निर्माण प्रबंधन (Construction Management) के सिद्धांत

[Nirman prabandhan (Construction Management) ke Siddhant]

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Lecture – 41

Construction 4.0 se Parichay (Bhaag– 2)

Introduction to Construction 4.0
Part 2

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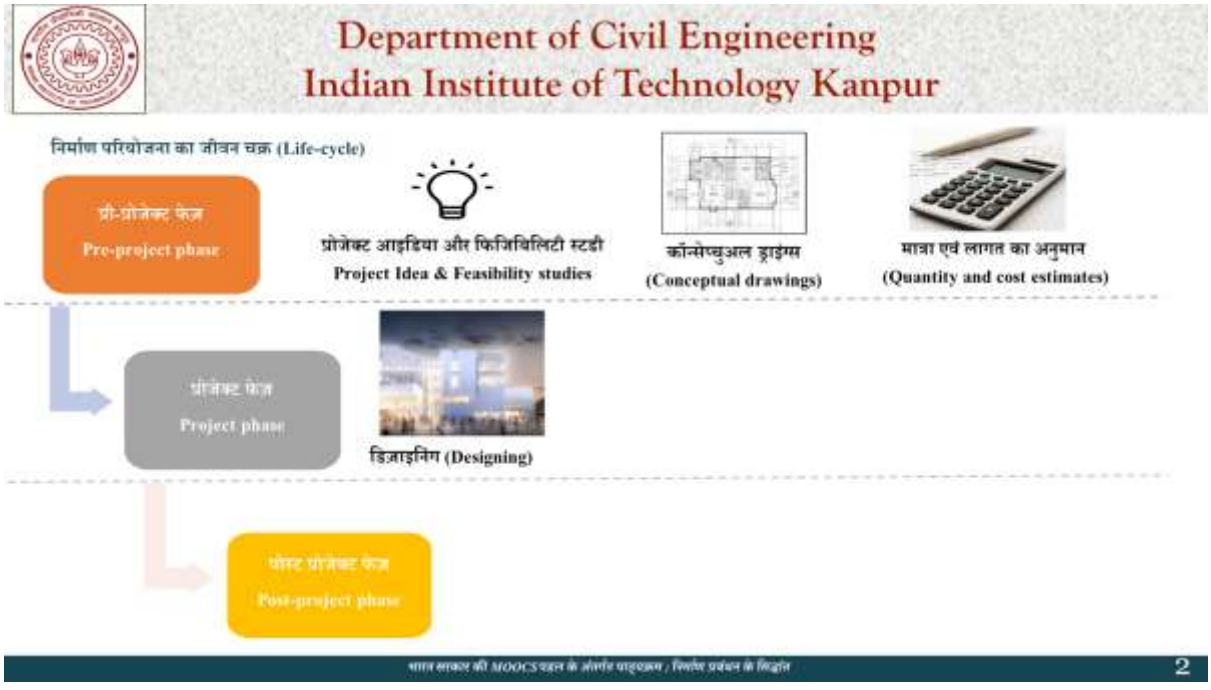
Namaskaar, aaj ham pichhale lecture mein kee gaee charcha construction 4.0 ko aage badhaayenge.

(Reference Time 00:20)



Pichhale lecture mein hamane dekha kis prakaar construction 4.0 ke vibhinn aspects, project idea aur feasibility study, conceptual drawings, maatra evan laagat ka anumaan va designing mein kaaryarat hain. Aaj ham isee charcha ko aage badhaayenge. Pichhale lecture mein hamane ek example dekha tha aap aapaka ghar bana rahe hain. Ghar ke drawings ka prayog karake aapane maatra evan laagat ka anumaan kar liya hai aur aapane design team kee madad se design banava liye hain. Ab aapake paas designers aur architects se design aa chukee hain.

(Reference Time 01:02)

Ab aap agale phase par ja rahe hain jo hai tendering. Tendering mein aap ek contractor dhoondhenge jo aapaka ghar banaane ke liye taiyaar ho.

(Reference Time 01:09)

Tendering process: tendering process ka itihaas kuchh is prakaar hai.

(Reference Time 01:15)

अनुबंध - पहले और अभी (Past & Present)

Pahale bahut saare kaagazon, drawings aur documents kee madad se tendering process kee jaatee thee. Jab bhee ham kisee bhee project ka tender dena chaahate the ya bid submit karana chaahate the to ham har gatividhi kaise karenge, usakee specifications kya hongee, usake liye hamaare quality, safety kee maapadand kya rahenge aur ham usake liye kitana charges karenge? Is prakaar kee jaanakaaree poore project ke liye dete the aur un sabhee documents ko ek saath laakar kaheen pe submit karate the.

Vah kuchh is prakaar dikhata tha. Ab ham thoda sa aage badh chuke hain. Kaagazon kee jagah yah prakriya ab computers kee madad se kee jaatee hai. Digitally contracts banate hain jahaan par saaree gatividhiyaan jo specifications hain vah sab computerized document mein rahatee hain. Jo hamaaree tendering team hain jo document submit karatee hain vah bhee computerized system mein submit karatee hain aur jo in contracts ko padhane vaala hai ya unaka moolyaankan karane vaala hai vah bhee unhen digitally form mein padhate hain. Usake baad ya to unhen ham digitally sign karate hain ya phir ho sakata hai ki sirph sign ham haanth se kar rahe hon lekin moolat: process ab digitally ho gaya hai.

(Reference Time 02:38)

Aage badhate hain tendering ka bhavishy kya hai? Kis prakaar technology kee madad se contract management mein advancements hue hain. Isamen mukhyat: teen bindu hain. Sabase pahala hai ki naee technology kee madad se ham ab sunishchit kar sakate hain ki ek contract ya document management system ho, saare dastaavez jo ek jagah se doosaree jagah ja rahe hain vah sab ek saath hon, khaasakar ke ek baar jab construction shuroo ho jaata hai to usamen jitane bhee changes hain ya jo bhee gatividhiyon mein badalaav kiya gaya hai use sahee samay par bataaya jae aur usakee information sahee samay par update kee jae. Yah ensure (sunishchit) karane ke liye document management system ka prayog hota hai. Yah bahut mahatvapoorn hai kyonki ek project kabhee-kabhee 4 saal, 5 saal ya 10 saal bhee chal sakata hai aur possible hai ki jo stakeholders ya personnel hamaare project ke shuruaat mein the, project khatm hote-hote vah us project par na rahe. Isaliye jarooree hai ki ek management system ho jahaan par sabhee dastaavez rakhe jaaye.

