

SYSTEM AND METHOD FOR REAL TIME REPORTING OF SITE FOUNDATION INSTALLATION DATA

TECHNICAL FIELD

[0001] The present invention relates to a system and method to electronically record, store, process and allow access to construction project data in real-time, and, more specifically to a system that implements Enterprise Resource Planning (ERP) and a Time Management System (TMS) to manage construction work, inventory and records for pile inventory and installation.

BACKGROUND

[0002] A foundation is the element of an architectural structure which connects it to the ground, and transfers loads from the structure to the ground. Foundations often include several piles that are placed into the ground. A pile is basically a long cylinder of strong material such as concrete that is installed into the ground to act as a long term support for structures built on it. A constructed pile, typically made of reinforced concrete, is about 30 – 60 meters long and weighs several tons. Skilled workers with heavy machinery and tools are needed to install such piles. A pile is often installed into the ground to establish a site foundation or to provide structural support for a building or other structure.

[0003] Pile foundations are capable of taking higher loads than other foundations such as spread footings. Pile foundations are often used when a layer of weak soil at the surface cannot support the weight of a building or other structure. The load can bypass the layer of weak soil and be transferred to the deeper layer of stronger soil or rock. Pile foundations can also be used when a building has very heavy, concentrated load, such as in a high rise structure, bridge, or water tank. Pile foundations are used

extensively for the support of buildings, bridges, and other structures to transfer structural loads to the ground and to avoid excessive settlement or lateral movement.

[0004] The type of piles used and method of installation typically depends on several factors including the location, soil, and the size and weight of the structure to be built. A bored pile refers to a method that involves boring a circular hole into the ground, installing steel reinforcement and filling the bore hole with concrete to form a pile. Boring is carried out to the design depth by means of either a crane mounted or a track mounted hydraulic drilling rigs. Micropiles, often referred to as mini piles, are often used for underpinning. They can be used to create foundations for a variety of project types, including highway, bridge and transmission tower projects. Due to the smaller size of machines, micropiles are especially useful at sites with difficult or restricted access, or with environmental sensitivity.

[0005] Construction experts often use one or more specialized procedures in conjunction with pile installation. For example, deep cement mixing refers to a civil engineering deep foundation technique where a binder material, typically cement, is injected into the ground for ground stabilization and land reclamation. A slurry wall is a barrier built underground using a mix of bentonite and water to prevent the flow of groundwater. A slurry balances the hydraulic pressure which can prevent the collapse of a trench due to the hydraulic pressure in the surrounding soil.

[0006] As with other construction projects, detailed record keeping is essential to building a site foundation. For example, data related to ground/soil quality, structural design plans, labour, equipment and inventory must be recorded and constantly updated. Current methods involve manually recording copious amounts of detailed information by field operators and other workers. A daily site report includes information such as the pile inventory, manpower, machinery, weather, materials and the locations where piles are to be installed. A site supervisor manually records data for each pile as it is moved and installed and calculates the pile pay length.

[0007] As a project progresses, records are sorted and consolidated. A trained employee must review and check entered data and calculations before submission. Data is manually copied into payment sheet reports and a production brown book. Thereafter, the data is reviewed again for accuracy by a quantity surveyor who inputs the data into a digitized spreadsheet (e.g. Microsoft Excel) and verifies discrepancies with site supervisors. Thereafter, a draftsman copies spreadsheet information that is prepared by a quantity surveyor (QS) to generate “as-built” information. The final step includes compiling weekly and monthly project progress reports for management meetings.

[0008] Manual recording of pile data is both inefficient, tedious and prone to error. Data is manually entered onto forms, copied to multiple sources and then manually entered into a computer. This presents the possibility of discrepancies and creates a lag time between the completion of work and the accessibility of data by workers and management. Further, physical records must be properly maintained to ensure that they are organized and not damaged or lost. Records must be physically transported to a central office, organized and secured. This presents more problems related to storing and retrieving the data. Further, because there are no standard formats, variations between recording practices can lead to additional discrepancies and lost data.

[0009] Others have attempted to solve problems associated with recordkeeping in the construction industry. For example, Japanese publication number JP2015118435 describes a construction quality management system. A quality management server acquires site information on a construction site and information on piles and pile holes used in construction. However, the system is limited to specific aspects of construction quality control and management. The system does not significantly reduce the time, expense and complexity of data entry and record keeping.

[0010] US publication number US 7720703 B1 describes a system and method for tracking and managing construction projects. The system is intended to assist a

contractor in managing data and information associated with a construction project. In one method, a drawing from a construction project is provided that has one or more intelligent objects. Information is then gathered relating to labour, materials and schedules for the project. The information is associated with the respective intelligent object and visually represented on the drawing. The drawing is displayed and certain aspects associated with the intelligent objects can be quickly identified. However, the system has limited functionality and is mainly used by a contractor for managing the labour, materials and schedules of projects.

[0011] Although, these systems and methods record and manage construction data, they have shortcomings. They have limited use in the industry, specifically for managing data and information related to pile inventory and installation. Further, the prior art systems fail to integrate Enterprise Resource Planning (ERP), a Time Management System (TMS) and utilize mobile devices for data input and access at worksites. A need, therefore, exists for an improved system and method for real time reporting of pile construction site data using mobile devices.

SUMMARY OF THE INVENTION

[0012] The invention recognizes that there exists a need for a system and method to electronically record construction project data in real-time, and, more specifically to a system that implements Enterprise Resource Planning (ERP) and a Time Management System (TMS) to manage construction work, inventory and records for pile inventory and installation.

[0013] The following summary is provided to facilitate an understanding of some of the innovative features unique to the disclosed embodiment and is not intended to be a full description. A full appreciation of the various aspects of the embodiments disclosed herein can be gained by taking into consideration the entire specification, claims, drawings, and abstract as a whole.

[0014] The invention includes a Mobile Site Reporting System for recording and analyzing site foundation installation data comprising (1) a central computer, (2) at least one mobile device, (3) one or more modules, (4) a Time Management System (TMS), (5) an Account Package and (6) a Project Management System. Each module can receive site foundation installation data from a mobile device, standardize site foundation installation data and store site foundation installation data. Each Mobile Site Reporting System (MSR) module can allow a user to retrieve site foundation and installation data, generate site foundation installation reports based on site foundation installation data and time data, and display site foundation installation reports on a personal computer or mobile device. The Time Management System (TMS), Account Package and Other System can process data and optimize the schedule of tasks for the construction of a site foundation.

[0015] The MSR system can include a project module, a master module, a design module, a bore log module, a production module, a warehouse module, an obstruction module, a claim module, a journal module, a management module and a manpower module. The bore log module can estimate the soil composition at a digging site based on data from soil samples from more than one location at a work site. The warehouse module can determine the optimal combination of piles to use for a project based on inventory. The system can also incorporate a real-time locating system to monitor and record the location of piles. GPS technology can be used to monitor and record the location of employees, work site activities, materials and equipment.

[0016] Among other functions, the MSR system can detect discrepancies between a design specification and as-built site foundation. It can also generate reports on a project for one or more users. The system can also send notifications regarding a project's status to one or more users and send alerts to one or more users upon detecting a delay in a planned schedule. Further, the system can send alerts to one or more users upon detecting a discrepancy between a design specification and a

foundation as built. A mobile device can record an image or video and associate it to a particular pile. A mobile device can also record an image or video and associate it to a task of a project.

[0017] The invention also includes a method of optimizing and monitoring the progress of construction of a site foundation comprised of the steps of (1) receiving input relating to a site foundation from a mobile device or personal computer, (2) utilizing a Time Management System (TMS), Account Package, Project Management System and Other System to devise a project schedule, manage and allocate resources, (3) receiving information relating to project updates from a mobile device and/or a computer, (4) generating reports based on the project schedule and information relating to project updates and (5) allowing one or more users to access the project schedule and reports from a personal computer and/or a mobile device.

[0018] The information relating to project updates can include digital images. The information relating to project updates can include delays to the project schedule. The information relating to project updates can include one or more images that are associated with a pile. The information relating to project updates can also include one or more images that are associated with a task. The input relating to the design of a site foundation can include bore log data and data related to an inventory of piles.

[0019] The method can include the additional step of detecting discrepancies between a design specification and as-built site foundation based on comparing the project schedule with information relating to project updates. It can include the additional step of sending notifications relating to a project's status to one or more users. It can include the additional step of sending alerts to one or more users upon detecting a delay in the project schedule. Further, it can include the additional step of sending alerts to one or more users upon detecting a discrepancy between a design specification and a foundation as built.

INTRODUCTION

[0020] A first aspect of the invention is a system and method for real time reporting of site foundation installation data in a construction industry.

[0021] A second aspect of the invention is a system and method for real time reporting of site foundation installation data in a construction industry in which the system includes a project module, a master module, a design module, a bore log module, a production module, a warehouse module, an obstruction module, a journal module, a manpower module and a management module.

[0022] A third aspect of the invention is a system for real time reporting of site foundation installation data in a construction industry in which one or more mobile devices include an imaging device to capture image of site foundation installation data and/or pile data in real time.

[0023] A fourth aspect of the invention is a method for entry, recording and providing access to real time reporting of construction site data, particularly for pile work and foundation installation.

[0024] Other aspects and advantages of the invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The summary above, as well as the following detailed description of illustrative embodiments, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the present disclosure, exemplary constructions of the disclosure are shown in the drawings. However, the disclosure is

not limited to specific methods and instrumentalities disclosed herein. Wherever possible, like elements have been indicated by identical numbers.

[0026] FIG. 1 is a schematic diagram of an Enterprise Resource Planning (ERP) system **100** with real time reporting of construction site data using mobile devices, according to the present invention;

[0027] FIG. 2 is a flow chart depicting a project module workflow of the MSR system **141** of FIG. 1, according to the invention;

[0028] FIG. 3 is a flow chart depicting a master module workflow of the MSR system **141** of FIG. 1, according to the invention;

[0029] FIG. 4 is a flow chart depicting a design module workflow of the MSR system **141** of FIG. 1, according to the invention;

[0030] FIG. 5 is a flow chart depicting a bore log module workflow of the MSR system **141** of FIG. 1, according to the invention;

[0031] FIG. 6 is a flow chart depicting a production module workflow of the MSR system **141** of FIG. 1, according to the invention;

[0032] FIG. 7 is a flow chart depicting a warehouse module workflow of the MSR system **141** of FIG. 1, according to the invention;

[0033] FIG. 8 is a flow chart depicting an obstruction or delay module workflow of the MSR system **141** of FIG. 1, according to the invention;

[0034] FIG. 9 is a flow chart depicting a project module and master module workflow using the MSR system **141** of FIG. 1, according to the invention;

[0035] FIG. 10 is a flow chart depicting a combination of design module, bore log module, production module and warehouse module workflow of the MSR system 141 of FIG. 1, according to the invention;

[0036] FIG. 11 is flow chart depicting a combination of production module, manpower module, obstruction module, claim module, warehouse module, journal module and reports module workflow of the MSR system 141 of FIG. 1, according to the invention;

[0037] FIG. 12A and 12B are flow charts depicting the overall workflow of the MSR system 141 of FIG. 1, according to the invention; and

[0038] FIG. 13 depicts a pile installation record prepared using the MSR system 141 of FIG. 1, according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

[0039] While the invention is primarily described for use with constructing foundations and installing piles, it is understood that the invention is not so limited and can be used to assist in other endeavors that require accurate and extensive record keeping. Other applications include, for example, using the invention in production, shipping, storage or in maintaining and providing access to records for a warehouse or factory.

[0040] Reference in this specification to "one embodiment/aspect" or "an embodiment/aspect" means that a particular feature, structure, or characteristic described in connection with the embodiment/aspect is included in at least one embodiment/aspect of the disclosure. The use of the phrase "in one embodiment/aspect" or "in another embodiment/aspect" in various places in the specification are not necessarily all referring to the same embodiment/aspect, nor are

separate or alternative embodiments/aspects mutually exclusive of other embodiments/aspects. Moreover, various features are described which may be exhibited by some embodiments/aspects and not by others. Similarly, various requirements are described which may be requirements for some embodiments/aspects but not other embodiments/aspects. Embodiment and aspect can be in certain instances be used interchangeably.

[0041] The terms used in this specification generally have their ordinary meanings in the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. For convenience, certain terms may be highlighted, for example using italics and/or quotation marks. The use of highlighting has no influence on the scope and meaning of a term; the scope and meaning of a term is the same, in the same context, whether or not it is highlighted. It will be appreciated that the same thing can be said in more than one way.

[0042] Consequently, alternative language and synonyms may be used for any one or more of the terms discussed herein. Nor is any special significance to be placed upon whether or not a term is elaborated or discussed herein. Synonyms for certain terms are provided. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any terms discussed herein is illustrative only, and is not intended to further limit the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

[0043] Without intent to further limit the scope of the disclosure, examples of instruments, apparatus, methods and their related results according to the embodiments of the present disclosure are given below. Note that titles or subtitles may be used in the examples for convenience of a reader, which in no way should limit the scope of the

disclosure. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure pertains. In the case of conflict, the present document, including definitions, will control.

