-class expertise. It is anticipated to create a modern integrated urban hub that sets new and improved urban planning standards for future developments in Oman and the region. This integrated development in the sultanate, brings with it multi-fold opportunities for potential investors from across the region and the globe to be associated with it," Al Mahrouqi explains.

Local community development will be a key focus for the Yiti development by enabling and providing ample business opportunities for local companies, SMEs, giving them the exposure to work with global industry firms. In line with Omran Group's In-Country Value programme, Yiti Development will generate direct and indirect employment opportunities for Omani youth and create sustainable commercial benefits for the sultanate. In addition, it will stimulate the local market through the procurement of local goods and services, enhancing the capabilities of the local workforce and increasing productivity in the country.

DAR AL ARKAN PARTNERSHIP

As part of the masterplan, Dar Al Arkan will develop a mixed-use project 30 minutes from Muscat's city centre in the areas of Yiti and Yenkit. Situated on a hilltop in a stunning location, the project will comprise premium residential units – all with frontline picturesque sea views – as well as commercial outlets, hospitality offerings and other services. The project will be developed over the next 10 years. Most importantly, it will be developed with a sustainable and environmentally-friendly approach to fit in with the characteristics of the area and showcase the sultanate's unique natural beauty.

Work on the development will start this year and completion of the first phase is due in 2026. ■



Yiti Development will be carried out in four phases.



Some of the 43,000 fully textured buildings included those at the Oman Convention and Exhibition Centre.

Hi-tech solutions ease digital twinning

DAVID HUIE* of Bentley Systems highlights how the company's software applications provided Khatib & Alami with an ideal reality modelling solution when tasked by Oman to produce a detailed digital twin of a 250-sq-km area of Muscat.

TO enhance national security and improve preparedness for climate-related disasters, Oman wanted to create a detailed digital twin of an area of approximately 250 sq km of the sultanate in and around Muscat. Hence, multi-disciplinary design consultancy firm Khatib & Alami (K&A) was contracted to capture 330,000 images with unmanned aerial vehicles (UAVs) and construct a 3D reality model of the area, which included 43,000 fully textured buildings.

Khatib & Alami was required to produce a resolution of 10 ground sampling distance (GSD) and provide relative accuracy of less than 20 cm. Additionally, the project needed to serve as a model to help build similar 3D modelling services in the region.

Every aspect of the complex project had to be finished within 125 days. In addition, due to the country's airspace constraints –

including working around classified areas and commercial flights – K&A's team only had 14 days available for flying and image capture. Adding to the pressure was the weather, which presented a challenge with harsh sunlight, high temperatures, elevated humidity, and windy conditions. As they prepared to take on the project, they discovered that captured images could not be geo-tagged due to limitations in the UAV hardware. As a result, they needed to seek out software that could mark ground control points to provide model accuracy.

IMAGE CAPTURE CHALLENGES

Khatib & Alami determined that overcoming the flight challenges would require careful management, with teams working in parallel to check the accuracy of captured images during the limited flight time. Simply put, the team could not afford to have any major errors at the end of the image capture, as they could not go

back and recapture any images after the first 14 days. Seeking the best software for accurately capturing data the first time and quickly producing a reality model was key to both meeting the deadline and produc-



Huie ... the cost savings are now passed onto the Oman government.

ing the high level of detail that their client required.

Before the project began, Khatib & Alami's team examined various applications to determine what would

help them best execute the project. One application produced image sizes that were too large, which would slow down the pace of image processing over the large production area. In addition, it lacked tiling capabilities, which would result in significant image damage that would also present obstacles to project completion in the tight timeframe. Another application could not produce accurate enough GSD calculations to meet the high standards set by Oman, while a third failed to produce strong quality when spread over the large project area.

They finally found the solution to their challenges when they examined the capabilities of ContextCapture, Bentley's reality modelling application. They discovered

that ContextCapture supports efficient reality capture of large areas and can quickly produce information in a variety of formats, including KML, high DSM, low DSM, and i3s for full, smooth GIS integration. Tiling support helped them overcome data errors during capture by finding matches for the correct images, and reconstruction algorithms helped them seamlessly integrate differing image brightness levels and angles. ContextCapture also supports running parallel processing on multiple powerful hardware systems simultaneously, which helped them define and manage the size and schedule of the project.

K&A's team took advantage of ContextCapture's interoperability to export the captured data into a third-party application that they were already familiar with to produce the 3D reality model and fully texture the 43,000 buildings. With Bentley's LumenRT, they brought the digital twin to life with animated videos that could simulate flooding and produce a day/night cycle. The simulations now allow the Oman government to determine secure routes in case of climate emergencies and improve security in hidden and rugged areas.

"To deliver the project, our team captured 330,000 drone images and created a digital twin model and auto-vectorized 43,000 buildings of the whole area in 3D using Bentley's ContextCapture and Esri ArcGIS, resulting in extremely detailed, high



A total of 330,000 images were captured with unmanned aerial vehicles (UAVs).

quality visualisations and analysis. [The 3D model] was delivered in just 90 days – 35 days ahead of schedule with enhanced quality and at a reduced cost," says Rouba Zantout, Manager and Senior Business Analyst, Khatib & Alami.

With the help of Bentley applications, Khatib & Alami far exceeded expectations. The firm's UAV flights captured more data than anticipated and, as a result, the team was able to expand the survey area from 250 sq km to 280 sq km, all within the same 14-day deadline.

While the original plan was to achieve a GSD of 10 cm and a digital surface models (DSM) accuracy of 20 cm, the result had both a GSD and DSM accuracy of 5 cm, in some cases ranging up to a 2-cm accuracy. By automating the vectorisation process for building textures, they were able to fully texture the 43,000 buildings

in just 30 days.

In addition to the greatly improved results, Bentley applications helped Khatib & Alami save time and costs during the design process. Automation allowed the firm to reduce resource hours, saving \$150,000. Additionally, the team finished the project in just 90 days rather than the 125 days scheduled, which lowered costs by another \$48,000. The cost savings are now passed onto the Oman government, as it is leveraging the digital twin for complex scenario planning and optimised solutions that keep the country secure and prepared for any potential disruption to regular life. ■

** David Huie is Bentley Systems' senior product marketing manager responsible for the OpenCities brand and applications, as well as other reality modelling and digital twin solutions for municipal government organisations.*



Images were captured of a 280 sq km area of Muscat.