Yah ek dastaavez prabandhan pranaalee hai jisake upayog se yah sunishchit kiya ja raha hai ki sabhee documents update ho aur sahee jagah par available hain. Isake alaava ek naee vichaaradhaara jo abhee prasiddh ho rahee hai vah hai smart contracts. Smart contracts cryptocurrency ka use karate hain jahaan par uddeshy yah hai ki jo hamaara contract hai vah khud-ba-khud executed ho jae. Main aapako detail mein samajhaata hoon. Maan leejiye ek contract hai jisamen likha gaya hai ki jab kaary 10% khatm ho jaayega to contractor ko itana payment milega. Ab abhee jo hamaaree pranaalee hai usamen ham kya karate hain ki ek baar jab kaam khatm ho jaata hai to hamaara jo contractor hai vah ek bill submit karata hai ki hamaara 10% kaam khatm ho gaya hai hamen paisa deejiye phir client ya jo maalik hain unakee taraph se ek team jaatee hai jo yah sunishchit karatee hain ki haan yah kaary poorn ho chuka hai. Vah bill ko certified karate hain aur usake baad payment hota hai. Is pooree prakriya mein ek jo dikkat hai vah yah hai ki yah prakriya kabhee-kabhee time letee hai aur kabhee-kabhee yah bhee ho sakata hai ki owner ya maalik kee taraph se ya phir contractor kee taraph se bahut jyaada delay ho ya deree ho rahee ho jis kaaran se payment time pe na hota ho. Is cheez ko door karane ke liye ek vichaaradhaara hai ki kyon na ham hamaare contracts ko smart banaaye, smart contracts karen jo basically jaakar dekh pae ki haan, jitana kaary poorn hona tha kya vah poora ho chuka hai? Technology kee madad se vah check kare vah kaary poorn ho chuka hai. Jab vah checklist pooree ho jae agar technology bataaye ki haan jo kaam hona tha vah poorn ho chuka hai to payment khud-ba-khud released ho jae. To

is tarah kee ek vichaaradhaara hai jahaan par smart contracts ek aham bhoomika nibha sakate hain.

Aage badhate hain ek agalee technology jo is kaary mein upayogee ho sakatee hai vah hai, ai ka prayog. AI (artificial intelligence) usaka prayog dispute resolution mein. Hamane pichhale lectures mein dekha kis prakaar ek clean dispute banata hai aur kis tarah vah dispute ya vivaad bahut samay tak chalata rahata hai aur us kaaran se poora project late ho jaata hai. Artificial intelligence ke upayog se dispute resolution ka kaary bahut hee tejee se kiya ja sakata hai. Yahaan par soch yah hai ki jitana bhee contracts hai ya jitanee bhee information hai jo hamaare contracts management system mein available hai use artificial intelligence system ko diya jae, saath-hee-saath artificial intelligence system ko jo hamaara constitution (sanvidhaan) hai, indian contract act hai, is tarah ke vibhinn documents kee jaanakaaree ho aur saath-hee-saath is tarah ke vivaad jab prurv mein kisee doosare projects par hue hain to vahaan par kya nirnay raha tha yah jaanakaaree bhee us management system ke paas ho. Hamaara artificial intelligence ka model yah saaree information par traind ho taaki agar bhavishy mein kabhee is tarah ka koee vivaad aata hai to hamaara artificial intelligence hamen madad kar pae ki kya vah documents hain, kya vah cases hain aur kaun-kaun se constitution ke clause hain jo is case mein applicable rahenge taaki is pooree process mein jo time jaata hai vah bachaaya ja sake aur nirnay lene me suvidha ho. Is prakaar naee technologies kee madad se contract management ko aur effective way mein kiya ja sakata hai.

(Reference Time 07:43)

Ab ham aage badhate hain maan leejiye aapane ek contractor dhoondha hai aur aapane tender unhe de diya hai. Ab aata hai construction (nirmaan) ka kaary. Yah vah step hai jab aap nirmaan karenge.

(Reference Time 07:57)

Ab nirmaan ke baare mein agar baat karen ya construction phase ke baare mein agar baat karen to jo purva mein hota tha usaka mere paas koee achchha example nahee hai. Lekin main ummeed karata hoon aap sabhee ne shaayad bahubalee movie dekhee hogee aur jis prakaar us movie mein unhen ek statue ko uthana hota hai to vah ek chain pulley ka system banaate hain logon kee madad se use kheenchate hain aur uthaate hain kuchh us prakaar main ummeed karata hoon shaayad pahale construction kee pranaalee rahee hogee.

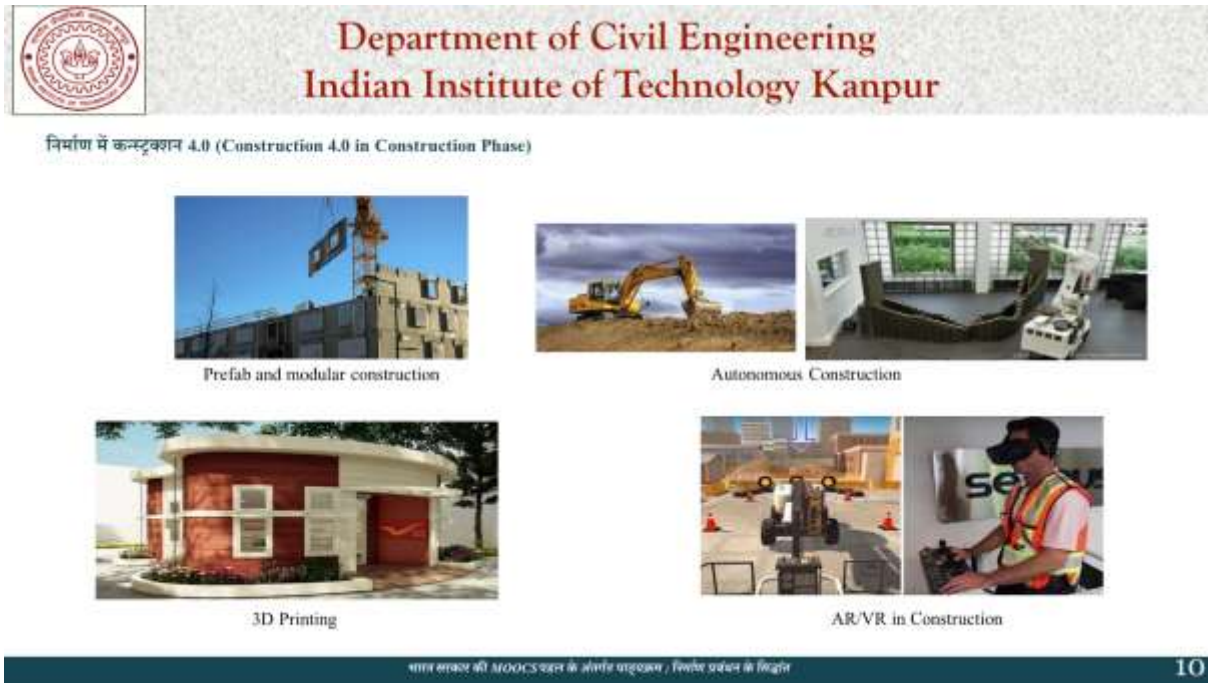
(Reference Time 08:26)