[0044] The term “Account Package” refers to a program or of software designed to share data related to accounting such as accounts payable, invoicing, operations and management.

[0045] The term “app” or “application” refers to a self-contained program or piece of software designed to fulfil a particular purpose, especially as downloaded onto a mobile device.

[0046] The term “as-built” refers to a revised set of drawing submitted by a contractor upon completion of a project or a particular job. They reflect all changes made in the specifications and working drawings during the construction process, and show the exact dimensions, geometry, and location of all elements of the work completed under the contract.

[0047] The term “bore log” refers to the practice of making a detailed record (well log) of geologic formations penetrated (or soil removed) by a borehole.

[0048] The term “bored pile” refers to a method that involves boring a circular hole into the ground, installing steel reinforcement and filling the bore hole with concrete to form a pile. Boring is carried out to the design depth by means of either a crane mounted or a track mounted hydraulic drilling rigs.

[0049] The term “checksum” refers to a small-sized datum derived from a block of digital data for the purpose of detecting errors which may have been introduced during its transmission or storage.

[0050] The term “comma-separated values” or “CSV” refers to a file that stores tabular data (numbers and text) in plain text. Each line of the file is a data record. Each record consists of one or more fields, separated by commas. The use of the comma as a field separator is the source of the name for this file format.

[0051] The term “deep cement mixing” or “DCM” refers to a civil engineering deep foundation technique where a binder material, typically cement, is injected into the ground for ground stabilization and land reclamation. In ground stabilization applications it is typically used to obtain a better load bearing capability of the existing soil (e.g. in order to bear buildings and other structures). In land reclamation applications it is typically used when cheaper techniques such as dredging or draining cannot be applied because of environmental concerns due to contaminated soil that these two techniques would release.

[0052] The term “diaphragm wall” refers to a wall constructed using a narrow trench excavated in ground and supported by an engineered fluid (typically a bentonite mud) until the mud is replaced by the permanent material. Generally diaphragm walls are made from reinforced concrete, though unreinforced walls can also be used.

[0053] The term “driven pile” refers to deep foundation elements driven to a design depth or resistance. If penetration of dense soil is required, predrilling may be required for the pile to penetrate to the design depth. Types include timber, pre-cast concrete, steel H-piles, and pipe piles. The finished foundation element resists mainly compressive, sometimes uplift and lateral loads.

[0054] The term “driven pile foundation” refers to a specific type of pile foundation where structural elements are driven into the ground using a large hammer. They are commonly constructed of timber, precast pre-stressed concrete (PPC), and steel (H-sections and pipes). Driven piles, in particular, can be a preferred foundation system because of their relative ease of installation and low cost.

[0055] The term “enterprise content management” or “ECM” refers to a formalized means of organizing and storing an organization's documents, and other content, that relate to the organization's processes. The term encompasses strategies, methods, and tools used throughout the lifecycle of the content. The documents can be referred to as “enterprise documents.”

[0056] The term “Enterprise Resource Planning” or “ERP” refers to business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back office functions related to technology, services and human resources. The ERP system definition, then, would be a set of software applications that organize, define and standardize the business processes necessary to effectively plan and control an organization.

[0057] The term “foundation” is the element of a structure that connects it to the ground, and transfers loads from the structure to the ground.

[0058] The term “Jack-in Piling System” refers to a modern technique by which pre-formed piles (e.g. pre-stressed spun piles, precast RC piles, H-piles or steep pipe piles) are hydraulically jacked into the ground as displacement piles.

[0059] The term “jet grouting” refers a construction process that uses a high-pressure jet of fluid (generally 20 – 40 MPa) to break up and loosen the soil at depth in a borehole and mix it with a self-hardening grout to form columns, panels and other structures in the ground.

[0060] The term “Mobile Site Reporting” or “MSR” refers to an application that uses mobile phones or similar portable electronic devices for entering data at, for example, a construction site and generates reports.

[0061] The term “micropiles,” or sometimes “minipiles,” refers to deep foundation elements constructed using high-strength, small-diameter steel casing and/or threaded

bar. Capacities vary depending on the micropile size and subsurface profile.

[0062] The term “module” refers to a self-contained unit, such as an assembly of electronic components and associated wiring or a segment of computer software, which itself performs a defined task and can be linked with other such units to form a larger system.

[0063] The term “pile” refers to a long slender column usually of timber, steel, or reinforced concrete driven into the ground to carry a vertical load.

[0064] The term “pile driver” refers to a mechanical device used to drive piles into soil to provide foundation support for buildings or other structures.

[0065] The term “real-time locating system” or “RTLS” refers to a system that automatically identifies and tracks the location of objects or people in real time, usually within a building or other contained area. Wireless RTLS tags can be fixed or attached to objects, and in most RTLS, fixed reference points receive wireless signals from tags to determine their location. They typically use radio frequency (RF) signals.

[0066] The term “routine,” “subroutine,” “procedure,” “function,” or “method” refers to a portion of code within a larger program that performs a specific task and is relatively independent of the remaining code.

[0067] The term “site foundation installation data” refers to input recorded and/or submitted into the MSR system by administrators, employees, managers, architects, designers, engineers, supervisors, geologists, drafts persons and others related to the design and construction of a site foundation. It can include project designs, bore log information, human resources, inventory, schedules, finances, equipment location/availability, a project’s status/progress, obstructions/delays as well as information on individual piles such as their size, location, depth and specifications.

[0068] The term “slurry wall” refers to a technique used to build reinforced concrete walls in areas of soft earth close to open water or with a high ground water table. This technique is typically used to build diaphragm (water-blocking) walls surrounding tunnels and open cuts, and to lay foundations.

[0069] The term “Time Management System” or “TMS” refers to a system that plans and exercises control over the amount of time spent on specific activities, especially to increase effectiveness, efficiency or productivity.

[0070] Other technical terms used herein have their ordinary meaning in the art that they are used, as exemplified by a variety of technical dictionaries.

Description of Preferred Embodiments

[0071] The particular values and configurations discussed in these non-limiting examples can be varied and are cited merely to illustrate at least one embodiment and are not intended to limit the scope thereof.

[0072] **FIG. 1** depicts an Enterprise Resource Planning System (EPR) **100** for real time reporting of site foundation installation data in the construction industry, according to one aspect of the invention. The Enterprise Resource Planning System (EPR) **100** can have one or more mobile devices (**101, 102, 103, 104, 105, 106**) and/or one and more computing devices (**162, 164, 166**) connected to Mobile Site Reporting (MSR) system **141**. The mobile devices and/or computing devices can be used by one or more users of different departments of a construction enterprise. The MSR system **141** can include various modules in addition to other components.

[0073] In a preferred embodiment, the MSR system **141** includes a module system, a Time Management System (TMS) **143**, an Account Package **144**, a Project Management System **145** and Other System **146**. The module system can include one

or more modules (**121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132**) configured to receive and store data in a standardized format. The modules can also be configured to retrieve data, process the retrieved data and generate reports. The module system can include a Master Module **121**, a Project Module **126**, a Design Module **122**, a Bore Log Module **127**, a Production Module **123**, a Warehouse Module **128**, a Manpower Module **124**, an Obstruction Module **129**, a Claim Module **125**, a Miscellaneous/Others Module **132**, a Journal Storage Module **130** and a Management module **131**. The module system can be connected to the TMS **143**, Account Package **144**, Project Management System **145** and Other System **146**.

[0074] The ERP system **100** can integrate areas such as planning, purchasing, inventory and human resources. The TMS **143** can store and analyze the amount of time spent on specific activities to allow the users to plan and exercise control over activities to increase effectiveness, efficiency and productivity of the enterprise. In one embodiment of the invention, the TMS stores time spent by each construction department for performing tasks related to site foundation installation.

[0075] The Account Package **144** can store, analyze and share data related to accounting such as accounts payable, invoicing, operations and management. The Project Management System **145** can store, analyze and share data related to human resources, resource management and project billing. The ERP System **100** can also utilize other systems to accomplish particular goals for a project.

[0076] Using a mobile device (**101, 102, 103, 104, 105, 106**) a user can input data related to site foundation installation in real time. Respective modules (**121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 132**) in the MSR system **141** can receive the data, store it and analyze it. In one aspect of the invention, the modules standardize the data input by respective users before storing it. As the data is available in standardized format, the users can easily prepare required reports and results in real time. The standardized format can include document format, text format, printable format and

readable format.

[0077] The mobile devices (**101, 102, 103, 104, 105, 106**) can include devices that can connect to the Internet, such as mobile phones, tablets, Personal Digital Computer (PDA), Enterprise Digital Assistant (EDA) and smartphones. The computing devices (**162, 164, 166**) can include laptops, tablets and general-purpose computers. The mobile devices and the computing devices can be connected to the MSR system **141** via a network such as a (Local Area Network) LAN, (Wide Area Network) WAN, the Internet or similar connection.

[0078] **FIGS. 2 to 8** illustrate types of data that can be entered by users of the system **100** and possible data and reports that users of each department can generate using the system **100**. The data and reports are not limited to those described in **FIGS. 1 to 11**. Data can be analysed in various ways to produce reports to improve operation efficiency and the information flow. This can improve the speed and quality of work as well as allow more informed strategic decisions in the construction industry, particularly for projects related to installing piles and building foundations and building foundations.

[0079] **FIG. 2** is a flow chart **200** depicting a Project Module workflow of the system **100** of **FIG. 1**, according to one aspect of the invention. The user, for example, an administrator or a contract manager, can use a mobile device (**101, 102, 103, 104, 105, 106**) electronic device or computing device (**162, 164** or **166**) to input project information **206**. The project information can include client information **202**, contractor information **208**, project start and/or end date **204** and contract sum information **210**. The project module **126** in the MSR system **141** can be configured to receive the project information **206** from the mobile device and store it. Further, the Project Module **126** can also be configured to allow the administrator or contract manager to retrieve project information **206** from the MSR System **141** and generate a list of project report information **211** as needed. The list of project report information **211** can include contract sum incurred **216**, project duration/schedule **224**, budget management **220**,

and project full details **226**. Further, an administrator or contract manager can generate a client list **214** and contractor list **218** for a selected period, for example, a business analysis.

[0080] **FIG. 3** is a flow chart **300** depicting a Master Module workflow of the system **100** of **FIG. 1**, according to one aspect of the invention. The user, for example, a quantity surveyor, using a mobile device (**101, 102, 103, 104, 105, 106**) electronic device or computing device (**162, 164, 166**) can input job information **303**. The job information **303** can include pile type **301**, mobilisation and demobilisation of the rig **302**, total number of piles **304**, subcontractor information **307**, an individual project duration/schedule **306** as well as the total contract sum for a job **305**.

[0081] The Master Module **121** in the MSR system **141** can be configured to receive the master information **303** from the mobile devices (**101, 102, 103, 104, 105, 106**) and store the master information **303** in the MSR system **141**. Further, the master module **121** can also be configured to allow the quantity surveyor to retrieve the master information **303** from the MSR system **141** and generate master report information **309**. The master report information **309** can include the contract sum incurred **311**, the project/job duration/schedule **314**, mobilisation and demobilisation claims **310**, the total different pile size/pile type **313** and budget management **312**. The quantity surveyor can also generate the subcontractor list **315** for a selected period based on a job type to do a business analysis.

[0082] **FIG. 4** is a flow chart **320** depicting a Design Module workflow of the system **100** of **FIG. 1**, according one aspect of the invention. The user, for example, an engineer, using a mobile device (**101, 102, 103, 104, 105, 106**) electronic device or computing device (**162, 164, 166**) can input design information **323**. The design information **323** can include the date **321**, drawing revision **324**, pile details **323** and pile status **325** based on approved technical drawings. The pile status **325** can include both on-hold and released piles.

[0083] The Design Module **122** in the MSR system **141** can be configured to receive the design information **323** from the mobile device **101, 102, 103, 104, 105** or **106** and store the design information **323** in the MSR system **141**. Further, the Design Module **122** can be configured to allow the quantity surveyor to retrieve the design information **323** from the MSR system **141** and generate a full list of design report information **329** as needed. The design report information **329** can include drawing details **327**, pre-input individual pile information **330** and design revision history **328**. The engineer can also review and compare the pile's design **331** against actual (as-built) during or after a project is completed.

[0084] **FIG. 5** is a flow chart depicting a Bore Log Module workflow of the system **100** of **FIG. 1**, according to one aspect of the invention. The user, for example, an engineer, using a mobile device (**101, 102, 103, 104, 105, 106**) electronic device or computing device (**162, 164, 166**) can input bore log information **343** for each bore hole based on a technical drawing prior to piling works. The bore log information **343** can include the depth (e.g. in metres) **341**, type of bore (soil/ rock) **344** and soil/rock description **342**.