Ab yah badal chuka hai agar modarn de mein aap koee construction project ya nirmaan kaary dekhenge to aap is chitr mein dekhie kitanee cranes aur kitanee machines ka upayog aajakal ham kar rahe hain.

(Reference Time 08:36)

Yah chitr dekhie yah ek refinery ka chitr hai jahaan par agar aap ek jagah khade hokar nirmaan kaary dekh rahe hon to aap dekh sakate hain kam-se-kam 50 se 100 aisee cranes hai jo alag-alag saamaan ko uthaane mein madad kar rahee hain vaheen aise equipments hain jaise construction boom place, jo concrete ko place karane ke lie ek upayog mein aata hai. Usee prakaar kaee alag-alag technology ya methods hain jisase construction modernized ho raha hai. Yah aaj ke sandarbh mein nirmaan kuchh is prakaar ho raha hai.

(Reference Time 09:09)



Ab ham baat karate hain construction 4.0 kis prakaar aane vaalee naee technologies construction ko badal sakatee hain. Sabase pahale ek important pahaloo hai prefabrication ka. Main bataana chaahoonga prefabrication bahut projects par prayog ho raha hai lekin aisa maana jaata hai ki aage chalakar prefabrication bahut jyaada hoga.

Sabase pahale ham jaanate hain, prefabrication kya hai? Prefabrication mein hota yah hai ki site par concreting ya element ko banaane kee jagah pooree building ya poore project ke har ek element ko kaheen offsite, us site kee jagah kaheen aur factory mein banaaya jaata hai aur phir usako laaya jaata hai project site par aur phir use sirph install kiya jaata hai. Aap isako kuchh is prakaar samajhie ki bachapan mein shaayad ham log jab lego game khelate the to agar hamen ek building banaana hai to alag-alag lego ke pieces hote the chhote-chhote pieces. Un pieces ko maan leejie kisee factory par banaaya ja raha hai factory par banaane se phaayada yah hai ki ek controlled environment hai use controlled environment mein kaary ho raha hai to safety aur quality ke issues kam aate hain, construction jyaada tejee se kiya ja sakata hai aur saath-hee-saath wastage bhee kaam ho raha hai to is prakaar aap samajhie ki un lego ke pieces ko ya building ke chhote-chhote elements ko factory mein ya kisee alag site par banaaya jaata hai phir use railers ya trucks kee madad se site par laaya jaata hai aur phir unhen install kiya jaata hai yah hua prefabrication aur modularization.

Isake alaava construction 4.0 mein autonomous construction bhee bahut prachalit hai. Autonomous construction mein basically uddeshy yah hai ki gatividhiyon ko kuchh is prakaar automate kiya jae ki hamen human interference, vyaktiyon ka interference kam karana hai isaka ek example hai aap dekhenge ki kuchh campanies hain jinhonne is prakaar earth mooving equipments banae hain jinase mittee nikaalee jaatee hai jo pooree tarah automated hai. Ek udaaharan agar aap dekhana chaahe to vah hoga autonomous car ka. Is prakaar kee caren aa gaee hain jahaan par insaan ke bina baithe bhee caren chal pa rahee hain. Usee prakaar construction mein maan leejie hamen road banaana hai ab jis jagah par hamen road banaana hai vahaan par kaheen par mittee bharanee hai ya kaheen se mittee khodee jaanee hai ab aapane ek machine ko yah pooree information de dee ki hamaara road ka jo satah hai usaka level kya rahega, ab vah machine jaise-jaise aage badhegee vah dekhegee ki aage jo mittee ka dher hai vah neeche hai ya oopar hai, us prakaar vah aage badhegee aur ya to vahaan se excavate karegee mittee ko nikaalegee ya phir vahaan par mittee bharatee jaegee aur is prakaar vah aage badhatee jaegee. To yah hua earth work mein automation. Yah poora process sensor kee madad se kiya ja raha hai jahaan par bina kisee human interference se poora earth work ya poora sadak ke lie jo naap karana hai vah ek automatic machine ke upayog se kiya ja sakata hai.

Usee prakaar ek aur technology jo abhee recently bharat mein upayog mein laee gaee hai vah 3D printing. Yah example bangalore ke ek post office ka hai jahaan par ek 3D printing machine usamen drawing dee gaee ki kis tarah se post office dikhega use machine ne cementitious materials kee layers banaakar yah pooree building ko khada kiya hai.

Isake alaava construction phase mein ar aur vr bahut upayogee ho sakate hain. Ar (augmented reality) kahalaata hai aur vr (virtual reality) kahalaata hai. Hamane pichhale lecture mein virtual reality ka ek udaaharan dekha tha jahaan mainne aapako dikhaaya tha ki maan leejie hamen koee ek road banaana hai ab ham chaahate hain ki main us road par pahale hee drive karake dekhoon ki agar mujhe chaar ya paanch lanes badalana hai 100 kee speed par aur turn lena hai to kya main vah le pa raha hoon. Vah hamane virtual reality kee madad se kiya tha jahaan par ek car racing game banaaya aur jo maip hai vah ek real project banaaya. Yah bahut upayogee hai vr construction projects mein quality mein bhee kaam aata hai. Quality kee training jab ham de rahe hain to ham virtual reality mein de sakate hain.

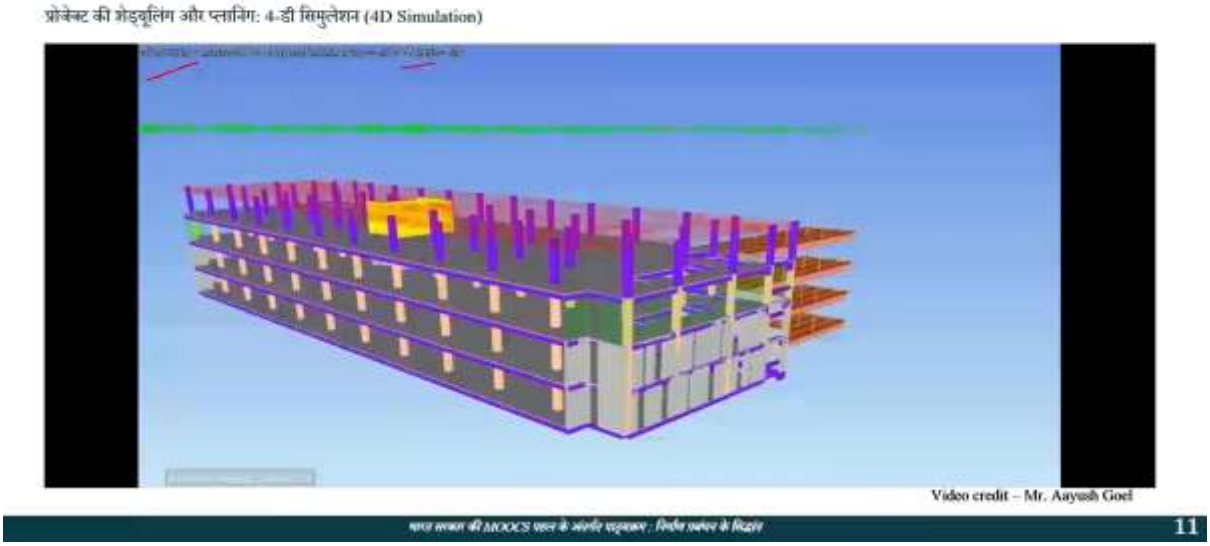
Usee prakaar safety kee jo ham training de rahe hain vah bhee virtual reality mein dee ja sakatee hai. Udaaharan ke taur par maan leejie aapake paas ek project hai jahaan par 100veen floor par ja kar kaam karana hai. Ab abhee tak aap apane worker se poochhate hain ki kya

tum height par kaam kar sakate ho, kya tum oonchaee par kaam kar sakate ho tumhen dar to nahin lagata. Abhee tak vah jo hamen kah rahe hain vah hamen maanana padata hai. Ab kaee baar hota hai kyonki worker kabhee gaya nahin hota hai utanee height par to use pata nahin hota hai ki kya vah dar raha hai ya kya use dar lagata hai. Virtual reality kee madad se is samasya ko door kiya ja sakata hai. Ham ek aisa environment bana sakate hain jahaan par manushy ko lage ki vah 100 floor ke oopar ja raha hai aur phir ham usase kahate hain ki ab tum yahaan par kaam karo, yah sab ek virtual reality mein ho raha hai. To vah ya worker sahee mein to ek room mein hee hai lekin yah headset kee madad se use aisa lag raha hai ki vah 100veen manjil par hai, ab ham dekhenge kya us height par vah kaary kar pa raha hai. Is prakaar ek initial screening mein madad hotee hai hamen dhyaan rakhana hota hai ki hai yah virtual reality ho.

Ho sakata hai sahee mein jab vah oopar jae to kaee aur naee baadhaayen aayen lekin virtual reality kee madad se ek screening step aa sakata hai jahaan par yah upayogee ho sakata hai. Isake alaava augmented reality ek aur aisa facet hai jo construction mein bahut useful hai. Maan leejie ham aapake example ko aage lekar chalate hain aapaka ghar achchhe se ban gaya tha aur maan leejie 5 ya 10 saal baad aap chaahate hain ki aapake room mein aapako koee ek naee facility add karavaana hai. Ab maan leejie construction team ko aapane bulaaya aur kaha ki is wall ke andar se aap do wiring aur nikaalie aur yahaan par maan leejie ek naya charging point ek naya sensor lagaie. Ab duvidha yah ho sakatee hai ki puraanee jo team thee vah nahin hai aur jo naee team aaee hai use pooree tarah information nahin hai ki is deevaar ke peechhe kya hai kyonki finishing aur plaster aur paint hone ke baad hamen nahin pata hota hai ki usake andar kya hai. In jagahon par augmented reality ya ar ka upayog kiya ja sakata hai. Ar mein bim, model agar update kar diya jae, to ham kuchh is prakaar kar sakate hain ki main us room mein us jagah par jaoon aur augmented reality kee madad se dekhoon ki is deevaar ke peechhe kya-kya hai. Bim model mein saaree information available hogee to augmented reality model hamen bataaya ki yah jo deevaar abhee jo sirph aage kee satah dikh rahee hai isake peechhe kitane conduits, kitanee wirings, kaun-kaun see pipelines kahaan se ja rahe hain, yah jaanakaaree milane kee madad se ham yah sunishchit kar paenge ki ham jo bhee kaary kar rahe hain usase hamaaree puraanee jo bhee construction ya nirmaan kaary kiya gaya tha usamen koee bhee disturbance na ho.

Augmented reality ka ek example aapane kuchh shopping kee websites par dekha hoga jab aap phone par agar koee cheej aardar karate hain to vah kaee baar aapase kahate hain ki yah dekhie aapake room mein kaisa dikhega vah augmented reality ka example hai. Jaise usamen aap chooses karate hain ki tv agar is room mein dikhega to kaisa dikhega? To vah aapako dikha paate hain ki agar aap yah tv jo maan leejie 50 inch ka hai use apane room mein lagaenge to vah kis prakaar dikhega. Vahee technology hai use construction mein upayog laaya gaya hai taaki ham dekh pae ki jo bhee services ya utilities jo abhee chhapee huee hain hamen nahin dikh rahee hai vah kis prakaar dikhega. To is prakaar hamane dekha ki construction phase mein yah ek bahut hee important aspect hai aur technology ka upayog bahut hee useful ho sakata hai.