[0085] The Bore Log Module **127** in the MSR system **141** can be configured to receive the bore log information **343** from the mobile device (**101, 102, 103, 104, 105, 106**) and store the bore log information **343** in the MSR system **141**. A bore hole identity number can be assigned and the bore log can auto populate in each pile in the production module. The bore log report information **348** can include soil/rock details **346**, soil log information for nearest pile to be installed **347** and a set of pile hole's bore log **349**.

[0086] **FIG. 6** is a flow chart **360** depicting a Production Module workflow of the system **100** of **FIG. 1**, according to another aspect of the invention. The users, for example, a site supervisor, using an user interface in the mobile device (**101, 102, 103, 104, 105, 106**) or the electronic device or computing device (**162, 164, 166**) can input

production information **363**. The production information **363** can include pre-input design details **323**, equipment/inventory accepted **364**, pre-input master details **303**, pre-input bore log **365** and pile information **362** at the production stage.

[0087] The Production Module **123** in the MSR system **141** can be configured to receive the production information **343** from the mobile device and store the production information **363** in the MSR system **141**. Further, the production unit **123** can be configured to allow the site supervisor to retrieve the production information **363** from the MSR system **141** and generate a full list of production report information **367**. The production report information **367** can include pile installation records **368**, daily production reports **369**, daily site activity reports **370**, as-built (CSV export) reports **371**, rig production reports **372**, team production (assigned to rig) reports **374**, wastage analysis reports **373**, and pile inventory used/transfer/balance reports **375**.

[0088] **FIG. 7** is a flow chart **380** depicting a Warehouse (Equipment/Inventory) Module workflow of the system **100** of **FIG. 1**, according to the invention. The users, for example, a warehouse administrator, using an user interface in the mobile device (**101**, **102**, **103**, **104**, **105**, **106**) or the electronic device or computing device (**162**, **164**, **166**) can input warehouse information **383**. The warehouse information **383** can include suppliers **381**, delivery order/transfer notes **384**, delivery dates **386**, item descriptions **382**, quantities **385** and quality/condition **387**. When an inventory is delivered directly to a project site by supplier, the engineer or supervisor can input and accept the inventory on-site. In an alternative embodiment, equipment can be detected using RFID (Radio-frequency identification) tags and automatically entered into the system.

[0089] The Warehouse Module **128** can generate a list of inventory information, such as the person in charge, total (quantity) received/used/rejected, balance (quantity), delivery date, delivery location and quality/condition of a product. RFID tags can be used to track the progress and movement of piles. It can also be used, for example, upon completion of a project to account for piles and other materials that are

incorporated into a foundation. Warehouse report information **388** can person in-charge **389**, delivery accepted date **390**, total quantity received **391**, delivery location **392**, used/rejected balance **393** and quality/conditions checked **394**.

[0090] **FIG. 8** is a flow chart depicting an Obstruction or Delay Module workflow of the system **100** of **FIG. 1**, according to the invention. The user, for example, a warehouse administrator, using a mobile device (**101, 102, 103, 104, 105, 106**) electronic device or computing device (**162, 164, 166**) can input obstruction information **403** of a project site. The obstruction information **403** can include an obstruction reason **401**, obstruction photo **402** and date/time **404** at which obstruction occurred.

[0091] The Obstruction/Delay Module **129** in the MSR system **141** can be configured to receive the obstruction information **403** from a mobile device and store the obstruction information **403** in the MSR system. Further, the obstruction module **129** can also configured to allow the warehouse administrator, the engineer or the site supervisor to retrieve the obstruction information **403** from the MSR system **141** and generate a list of obstruction report information **408**. The obstruction report information **408** can include the duration of delay **407**, a photo **410** and daily site activity report **411**. The project manager can use these logs to request extensions of time or alert others of delay **406**.

[0092] **FIG. 9** is a flow chart **500** depicting a Project Module and Master Module workflow using the system **100** of **FIG. 1**, according to the present invention. The process can start at step **501**, when the quantity surveyor or administrator or contract manager logs into the MSR system **141** by entering the login details, when a new project is awarded. As at step **502** and **503**, when the login is successful, the administrator or the contract manager can enter the project details in real time. The details of project information entered by project module are depicted in **FIG. 2**. In case of any changes required, the administrator or contract manager can amend the entered data and update the information as at step **504**. Similarly, the quantity surveyor can

input the job type details that might involve one or more job type, as at the step **505**. The details of master information entered by master module are clearly shown in **FIG. 3**. The job type can be jack-in pile, driven pile, micro pile, bored pile, jack gout pile, deep cement mixing, diaphragm wall and slurry wall. If required, the quantity surveyor can amend the project details and update the same as at step **506**. The project and job type details entered by the administrator/contract manager and quantity surveyor can be stored by project module **126** and master module **121**. As at step **507**, once the data is entered, the process ends, hence the quantity surveyor or administrator or contract manager can log out of the system.

[0093] **FIG. 10** is a flow chart **510** depicting a combination of design module, production module, warehouse module and bore log module workflow of the system **100** of **FIG. 1**, according to another aspect of the present invention. Based on the project details, an engineer can prepare drawings of foundation installation data and input them into the design module. The process can start as at step **511**, when the engineer logs into the system by entering the login details, when the technical drawing is approved. As at step **512**, when the login is successful, the engineer can input the bore log details in real time. The details of bore log information entered by bore log module are shown in **FIG. 5**. The engineer can also input design information for each pile that is associated with the bore hole identity number. Details of design information entered by the design department are shown in **FIG. 4**.

[0094] The Engineer can put “on hold” or release the selected pile(s) for production as at step **515**. As at step **518**, a warehouse administrator can issue equipment/inventory to site. The equipment/inventory can be transferred to a project site from another project site by an engineer or site supervisor. At the project site, the site supervisor can input pile production data during the piling process as at step **519**. In case of any amendment, the pile production data can be amended and updated in the system as at step **519**. As at step **520**, the process ends, hence the engineer can log out of the MSR system **141**.

[0095] FIG. 11 shows a flow chart 530 depicting a combination of production module, manpower/obstruction/journal module, claim module, warehouse module and reports module workflow of the system 100 of FIG. 1, according to one aspect of the present invention. The process can start at step 531, when the site supervisor logs into the MSR system 141 by entering login details. When the login is successful, as at steps 532 and 534, a warehouse administrator can issue equipment/inventory to a site. These equipment/inventory can be transferred from one project site to another by an engineer or site supervisor. At a project site, the site supervisor can input pile production information during the piling process as at step 533. In case of changes, the pile production data can be amended and updated in the system as at step 535.

[0096] The site supervisor can input the manpower, obstruction and journal information, as at step 536. The manpower, obstruction and journal information can be amended and updated in the system as at step 537. As at step 540, the quantity surveyor can generate required reports, such as a pile installation report, a daily production report and/or a daily site activity report. In case of any claims, the quantity surveyor can process the claim and generate claim reports in real-time. As at step 539, the claims can be amended and updated before generating the claim report. As at step 541, the process ends, when the engineer, site supervisor or quantity surveyor logs out of the system.

[0097] A software mobile application ("App") can be installed on the mobile device (101, 102, 103, 104, 105, 106) electronic device and the web-based application can be accessed on a computing device (162, 164, 166) to allow users to log into the MSR system 141 and to, among other things, input site foundation installation data and view reports generated by the MSR System 141. Further, the MSR system 141's modules can include one or more software routines to allow the system to perform the tasks/processes described in the FIGS. 1-11.

[0098] As applicable, the system and/or a method of executing the instructions for the system **100** can be provided as computer executable instructions on a computer-readable storage medium. In this context, computer-readable storage medium can include physical media, such as CDs, DVDs and flash (solid-state) drives, as well as permanent or temporary media, such as computer ROM, computer RAM, and digital delivery services, either as a single, or as a multiple sharing service.

[0099] **FIGS. 12A and 12B** are flow charts **560** and **570** depicting an overall workflow of the MSR system **141** in the system **100** of **FIG. 1**, according to one aspect of the invention. The process can start at step **561** when the site supervisor logs into the system **100** by entering the login details. As at step **562**, the project information can be entered by the project department. As at step **563**, the master information can be entered by the master module. Then, as at step **565**, an engineer can input the bore log details in real time. The details of bore log information entered by bore log module are shown in **FIG. 5**. The engineer can also input design information for each pile that is associated with the bore hole identity number, as at step **564**. The details of design information entered by the design module are shown in **FIG. 4**. In case an amendment is necessary, the design information can be updated.

[00100] The transfer of equipment/inventory is depicted at step **569** and **568**. Equipment/inventory can be transferred from one project site to another project site by an engineer or site supervisor; or from a store to project site by store administrator or store supervisor. At the project site, the site supervisor can input the pile production information during the piling process as at step **567**. If an amendment is necessary, the pile production data can be amended and updated in the system as at step **566**. As at step **576, 571, 572, 573**, the foundation installation data from manpower module, obstruction module and journal module can be entered into the system. Normally, the MSR system **141** has at least one data pool **576** through which the data flows. The data pool **576** can allow standardization and synchronization of data stored in the MSR system **141**. As at block **574** and **575**, the claim and management modules can retrieve

data from the data pool **576** to generate various reports **578** such as the daily production report **579**, pile installation record **368**, pile data in Comma-Separated Values (CSV) **581**, various other reports **582** and **583**. The system can be linked with an ERP system.

[00101] **FIG. 13** is a sample pile installation record prepared using the system of **FIG. 1**, according to one aspect of the invention. This format, or a similar format, can be designated as a “standardized report” by a construction group. The production unit can generate the pile installation record using the production data. The pile installation record **368** can include the system generated data shown in **FIG. 14** retrieved from the database. For example, the pile installation record can include the report date, start/end time, pile number, zone/block, pile group, design penetration length, pile size, pile type, welding method and status information. Data retrieved from the database can include the pile length, total length, above/below measurements, penetration, toe level, jack-in force, pile type, final set and joint as well as a “notes” or “remarks” section. The report can also include a section for an image or photograph. Here, the report includes an image of handwritten notes. A section for signatures can also be included. Signatures can be digital and/or drawn on a screen using a tablet or computer with touch screen capabilities.

[00102] The invention allows for more accurate and reliable system of maintaining and accessing records. It also reduces the time, cost and human resource needed for data management. The system can assist management, and others involved with a project, in making more informed strategic decisions.

WORKING EXAMPLE

I. Use of the Invention to Improve Efficiency, Lower Costs and Improve Work Quality in Installing Reinforced Concrete (RC) Piles

[00103] Conventional methods of pile installation typically involve manually recording

and storing data by multiple employees/departments throughout the process. For example, data must be entered into each of the following medium, and thereafter, maintained for reference.

- 1) Daily site Journal
- 2) Installation Records
- 3) Payment Sheet
- 4) Production Brown Book
- 5) Daily Pile Completion Record
- 6) Claim Record
- 7) As-built

[00104] The present invention includes a system of software and hardware that creates a single, standardized digital record that is updated through the construction process. Data can be entered and accessed using smart devices (e.g. hand phones or tablets) at a work site as well as at other locations through computer terminals. The system can also access data from an internal database (e.g. employee records, project plans/guidelines) as well as data through the internet (e.g. weather and geological information).

Creation of Project in MSR System

[00105] The process can begin with an architect or designer submitting the plans and specifications for a construction project into the system. This is typically completed in an office environment using desktop computers. Thereafter, data can be added from a work site/location where the piles will be placed and the foundation constructed. For example, data from the land survey, soil and geology analysis can be entered into the system remotely by an engineer. The system can also compile information (e.g. maps, geological information, weather data, environmental and zoning information, etc.) from company resources or private or public sources through the internet. Throughout the process, reports and data will remain accessible to others involved in the project.

[00106] The system includes application software (i.e. an App) so that it can be used with mobile devices such as smart phones or computer tablets by those working at a construction site (e.g. engineer and sit supervisor). This allows workers to input information and update the system as well as the ability to access data from the system remotely. Remote users can access the system by, for example, an Internet connection or LAN link. In one aspect of the invention, the software prompts a worker to input information and follow a set of programmed tasks, thus assuming some of the roles of a supervisor.

Entry of Data from Project into the MSR system

[00107] The number, size and type of piles can be ordered based on the design, ground survey and other factors. The system can use an algorithm (or multiple algorithms) to determine one or more possible designs/arrangements including the optimum pile length for each. Among other criteria, the system can consider the priorities of the architect and client, including costs, esthetics and potential risk factors. Other options can include the size/design of the piles (pre-stressed spun piles, precast RC piles, H-piles or API pipe piles) along with the method of installation (with a pile driving hammer or cast-in-place). An architect or other individual can consider and choose options with input from the client. The system can compile an inventory list or other documents needed to prepare for a project.