(Reference Time 17:35)



Isake alaava construction mein 4D simulation ek doosara pahaloo hai jahaan par technology ka upayog ho sakata hai. Aaiye ham is video ko dekhate hain is video mein jo design team ne poora project banaaya tha usake saath ek primavera ya msp ka jo project ka schedule hai ki kaun sa kaary kab hoga un donon ko integrated kiya gaya hai. Ab yahaan par aap dekhenge oopar yahaan par time dikh raha hai ki alag-alag din kaun-kaun sa elements banate jaenge. To sabase pahale foundation bana, phir sharewall ka reinforcement sariya aaya, phir column ka sariya aaya, phir columns kee concreting huee. Yahaan par aap dekh rahe hain abhee ham week paanch par hain, week 5 ke baad yahaan par koee element tha jo banaaya hamane usake baad jo pahalee manjil aane vaalee hai usaka jaal bichhaaya, usaka jaal bichhaane ke baad ho sakata hai ham usake concreting karen.

Is prakaar yah poora project ka ek 4D simulation bana diya gaya hai jisakee madad se ham dikha pa rahe hain ki kis din ya kaun se haphte par kaun sa kaary hai jo poorn hoga aur yah kis step mein hoga. Yah kaary ek chhote project jaise maan leejie ghar mein ho sakata hai utana mahatvapoorn na ho lekin agar koee bada laarj scale project kiya ja raha hai, to yah bahut jarooree ho jaata hai kee saaree gatividhiyaan sahee samay par kee jae. To is tarah ke ek simulation model kee madad se easy ho jaata hai ki ham construction workers ya construction team ko bata pae ki aapako kaary kis prakaar karana hai aur saath-hee-saath jab yah kaary poorn hota jaata hai, jab yah kaary poora hota jaata hai aap vah information bhee update karate jaate hain to maan leejie aapane kaha tha ki week paanch pe doosare floor kee concreting ho jaanee chaahie. Ab aap week paanch pe dekhenge ki kya vah sahee mein ho gaee agar vah nahin huee hai to kaary jahaan tak hua hai vah information aap update karate hain, jaise hee aapako information update karate hain yah schedule khud-ba-khud update ho jaata hai aur vah aapako bataata hai ki aap aaj tak kitana percent kaam complete kar chuke hain, aapane kya plan kiya tha kya aise kaary hain jo slow hai ya dheere chal rahe hain, aise kaun se kaary hain jahaan par hamen dhyaan dene kee jaroorat hai. To is prakaar simulation kee madad se ham bahut easily poore project ko visualize kar sakate hain.

(Reference Time 20:02)

Ab ham aage badhate hain tendering hua, construction hua, maan leejie poora project ban chuka hai, isake baad agala mahatvapoorn step hai handover ka. Handover kya hota hai? Handover ek gatividhi hotee hai jahaan par aamataur par jo hamaaree construction agencies hain jinhonne poora nirmaan kaary kiya hai.

(Reference Time 20:22)

Vah aatee hai aur handover karatee hain malik ko keys detee hain. Ab handover ke samay ek vishesh requirement hotee hai, vah requirement hotee hai as built drawings kee.

(Reference Time 20:37)

कनस्ट्रक्शन हैंडओवर (Construction Handover) – Past & Present

Image credit: Template.net

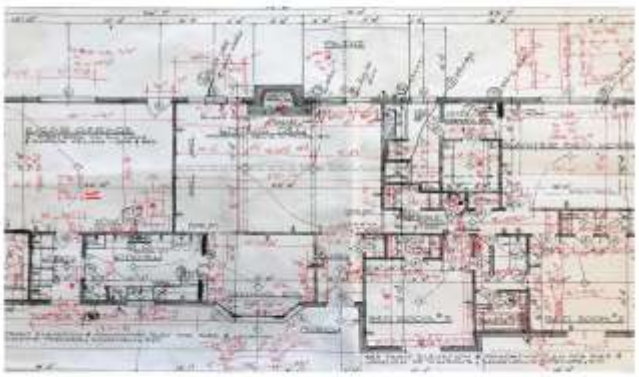


Image credit: theconstructor.org

As built drawings kya hain? As built drawings darshaatee hain ki aapane jab project shuroo kiya tha to aapane ek drawings banaee thee aur chaaha tha ki hamaara jo project ban raha hai vah kuchh is prakaar in drawings ke hisaab se banana chaahie, lekin construction mein yah bahut aam baat hai ki thoda bahut jab ham construct karate hain to changes aate hain, kuchh cheejen badal jaatee hain. To uddeshy as built drawing ka yah hota hai vah sab changes ko ham maark karen likhakar rakhen ki jo hamane ab banaaya hai vah kuchh is prakaar hai. Yah drawings ko save karake rakha jaata hai sambhaal kar rakha jaata hai taaki bhavishy mein agar jaroorat pade to in drawings ko dekha jae.

Abhee aap dekhenge handover moolat: kuchh is prakaar hota hai ek checklist hotee hai jahaan par basically jo quality engineer hain ya jo thekedaar hain jinhonne vah banaaya hai vah jaate hain owner ke saath aur kuchh point par pooree checklist banaate hain aur dekhate hain ki haan har kaary jis prakaar hona chaahie tha hua hai ki nahin hua hai. Agar koee deviation ya koee badalaav hota hai to use likh liya jaata hai. Right mein aap dekhenge ki generally ek drawing ko liya jaata hai jis drawing se banaana tha us drawing kee madad se har camera mein jaate hain aur dekhate hain ki jo dimension, maan leejie yahaan par likha hai 22 inch kee hona chaahie vah 22 inch kee jagah kitanee hai vah naee dimension ko likh diya jaata hai. Yah vartamaan kee pranaalee hai jisamen har ek information ko jo puraanee drawings hotee hai use par haanth se update kar diya jaata hai lekin yah bahut mushkil hota hai. Kyonki sochie aap 15 saal baad us ghar mein kuchh kaary karaana chaahate hain aur aap kuchh is prakaar kee drawing dekh rahe hain bahut mushkil ho jaata hai yah dhyaan dena ki jo cheej banaee gaee thee vah kis prakaar likhee gaee hai aur is pooree drawing ko samajhane mein bahut dikkaten aatee hain aur ek aur doosara pahaloo hota hai ki kaee aisee construction kee gatividhiyaan hotee hain jo chhup gaee hotee hai jo ab achchhee nahin rahee hotee hai vah information as built mein kaee baar miss ho jaatee thee ya rah jaatee thee. Is cheej ko door karane ke lie bhee construction 4.0 ka use kiya ja sakata hai.

(Reference Time 23:01)

Maan leejie hamen vahee kaary karana hai ki jo room hamaara ban gaya hai us room ko kis prakaar se ham usaka ek as built banaen. Aajakal kuchh is prakaar ke software aa gae hain jahaan par aap camera ya phone ke camera kee madad se ek poora 3D video bana sakate hain metaoptic ek aisa software hai jo is kaary mein upayogee hota hai. To aap kisee bhee room mein jaakar is tarah se ek model bana sakate hain, saath-hee-saath isamen saaree information available hotee hai. To aap agar maan leejie chaahen ki mujhe dekhana hai ki yah jo table hai is table ka lenth kitana hai, to aap do point select kar sakate hain click karenge ek jagah aur phir doosaree jagah to vah aapako bata dega ki is table kee chaudaee ya lambaee kitanee hai. Is prakaar kisee bhee building ke andar ka jo interior hai use agar hamen record karana hai to is tarah ke video ham bana sakate hain aur yah sabhee information ko jo hamaara bim model tha usamen daal sakate hain. To abhee tak hamaare paas model tha jo bata raha tha room kaisa dikhana chaahie ab hamane camera kee madad se pooree information ko captured kiya hai aur us information ko usee model mein update kar diya hai taaki hamaare paas jaanakaaree rahe ki yah room jab ban chuka hai to kis prakaar dikh raha hai. Yah hua interior measurements ka example.

(Reference Time 24:25)

Isee prakaar se kuchh technologies hai jaise drones ya phir 3D scanning jisake prayog se aap pooree building ko scan kar sakate hain usaka ek digital imeges bana sakate hain dekh sakate hain ki jo bhee apane drawing mein chaaha tha kya construction usee prakaar hua hai aur yah information ya is jaanakaaree ko aap apane model mein update kar sakate hain.

(Reference Time 24:51)

Is prakaar technology kee madad se handover kee prakriya aasaan kee ja sakatee hai.

(Reference Time 25:00)

Aur yah jo information ham abhee tak dekh rahe the jo save kee gaee hai usaka upayog operation and maintenance (sanchaalan evan rakharakhaav) mein bhee kiya ja sakata hai. Yah ek bahut hee important pahaloo hai kyonki aap samajhie ham construction ka kaary generally do se teen saal mein poorn karate hain aapaka ghar ka example len, to maan leejie apane vah ghar 2 saal mein bana liya hai lekin us ghar mein aap ho sakata hai 40 se 50 varsh rahenge. Vah jo building hai usaka operation and maintenance kaary construction ke maayane bahut jyaada hai, 30-40 saal tak aap use operate ya maintain karenge aur iseelie jarooree ho jaata hai ki hamaare paas sahee tarah kee technologies ho sahee methods ho jo hamen madad karen ki ham kis prakaar sanchaalan aur rakharakhaav karen taaki kharcha hamaara kam ho.

(Reference Time 25:51)

Operation and maintenance mein construction 4.0 kis prakaar upayog mein laaya jaata hai usake ham kuchh udaaharan dekhenge.

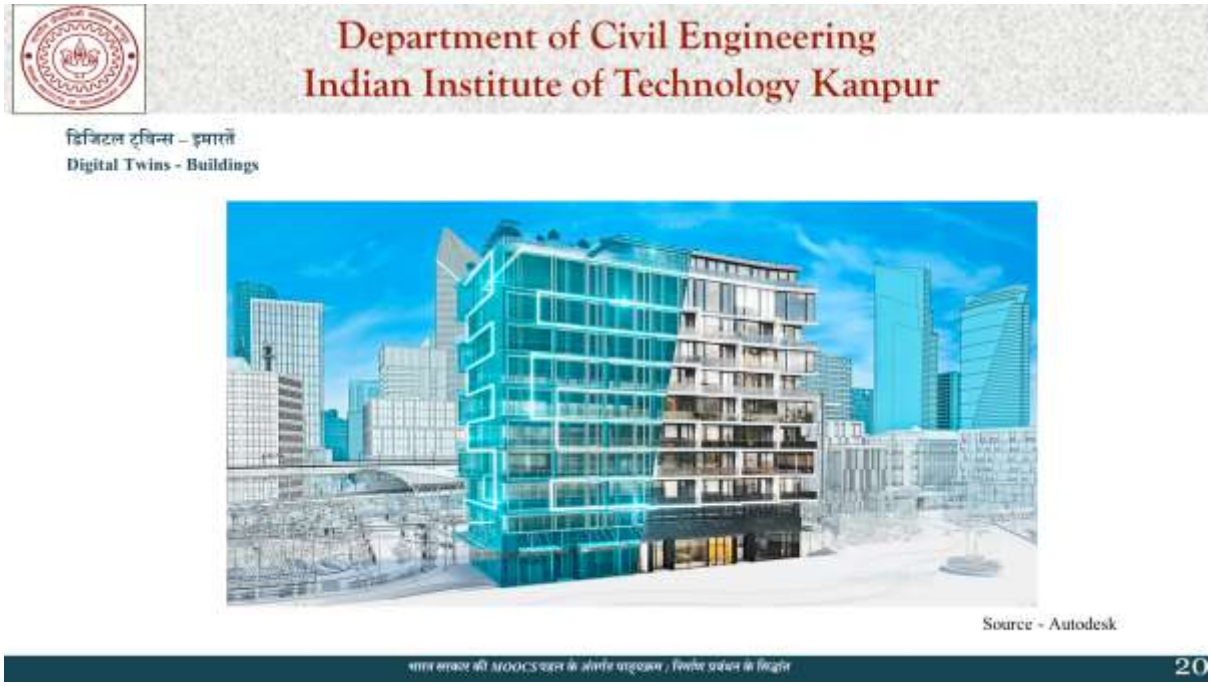
(Reference Time 26:05)