[00108] In typical use of the system, a quantity surveyor will input project details involving one or more job types (e.g. jack-in pile, driven pile, micro pile, bored pile, jack grout pile, deep cement mixing and/or wall slurry). Others involved in the project can review the details and submit additional information. After the technical drawing is approved, an engineer can input bore log information into the bore log module. Then he/she can enter design information for each pile that is associated with the bore hole identification.

Utilization of MSR, Account Package and Project Management System

[00109] Based on the nature and scope of the project and environmental factors, the system can use software systems to determine the machinery and other resources (including labour) needed to most efficiently complete the project. The system can generate a proposed schedule based on the project data that can include a proposed number of piles and a schedule for driving each pile into the ground based on the available resources and manpower. The system can also calculate the projected costs involved. The system can also compile financial documents and compile reports for a project.

[00110] In typical use of the system, an engineer can decide whether to release or put “on hold” selected piles for production. A warehouse administrator can issue equipment and/or inventory to the job site. At the job site, a site supervisor can input pile production during the piling process.

[00111] Upon receiving the piles, an employee can enter inventory data into the system. This can include, for example, the number of piles along with data on each pile. Thus, the system can maintain accurate locations of piles as a project progresses. When the piles are drilled or pushed into the ground, the system can automatically record the date/time of the installation.

[00112] In typical use of the system, a site supervisor will input pile production, manpower, obstruction and journal information. Thereafter, the site supervisor can generate reports such as a pile installation report, daily production report and daily site activity report. A quantity surveyor can process the claim and generate claim reports in real-time.

[00113] Bore log information (i.e. geological and soil details) is essential to building a proper foundation and installing piles. Typically, soil samples will be taken from multiple locations on a work site. An engineer can input this information (including the location

of where the sample was collected) into the system using a mobile phone or computer. Thereafter, the system can determine which soil sample most accurately reflects the soil where a pile is installed. Alternatively, the system can also use data from soil samples at different locations to estimate the content of soil at digging sites (pile installation points). This can be achieved by using an algorithm or by extrapolating between differences between points where samples have been analyzed.

[00114] The system can also determine the most practical and economical means for assembling, delivering and installing piles. For example, the system can process data entered by an engineer or site supervisor and come up with a schedule and plan of tasks. This can be done to optimize the use of human resources and materials. The system can account for both costs and quality in optimizing the design and schedule of tasks.

[00115] As another example, the foundation may require a pile of 18 meters in length. Conventionally, an engineer might combine three separate 6 meter piles for the task. Using the MSR system, piles of multiple sizes can be optimally utilized from the available inventory to produce the 18 meter pile. Doing so can reduce labour/material costs and minimize the waste of materials.

[00116] The smart devices (e.g. cell phones or tablets) can also capture images of documents and link them to a corresponding pile. This allows an employee access to such information as the specifications of a pile and its installation date/time as well as the progress of a project in real time. For example, a project could be delayed if a worker encounters a defective pile. A site supervisor could document the problem by taking photos and typing in a description of the problem into the system. This information (linked to the pile) can be relayed to others who can assist in overcoming the problem, by for example, arranging for a replacement. Others can also make scheduling and labour adjustments accordingly. The information can also be relayed to the manufacturer or supplier.

[00117] A delay could also be caused by a mechanical failure such as the breakdown of a crane. This information can be relayed to others who can assist in overcoming the problem, by for example, arranging for repair or an alternate crane. The system can adjust scheduling, resources and labour to accommodate the problem and anticipated delay.

[00118] Throughout the construction process, users can access data from the system (e.g. modules) to monitor their work and follow progress of the project. For example, a user can access data or reports based on site foundation installation data and time data. The data can be accessed on a personal computer or mobile device. This allows project managers/engineers/supervisors to monitor work of their workers and report on progress to a client or main contractor.

[00119] Thus, the system maintains data on the progress of the projects. It can send alerts or notices when a project is behind (or ahead of) a planned schedule. A Time Management System (TMS) can be incorporated into the system to optimize time and labour allocated to particular aspects of a project. Similarly, the Enterprise Resource Planning System (ERP) can be similarly adapted to tactfully allocate resources before and during work on a project. The Account Package can efficiently maintain and process data related to accounting issues such as payroll, fees for materials/supplies and other related costs. The project management system can store, analyze and share data related to human resources, resource management and project billing.

[00120] The system can include one or more error detection methods. For example, a checksum of the designed specification can be compared to the actual installed specifications. If there is a variant of (+/-) a pre-determined percentage (e.g. greater or lesser than 20%), the MSR system can prompt the installation team as they input the data on the handheld device. This is one method of detecting discrepancies between a design specification and as-built site foundation. Similarly, the system can monitor the progress of a project for discrepancies between the progress of project and a planned

schedule. The system can send an alert when there is a delay above a programmed threshold (e.g. one day).

[00121] The system can also send alerts to the manager-in-charge to notify them of such discrepancies. This allows the system to compare building plans with aspects of a project as it progresses. For example, a project manager can receive an alert if a project is not proceeding according to an approved plan. He/she will be notified of deviations from a construction plan.

Use of GPS Technology and Real-time Locating Systems

[00122] The system can also include GPS (Global Positioning Satellite) technology. For example, the system can automatically update the user's location which can be linked/attributed to a particular worksite. This allows the system to identify a location with a task or update by an employee. The system can also track the location of tasks along with materials and supplies. For example, the system can associate a particular GPS signal or mobile device with a crane used to install piles. This allows the system to monitor the location and movement of the crane.

[00123] In an alternative design, the system can use a real-time locating system (RLTS). For example, radio-frequency identification (RFID) tags that can be embedded or attached to piles, machinery and/or equipment. A site supervisor can enter a job site and activate the system to detect RFID labelled material. The system can give a list or report of the material at a job site. This is particularly useful for monitoring materials such as piles, machinery and equipment. After the completion of a project, the system can verify the presence (or absence) of materials and equipment such as piles.

Standardization of Data and Reports

[00124] A "standardized report" is one with a format, particular content, information and units as designated by a manager or other person of authority. It helps ensure that data is complete, properly recorded, presented and stored. See, for example, FIG. 13. Using a standardized format also promotes accuracy, efficiency and assists with

enterprise content management (ECM).

[00125] Reports can be standardized and viewed by users involved in the project. Throughout the process, users in a remote access area can view updates as they are made at the worksite. Calculations can be automatically completed by the system and incorporated into the data/reports. This access can be particularly important to supervising authorities as well as investors or stakeholders of a project. Similarly, the system can generate reports related to finance/accounting such as expense reports, invoices and purchase orders.

[00126] The system can be configured to use password and encryption technology. Further, different users can be given different levels of access to the system. For example, a project manager or engineer can have broad access to the system and the ability to make changes to a master plan and scheduling. However, a site supervisor's access can be limited to entering information related to specific tasks according to his/her work duties.

[00127] Benefits of the system include:

- 1) Data can be accessed anywhere, by anyone involved in the project.
- 2) Single entry ensures data integrity (less prone to human error).
- 3) Automatic calculation eliminates human error.
- 4) Automating repetitive paperwork increases productivity.
- 5) Electronic data is easy and quick to retrieve.
- 6) A shared pool of data improves information flow between business functions.
- 7) The system generates timely and accurate information to help management make quick and more informed decisions/planning.

II. Use of Mobile-Friendly/App Version of the Invention at a Construction Site

[00128] In a preferred embodiment, the user can follow the steps below for typical entry and access of system data.

Login Page:

A user can login to Mobile App with individual account.

Project List Page:

After login to the app, the user can view the projects of which he/she is assigned.

Main Page:

After clicking on a particular project, the user is directed to a main page that shows the modules. Typically, the modules displayed are the Production, Design, Manpower, Obstruction, Journal, Inventory/ Equipment and Incoming Transfer Modules.

Depending on the title of the user, he/she may be limited to access modules that are relevant to his/her duties. The system roles/simplified roles are listed in the chart below:

Employee/Title	Module Access
Contract Manager	Project, Claim
Administrator / Project Manager	All
Quantity Surveyor	Master, Claim
Engineer	Design, Production, Delay, Journal, Manpower, Equipment, Inventory
Site Supervisor	Production, Delay, Journal, Manpower, Equipment, Inventory
Draft Person	Design, Production
Warehouse Manager/Supervisor	Equipment, Inventory
Management / EXCO	Management

Design Module:

Under the “Outstanding” design module, the user can view design information that is

necessary to proceed with piling. Further, the user can click an “Add Production” button to input production records for the particular pile. The user can also view the design and additional details as well as submit the production records into the system.

Production Module:

The user can click the “Add Production” button, and then he/she can input production details into the production form. If user inputs the production in pathway, he/she can continue to input that production record under the “Work In Progress” tab. In other words, the App will temporarily save the production data on the device. When the user clicks the “Created Production” tab, he/she can view the production records.

Manpower Module:

The user can daily/periodically add manpower details into the Manpower Module. The App has the ability to record and identify the previous/latest entry which can help to reduce input times.

Obstruction Module:

The user can add information/data related to an obstruction that occurs in the site. Such an obstruction can include, for example, a machinery breakdown, accident/incident, and others.

Warehouse Inventory and Equipment Module:

The user can view the inventory items and equipment for a particular project.

Incoming Transfer Records Module:

If there is any incoming transfer of inventory or equipment, the user can accept or reject the transfer in this module.

[00129] It will be appreciated that variations of the above disclosed and other

features and functions, or alternatives thereof, may be combined into other systems or applications. Also, various unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

[00130] Although embodiments of the current disclosure have been described comprehensively, in considerable detail to cover the possible aspects, those skilled in the art would recognize that other versions of the disclosure are also possible.

What is claimed is:

1. A Mobile Site Reporting System for recording and analyzing site foundation installation data comprising:

- a. a central computer;
- b. at least one mobile device;
- c. one or more modules;
- d. a Time Management System;
- e. an Account Package; and
- f. a Project Management System;

wherein each of the one or more modules receives site foundation installation data from the at least one mobile device, standardizes the site foundation installation data and stores the site foundation installation data;

wherein each of the one or modules allows a user to retrieve the site foundation installation data, generate reports based on the site foundation installation data, and display the site foundation installation data and the reports on a personal computer or mobile device; and

wherein the Time Management System, Account Package and Project Management System utilize the site foundation installation data to optimize a work schedule for construction of a site foundation,

wherein said one or more modules comprise:

a design module that receives design information and generates a list of design report information; and

a warehouse module that receives warehouse information and generates a list of inventory information,

wherein the design information comprises information on technical drawings of site foundation installation data, a foundation installation status of either “on-hold” or “released”, and real-time bore-log details;

wherein the warehouse module determines the optimal combination of materials to use for a project based on inventory.

2. The Mobile Site Reporting System of claim 1, wherein said one or more modules further comprises at least one of a project module, a master module, a bore log module, a production module, an obstruction module, a claim

module, a manpower module, a journal module or a management module.

3. The Mobile Site Reporting System of claim 2, wherein the bore log module estimates the soil composition at a digging site based on data from soil samples from more than one location at a work site.
4. The Mobile Site Reporting System of claim 1, wherein the at least one mobile device records an image and associates the image with a particular pile.
5. The Mobile Site Reporting System of claim 1, wherein the at least one mobile device records an image and associates the image with a task of a project.
6. The Mobile Site Reporting System of claim 1, wherein the Mobile Site Reporting System detects discrepancies between a design specification and as-built site foundation.
7. The Mobile Site Reporting System of claim 1, wherein the Mobile Site Reporting System incorporates a real-time locating system to monitor and record a location of piles.
8. The Mobile Site Reporting System of claim 1, wherein the Mobile Site Reporting System uses GPS technology to monitor and record the location of workers, work site activities, materials, machinery and/or equipment.
9. The Mobile Site Reporting System of claim 1, wherein the Mobile Site Reporting System sends notifications regarding a project's status to one or more users.
10. The Mobile Site Reporting System of claim 1, wherein the Mobile Site Reporting System sends alerts to one or more users upon detecting a delay in a planned schedule.
11. The Mobile Site Reporting System of claim 1, wherein the Mobile Site Reporting System sends alerts to one or more users upon detecting a discrepancy between a design specification and a foundation as-built.

12. A method of optimizing and monitoring the progress of construction of a site foundation comprised of the steps of:
 - a. receiving input relating to a design of a site foundation from a mobile device and/or a computer, wherein the input includes design information and data related to an inventory of foundation materials, wherein the design information comprises information on technical drawings of foundation installation data, a foundation installation status of either “on-hold” or “released”, and real-time bore-log details, wherein the data related to an inventory of foundation materials is used to determine the optimal combination of materials to use for a project based on inventory;
 - b. utilizing a Time Management System (TMS), Account Package and/or Project Management System to devise a project schedule, manage and allocate resources;
 - c. receiving information relating to project updates from a mobile device and/or a computer;
 - d. generating reports based on the project schedule and the information relating to project updates; and
 - e. allowing one or more users to access the project schedule and the reports from a personal computer and/or a mobile device.
13. The method of claim 12, wherein the information relating to project updates includes digital images.
14. The method of claim 12, wherein the input relating to the design of a site foundation includes bore log data.
15. The method of claim 12, wherein the information relating to project updates includes delays to the project schedule.
16. The method of claim 12, wherein the information relating to project updates includes one or more images that are associated with a pile.
17. The method of claim 12, wherein the information relating to project updates includes one or more images that are associated with a task.