Yahaan par ek bahut important concept digital twins ke baare mein baat karana jarooree hai. Digital twins ek concept hai jahaan par jo hamaara physical building hai, jo hamaaree actual building hai usaka ek computerize digital replica banaaya jaata hai. To computer kee madad se ek digital replica banaate hain aur ham sunishchit karate hain physical world mein jo bhee changes aa rahe hain vah sabhee changes deviation hamaare digital model mein bhee dekhen. Yah ek example hai amsterdam airport ka, jahaan par unhonne poore airport ka ek digital train banaaya hua hai. Ab ise vah kis prakaar upayog mein lete hain us pe thodee see charcha karate hain. Maan leejie aap kisee bhee airport par jaate hain ab us airport mein alag-alag steps hote hain sabase pahale aapaka starting mein kuchh security check hota hai phir aap andar jaate hain aapaka saamaan checking karate hain saamaan checking karane ke baad aapaka final gate ke pahale check hota hai aur phir aap gate ke andar jaate hain, is prakaar ek pooree pranaalee rahatee hai. Ab maan leejie aap aise kisee airport ka operation and maintenance kar rahe hain usaka aap sanchaalan kar rahe hain. To digital twin kee madad se aap dekh paate hain ki aap maan leejie aapake paas information hai ya jaanakaaree hai ki agale 1 ghante mein yah sabhee flights udane vaalee hai, in flights se maan leejie 500 log jaane vaale hain aapake paas real information hai ki gate par abhee hamaare kitane log khade hain jinhen security cross karana hai yah digital twinn model aapako bata sakata hai ki abhee aapake jitane log khade hain jinhen yah flight lena hai unhen kitana time lagega security ko cross karane mein, yah information digital twin model aapako de sakata hai usakee madad se aap dekh sakate hain ki ho sakata hai kaheen aur aise security personnel ya aise log hoon jo phree hain aap unhen chaahenge ki vah doosare gate se is gate par aa jae kyonki yahaan kee jo prakriya hai vah fast kee ja sake ya tejee se kee ja sake. Yah ek example hua ki digital twin jab hamaare paas real information hai to vah model hamen bata pa raha hai ki koee aisee gatividhi hai jo bahut slow chal rahee hai agar ham koee intervention kar pae ya kuchh usamen badal pae to vah gatividhi speed-up ho sakatee hai ek yah ek example hoga.

Isee prakaar sign francisco airport mein jitana bhee samaan hai usaka poora digital twin banaaya gaya hai ab jo saamaan ham checkin karate hain vah kaun see flight mein load hota hai aur vah kahaan par vaapas se offload hota hai yah pooree prakriya digital twin kee madad se sunishchit kee gaee hai. Isee prakaar operation and maintenance mein ham digital twin ke prayog se pata laga sakate hain ki maan leejie koee ac hai hamaare camera mein vah ac maan leejie 4 saal puraana ho chuka hai to hamaara digital twin model hamen is prakaar kee

jaanakaaree de sakata hai ki isaka maintenance karaana chaahie isaka filtar jo hai vah badalane ka time aa chuka hai ya phir maan leejie koee phrij hai jisaka har 3 saal mein maintenance karana hota hai aapane abhee tak nahin kiya hai to vah digital twin model us building kee yah jaanakaaree aapako dega ki kyon na aap in saare equipment ka operation ya maintenance vakt pe karen. Is prakaar digital twin ka uddeshy yah hai ki jo bhee aisee critical information hain jisakee madad se sanchaalan aur rakharakhaav achchhe se kiya ja sakata hai us information ko collect karen. Yahaan par ek baat ka dhyaan dena jarooree hai ki digital twins ka idea yah nahin hai ki ham har jagah sensor aur kaimare se laga den aur har cheej record karen. Digital twin kuchh mukhy parpaj ke lie hote hain kuchh specific goal hai kuchh kaary hai jo bahut jarooree hai sirph unheen ke lie upayog mein laaye jaane chaahie. Maan leejie koee brigade hai us brigade se vartamaan mein roj gaadiyaan ja rahee hain ab usaka inspection jo hai vah maan leejie har 6 maheene mein hota hai lekin kisee kaaran se maan leejie vahaan pe brigade ke baad ek mela laga hai aur vahaan par maan leejie suddenly bahut jyaada traffic ja raha hai, bahut saaree gaadiyaan ja rahee hain un gaadiyon ke vahaan se jaane se maan leejie us brigade ka jo maintenance tha ya inspection hona tha vah 6 maheene kee jagah 3 maheene par karana padega aamataur par yah jaanakaaree hamaare paas nahin rahatee hai, digital twin kee madad se ham record kar sakate hain ki har maheene kitana traffic vahaan se ja raha hai agar kisee kaaran kisee din ya kisee samay par jyaada traffic ja raha hai to digital twin hamen madad karega ki vah hamen bataen ki jarooree hai ki ham isaka inspection 6 maheene kee jagah thoda porve 3 maheene pe hee karen. Is tarah ke vibhinn use cases ya examples hain jahaan par digital twin prayog mein laaya jaata hai.

(Reference Time 30:51)



Vaise hee ek example hai buildings ka. Maan leejiye aapane shaayad kuchh jagah pe ye dekha hoga khaas taur par aap dekhenge collages kee ya corporate buildings jo hotee hain vahaan par aisee lights ya sensor system lagaaye jaate hain ki agar koee aadamee aata hai to vah lights chaaloo ho jaatee hai ya vah lights band ho jaatee hain agar koee baahar jaata hai to. Usee prakaar maan leejiye ac ka ek system hai jo centrally air-conditioned system hai vahaan par digital twin aakalan laga sakata hai ki room mein kitane log hain. Maan leejiye kisee classroom mein 50 log hain, to us prakaar agar esee ka adjustment karana hai to vah adjustment kiya ja sakata hai, temperature kam jyaada kiya ja sakata hai. Maan leejiye kisee kaaran se kisee room jisamen 100 log aa sakate the vahaan 100 ki jagah abhee 20 hee log