18. The method of claim 12, including the additional step of detecting discrepancies between a design specification and as-built site foundation based on comparing the project schedule with the information relating to project updates.
19. The method of claim 12, including the additional step of sending notifications relating to a project's status to one or more users.
20. The method of claim 12, including the additional step of sending alerts to one or more users upon detecting a delay in the project schedule.
21. The method of claim 12, including the additional step of sending alerts to one or more users upon detecting a discrepancy between a design specification and a foundation as built.

ABSTRACT**SYSTEM AND METHOD FOR REAL TIME REPORTING OF
SITE FOUNDATION INSTALLATION DATA**

The present invention includes a system and method for real time reporting of construction site data. Mobile devices can be used at construction sites to record and update data in real time. A Mobile Site Reporting System (MSR) is configured with a set of modules and a database that stores, standardizes and process construction data. The system can receive construction site data, process the data, prepare enterprise documents, make calculations, make strategic decisions, present construction site data and calculated results, prepare as-built data and diagrams, prepare purchase orders, prepare daily work reports, prepare claim reports and summarize construction activity.

FIG. 1

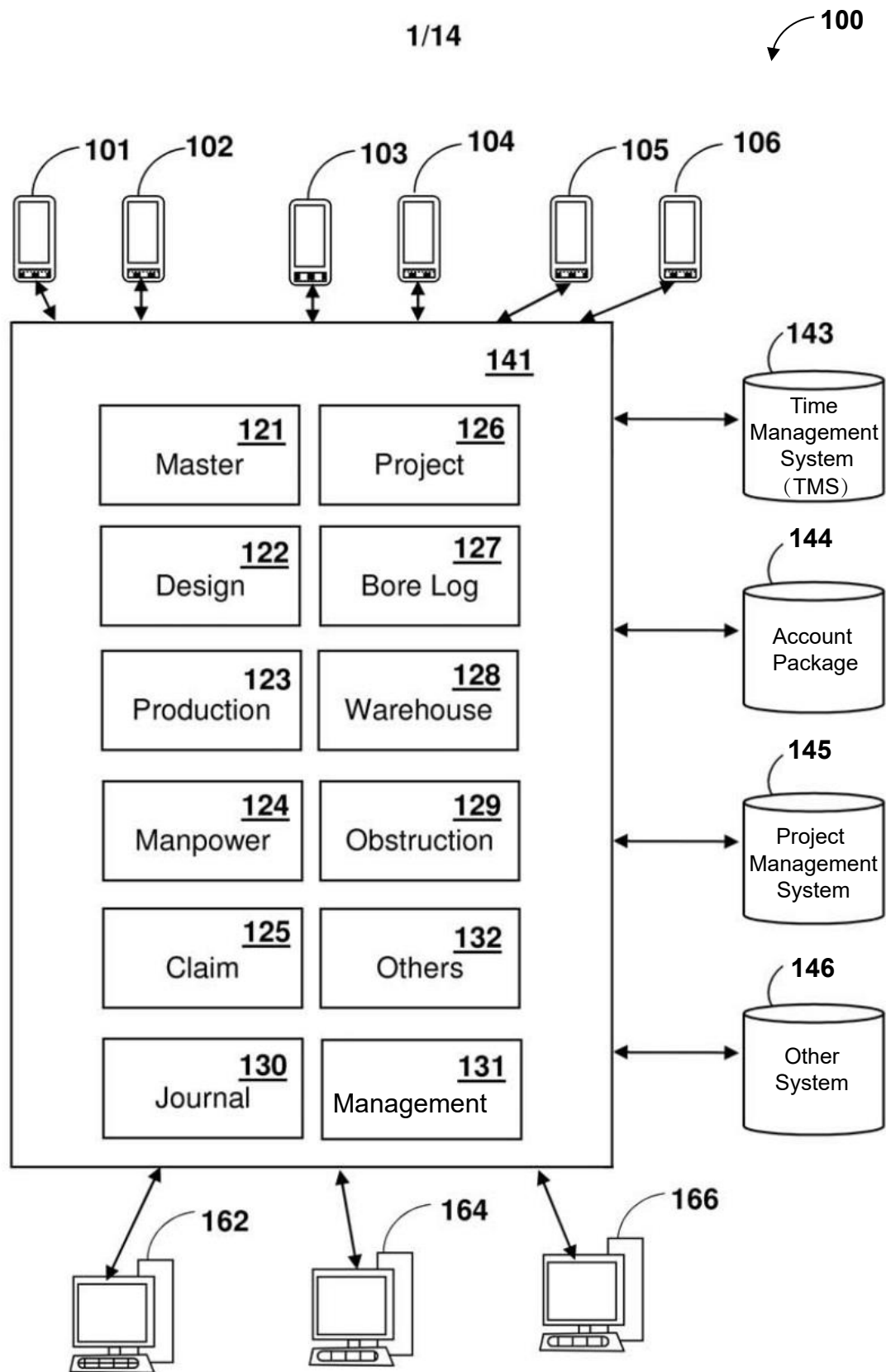


FIG. 1

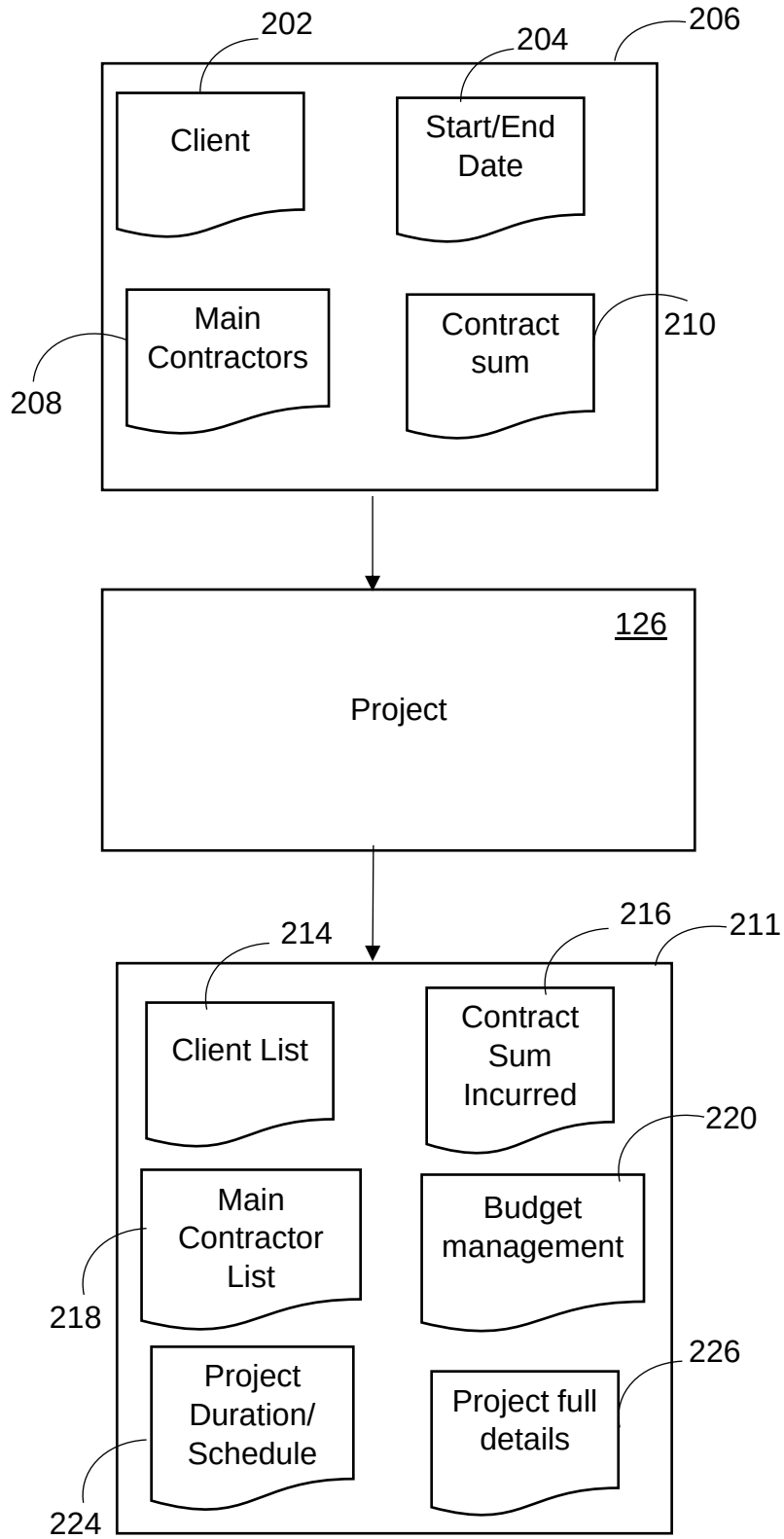


FIG. 2

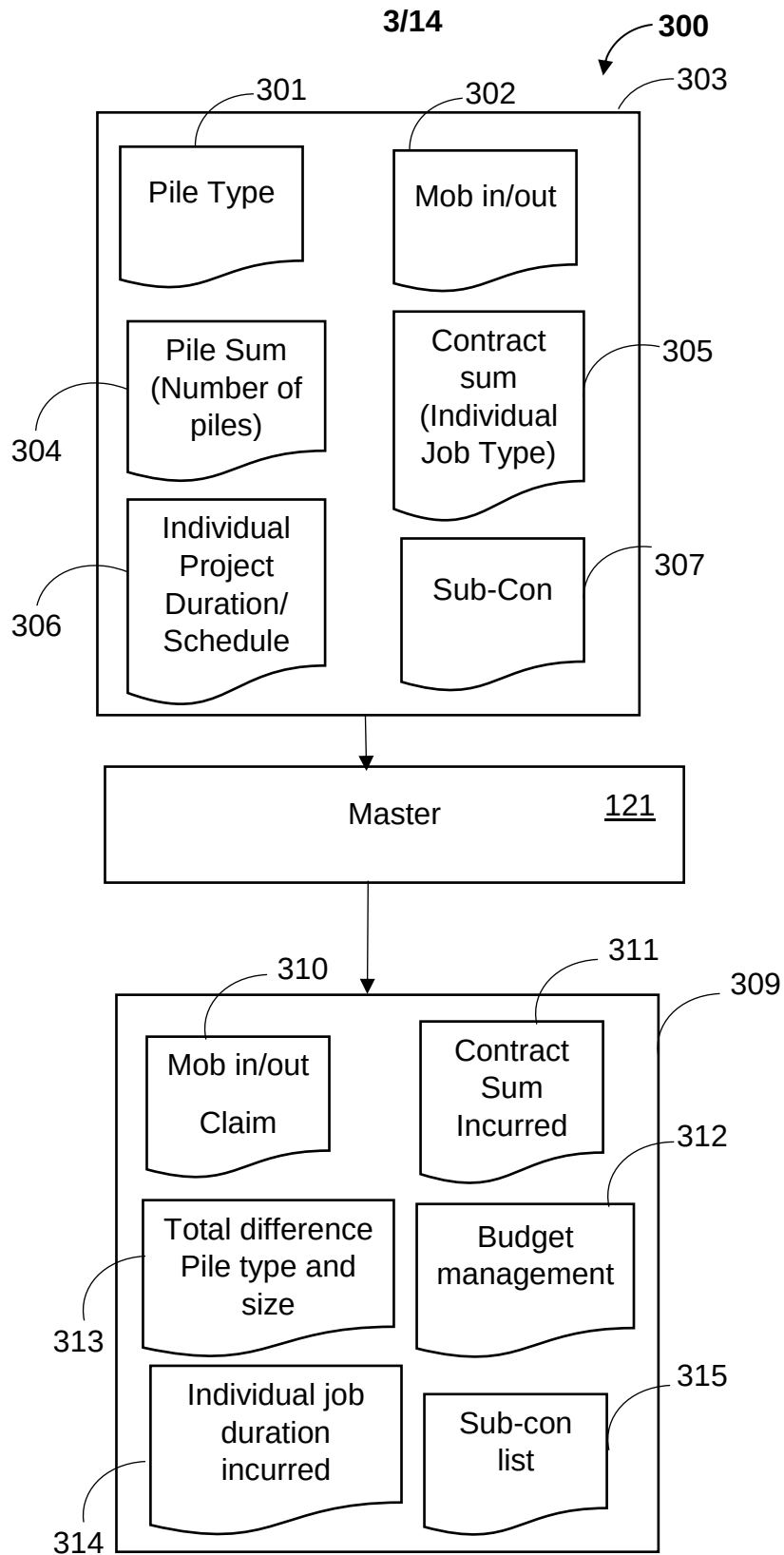


FIG. 3

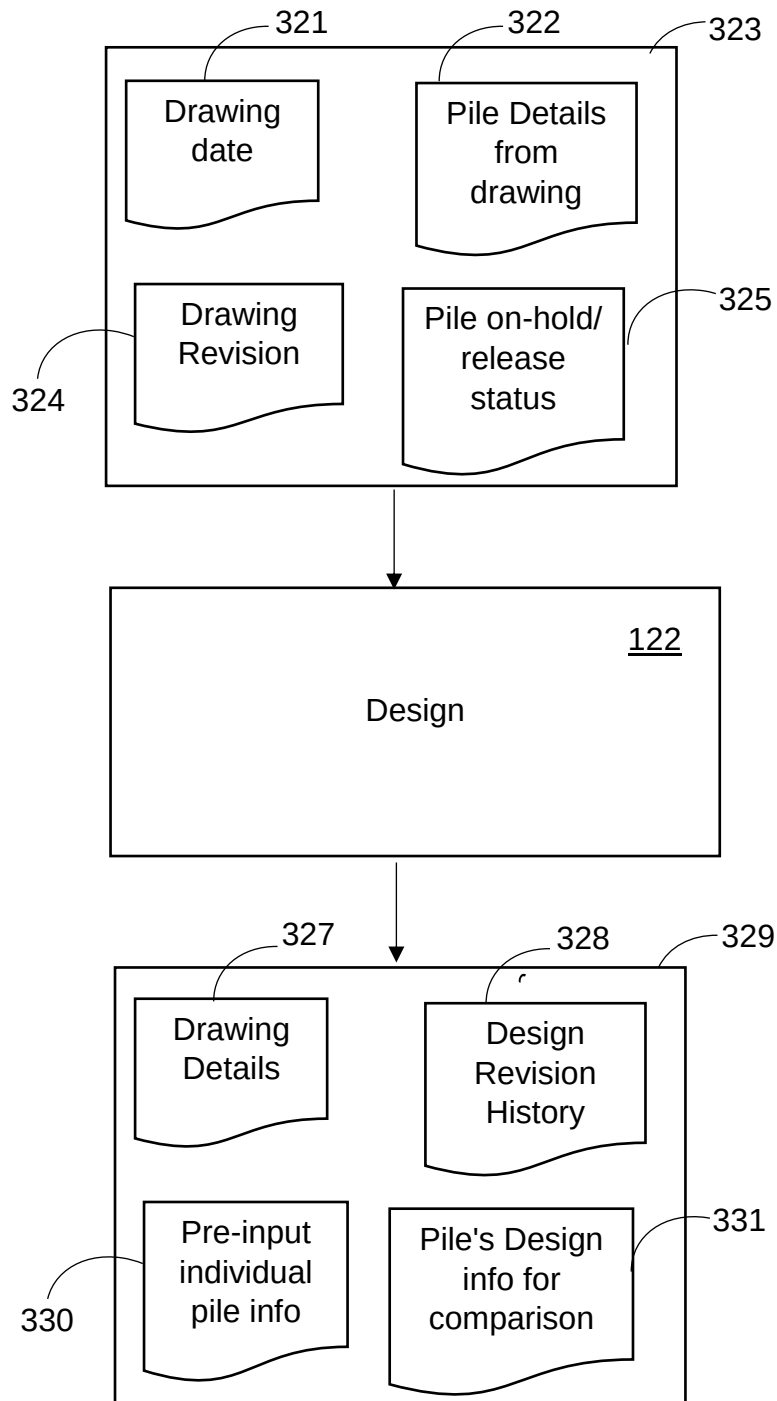


FIG. 4

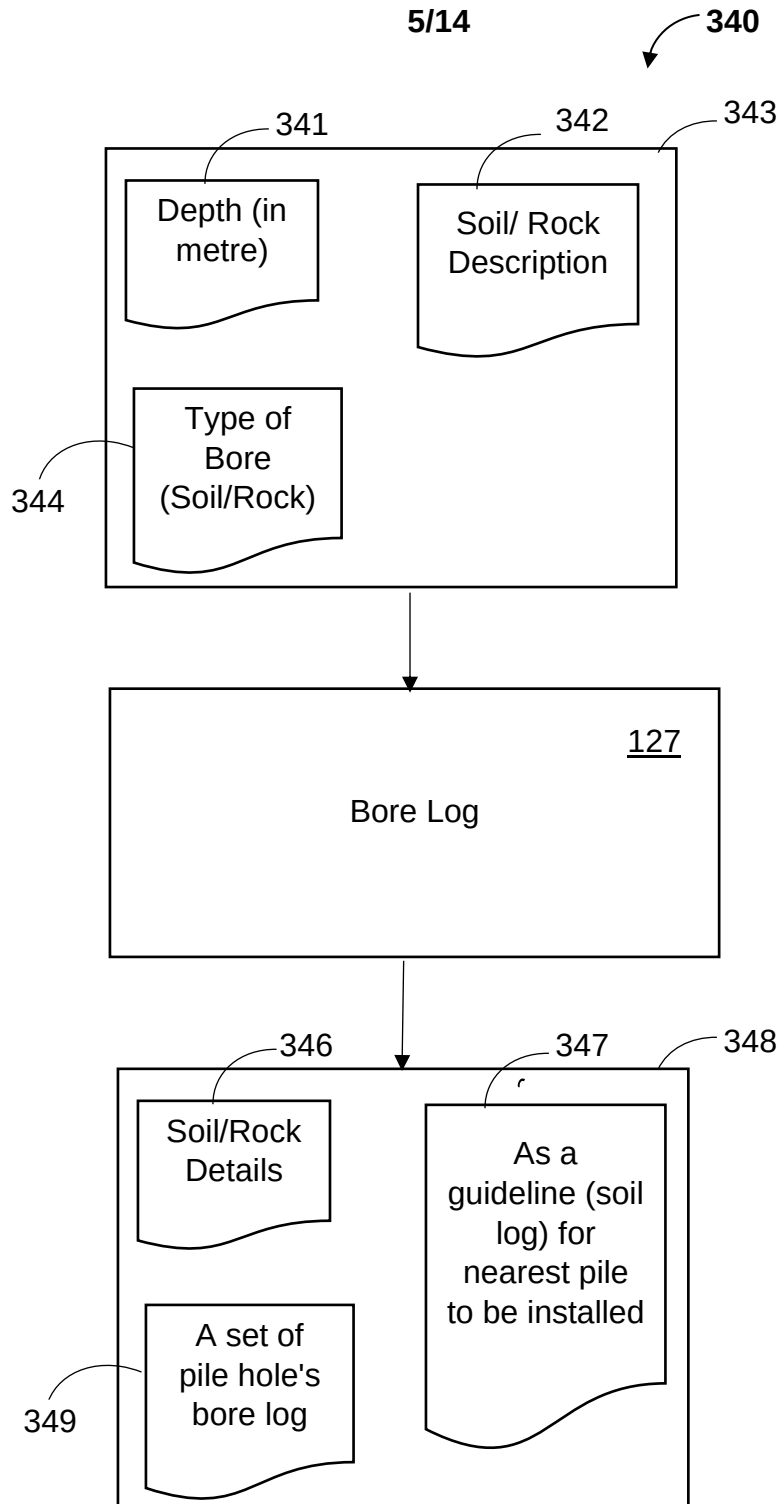


FIG. 5

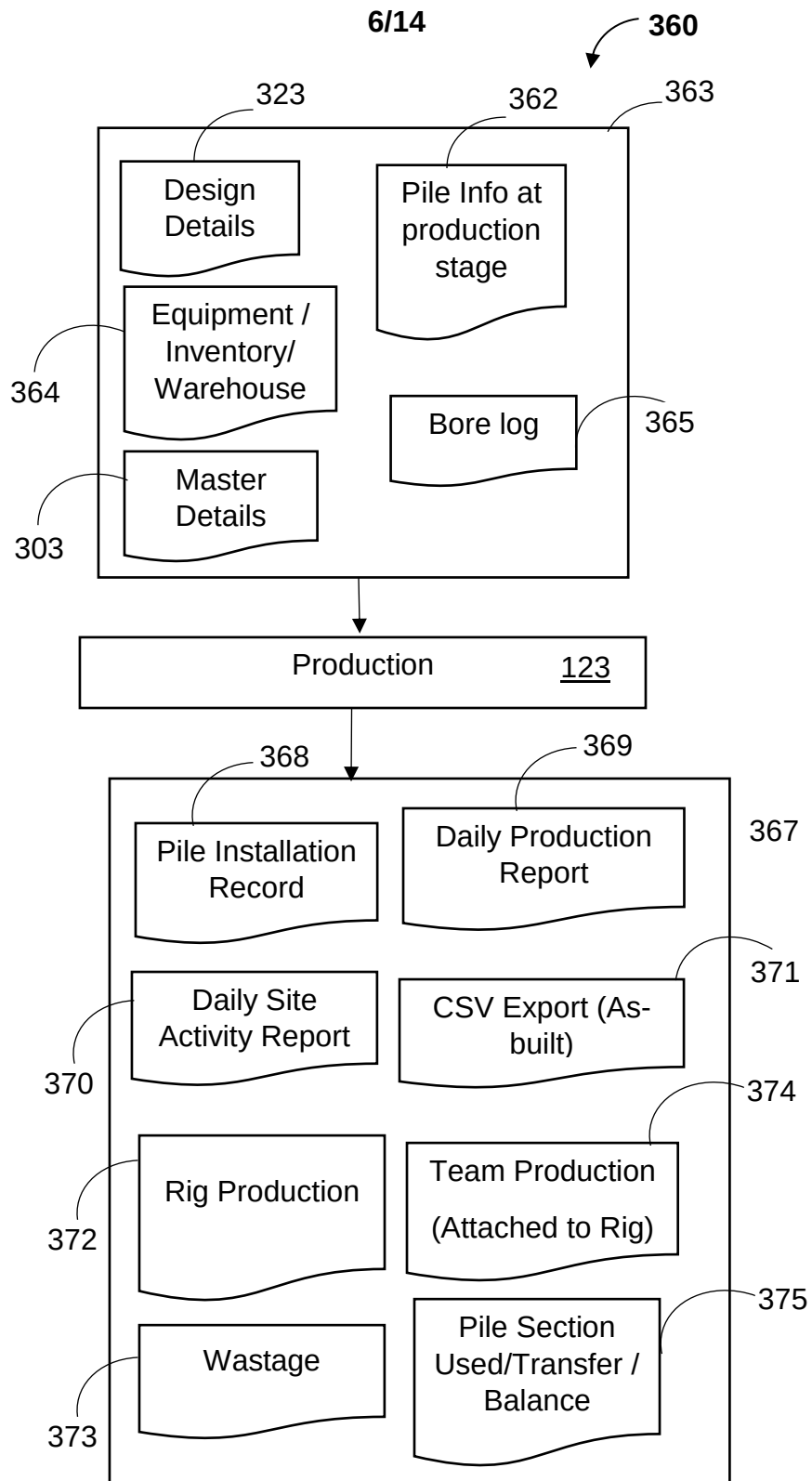


FIG. 6

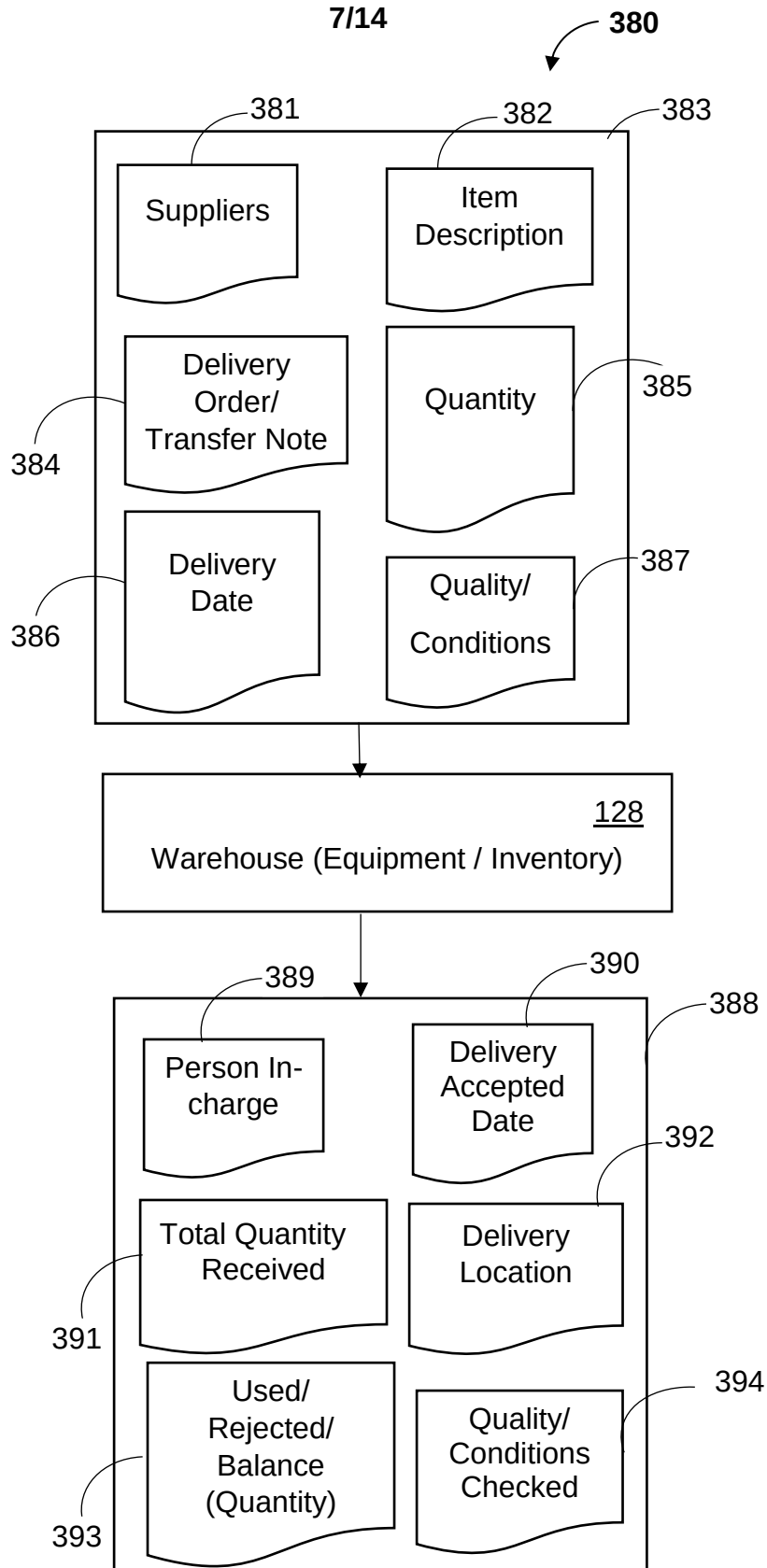


FIG. 7

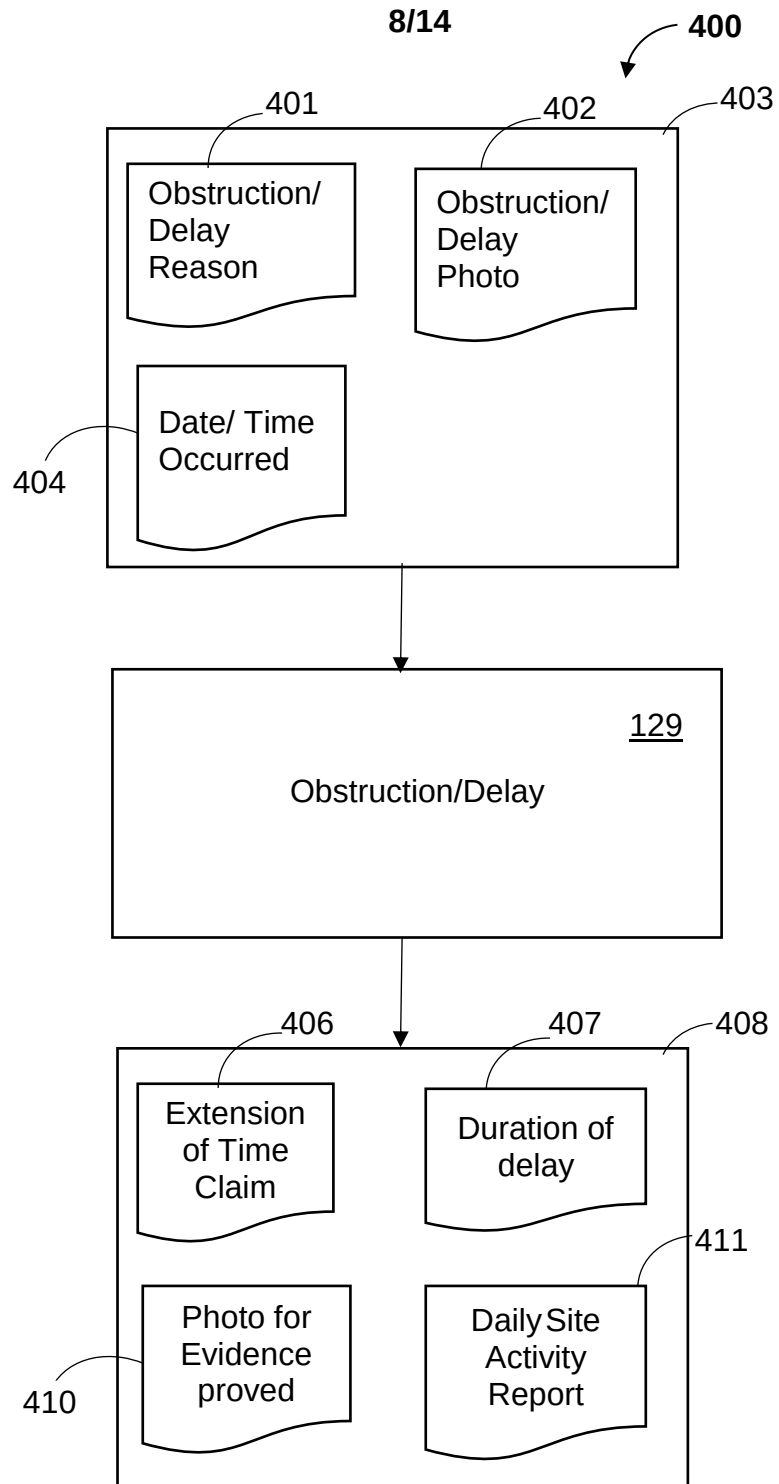


FIG. 8

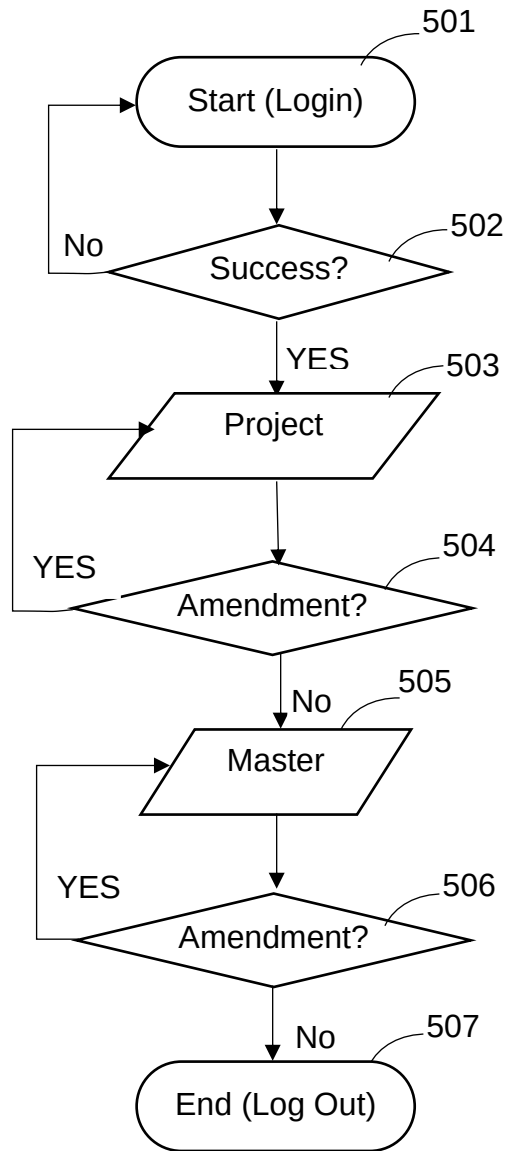


FIG. 9

10/14

510

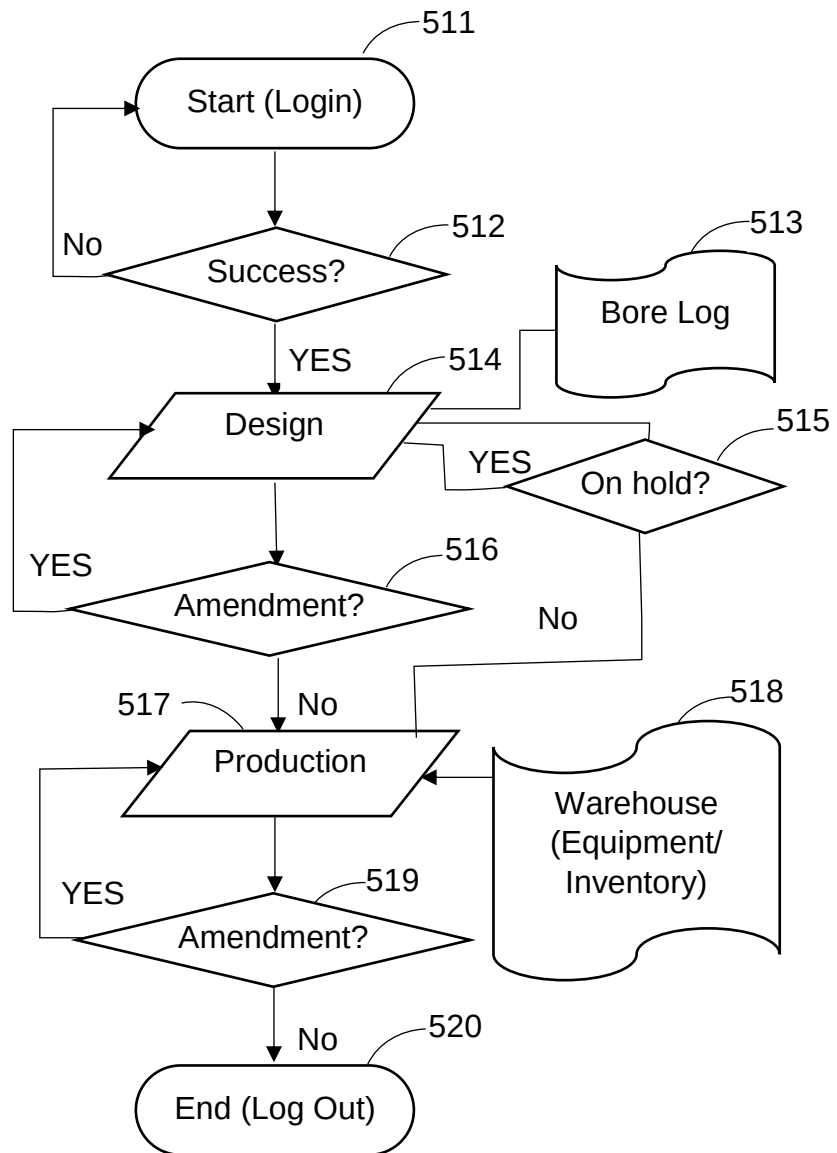


FIG. 10

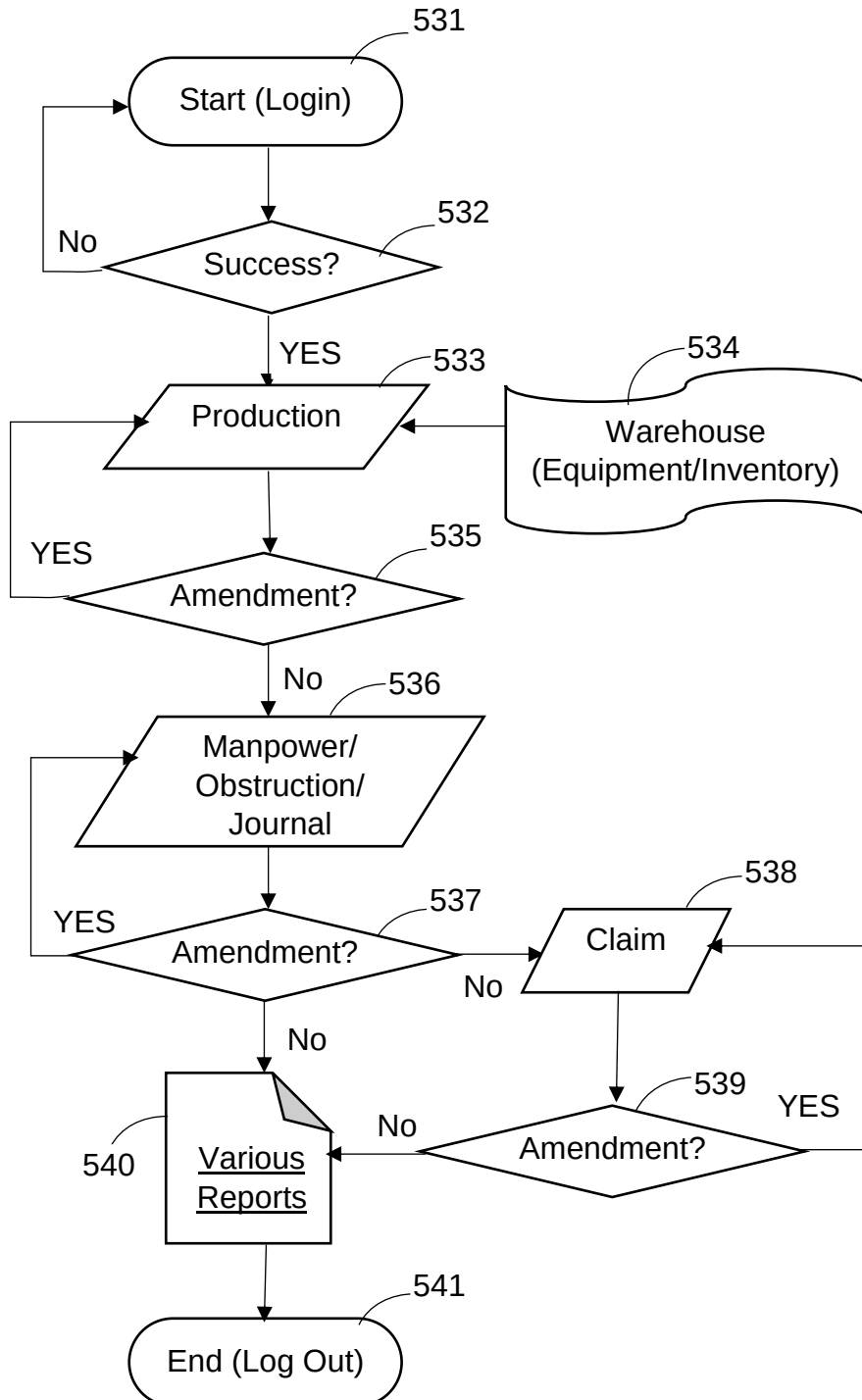


FIG. 11

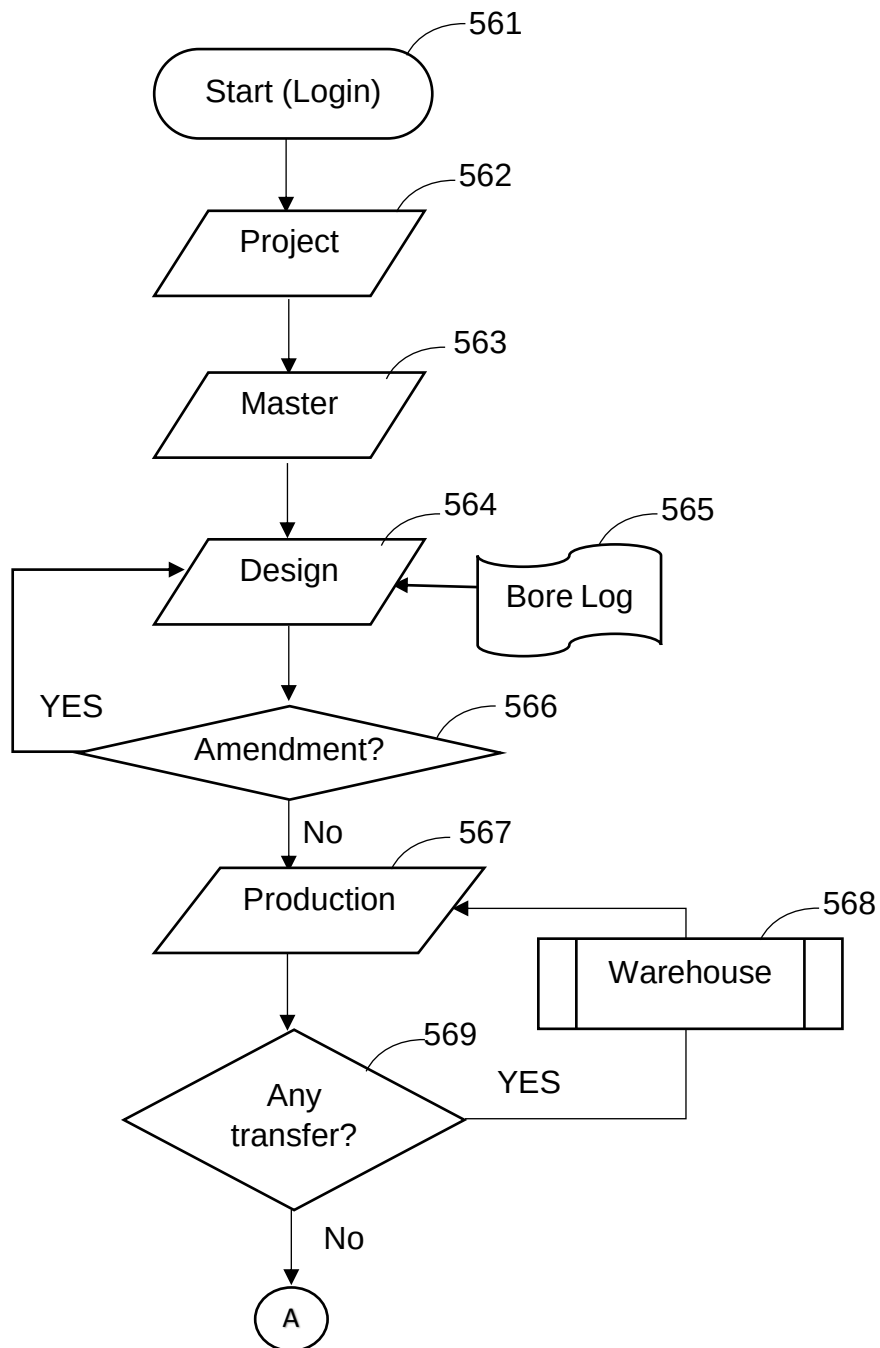


FIG. 12A

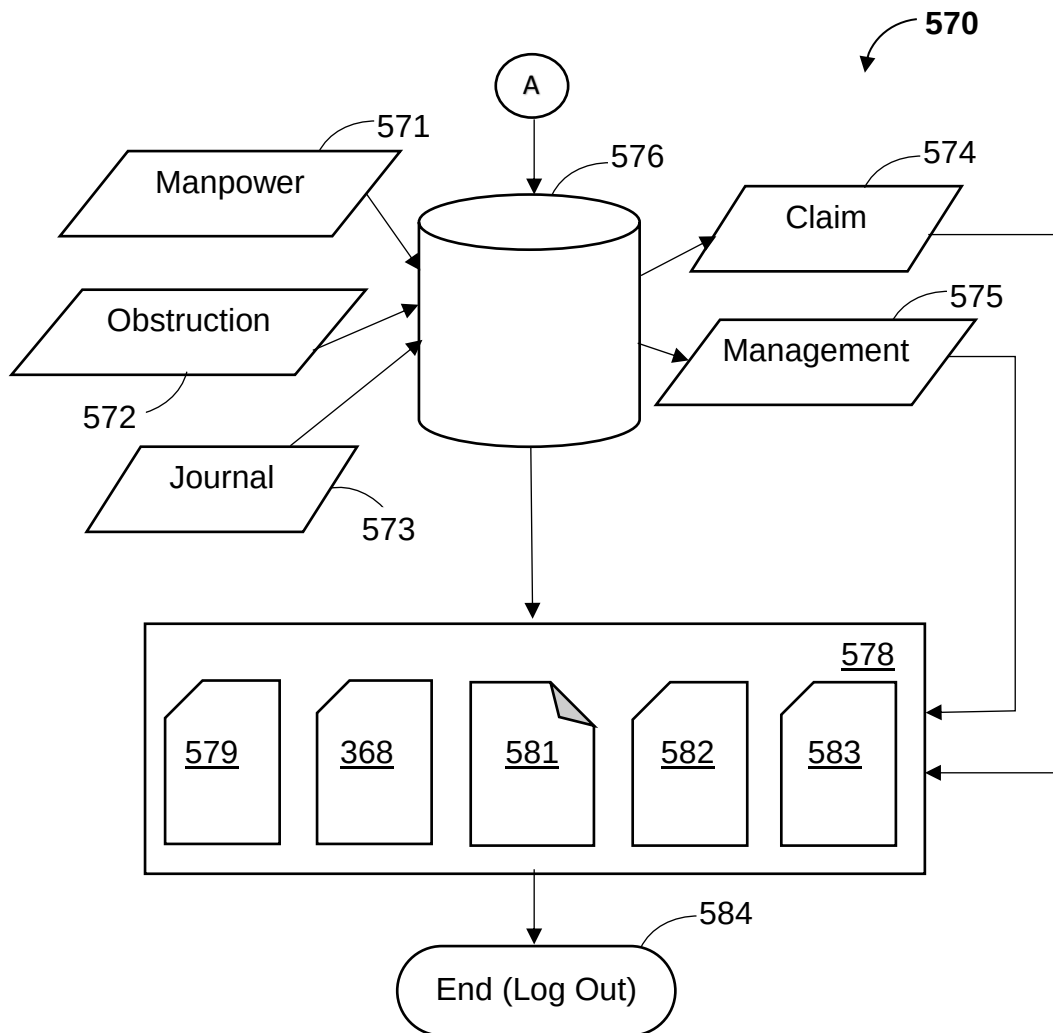
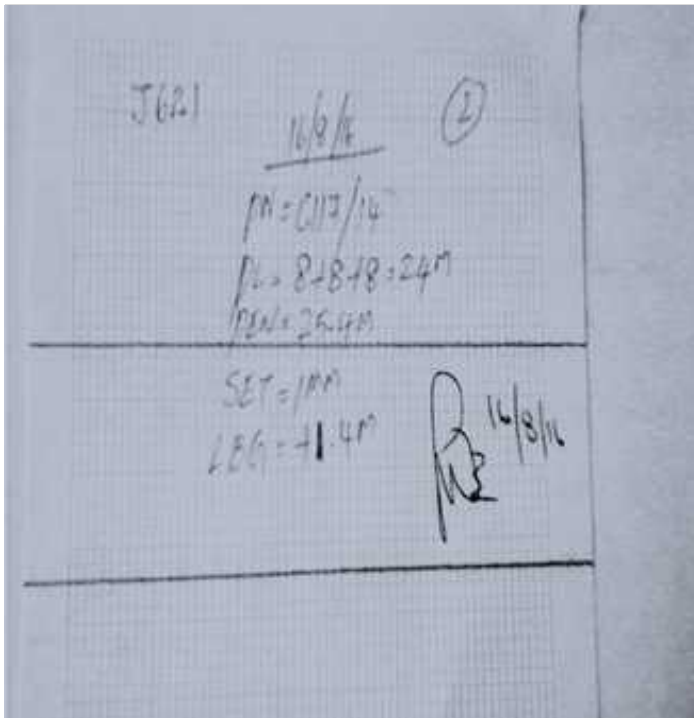


FIG. 12B

Jack-in Piling Record :: JR0116C Tampines North Drive 1

Completion Date/Time:	16/08/2016 12:25
Start Date/Time:	16/08/2016 11:25
Rig No.:	CSCG-J621
Pile No.:	C117/14
Zone/Block:	ZONE 2
Pile Group:	C117
Design Penetration Length (m):	30.0
Pile Size:	400mm
Pile Type:	RC PILE
Welding Method:	SMAW
Status:	Approved (Claimable)
Type of Test:	

Pile Length (m):	8+8+8
Total Length (m):	24.0
Above(-) / Below(+) G.L (m):	1.4
Penetration (m):	25.4
A.G.L (RL) (m):	110.492
Cut Off Level (RL) (m):	103.4
Toe Level (m):	85.092
Pile Length from COL (m):	18.308
Jack-In Force (tonne):	402.0
Final Set (mm):	1.0
Joints:	2
Remarks:	



Penetration Under Maximum Jacking Force

Penetration Depth (m)	Jacking Force (tonne)	Remarks
1	13.0	
2	13.0	
3	13.0	
4	25.0	
5	25.0	
6	65.0	
7	65.0	
8	85.0	
9	85.0	
10	110.0	
11	110.0	
12	125.0	
13	125.0	
14	142.0	
15	142.0	
16	175.0	
17	175.0	
18	210.0	
19	210.0	
20	225.0	

Penetration Depth (m)	Jacking Force (tonne)	Remarks
21	250.0	
22	310.0	
23	330.0	
24	394.0	
25	402.0	25.4
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		

CS Construction & Geotechnic Pte. Ltd.
Representative

Main Contractor Representative

RE / RTO Representative

Name & Signature

Name & Signature

Name & Signature

Date: _____

Date: _____

Date: _____

FIG. 13