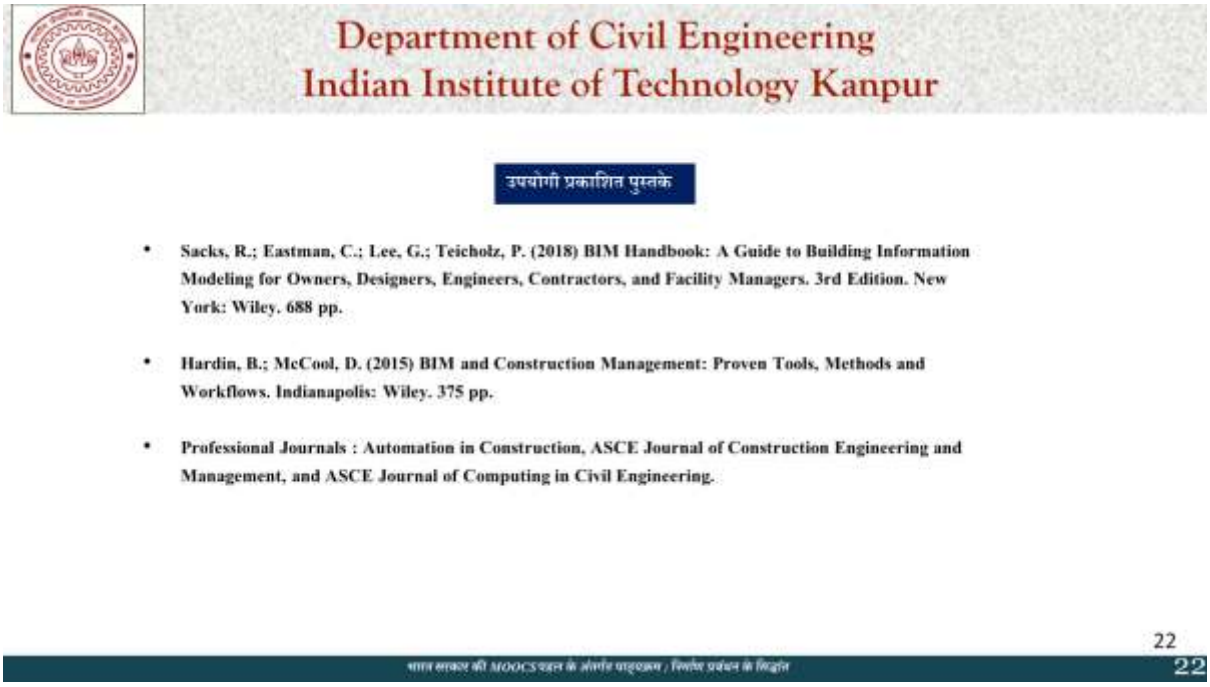
baithe hain, to esee jo designed tha 100 logon ke liye usakee jaroorat nahee hai ki vah 100 logo ke liye chale vah sirph 20 logo kee jaroorat ke hisaab se kis prakaar temperature ya fan speed adjust kee ja sakatee hai vah digital 10 ke upayog se sunishchit kiya ja sakata hai.

(Reference Time 30:51)

Yah kuchh examplace hue operations and maintenance ke. Jahaan par digital twin ya phir construction 4.0 bahut aham bhoomika nibha sakate hain. Isake baad hamaara aakharee step aata hai demolition ka. Generally ise ham nahin dekhate hain lekin aap samajhie jo bhee building ham bana rahe hain usakee ek life hai usaka ek jeevan hai maan leejie 50 saal, 60 saal, 100 saal. 100 saal baad use toda jaega ab ho sakata hai jo kaary hamane 100 saal prove kiya tha jo hamane building banaee thee vah ham 100 saal baad tod rahe hain is pooree prakriya ke beech bahut saare changes hue honge maan leejie 100 saal baad jab aap todane ja rahe hain usake sirph teen saal porve hee kisee building kee maan leejie flooring badalee gaee ho ya maan leejie vahaan ke jo bhee equipment the fans (pankhe) the vah badale gae ho agar is tarah kee jaanakaaree nahin hogee to sirph yah maan liya jaega ki vah building bahut puraanee hai aur use tod diya jae, lekin building information modeling aur digital twin kee madad se ab hamen yah sab jaanakaaree hogee ki kya-kya element ya kis-kis aspect ko kab hamane repair kiya tha, kab unhen badala tha ya kab hamane unakee jagah naee cheejen upayog mein lee thee. Yah jaanakaaree hone se yah phaayada ho sakata hai ki jab ham puraane construction ko tod rahe hain to jo bhee aisee cheej hain jinhen ham bacha sakate hain ya nikaal sakate hain hamen information hai ki yah jyaada puraanee nahin hai, to us information ko use karen aur use information kee madad se un saare elements ko nikaal pae. Is prakaar building information modeling aur construction 4.0 agar pooree life cycle mein upayog laaya jae, to jab ham demolition karate hain us samay bhee yah upayogee ho sakata hai. Aaj ke lecture mein hamane construction 4.0 ke vibhinn pahaluon ko dekha main ek baat par gaur karana chaahoonga ki yahaan par aaj jo hamane technology ya methods discuss kie, kuchh vartamaan mein laagoo kiya ja rahe hain kuchh pe abhee sanshodhan chal raha hai research and development ho rahee hai, kuchh cheejen ho sakata hai aapako aisa lage ki yah to bahut mushkil hai main bilkul aap aapakee baat se sahamat hoon kuchh gatividhiyaan abhee mushkil hai lekin ab vartamaan mein itanee technology develop ho rahee hai ki agar ham chaahen to yah kuchh pahaloo jo hamane aaj discuss kie unhen real world mein laaya ja sakata hai. Main ummeed karata hoon aap bhavishy mein jab bhee nirmaan kaary karenge

kuchh is prakaar kee technologies ko dhyaan rakhenge koshish karenge ki kis prakaar ham latest technology ya methods ka upayog karen aur sunishchit karen ki jo kaary ham kar rahe hain vah kam-se-kam laagat mein ho sake, sahee quality ka ho sake vahaan par koee bhee safety kee problem na ho aur ham vah poora kaary vakt se poorn kar paen yah technologies ya advancement jinakee hamane aaj baat kee hai yah upayogee rahenge.

(Reference Time 35:03)



Yah kuchh references hai agar aap aur interested hain to is topic ke baare mein detail mein padh sakate hain. Bahut-bahut dhanyavaad